Whitepaper: FILLING THE COASTAL DATA GAP AT PORT RICHEY

1. Executive Summary

Coastal resilience relies on precision. For communities like Port Richey, Florida, the absence of local federal monitoring stations has historically meant relying on distant approximations for critical water level forecasts. SkyWind Solutions fills this gap with their proprietary generative AI forecasting system to provide Port Richey with hyperlocal tide predictions.

This whitepaper details the performance of SkyWind's hyperlocal model during the October - November 2025 period of their recent pilot, demonstrating a significant improvement in accuracy over traditional harmonic modelling methods, particularly during high-impact "King Tide" events.

2. The Challenge: The Data Gap

Accurate tidal forecasting is essential for municipal planning and flood mitigation. However, the port at Port Richey, FL, lies outside the operating regions covered by the NOAA-NOS (National Ocean Service) network. In the absence of a local station, stakeholders have historically been forced to rely on the closest hourly forecast system located at Clearwater Beach, FL. This distance introduces significant error, as local bathymetry and meteorological conditions in Port Richey differ from those in Clearwater.

3. The Solution: Generative AI Forecasting for Hyperlocal Data

SkyWind Solutions' proprietary AI-based modeling approach learns site-specific coastal behavior from historical and real-time data to deliver hyperlocal water-level forecasts.. Unlike traditional harmonic models, which are derived from fixed astronomical tidal cycles, SkyWind Solutions' AI-powered platform generates accurate forecasts accompanied by confidence intervals, which show the upper and lower bounds of likely outcomes. This approach of quantifying uncertainty, empowers decision-makers to plan for unexpected deviations in water levels.

To validate the efficacy of this system, SkyWind Solutions utilized the observational buoy at Port Richey Waterfront Park as the ground truth for verification. The performance of the SkyWind Solutions' model was compared directly against the NOAA Clearwater Beach forecast, which serves as the standard proxy in the absence of SkyWind Solutions' productt.

4. Performance Analysis

The following analysis compares the Root Mean Square Error (RMSE) of SkyWind's forecasts against the NOAA proxy over October and November. A lower RMSE indicates higher accuracy.

A. Overall Accuracy (October & November) Over the two-month verification period, SkyWind's generative AI model demonstrated superior accuracy compared to the NOAA proxy.

● **SkyWind RMSE:** 0.742 feet

● **NOAA (Clearwater) RMSE:** 1.01 feet

This represents a substantial reduction in error, providing a tighter correlation with the actual conditions observed at the Port Richey Waterfront Park buoy.

B. High and Low Tide Precision Accuracy at tidal peaks and troughs is critical for navigation and flood control.

- **High Tides:** SkyWind achieved an RMSE of **0.757 feet**, outperforming NOAA's proxy at **0.986 feet**.
- **Low Tides:** SkyWind achieved an RMSE of **0.718 feet**, compared to NOAA's proxy at **1.00 feet**.

C. Extreme Events: King Tides The system's value was most evident during the "King Tide" periods (October 3–10 and November 3–10), where water levels are naturally highest and flood risks are acute. During these critical windows, SkyWind's model significantly outperformed the traditional proxy.

● **SkyWind RMSE:** 0.438 feet

● **NOAA (Clearwater) RMSE:** 0.738 feet

This nearly **40% reduction in error** during King Tides highlights the model's ability to capture localized tidal anomalies that distant proxy stations miss.

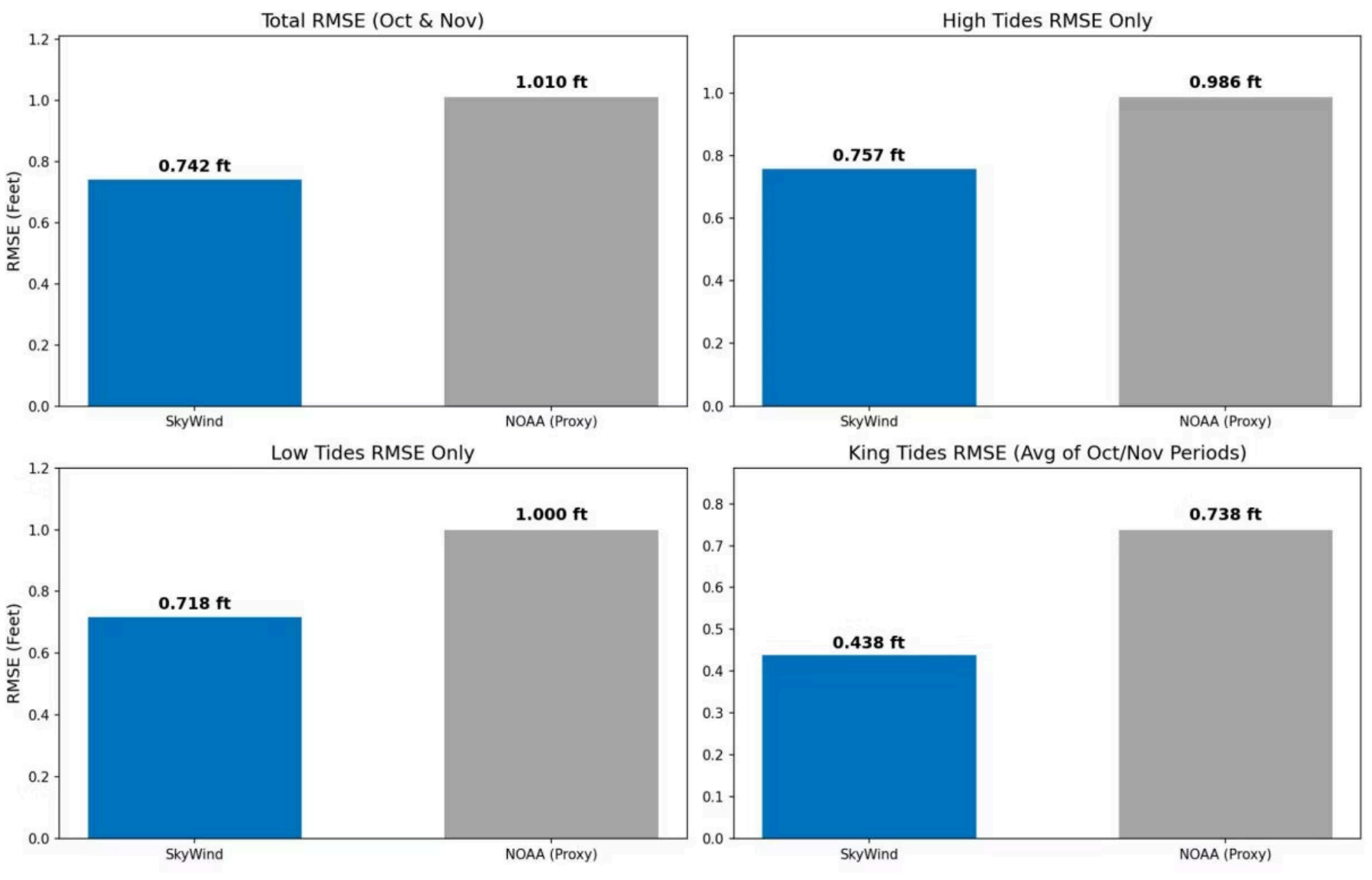

Figure 1. A model comparison between SkyWind and the NOAA forecast at Clearwater Beach. The top left panel are the RMSE scores for all data in October and November. The top right shows the error for high tides only. The bottom left shows low tides only. Finally, the bottom right shows the error comparison for King Tide periods in October and November.

5. Conclusion

The data from October - November, 2025 confirms that solely relying on the Clearwater Beach proxy for Port Richey water levels results in significant inaccuracies, with errors frequently exceeding 1 foot.

These errors are most consequential during elevated water-level events, including King Tides, when small differences can determine whether local flooding thresholds are reached.

The analysis further shows that site-specific forecasting substantially reduces this uncertainty by resolving conditions at Port Richey itself rather than inferring them from regional proxies. This improved alignment with observed conditions provides the City of Port Richey with a more reliable basis for evaluating coastal risk, prioritizing preparedness actions, and managing infrastructure exposure during high-water events.