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Improving resilience of Cagayan de Oro's water supply to flooding

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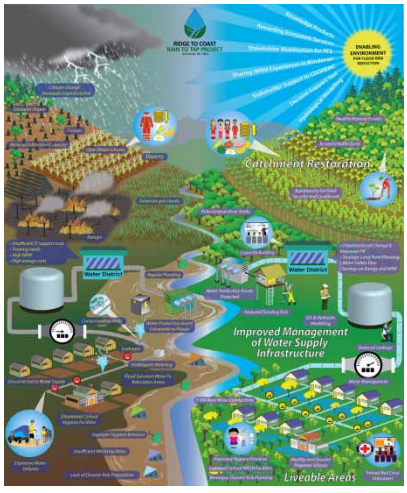
Abstract

The 'Ridge to Coast, Rain to Tap' (R2CR2T) project aims to address several identified factors in order to reduce flood vulnerability and improve the resilience of the water supply in Cagayan de Oro, Philippines. The project, which started on 1st January 2018, has adopted an integrated approach, working both directly on the water supply infrastructure and at a systemic level in the river basin. Through capacity development, investments and technical assistance, the project will provide a strong boost to improve the operations of the Cagayan de Oro Water District (COWD). Water supply coverage, sanitation services and disaster risk reduction are being expanded to up to 7,000 previously unserved households in relocation areas, primarily inhabited by people who lost their homes in the 2011 Sendong flood. In the upstream Cagayan de Oro River Basin (CDORB), several pilot reforestation interventions are being implemented in partnership with local Indigenous Peoples (IP) communities to demonstrate effective and sustainable ways for addressing the causes of flooding. The project aims to contribute to an enabling environment in which public and private stakeholders in CDO and Bukidnon Province cooperate towards flood risk reduction. The R2CR2T project is a Public-Private Partnership including partners Cagayan de Oro Water District, VEI, FITC, Unifrutti Tropical Philippines Inc, Cagayan de Oro River Basin Management Council, Hineleban Foundation, Bukidnon Indigenous Peoples Advisory Council, Wetlands International, Philippines Red Cross and Netherlands Red Cross. The R2CR2T project is 49% co-funded by the Netherlands Ministry of Foreign Affairs, and administered by the Netherlands Enterprise Agency (RVO) through the Sustainable Water Fund.

Key words: flooding, R2CR2T, resilience, water supply

Graphical Abstract



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LIST OF ACRONYMS

BIPAC	Bukidnon Indigenous Peoples Advisory Council
BPS	Booster Pumping Station
CDO	Cagayan de Oro
CDORB	Cagayan de Oro River Basin
CDORBMC	Cagayan de Oro River Basin Management Council
COWD	Cagayan de Oro Water District
DENR	Department of Environment and Natural Resources
DPWH	Department of Public Works and Highways
DRR	Disaster Risk Reduction
FITC	FRRL Industrial Trading Corporation
HFI	Hineleban Foundation Inc.
IP	Indigenous Peoples
JICA	Japan International Cooperation Agency
LGU	Local Government Unit
NLRC	Netherlands Red Cross
PPP	Public-Private Partnership
PRC	Philippines Red Cross
R2CR2T	Ridge to Coast, Rain to Tap (project)
RB-PMO	River Basin Project Management Office
USAID	United States Agency for International Developement
UTPI-MKAVI	Unifrutti Tropical Philippines Inc. – Mt. Kitanglad Agriventures Inc.
VEI	Vitens Evides International B.V.
WI	Wetlands International

INTRODUCTION

Severe flooding events Sendong/Washi (2011) and Vinta/Tembin (2017) have shown that the Cagayan de Oro River Basin (CDORB), Cagayan de Oro (CDO) institutions and citizens, and in particular CDO's water supply system are vulnerable to flooding. In Region X (Northern Mindanao), Tropical Storm Sendong led to over 1,250 casualties, damaged or destroyed 40,000 houses and interrupted water supply in CDO for three weeks (NDRRMC 2012). The primary booster pumping station of the CDO Water District (COWD), six production wells and COWD's bulk water supply were severely hit. Examples of the extent of the damages at COWD are shown in Figures 1 and 2.

A number of factors that contributed to the occurrence and impact of these flash floods have been identified (INREMP-WMPCO Talakag 2014; Mabao & Cabahug 2014; Franta *et al.* 2016), including the following:

- Steep topography and funnel-shape of the 1,380 km^2 CDORB, which is located mostly in Bukidnon Province and CDO
- Decades of deforestation and destruction of upstream forests due to logging, mining, *kaingin* (slash-and-burn farming) and large-scale monoculture farms
- The presence of formal and informal settlements in flood-prone areas
- Lack of preparedness among stakeholders, among which the CDO Local Government Unit (LGU) and COWD
- Widespread complacency about the potential for a tropical storm to produce disastrous flooding in the city
- As flash flooding occured around midnight, many people were taken by surprise in their sleep
- The increasing frequency and severity of tropical storms hitting central Mindanao, attributed to climate change.

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Figure 1 | Damaged genset at Production Well 19, Photograph: COWD.

Figure 2 | Flooded booster pumps at Macasandig BPS Photograph: COWD.

INITIATIVES TO INCREASE FLOOD RESILIENCE

Since the tragic events in 2011, initiatives aimed at increasing flood resilience have commenced at multiple levels (initiatives described below are not a comprehensive overview).

The Department of Public Works and Highways (DPWH), with the support of primary funders CDO LGU and Japan International Cooperation Agency (JICA), is working on a flood wall/flood dyke project on both river banks in the downstream section of the CDO river, aimed at protecting CDO's low-lying urban areas. While several sections have been constructed, other sections are far

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from completion, as DPWH is still in the process of relocating the current land owners. Protection by the flood wall/flood dyke is anticipated to become effective around 2025.

The Cagayan de Oro River Basin Management Council (CDORBMC) was created in 2010 under the lead of the Archdiocese of Cagayan de Oro City and the Regional Department of Environment and Natural Resources (DENR 10) through the River Basin Project Management Office (RB-PMO). The CDORBMC acts as a Multi-Stakeholder Platform in which stakeholders interact to improve common understanding, define roles and agree on joint action towards sustainable ridge to reef management, based on principles of good governance. In 2013, the CDORB had a population estimated at just over 500,000 inhabitants (INREMP-WMPCO Talakag 2014). Tropical Storm Sendong in 2011 was a wake-up call to coordinate all efforts to improve river basin management.

COWD, supported by JICA and USAID, has implemented various interventions to increase flood resilience and reduce down-time in case of another large flood. These interventions include the following:

- Partial replacement of centrifugal pumps by submersible pumps and elevation of control panels and transformers at Macasandig Booster Pumping Station (BPS)
- Elevation or relocation of the laboratory facilities and offices at Macasandig BPS
- Installation of submersible pump-motor assemblies at six existing and one new production well, elevation of all controls above Sendong flood level
- Five generator sets mounted on mobile carts to enable evacuation during typhoon signals
- Drafting of an Emergency Response Plan (COWD 2017), clearly defining roles, responsibilities, actions and protocols in case of storm signal warnings by the Philippines Atmospheric Agency PAGASA.

COWD's response to the floods caused by tropical storm Vinta showed that these measures have been somewhat effective, as COWD's water interruptions were limited to one week. Nevertheless, additional measures are required to reduce COWD's flood vulnerability further.

PPP PROJECT: RIDGE TO COAST, RAIN TO TAP

The 'Ridge to Coast, Rain to Tap' (R2CR2T) project has adopted an integrated approach to reduce flood vulnerability and improve the resilience of the water supply in the CDORB. Flood resilience is being tackled both directly at the level of the water supply infrastructure and at a systemic level in the river basin. Through capacity development, investments and technical assistance, the project will provide a strong boost to improve the operations of COWD. These activities include Water Safety Planning, Non-Revenue Water reduction, GIS and hydraulic modeling, increased efficiency HR processes and COWD succession planning. Water supply coverage, sanitation services and disaster risk reduction are being expanded to up to 7,000 previously unserved households in relocation areas, primarily inhabited by people who lost their homes in the 2011 Sendong flood. In the upstream CDORB, several pilot reforestation interventions are being implemented in partnership with local Indigenous Peoples (IP) communities to demonstrate effective and sustainable ways of addressing the causes of flooding. The project aims to contribute to an enabling environment in which public and private stakeholders in CDO and Bukidnon Province cooperate towards flood risk reduction.

Figure 3 shows the project's 'Theory of Change', a schematized illustration showing the current problems on the left and the desired future situation on the right.

The EUR 6 million R2CR2T project started in January 2018 and will be completed by December 2022 (5 years). The project is 50% subsidized by the Netherlands Ministry of Foreign Affairs, while the other half is funded by the project partners. The R2CR2T Public-Private Partnership consists of multiple formal and implementing partners:

- Public: Cagayan de Oro Water District (COWD)

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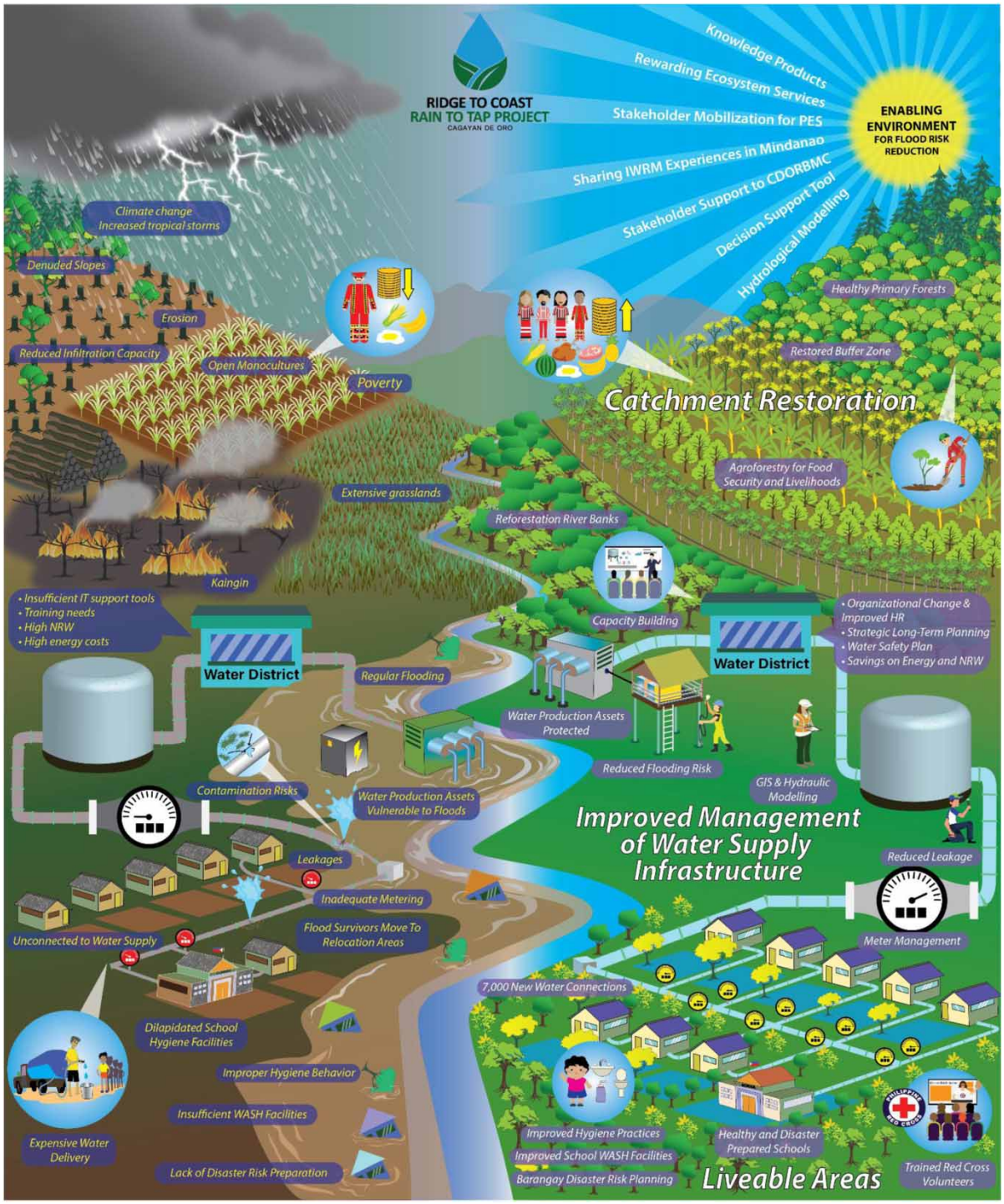

Figure 3 | Theory of Change, Ridge to Coast, Rain to Tap project. Illustration: Warwin Sabasaje, 2018.

- Private: Vitens Evides International B.V. (VEI), FRRL Industrial Trading Corporation (FITC), Unifrutti Tropical Philippines Inc. – Mt. Kitanglad Agriventures Inc. (UTPI-MKAVI)
- Non-governmental/non-profit: Cagayan de Oro River Basin Management Council (CDORBMC), Hineleban Foundation (HFI), Bukidnon Indigenous Peoples Advisory Council (BIPAC), Wetlands International (WI), Philippines Red Cross (PRC), Netherlands Red Cross (NLRC).

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FLOOD RESILIENCE STRATEGY

The R2CR2T project targets improved flood resilience at four different levels:

1. **Enabling Environment for Integrated River Basin Management (IRBM).** Support is provided to the CDORBMC via knowledge development, financing of staff, business/action planning and knowledge sharing events. A hydrological model and Decision Support Tool will be developed to support fact-based decision making and lobbying for implementation of restoration measures among the CDORB's main land-users, decision makers and potential financiers for reforestation projects. Scaled up across the CDORB, ecosystem conservation measures can improve the hydrological characteristics of the catchment through retention of upstream water and reduction of peak flood levels. Further long-term benefits are improved water quality, reduced siltation of the downstream Macajalar Bay (which is crucial for the health of its reefs) and restored sustainable recharge of groundwater aquifers, which many CDO stakeholders including COWD use as their primary source of water.
2. **Reforestation pilots in Talakag, Bukidnon.** In the impoverished and politically volatile upper reaches of the CDORB, reforestation is being implemented in close partnership with Indigenous Communities according to Hineleban Foundation's Rainforestation methodology (Hineleban Foundation website 2018). Addressing the drivers of deforestation and poverty in these rural areas is key. As these areas are all Ancestral Domains, local IP communities take a leading role in the identification of suitable interventions. Participatory Cultural Impact Assessments have been conducted by the Bukidnon Indigenous Peoples Advisory Council (BIPAC) with three IP communities in Lirongan and Baylanan, Talakag, building support for a combination of food-security, livelihood generation and reforestation measures. 146 ha of currently low-yield agricultural land are being converted to agroforestry, (re-)introducing adlai (an endemic grain used as alternative for rice), abaca (a banana-like plant used to produce fibre), coffee and goats as livelihood alternatives. The Hineleban Foundation further supports the entire supply chain by offering transport, processing, packaging, marketing and sales at up-market prices, ensuring higher returns for the farmers, who are paid double to triple the going market rates for these crops. In parallel, 150 ha of erosion-prone river gullies are being reforested, as well as 15 ha of degraded buffer zone of the Mount Kitanglad Range National Park, contributing to the protection of some of the last remaining primary forests in Mindanao, which are located directly uphill.
3. **Resilient COWD water supply infrastructure and disaster preparedness.** Adaptations will be made to six of COWD's most flood-prone production wells, such as elevation of electrical controls and generators at production wells, or mobilization of generators onto carts. The generators at the main booster pumping station, Macasandig, will undergo similar adaptations, while a flood-proofing of the main booster pumps building is envisaged. COWD's Emergency Response Plan has been reviewed and annual flood drills are being conducted in preparation of Mindanao's typhoon season, which runs from November to February. Apart from these flood-resilience measures, distribution extensions and household connections for 7,000 families living in relocation areas are under construction.
4. **Disaster Risk Reduction (DRR) at CDO's barangays and schools.** In further support of the 7,000 households that are being connected to safe water supply in CDO's relocation areas, the Philippines Red Cross (PRC) has started implementing Water, Sanitation and Hygiene (WASH) behaviour change and DRR programs. These programs are aimed at the 7,000 families, four nearby schools and DRR officials of the five barangays in which the project is working. This will be achieved via Vulnerability Capacity Assessments, Disaster Risk Reduction Plans and related trainings and practice drills.

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CONCLUSION

By December 2022, the 'Partnership for Sustainable Water Supply: Ridge to Coast, Rain to Tap' and its funding agency, RVO, intend to provide sustainable water supply to flood relocation areas and vulnerable communities in CDO city. The project will contribute to increasing the resilience of the river catchment, CDO's water supply system and the communities themselves to heavy rainfall, flooding and power outage events.

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