

**TERMS OF REFERENCE  
(TOR)**

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**SUPPLY, DELIVERY, INSTALLATION, TESTING, AND  
COMMISSIONING OF FLOOD MONITORING SENSORS AND STREET  
LEVEL FLOOD ANALYSIS SYSTEM**

**I. RATIONALE AND BRIEF BACKGROUND**

The Republic Act No. 10121 known as the Philippine Disaster Risk Reduction and Management Act of 2010 defines Early Warning System as the set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss.

A people-centered early warning system necessarily comprises four (4) key elements: knowledge of the risks; monitoring, analysis and forecasting of the hazards; communication or dissemination of alerts and warnings; and local capabilities to respond to the warnings received. The expression "end-to-end warning system" is also used to emphasize that warning systems need to span all steps from hazard detection to community response.

Flooding occurs most commonly from heavy rainfall when natural watercourses lack the capacity to convey excess water. Various climatic and non-climatic processes can result in different types of floods: riverine floods, flash floods, urban floods and other factors. Given that Quezon City is highly susceptible to evolving disaster risks due to multiple hazards, it is therefore a must to continuously improve on this matter and invest on modern technologies that will promote knowledge building, awareness raising, and disaster preparedness not just for the CDRRMO but to the citizens of Quezon City.

By providing additional flood sensors to monitor street flooding, it will enhance the current system which only focuses on water ways flooding, this in turn will further capacitate disaster preparedness of the city along with faster decision making based on near real-time monitoring of flooded streets around the city.

**II. PROJECT DESCRIPTION**

The concept of the project is to enhance the capabilities of CDRRMO by increasing the number of flood sensors installed in the city and combining it with a science-based data driven analysis system to improve decision making and early warning to the public. The additional sensors will be used to monitor street flooding which has a more direct impact on citizens.

Since these are critical systems for disaster preparedness and the country is already in the severe weather season along with the COVID-19 situation, the CDRRMO recommends a system that is already existing and proven working by other Local Government Units in Metro Manila. The CDRRMO is aiming to have a system aligned with SMART CITY models or solutions that are automated, faster to implement, easy to manage, and more cost effective.

III. **PROJECT SCOPE OF WORK**

The CDRRMO plans to install five (5) flood sensors within the City identified by CDRRMO. The datasets will then be integrated into the existing display and storage system of CDRRMO along with the previously procured five (5) flood sensors that monitors the waterways.

**System Output**

- Operational Flood Sensors (5)
- Street Level Flood Analysis System
  - Data Storage and Processing
  - Graphs & Tables
  - Historical data
  - Alerts
  - Integration to existing Flood Risk Analysis System

**Technical Specifications**

1 Lot	Description	Delivery Time
1 Lot	<b>1. Five (5) Flood Sensors</b> <ul style="list-style-type: none"><li>• Water Level Monitoring (Telemetered)</li><li>• Cost effective climate monitoring solution</li><li>• DOST's Project NOAH certified equipment</li><li>• Power supply through solar</li><li>• Plug and play</li><li>• No programming and complex wiring</li><li>• Data Logger (Onset)</li><li>• Real-time access to data from any web browser</li><li>• Enables to monitor data 24/7 via web browser or smartphone.</li><li>• Alarm capabilities via text/email</li><li>• LCD display for easy field deployment</li><li>• Cloud-based data access</li><li>• Smart Sensor Connectors: 10 inputs.</li><li>• Logging Rate: Configurable for as low as one (1) second.</li></ul>	30 Calendar Days

	<ul style="list-style-type: none"> <li>• Optimum Range: 33 ft. (10 m)</li> <li>• Case Material: 316 stainless steel or PVC</li> <li>• Max Range: 50 ft. (15.2 m)</li> <li>Resolution</li> <li>• Digital: 0.0135 in. (0.3438 mm)</li> <li>• Analog steps: 4099 (0-10 VDC), 3279 (4-20 mA)</li> <li>• Interface: RS485</li> </ul>	
	<p><b>2. Sensor Service Maintenance, Warranty and Data Subscription</b></p> <p>Quarterly checking of station such as:</p> <ul style="list-style-type: none"> <li>• Water Level Sensor</li> <li>• Data logger</li> <li>• Battery</li> <li>• Solar Charge Controller</li> <li>• Solar Panel</li> <li>• 3-yrs coverage</li> </ul> <p>Replacement of devices and accessories such as:</p> <ul style="list-style-type: none"> <li>• Water Level Sensor</li> <li>• Data logger</li> <li>• Battery</li> <li>• Solar Panel</li> <li>• Solar Charge Controller</li> <li>• 3-yrs coverage</li> </ul> <p>Data Connectivity Subscription</p> <ul style="list-style-type: none"> <li>• 3 years coverage</li> </ul>	30 Calendar Days
	<p><b>3. Street Level Flood Risk Analysis System</b></p> <p>Data</p> <ul style="list-style-type: none"> <li>• Flood Sensor Data</li> <li>• Flood Risk Index Data Model</li> <li>• Provision of new API endpoint containing all collected and modeled data at <a href="https://api.iriseup.ph/endpoint">https://api.iriseup.ph/endpoint</a> API endpoint system</li> </ul> <p>Data Display</p> <ul style="list-style-type: none"> <li>• GIS, Table, Graph and Threat Matrix display of realtime and historical flood sensor data</li> <li>• GIS, Table, Graph and Threat Matrix display of Flood Risk Index Model with at least 12 hours forecast timeline</li> </ul>	30 Calendar Days

	<ul style="list-style-type: none"> <li>• GIS analysis overlaying data of flood sensor and flood risk index</li> <li>• Menu &amp; Settings to display clustered view, barangay view, per sensor view</li> <li>• Consolidation of existing and new flood sensors into one seamless and unified flood risk analysis system with categories “Street” “River” and other categories</li> </ul> <p>Report</p> <ul style="list-style-type: none"> <li>• Report Facility to assign automated email reports per barangay and its recipients</li> <li>• Email (HTML) Format</li> </ul> <p>Alerts</p> <ul style="list-style-type: none"> <li>• Alert Facility to provide flood monitoring and early warning alerts</li> <li>• SMS alerts for individual alerts with at least 500,000 credits</li> <li>• Integrated to existing Telegram alerts for group alerts</li> </ul> <p>Integration</p> <ul style="list-style-type: none"> <li>• Integration to existing flood risk analysis system</li> </ul> <p>Software License</p> <ul style="list-style-type: none"> <li>• Perpetual Software License with 3 year technical support and maintenance</li> </ul>	
	<p><b>4. Sensor Installation</b></p> <ul style="list-style-type: none"> <li>• 5 Locations</li> <li>• Site Survey</li> <li>• Installation and Calibration</li> <li>• Engineering works</li> </ul>	30 Calendar Days
	<p><b>5. Training</b></p> <ul style="list-style-type: none"> <li>• 1 Day Sensor Maintenance Training</li> <li>• 2 Days End User Training</li> </ul>	3 calendar days

	<ul style="list-style-type: none"> <li>All training will have eight (8) hours per day with five (5) attendees.</li> </ul>	
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IV. AREA OF COVERAGE

The sensor installation will cover five (5) locations within Quezon City and will be identified by the Emergency Operations Center (EOC) during the start of implementation. All identified locations below are still subject to change depending on the decision of CDRRMO.

STREET LEVEL FLOOD SENSOR	LOCATION
1	Barangay Tatalon, Victory Avenue
2	Barangay Roxas, Gumamela Street
3	Barangay Delmonte, West River Side Street
4	Barangay Santo Domingo, Retiro corner Don Jose Street
5	Barangay Loyola Heights, C. Salvador Street

V. PROJECT STANDARDS AND REQUIREMENTS

Bidders should have completed, a single contract that is similar to this Project or related to Supply, Installation and Maintenance of meteorological devices and data processing systems, equivalent to at least fifty percent (50%) of the ABC five (5) years from the date of submission and receipt of bids, a contract similar to the Project.

Bidders should have at least three (3) field staff for the installation and three (3) years on-going support and maintenance of 5 sensors. Bidders should have demonstrated experience and capacity to manage community based early warning systems in a highly urbanized city (HUC) in Metro Manila.

Bidders should have at least one (1) Meteorologist and one (1) IT-Data Science resources for Training and continuous consultation within the project as this is a science-based data driven project.

VI. PROJECT DURATION

The delivery period of the Project shall be within **thirty (30) calendar days** after the issuance of the Notice to Proceed.

VII. APPROVED BUDGET FOR THE CONTRACT

The approved budget for the contract amounts to **seventeen million five hundred seventy-five thousand three hundred thirteen pesos (P17,575,313).**

ITEM	BUDGET (PHP)
1. FIVE (5) FLOOD SENSORS	4,000,000
2. SENSOR SERVICE MAINTENANCE, WARRANTY AND DATA SUBSCRIPTION	2,000,000
3. STREET LEVEL FLOOD RISK ANALYSIS SYSTEM	8,400,000
4. SENSOR INSTALLATION	3,000,000
5. TRAINING	175,313
<b>TOTAL</b>	<b>17,575,313</b>

**VIII. BASIS OF PAYMENT**

Below are the deliverables that will be used as the basis for full payment.

Item	Deliverables	Payment Percentage
<b>Delivery &amp; Installation of Five (5) Flood Sensors set with Data Logger, Solar Panel and Data Connectivity</b>	Project Acceptance Document: Receipt, Inventory, Installation Completion and Maintenance & Warranty Certificate	15%
<b>Delivery of Street Level Flood Risk Analysis System</b>	Project Acceptance Document: Fully delivered system and documentation	75%
<b>Training</b>	Training Certificate	10%

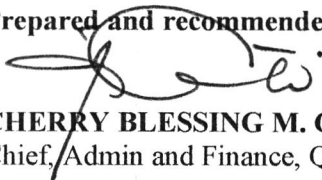
**IX. PENALTIES FOR BREACH OF CONTRACT**

Incomplete and delayed delivery will result in penalties based on standard Government implementing rules and regulations.


**X. CANCELLATION FOR OR TERMINATION OF CONTRACT**

Incomplete and delayed delivery and non-performance of services will result in penalties and termination of contract based on standard Government implementing rules and regulations.

Prepared and recommended by:

  
**CHERRY BLESSING M. GUTIERREZ**  
 Chief, Admin and Finance, QCDDRRMO

Noted by:

  
**RICARDO T. BELMONTE JR.**  
 Officer in Charge, QCDDRRMO  
 Secretary to the Mayor