



Smart flood towers for real-time flood monitoring and warning in Huế City, Vietnam

Overview

ISET-International (ISET) collaborated with the Water Resources and Climate Change Division of Huế City (DRM agency) to pilot two smart flood-warning towers that provide real-time, location-specific flood depth and on-site visual and audio alerts during flooding conditions. Huế currently has an existing network of concrete flood towers, and plans to replicate the smart flood tower model and lacks of knowledge on how best to do it. To avoid ad-hoc upgrades and building on the pilot's success, ISET supported the city in assessing flood risks and existing tower system and developed an investment road map that serves as a planning tool to prioritize 188 sites for future towers. Connected to Hue-S platform, the smart towers deliver timely alerts, remain functional during power outages, generate long-term flood data for planning, and enable systematic, phased expansion. The roadmap ensures strategic, demand-driven investment, avoiding ad-hoc installation and supporting a unified, scalable early-warning system for the whole city.

The gap

Climate change is intensifying flood extremes in Huế City, as seen in severe and recurrent floods of 2020, 2022, 2023, and 2025, when multiple record-breaking rainfall events caused widespread and devastating impacts. Although the city has a network of concrete towers, these structures only display static flood level marking and provide no real-time data or targeted alerts to guide response decisions. As a result, most neighborhoods still rely primarily on generic river level that do not reflect actual inundation conditions at the community level. Without a coordinated, system-wide upgrade plan, past investments have been fragmented, project-based, and ad hoc, leaving many high-risk neighborhoods without timely, actionable flood warnings.



Facts and figures



Cost of smart flood warning tower: US\$4,400 (including installation)
Cost of flood risk assessment and investment roadmap development: US\$7,000



Annual update/maintenance costs: US\$320/tower/year (covered by provincial DRM budget)



Time to implement Tower approval and installation: 1-2 months
Investment roadmap development: 4 months



Easy to replicate?
Yes, thanks to design, low cost and minimal maintenance requirements.

Photo: Smart flood tower in Quảng Điền commune, Huế City © Thanh Ngo, ISET Vietnam.

Our solution

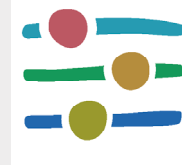
Two smart flood towers were first installed in Trung Làng village (Đan Điền commune) and Phò Nam A village (Quảng Điền commune). These towers record flood water levels and send real-time data to the provincial hydro-meteorological monitoring system and a city-wide app called Hue-S which is regularly used by over 90% of the province's population. Each tower serves as a local alert node, activating sirens and red rotating light when floodwater reaches dangerous levels. Built with withstand storms and equipped with solar batteries, the towers can operate independently for up to 30 days. Half of the installation and equipment costs were co-financed by the private company Wattec. The towers are now integrated into the city's early warning system, with designated agencies responsible for management and maintenance and with O&M funding allocated from the city budget.

To enable citywide expansion given the success of the pilot, a structured process was undertaken to transition pilot sites to a coordinated real-time warning network. Key datasets including historical flood maps, population density, road networks, infrastructures and existing tower locations, were analyzed using GIS and field surveys. This process identified 188 priority site for new or upgraded smart towers, along with enhancement to the tower design (e.g., color-coded lights, rising or receding water indicators, and depth-based loudspeaker alerts) to improve risk communication.

The resulting investment roadmap now provides Hue City with a strategic planning tool to guide phased, demand-driven upgrades and to mobilize local budgets and external support, ensuring that future investments are systematic rather than ad hoc.

How it increases resilience

As demonstrated by the two piloted units, smart flood towers strengthen community preparedness and timely actions by improving the speed, reliability and reach of early warnings. They



Climate Resilience Measurement for Communities (CRMC)

The Climate Resilience Measurement for Communities (CRMC) is a data-driven process, complemented by a web-based tool and mobile app, which helps communities to evaluate and measure how resilient they are to climate hazards. Using the results, they can identify and implement resilience-building interventions and run additional measurements to track improvements.

Find out more: ZCRAlliance.org/crmc

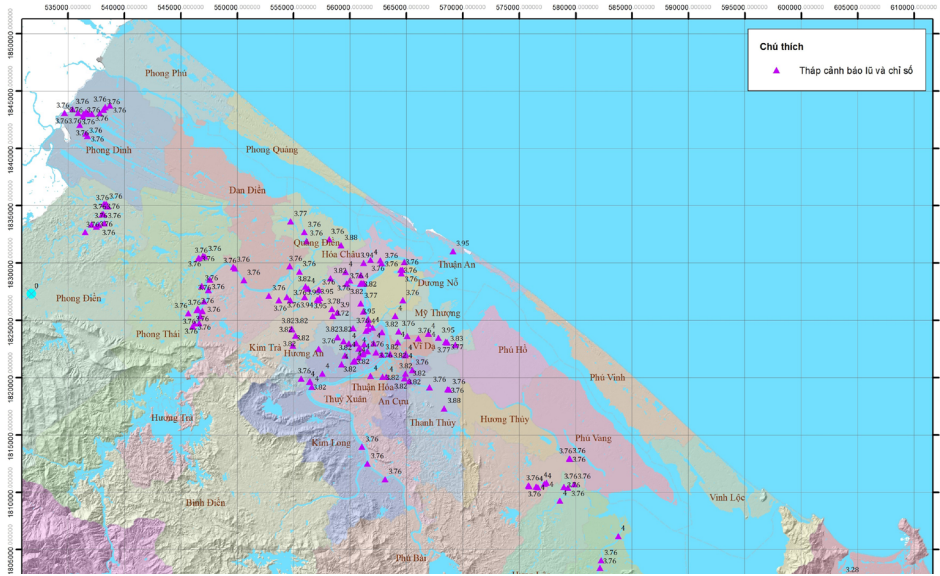


The Chairman of the Quảng Điền District People's Committee inspects the smart flood warning tower during the November 2023 floods © Photo: Huế Division of Water Resources and Climate Change

LIVED EXPERIENCE

“ When flooding happens, flood level data from the warning tower is updated on the website of Quảng Thọ commune. We also send updates to the village heads, who inform community members so they can take timely and appropriate actions. By comparing flood depths at other sites with the tower's measurements, we can use the data from Phò Nam A tower to predict the water level in other locations of the commune, also making it useful for other villages.”

– Mr. Lê Thanh Xuân, DRR official of Quảng Thọ (now Quảng Điền) commune



188 proposed locations for new smart towers

continuously transmit real-time flood-depth data from communities to the city's monitoring platforms, and provide alerts through both digital (SMS and Hue-S) and on-site channels (sirens and color-coded lights).

Built to withstand storms and equipped with solar power system and battery backup capable of operating for up to 30 days without external electricity, the towers remain functional even during power or network outages, providing redundancy and a last line of communication when all other channels fail.

When integrated with Hue-S and GIS-Hue, tower data support the translation of rainfall and river-level forecasts into localized flood-depth predications, supporting targeted, timely response. Overtime, the accumulated flood-depth records form a valuable evidence base for understanding changing flood behavior influenced by climate variability, river dynamics, urban development,

Conditions for success

Q: Is this intervention appropriate for other communities?

A: Yes, other provinces can learn and apply this approach.

Q: What conditions are needed for the interventions?

A: Integration with the city's early warning and data platforms; clear agency mandates for tower management and monitoring; allocated budget for annual operation and maintenance; and strong local government ownership.

Q: Was there anything special about the communities where interventions were effective?

A: Strong commitment and support of local governments.



(Left) Smart tower's data on Hue-S app, (Right) Smart tower at work during 2023 flood © Photo: Huế Division of Water Resources and Climate Change.



and drainage performance. This informs land-use management and the planning of drainage infrastructure that can better accommodate flood flows.

At the city level, the investment roadmap provides Hue City a coordinated, system-wide plan for upgrading and expanding the tower network, ensuring that investment are strategic and directed to the high risk and vulnerable areas rather than ad hoc. This creates a strong basis for mobilizing local budgets, socialized contributions, and development funding, and support sustainable operation and maintenance over time. The city plans to use the roadmap in discussion with a donor who has expressed interest in supporting the installation of additional smart towers.

Staff of Hue DRM Agency discussing locations of new smart flood towers © Photo: Water Resources and Climate Change Division of Hue City

Co-benefits

- Visible, easy-to-understand flood signals help residents build practical flood awareness in daily life. Over time, the towers become familiar reference points for understanding flood risk, supporting community preparedness.
- The roadmap gives Hue City a replicable model and a solid justification for investing and attracting external funding, supporting long-term expansion of early-warning infrastructure across the city.

Get in touch

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For more resilience solutions:
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The Institute for Social and Environmental Transition – International (ISET) is a non-governmental organization committed to building inclusive and transformative resilience in the face of natural resource, environmental, and social challenges, especially related to climate change, natural hazards, and urbanization. Officially operating in Vietnam since 2010, ISET has an intimate understanding of Vietnam’s institutional landscape and its strengths and challenges, and has proven expertise in working effectively across levels to bridge the still significant divide between science, policy, and implementation. ISET is working in Huế City and Gia Lai Province, both coastal areas in central Vietnam and Cần Thơ city in the Mekong Delta.