Defining The **X-Factor:**

Flood-Zone Relevance in April's Ohio Valley Flood Event

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Executive Summary

A significant flood event occurred in the central U.S. between April 3rd and 6th, 2025. Kentucky was hit particularly hard, but areas of surrounding states were also inundated. The event was characterized by widespread and unpredictable flood behavior. The National Weather Service described the flooding as “historic”.

Floods affected properties in areas designated as flood zones by the Federal Emergency Management Association (FEMA). In addition, many properties in areas designated as X Zones by FEMA were flooded. FEMA says an X Zone is an “area of minimal flood hazard, usually … above the 500-year flood level.”

The assessment which follows is based on analysis performed by the reThought Flood® reSearch Group using the insurer’s proprietary risk analysis models, and high-resolution satellite data from ICEYE, which operates the world’s largest synthetic aperture imaging radar constellation. In brief:

21,997

Properties suffered some degree of flooding.

15,065

Properties, or 68% of the total number flooded, are in FEMA-delineated high-risk flood zones.

6,932

Properties, or 32% of the total number flooded, are in FEMA’s low-risk X Zones.

Flooding therefore widely impacts properties outside mapped flood zones.

Properties in X Zones experienced flood depths comparable to or even exceeding those in A Zones.

Properties flooded are strongly correlated with a pre-event assessment of higher flood vulnerability by reThought Flood®.

Flooding vs Flood Zone Analysis

A significant flood event occurred in the Ohio Valley between April 3rd and 6th, 2025. Kentucky was hardest hit, alongside Arkansas, Missouri, Tennessee, and Michigan as the Kentucky, Green, Rough, Rolling Fork, and Ohio River basins experienced excessive rainfall. The event was characterized by widespread and unpredictable flood behavior.

According to the National Weather Service, "Multiple rounds of heavy rain and thunderstorms impacted the lower Ohio Valley April 1-6 … Flash flooding became a greater concern during the overnight as storms trained over the same locations. Over the next few days, waves of showers and storms rode along the frontal boundary bringing lots of rain which lead to widespread flash and areal flooding. Showers and storms came through daily, until the evening of April 6th. The resultant flooding turned into historic and near record-breaking river flooding along many river basins. Widespread flash flooding occurred over almost all of the area during rounds of heavy rain April 3-6."[i]

The affected areas experienced rapid water accumulation due to heavy rainfall. That led to river overflows, flash flooding, and urban drainage-system failures (Figure 1). Many flooded properties were mapped within FEMA floodplains. However, a significant portion of properties in X Zones – historically considered safe from flooding by many people – also suffered substantial flooding (Figure 2).

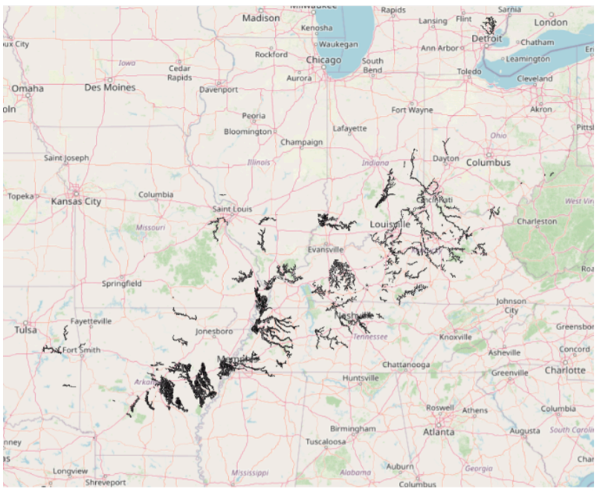


Figure 1: Flooded areas based on satellite observation.

Source: reThought Flood®

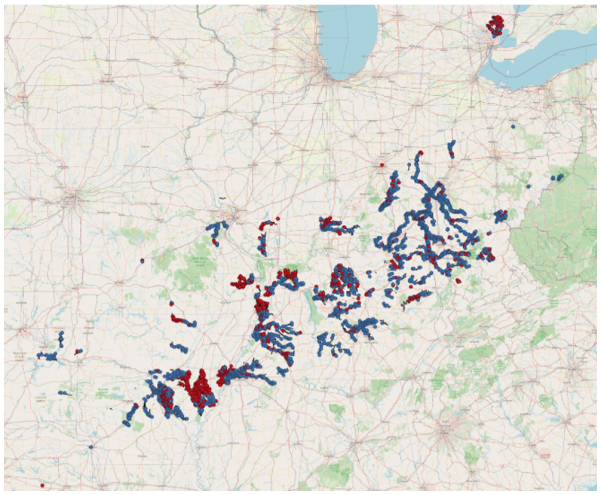


Figure 2: Buildings Flooded by Zone.

All 21,997 properties, birds-eye view

Blue – X Zone. **Red** – A Zone

Source: reThought Flood®

[1] https://www.weather.gov/lmk/HistoricRainfallFloodingApril2-62025

Flooding was extensive. Affected properties can be found across both high-risk A Zones and low-risk X Zones.

Flood waters clearly do not respect FEMA Zoning boundaries, making a property's location within an X Zone a poor indicator of lower vulnerability to flooding.

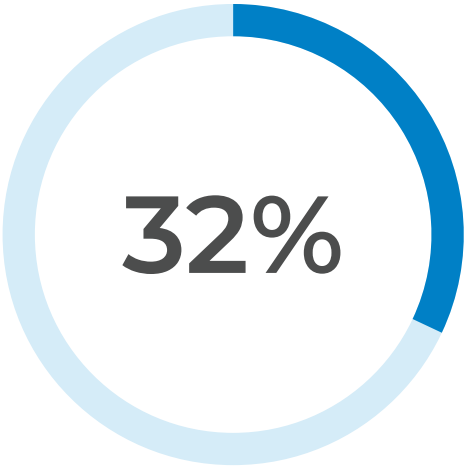
Of the 21,976 buildings flooded, 15,065 were in A Zones, considered the most likely to flood. However, they accounted for just 68% of all flooded buildings, about two thirds. The other third – 6,932 homes and commercial buildings – were in X Zones.

Table 1: Flooded buildings by FEMA Flood Zone

FEMA Flood Zone	Number of Flooded Buildings	Percentage of all of Flooded Buildings
A Zone	15,065	68%
X Zone*	6,932	32%

* Including properties outside mapped zones.
Source: reThought Flood®

Nearly one-third of all flooded properties were located in FEMA-designated X Zones, or areas outside any mapped flood zone – a striking reminder that "low-risk" classifications do not equate to "no risk."



These findings reveal a critical gap in conventional flood-risk perception across the U.S. They emphasize the urgent need for more dynamic, data-driven approaches to flood modeling, risk assessment, and insurance decision-making.

Average Flood Depth vs Flood Zone Analysis

Using high-resolution satellite data provided by ICEYE, reThought Flood® reSearch Group was able to determine the average flood depth, measured in feet, for all impacted properties (Figure 3). The data reflects the depth of floodwater observed during the event, and has been aggregated to highlight distribution trends across affected locations.

Figure 3: Number of buildings flooded by average depth of flood

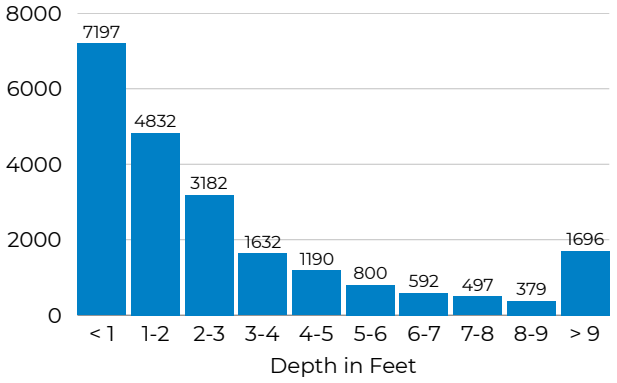
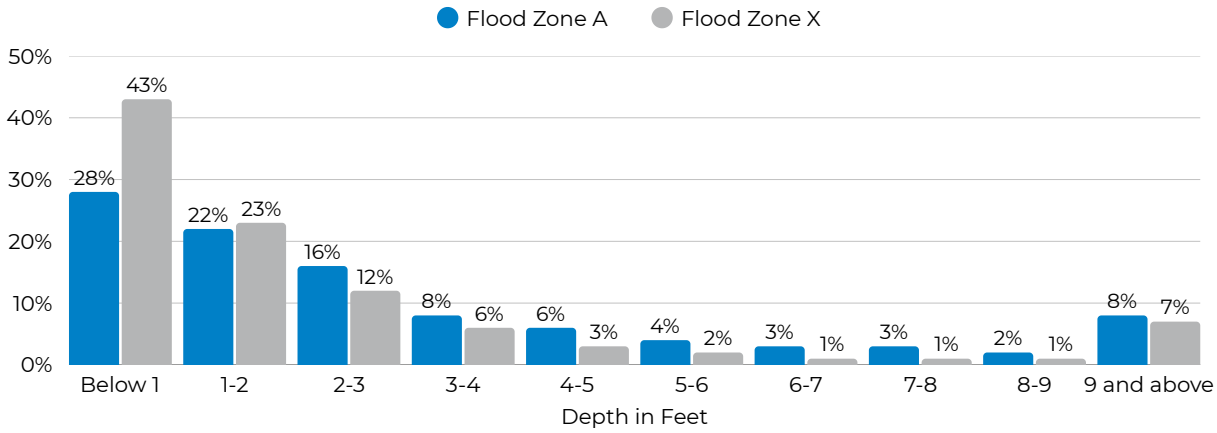


Figure 4 shows how water depth varied across the properties flooded. This provides invaluable insight into the severity of flooding in and across flood-zone classifications. Flood depth directly influences both the extent of damage and the cost of recovery, and is therefore an essential input to loss forecasting.

Figure 4: Average Flood Depth by Flood Zone



The average flood depth experienced by properties located across the Zones is derived from ICEYE's satellite-based flood detection. This analysis offers unique insight into the physical severity of flooding across zoning categories.

The data reveals that properties in X Zones experienced depths of floodwaters comparable to or even exceeding those measured at properties in A Zones. The finding underscores the limitations of reliance on FEMA flood zones for risk assessment. It reinforces the importance of using high-resolution, real-time flood intelligence in the evaluation of true exposure.

The band which includes depths of 9 feet or more reflects floodwaters of as much as 16 feet. This band captured more than 1,500 buildings due to its larger width. Hundreds of structures in X Zones were under more than 10 feet of water.

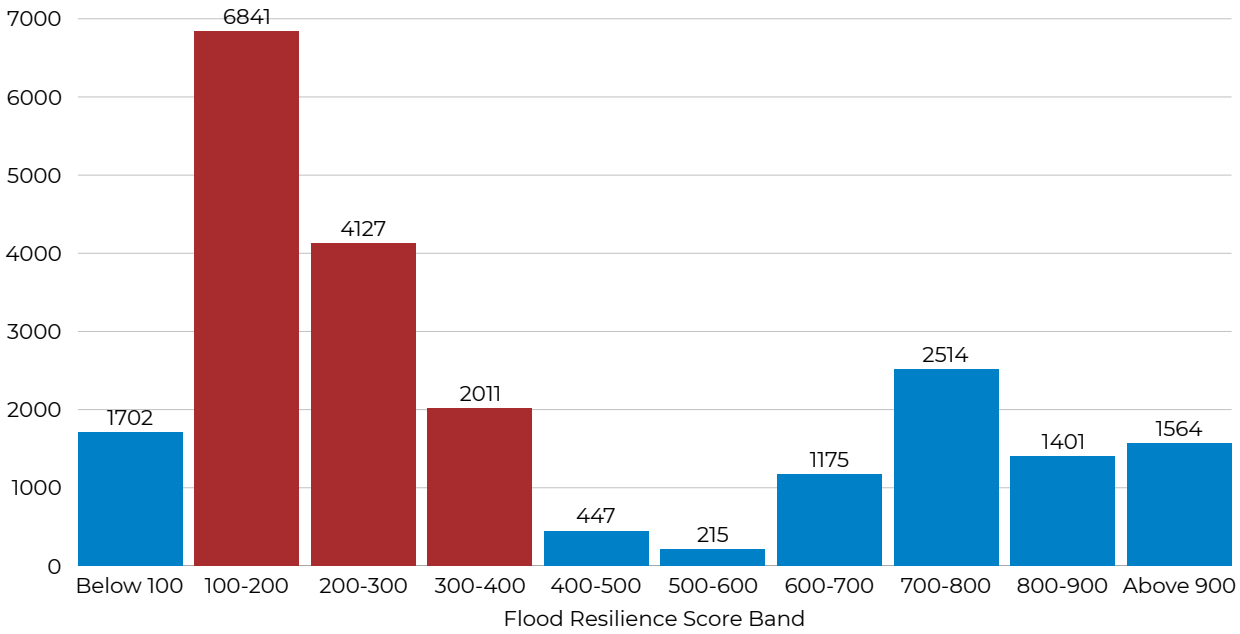
Despite their categorization as at low risk, properties X Zones are present across all flood depth bands. They experienced water levels comparable to those in A Zones. Zone designation alone therefore does not ensure safety from flooding.

reThought Flood® Resilience Score vs Flood Zone Analysis

reThought Flood's proprietary flood risk assessment metric, Flood Resilience Score (FRS), indicates an individual property's ability to withstand and recover from flood events. Properties are grouped into bands ranging from FRS 100 (lowest resilience) to FRS 1000 (highest resilience). FRS allows comparison of the flood vulnerability of individual structures across regions and portfolios.

The distribution of properties flooded by the 2025 Ohio Valley flood event reveals a strong concentration of flooded properties in lower FRS bands (Figure 5). This indicates that properties assessed by reThought Flood® as more vulnerable to flooding were more likely to be impacted by the event. This finding validates FRS as an efficacious forward-looking indicator of flood vulnerability, including for assets in areas outside FEMA flood zones.

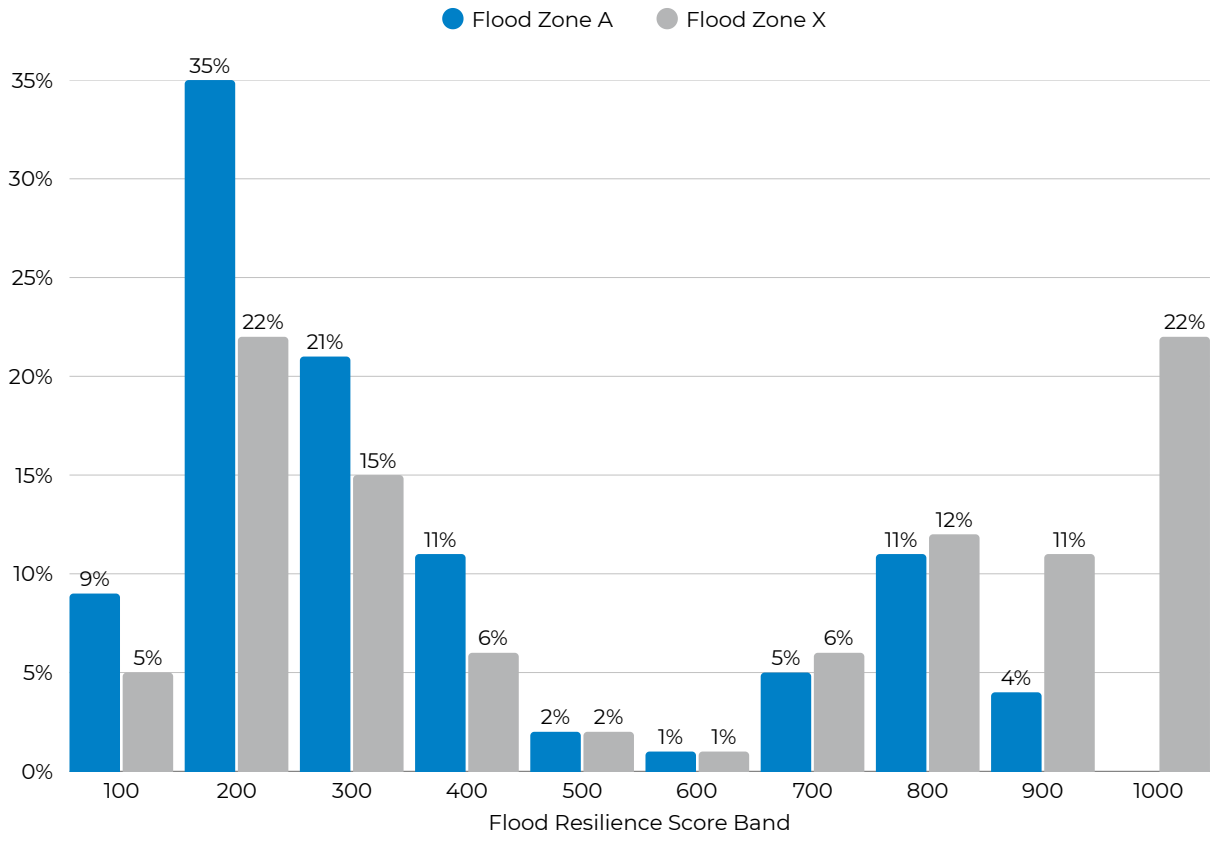
Figure 5: Number of flooded properties by reThought FRS band



Many flooded properties located in X Zones had been assessed at low FRS values which indicate high flood vulnerability (Figure 6). This demonstrates that FRS effectively identifies high-risk properties in areas traditionally considered at low risk of flooding.

This reinforces the fact that zone designation alone is insufficient to understand true flood risk. By considering factors beyond simple location, including building characteristics and reThought Flood's proprietary geocoding methodology, FRS provides a deeper, property-level view of resilience.

Figure 6: Flooded properties by reThought FRS band and Flood Zone



reThought Flood® reSearch Group's analysis of all 21,997 flooded properties reveals a strong inverse correlation between the Flood Resilience Score (FRS) Bands and the aggregated average losses under a modeled 1-in-250-year flood scenario, a frequency commonly used by commercial insurers. This means that as FRS increases – indicating higher resilience – the average flood-related loss per band decreases, validating the effectiveness of the FRS model as an indicative tool for underwriting.

This was calculated by assessing each flooded property using the reThought Flood® NextGen Flood Analytics platform. This brand-new platform models location-specific return-period losses. 1-in-250-year flood event losses were aggregated across FRS Bands and observed flood depths (Table 2). Key findings include:

- Properties in a high FRS Band, 801 to 900 or 901 to 1000, show consistently lower losses across most flood depth intervals. For example, properties assessed in FRS Band 901 to 1000 in the Less than 1 Foot depth group average modeled losses of only $26,684, compared to $103,701 for FRS Band 101 to 200 properties.
- Conversely, properties with an FRS of 400 or lower face substantially higher average losses, even at moderate flood depths. Modelled loss values often exceed the range $130,000 to $170,000.
- Some anomalies exist at specific depth ranges. For example:
  - FRS Band 401 to 500 shows unusually high losses of $987,786 at the 7 to 8 Foot flood depth band. It is a potential outlier, or indicative of highly exposed infrastructure despite moderate resilience scores.
  - FRS Band 801 to 900 also spikes at 6 to 7 feet, at $806,965, suggesting certain high-resilience properties may still suffer large losses under less common, localized conditions.
- Perhaps unsurprisingly, even the highest FRS bands report non-trivial losses with floodwaters rising beyond 9 feet of floodwater depth, such as $133,517 at FRS 1000. This implies that extremely high water depths can overwhelm even well-prepared buildings.

Table 2: FRS and aggregated average loss for modeled 1-in-250-year flood event

	< 1 ft	1-2 ft	2-3 ft	3-4 ft	4-5 ft	5-6 ft	6-7 ft	7-8 ft	8-9 ft	> 9 ft
FRS Band 100	$52,523	$86,231	$85,886	$138,317	$168,050	$150,750	$136,748	$155,082	$91,444	$153,150
FRS Band 200	$103,701	$113,844	$116,057	$134,460	$142, 875	$132,194	$173,841	$133,633	$122,874	$391,322
FRS Band 300	$99,477	$107,288	$134,795	$138,117	$166,894	$124,239	$142,412	$135,171	$128,283	$209,572
FRS Band 400	$68,499	$101,383	$136,871	$164,529	$161,890	$188,875	$174,293	$165,635	$169,615	$278,747
FRS Band 500	$78,755	$88,626	$100,928	$79,561	$271,955	$128,861	$987,786	$711,545	$56,750	$312,427
FRS Band 600	$65,067	$76,588	$70,232	$92,238	$103,614	$171,184	$121,796	$52,589	$96,313	$74,129
FRS Band 700	$53,344	$77,779	$73,226	$72,136	$89,800	$98,565	$99,880	$78,103	$96,444	$191,759
FRS Band 800	$49,926	$58,955	$49,022	$95,862	$68,148	$73,694	$93,347	$46,817	$105,056	$195,951
FRS Band 900	$30,668	$61,173	$65,001	$47,297	$24,936	$47,058	$806,965	$14,924	$13,194	$95,568
FRS Band 1000	$26,684	$21,455	$29,722	$25,785	$33,561	$53,245	$72,752	$62,036	$16,226	$133,517

Conclusions

reThought Flood® reSearch Group's analysis of April 2025 flooding in the Ohio Valley underscores the necessity of assessing flood risk dynamically. It is essential to incorporate real-time satellite data and localized modeling. Use of FEMA flood maps on their own is not enough.

reThought Flood® deploys state-of-the-art data analytics, AI, and catastrophe monitoring to better understand and prepare for unpredictable flood risks. That helps to ensure that even properties in so-called safe zones are adequately protected.

This analysis, using reThought Flood's NextGen property Database, and powered by proprietary Flood Resilience Score (FRS), reveals a clear trend. As FRS increases, the aggregated average 1-in-250-year flood loss tends to decrease. This indicates that higher FRS values are strongly correlated with better flood performance.

The data also shows that during extreme flood events, substantial losses can still occur across all FRS bands, including in the highest. This highlights a key insight: while a higher FRS typically implies reduced vulnerability, it does not guarantee immunity from large losses when faced with low-frequency, high-severity flood events, or even unusual local conditions that lead to floods. Conversely, even properties with lower FRS assessments can sometimes experience moderate losses if the flood depth or severity is limited.

This pattern suggests that FRS is not only a measure of baseline flood resilience, but also has the potential to act as a proxy for how a property's loss profile might behave under various flood severities, especially in tail-risk scenarios. The observed correlation between FRS bands and loss aggregation reinforces the relevance of the score as a key metric for flood risk segmentation and underwriting analysis.