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Actuarial Rate Review

Texas Windstorm Insurance Association

Residential Rate Filing

Filed August 15, 2018

SERFF Filing Number: TEXS 131616522

on behalf of
Coastal Windstorm Insurance Coalition

Prepared by:
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Scope

The Coastal Windstorm Insurance Coalition ("CWIC") has retained me to conduct an actuarial analysis and recommended rate change based upon a review of the Texas Windstorm Insurance Association (TWIA) pending residential rate filing, Texas SERFF number TEXS 131616522 ("Filing") with the Texas Department of Insurance ("TDI") filed on August 15, 2018.

Author's Qualifications

I am a Fellow of both the Casualty Actuarial Society and Society of Actuaries and a member of the American Academy of Actuaries with several years of experience in consumer advocacy, pricing, reserving and regulation of all lines of property and casualty insurance.

I have been retained as a plaintiffs' actuarial expert witness in cases against Wells Fargo, Mortgage Investors Corp., State Farm, Infinity Insurance Company and Public Storage.

I have testified on behalf of the Florida Workers Advocates at the 2016 and 2017 NCCI rate hearings. Previously, I was employed by the state of Florida Office of the Insurance Consumer Advocate and have worked as a consultant for Mercer Oliver Wyman and Ernst and Young.

I have an MBA from the University of Utah (Phi Kappa Phi and Beta Gamma Sigma), a BS in meteorology from the University of Utah (while serving as an officer in the US Air Force) and a BS in mathematics from the University of Michigan.

Limitations and Restrictions

This analysis is constrained by data and information that TWIA designated as confidential. In response to TDI's questions and requests for additional data and information in support of the Filing, TWIA provided TDI with some documents that were designated as confidential that TDI declined to share with me.

This report is based on generally accepted actuarial methods and includes the use of actuarial assumptions and calculations as considered necessary. The estimates make no provision for the extraordinary future emergence of either new classes of losses or post-contractual expansions of policy coverage.

Due to the variability inherent in the estimation procedure, actual results may vary, perhaps substantially, from those indicated in this report. The data for this report was not audited; however, it was reviewed for reasonableness and consistency. It is the author's opinion that the data used in this report represent a reasonable basis from which to determine rates that are not excessive, inadequate, or unfairly discriminatory.

Executive Summary

The Filing uses the AIR and RMS hurricane models combined with industry experience and NOAA hurricane data to estimate TWIA's indicated rate change. The Filing's hurricane modeled losses are based upon the average of the RMS and AIR hurricane models.

Each of these two hurricane models has undergone significant revisions, and some revisions have resulted in large increases in modeled losses. Furthermore, there is a significant difference in the modeled losses between the two models.

For example, AIR modeled losses in TWIA's proposed reinsurance layer are 77.9% more than RMS modeled losses in the same layer[1]. The Filing uses the models to estimate both average annual expected losses and the cost of reinsurance.

The Filing indicates that both the AIR and RMS modeled average annual losses were provided by Guy Carpenter, TWIA's reinsurance broker.[2] Reinsurance brokers frequently provide modeling services for their clients; however, it should be recognized that brokers have a vested interest in the modeling results and may not be unbiased participants in the modeling process.

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[1] TWIA Exhibit 11, Sheet 2

[2] Notes to TWIA Exhibit 11, Sheet 2

There are a number of optional assumptions that Guy Carpenter could have selected before running each hurricane model, which could have had a significant impact upon estimated hurricane losses. The Filing did not provide sufficient disclosure about which options Guy Carpenter selected, and there was insufficient disclosure of model outputs.

For example, only after Cari Christman, Chief of Staff in the office of senator Larry Taylor, asked for additional information from TWIA did I discover in an email from TWIA that each model was run on a near-term basis[3]. I still do not know the rationale or impact of these model selections. Near-term models have historically overestimated hurricane losses.

Also, in the same email, I discovered that the AIR model was run using a "50%/50% Blend" (see footnote 3). I don't know why this selection was made and what impact it had upon the modeled losses. In my opinion, the rationale and impact for each and every optional model selection should have been fully disclosed in the Filing.

The models simulated 10,000 years of experience and the output for each model listed the simulated losses for each year, maximum winds, category of storm (tropical storm up to major hurricane category 5) and other important information.

The model outputs were provided to TWIA by Guy Carpenter, and apparently were classified confidential by either Guy Carpenter or AIR and RMS. Only very cursory summary information of model outputs was included in the Filing.

I asked for the detailed model outputs from TDI and was refused, and Cari Christman asked for this same information from TWIA and was also denied on grounds of confidentiality.

It is important that consumers who pay premiums to a quasi-public insurer, such as TWIA, have full access to all information produced by the hurricane models, which form the basis for the premiums they pay. All citizens of Texas are entitled to know that simulated model outputs are reasonable in comparison to historical storm frequency of occurrence and severity of losses.

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[3] RMS v17, Near-Term w/Loss Amplification and AIR Touchstone v5, Near-Term w/Demand Surge, 50%/50% Blend.

Because of the history of model volatility, potential bias and the current large difference in modeled losses between the two models, this report has relied primarily upon industry experience and NOAA hurricane data to determine the following indicated rate change:

Projected Loss & LAE Ratio	57.1%
Projected Total Losses and Fixed Expenses	78.1%
Permissible Loss and Fixed Expense Ratio	77.0%
Indicated Rate Change	1.4%

To estimate TWIA's 100-year probable maximum loss and cost of reinsurance, the Filing relies solely upon the average of the AIR and RMS hurricane models. In this report, the 100-year probable maximum loss is based upon the RMS hurricane model, Hurricane Ike loss experience, the 167-year history of major landfalling Texas hurricanes and actuarial judgment.

This report assumes that reinsurance and/or catastrophe bonds can be bought at 2 times expected losses, comparable to TWIA's recent Alamo Re $400 million catastrophe bond purchase, which was priced at 1.97 times expected losses, rather than the 3.2 times expected losses in the Filing.

It is always less expensive to fund losses with cash rather than reinsurance or catastrophe bonds. Of course, reinsurance reduces risk, but at current pricing levels, for every $1.0 billion TWIA spends on reinsurance, it can only expect to receive back about $300 million in loss reimbursements.

Furthermore, because reinsurance is so expensive, buying more than the minimum required by law keeps rates needlessly high and siphons money off to reinsurers instead of into the Catastrophe Reserve Trust Fund (CRTF). Therefore, it is recommended that TWIA only fund up to its minimum required 100-year PML to conserve cash and build the CRTF.

The Filing unnecessarily proposes to spend the same amount next year for reinsurance as was spent this year ($106,196,289) even though insured values have been decreasing for each of the last three years due to depopulation and are expected to continue to decrease. In my opinion, maintaining current reinsurance spending levels will unnecessarily fund potential losses well in excess of the minimum legally required 100-year PML.

Hurricane modelers regard their models as proprietary "black boxes". This leads to a general suspicion that the models may be manipulated or biased, which TWIA could dispel by developing its own customized, open to the public, hurricane model.

Therefore, it is recommended that TWIA take advantage of the flexibility options now being offered by hurricane modelers and do the following: 1) develop a customized model, as now currently being offered by AIR, that may be run in parallel with AIR's existing model, 2) validate the model against actual historical Texas industry hurricane experience to reproduce as closely as possible actual TWIA losses, 3) engage all stakeholders in the customization process, including representatives of the public, insurance industry, the Texas Department of Insurance and the Office of Public Insurance Counsel, 4) make the model as transparent and unbiased as possible with full disclosure of all methods and assumptions.

It is important to note that, TWIA does not need to build a model "from scratch" but could simply adjust model assumptions in an existing model, such as AIR, to fit actual historical TWIA experience, which would be a much easier, less expensive and more efficient way to create a hurricane model.

Texas Law

Texas law does not require that hurricane models be used to determine its rates, it only requires that they be based upon "past and prospective loss experience":

> "(a) Rates for coverage under this chapter must be made in accordance with this section.
>
> (b) In adopting rates under this chapter, the following must be considered:
>
> (1) the past and prospective loss experience within and outside this state of hazards for which insurance is made available through the plan of operation, if any;
>
> (2) expenses of operation, including acquisition costs;
>
> (3) a reasonable margin for profit and contingencies;
>
> (4) payment of public security obligations issued under this chapter, including the additional amount of any debt service coverage determined by the association to be required for the issuance of marketable public securities; and
>
> (5) all other relevant factors, within and outside this state.
>
> (c) Rates must be reasonable, adequate, not unfairly discriminatory, and non-confiscatory as to any class of insurer."[4]

Furthermore, Texas law provides that TWIA must only maintain available funding to a 1 in 100-year storm:

> "(b) The association shall maintain total available loss funding in an amount not less than the probable maximum loss for the association for a catastrophe year with a probability of one in 100. If necessary, the required funding level shall be achieved through the purchase of reinsurance or the use of alternative financing mechanisms, or both, to operate in addition to or in concert with the trust fund, public securities, financial instruments, and assessments authorized by this chapter.
>
> (c) The attachment point for reinsurance purchased under this section may not be less than the aggregate amount of all funding available to the association under Subchapter B-1."5

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[4] Texas Code, § 2210.355

[5] Texas Code, § 2210.453

Hurricane Models

The Filing uses AIR and RMS hurricane models, run by TWIA's reinsurance broker, Guy Carpenter, to estimate the net cost of reinsurance. The Filing also uses the AIR and RMS hurricane models combined with industry experience and NOAA hurricane data to estimate average annual expected losses. Because of the high degree of uncertainty, volatility and potential bias in the hurricane modeled losses, in my opinion, TWIA has relied too heavily on the hurricane model results and not enough upon historical results.

The Filing assumes TWIA's reinsurance premium next year will be the same as the current year ($106,196,289) and that TWIA will purchase about $2.3 billion of coverage on top of $2.0 billion of potential funding from member assessments and public securities. This assumption is made in spite of the large difference in the 100-year probable maximum loss estimates between the two hurricane models.

The Filing also assumes that reinsurance will be priced at a multiple of 3.2 times expected losses, which is at a significantly higher multiple than TWIA's recent Alamo Re $400 million catastrophe bond purchase, which was priced at 1.97 times expected losses.[6]

The RMS estimate of the 100-year probable maximum loss ($2.61 billion, adjusted for depopulation) is 35.7% less than the AIR estimate ($4.06 billion, adjusted for depopulation), which suggests, based on the RMS model, that TWIA only needs to purchase $610 million of reinsurance instead of $2.1 billion to reach or exceed its 100-year probable maximum loss.

Furthermore, if TWIA's Hurricane Ike's actual losses of $2.6 billion are adjusted for inflation and depopulation, it would result in TWIA projected losses of about $2.9 billion[7], which is nearly identical to the RMS 100-year probable maximum loss estimate of $2.61 billion. In my opinion, based upon the Texas history of most intense hurricanes, it is reasonable to consider Hurricane Ike to be about a 1 in 100-year storm.

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[6] *TWIA Secures $400m Alamo Re cat bond at 13% lower pricing,* http://www.artemis.bm/blog/2018/05/24

[7] Exhibit 2, Sheet 1, Row (4)

There has been a total of 17 category 3 or higher hurricanes making landfall in Texas from 1851 to 2017 (167 years, Exhibit 3.[8] That's an average of about one major hurricane every ten years (17/167). The Texas coastline is 367 miles long and a direct hit is anywhere from 30 miles to the right to 15 miles to the left of the center of the storm for a total of 45 miles.[9]

The largest concentration of TWIA exposures is in the Galveston area, and therefore a direct hit there is the most likely area to produce a large loss. Based on the foregoing, the probability of a major storm making a direct hit on Galveston would be 17/167 x 45/367 = 1.2%, which equals about one major loss every 100 years.

The large differences in TWIA's hurricane model estimates illustrates the large degree of uncertainty in the hurricane models. Moreover, hurricane model estimates have increased significantly in recent years. After hurricane Ike, RMS increased its 100-year probable maximum loss estimates for the Texas coast by 105%.[10]

Furthermore, in the past, the models have also overestimated the number of landfalling hurricanes, which was a significant problem for the near-term hurricane models introduced in 2006 after the very active 2004 and 2005 hurricane seasons (see following Karen Clark discussion). The large increases in modeled losses after big storms suggests that the hurricane modelers are inclined to overreact to (or perhaps capitalize on) large storms.

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[8] Even though Hurricane Ike was a category 2 storm at landfall, it is considered in this report to be one of the most severe storms in Texas history, because Ike's maximum sustained winds were reported as 110 mph at landfall, which was 1 mph short of a category 3.

[9] NOAA Technical Memorandum NWS TPC-5, page 3

10 Aon Benfield Analytics Proprietary & Confidential RMS Hurricane Model Change Analysis of the RMS Model Change and its Impact on the 2011 Reinsurance Renewal Season, updated as of March 23, 2011.

Karen Clark, who was the founder and developer of the first hurricane model (AIR) says that hurricane models cannot:

- "Produce accurate point estimates of infrequent events such as the 1 in 100-year loss,
- Produce credible, robust estimates of infrequent events of losses at specific locations,
- Predict near-term catastrophic losses."[11]

Ms. Clark further observed in this same report that after the eight 2004 and 2005 Florida hurricanes, the three major hurricane modelers (AIR, RMS and EQECAT) all developed near-term models that projected land falling hurricanes averaging more than twice (11) what actually occurred (4), and that U.S. insured hurricane losses were only $15.2 billion compared to average near-term model predictions of $65.3 billion.

The Filing indicates that both the AIR and RMS model estimates of average annual losses were provided by Guy Carpenter, TWIA's reinsurance broker.[12] Reinsurance brokers frequently provide modeling services for their clients; however, it should be recognized that brokers have a vested interest in the modeling results and may not be unbiased participants in the modeling process.

There are a number of optional assumptions that Guy Carpenter could have made before running the hurricane models, which could have had a significant effect on the results. In my opinion, the Filing did not provide sufficient disclosure about which options Guy Carpenter selected.

For example, I only found out through an email from Anna Stafford at TWIA to Cari Christman, Chief of Staff in the office of senator Larry Taylor, that each model was run on a near-term basis, which should have been disclosed in the original Filing and may have had a significant impact upon the modeled results.

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[11] Karen Clark & Company, Near Term Hurricane Models, Performance Update, January 2011.

[12] Notes for Exhibit 11, Sheet 2

Many large insurance organizations, such as TWIA, have their own catastrophe modeling staff and purchase (or in some cases develop) and run their own modeling software. To eliminate any actual or appearance of bias, it is recommended that TWIA purchase, customize and run its own hurricane model. TWIA could customize its own hurricane model to fit its own unique portfolio of risks.

At least one modeling company (AIR) is currently offering such customization services:

> "The fundamental reason why an insurer or reinsurer would want flexibility, one that modeling companies themselves readily acknowledge, is that models are not perfect, that is, they do not represent reality perfectly. There is ever-present uncertainty inherent throughout the modeling process as well as various sources of loss that we are not yet able to model… We are working with a number of third-party solution providers to enable their views of risk to be run alongside the AIR view. Third-party models and data can provide risk assessment capabilities where detailed probabilistic models do not yet exist, or they can offer alternative perspectives to existing AIR models."13

Hurricane modelers regard their models as proprietary "black boxes". This leads to a general suspicion that the models may be manipulated or biased, which TWIA could dispel by developing its own customized, open to the public, hurricane model.

Therefore, it is recommended that TWIA take advantage of the flexibility options now being offered by the modelers and do the following: 1) develop a customized model that may be run in parallel with an existing model as described above by the CEO of AIR, 2) validate the model against actual historical loss experience so that it reproduces as closely as possible actual TWIA losses, 3) engage all stakeholders in the customization process, including representatives of the public, insurance industry, the Texas Department of Insurance and the Office of Public Insurance Counsel, 4) make the model as transparent and unbiased as possible with full disclosure of all methods and assumptions.

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[13] *Model Flexibility: What is the Right Amount?,* Ming Lee, CEO, AIR Worldwide, May 28, 2014.

Analysis

Exhibit 1 is a summary of the rate change indications based upon the following major revisions to the Filing:

- Projected losses and loss adjustment expenses are based entirely upon actual industry historical experience, rather than the highly uncertain and volatile hurricane model estimates used in the Filing.
- The 100-year probable maximum loss is based upon the RMS hurricane model estimate, Hurricane Ike loss experience, the history of the most intense Texas hurricanes and actuarial judgment rather than an average of the AIR and RMS models used in the Filing.
- It is assumed that TWIA will only fund losses up to its minimum required 100-year PML to conserve cash and rebuild the CRTF rather than spend the same dollar amount on reinsurance that it spent for the current year.
- Reinsurance and/or catastrophe bonds are expected to be priced at 2 times expected losses, comparable to the recent Alamo Re $400 million catastrophe bond purchase, which was priced at 1.97 times expected losses instead of the 3.2 times expected losses in the Filing.
- It is assumed that depopulation will continue at current rates and that insured values will decline by about 15.0% from 11/30/2017, the valuation date of the models, to 9/10/2019, the peak of the 2019 hurricane season, (rather than the 5.0% assumed in the Filing.

All other data and assumptions are the same as those contained in the Filing.

Exhibit 2, Sheet 1 details the revised calculation of the net cost of reinsurance or catastrophe bonds. It assumes that reinsurance or catastrophe bonds are priced at 2 times expected losses consistent with TWIA's recent catastrophe bond purchase.

Exhibit 2, Sheet 2 shows the calculation of expected losses in the reinsured layers separately for the 100-year PMLs as determined by the RMS and AIR models and Hurricane Ike. The selected 100-year PML is the average of the Hurricane Ike and RMS model indications.

This exhibit utilizes Florida data as a proxy for Texas data, because the outputs from the RMS and AIR models used in the Filing were classified as confidential by TWIA when filed with TDI.

Exhibit 3 documents the 17 major hurricanes that have made landfall in Texas over the last 167 years. Even though Hurricane Ike was classified as a category 2 storm, it is considered one of the most intense Texas hurricanes in this report, because it was only 1 mph short of being classified as a category 3 storm.

Exhibit 4 shows the calculation of the projected 15.0% decline in insured values between the hurricane modeled valuation date of 11/30/2017 and the peak of the 2019 hurricane season of 9/10/2019.

Certification

I, Stephen A. Alexander, am a Fellow of the Casualty Actuarial Society, a Fellow of the Society of Actuaries and a member of the American Academy of Actuaries, and I meet the Qualification Standards of the American Academy of Actuaries to provide the actuarial report contained herein. The information contained in this report has been prepared by me in accordance with applicable Actuarial Standards of Practice as promulgated by the Actuarial Standards Board.

The Actuarial Standards Board is vested by U.S.-based actuarial organizations with the responsibility for promulgating Actuarial Standards of Practice for actuaries providing professional services in the United States. Each of these organizations requires its members, through its Code of Professional Conduct, to observe the Actuarial Standards of Practice when practicing in the United States.

I certify that the foregoing is true and correct.

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