Community Mapping for Disaster Risk Reduction and Management

Harnessing Local Knowledge to Build Resilience

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Philippine Disaster Risk Context

The Philippines is known to be highly vulnerable to natural hazards. The country is ranked third out of 173 countries in terms of vulnerability to disaster risks[1] and is considered as among the most vulnerable to climate change impacts. The Philippines is geographically located in the Pacific Ring of Fire, characterized by an ocean encircling belt of active volcanoes and earthquake generators. It is also along the path of turbulent typhoons, resulting in an average of about 20 crossing the Philippine area of responsibility annually. The archipelagic nature of the Philippine coastal areas increases its susceptibility to storm surges, tsunamis and sea level changes. Flooding, especially in urban areas, is common due to rains brought by typhoons and the monsoon.[2]

Disasters cause significant impacts in terms of damages to public and private assets. According to the Office of the Civil Defense, from 1970 –2009, average direct damage from disasters per year ranged from Php5 billion to Php15 billion (US $100 Million to US $300 Million). Cost of direct damage is equivalent to more than 0.5% of the national GDP.[3] In 2009, typhoons Pepeng and Ondoy caused the country a total of Php39 billion worth of damages in Luzon, including Metro Manila. And most recently on November 8, 2013, Supertyphoon Yolanda (Haiyan) wreaked havoc in central Philippines where 3.4 million families were affected and a total of Php 571.1 billion cost of damages and losses.[4]

National Disaster Risk Reduction and Management Act (Republic Act No. 10121) is the overarching policy that addresses the country's vulnerability to natural hazards. From 2010, the NDRRM Law ushered in a paradigm shift from emergency and relief operations to a more proactive approach that focuses on risk reduction through preparedness, mitigation, and prevention. The Law institutionalized the local Disaster Risk Reduction and Management (DRRM) offices and strengthened the mandates of the local DRRM Councils. It empowered local governments to prepare their DRRM plans and utilize at least 5% of their annual budget to support these plans.

Many local governments recognized the urgency and importance of integrating DRRM into decision-making. However, the requirements of RA10121 posed a challenge for local governments, whose land use and development plans were mostly outdated or were prepared by external experts tapped by local governments. Another barrier for local government units (LGUs) is accessing technical information on natural hazards that is required for DRRM actions and decision-making.

Box 1. 18 Major River Basins*

The River Basin Control Office of the Department of Environment and Natural Resources identifies 18 river basins or watersheds with drainage area greater than 1,400 square kilometers, covering 66 provinces, 56 cities, and 553 municipalities. Covering 36% of the total land mass of the Philippine archipelago, these 18 watersheds have been prioritized for integrated flood risk management.

These watersheds are:

1. Cagayan
2. Mindanao
3. Agusan
4. Pampanga
5. Agno
6. Abra
7. Pasig-Laguna de Bay
8. Bicol
9. Abulug
10. Tagum
11. Ilog-Hilabangan
12. Panay
13. Tagoloan
14. Agus
15. Davao
16. Cagayan de Oro
17. Jalaur
18. Buayan-Malungun

* *While the terms river basin and watershed are almost the same in most cases, river basin normally refers to "catchment area, drainage basin, or catchment basin" while the term "watershed" focuses more on the landforms within including not only movement of water but the ecology of the area. Moreover, river basin usually connotes very large catchments. In most cases, watersheds that cause flashflooding in the Philippines come from medium - small sized watersheds.*

Tributaries of Pampanga River in Candaba, Pampanga

Supporting LGUs to Take DRRM Actions

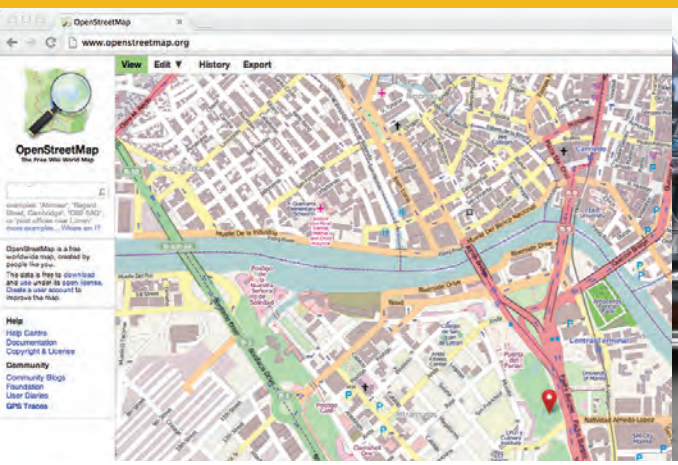
The Department of Interior and Local Government (DILG) has initiated various programs to support LGUs in DRRM and Climate Change Adaptation (CCA) planning and implementation. These programs include issuance of instructions and guidelines on mainstreaming DRRM and CCA into local government systems and processes; forging partnerships with critical institutions and stakeholders; and prioritization of LGUs that are high risk to flooding as these are located in the 18 major watersheds which include, among others, the Pampanga Watershed. The three LGUs along the Pampanga River participated as pilot sites to this Project, these are the municipalities of Lubao, Candaba and Guagua.

LGU access to hazard and risk data through user friendly tools that analyse this information is crucial to DRRM and CCA plan formulation and implementation. In support of this process, CSCAND[5] agencies have been producing hazard maps for LGUs at most at risk regions of the Philippines. These efforts are complemented by the Project NOAH, the Philippine government's flagship program with its mission "to undertake disaster science research and development, advance the use of cutting edge technologies and recommend innovative information services in government's disaster prevention and mitigation efforts."

Box 2. What is Project NOAH?

Launched in July 2012, Project NOAH -- Nationwide Operational Assessment of Hazards is a responsive disaster management program that makes use of advanced scientific research and cutting-edge technology to reduce risks in highly vulnerable communities. Its main objective is to prevent and mitigate disasters. NOAH provides 6-hour lead time warning to vulnerable communities against impending floods. Available in the NOAH website and mobile applications are hazard maps showing flood-prone areas discernible at a local scale or community level, anytime, anywhere. http://noah.dost.gov.ph/

Community Mapping using OpenStreetMap (OSM) Tools



OSM data and associated community mapping tools are effective at providing rapid support to LGU efforts in disaster risk reduction and management. As part of the Project activity and in line with the DILG's continuing support to LGUs in disaster preparedness and risk reduction, ESSC[6] implemented a series of training activities on community mapping methods, specifically using OSM.[7]

The OSM training familiarizes participants with OSM data and simple tools to enable them to produce a more robust municipal base map. The training is a combination of presentations, workshops, guided demonstrations and field work activities in selected barangays within each municipality.

A three-day training can produce significant improvements to the OSM base map, including:

- roads including road classification and names;
- waterways such as rivers, streams and irrigation canals;
- public facilities such as schools, open spaces, barangay halls, public buildings, places of worship, and other structures that serve as evacuation centers during calamities;
- land use such as agriculture and commercial and residential areas; and, administrative boundaries at the municipal and barangay levels.

Box 3. What is OSM?

OpenStreetMap, or simply OSM, is more than just a map. It includes the global community of over 1 million mappers who work mostly as volunteers to create free and open maps online. Unlike other web maps, the full data can be accessed and downloaded from the OSM portal. Contributing to OSM initially requires the help of experienced mappers to support local communities, private and public stakeholders, who work together to collect and share detailed information about their surroundings. Community stakeholders are the best resources when collecting localized information and identifying specific buildings like schools or churches, as well as roads and waterways on a map. OSM tools can easily be taught to build the capacity of local stakeholders to use and update the data.

The OSM Community has supported Disaster Resilience in the Philippines by providing data and mapping services for response and recovery in several major disasters including Typhoon Yolanda. Before disasters strike, volunteer OSM mappers also help to create data for emergency preparedness and other development challenges. http://www.openstreetmap.org/

Municipality of Candaba

BEFORE

AFTER

Figure 1. The shape of the Pampanga River was improved to make its width more realistic. Streams connecting to the river were also digitized as well as the roads in the municipality. Land uses and commercial establishments were updated. The municipal and barangay boundaries were also uploaded on OpenStreetMap.

Municipality of Guagua

BEFORE

AFTER

Figure 2. Roads were added and tagged properly. Rivers, fish ponds, streams and other types of land use were traced from Bing Aerial Imagery. Major points of interests for DRR-mapping were plotted such as evacuation centers, health facilities and social services.

Municipality of Lubao

BEFORE

AFTER

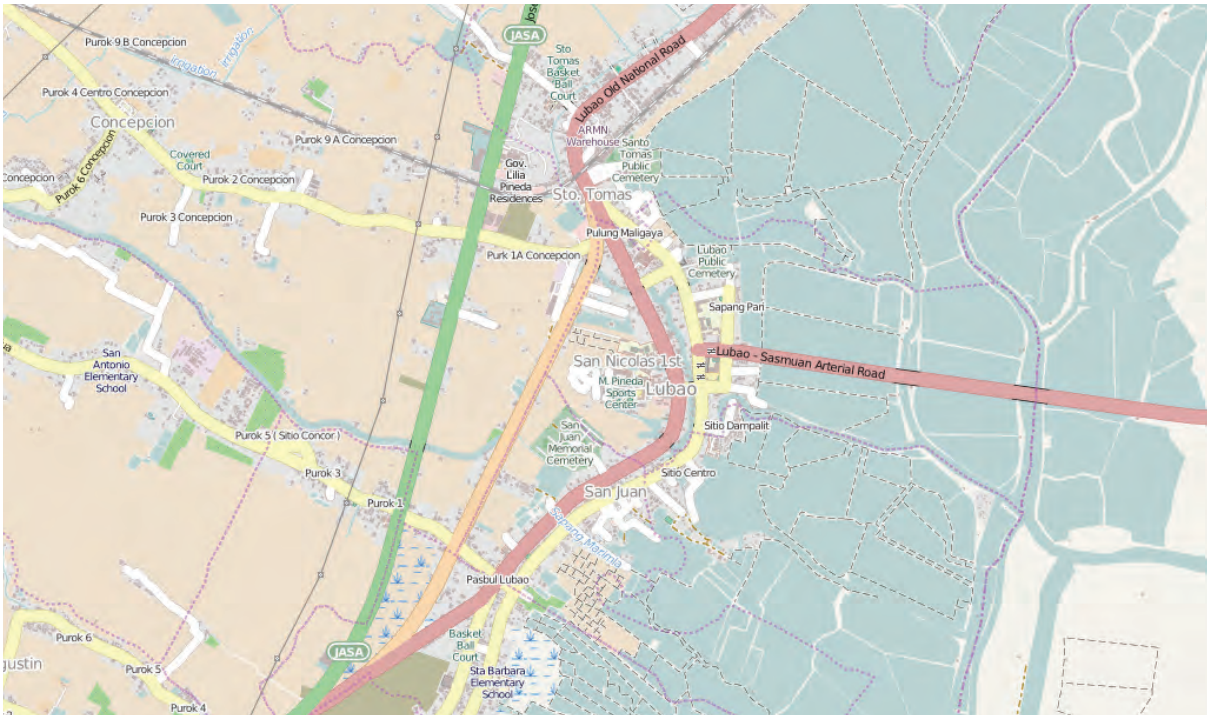
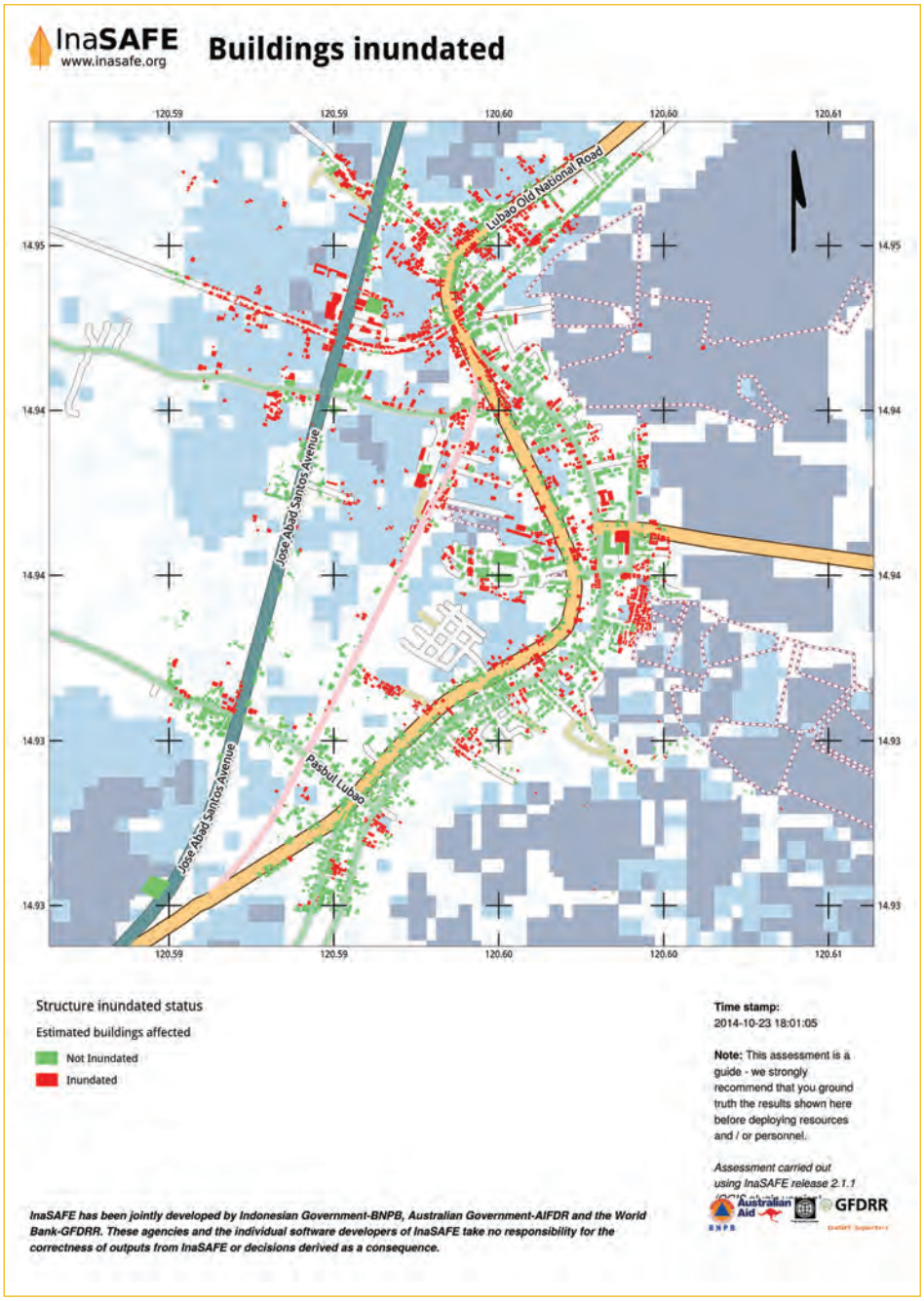


Figure 3. Buildings and land use types were the priority of Lubao mappers. Commercial establishments, residential and institutional buildings were added on the map. Individual buildings were traced from Bing Aerial Imagery and other roads were tracked using GPS device. The municipal and barangay boundaries were also uploaded to OpenStreetMap.

InaSAFE Tool for DRRM Planning



InaSAFE training can build the capacity of Municipal Planning and Development Coordination and Disaster Risk Reduction and Management Offices in an LGU. Training provides participants with a basic understanding of using InaSAFE to integrate base maps from OSM and currently available flood hazard information to develop impact scenarios within their municipality. Each municipality produces flood impact maps showing the risk to infrastructure, settlements, and population at the barangay scale. These maps can then be used as additional inputs to existing LGU disaster contingency plans and comprehensive land use plans.

Figure 4. InaSAFE impact results of inundated buildings due to flood in Lubao, Pampanga.

Box 4. What is InaSAFE?

InaSAFE is free software that produces realistic natural hazard impact scenarios for better planning, preparedness and response activities. InaSAFE provides a simple but rigorous way to combine data from scientists, local governments and communities to provide insights into the likely impacts of future disaster events. InaSAFE can be run on a standard desktop or laptop computer and does not require an internet connection. http://inasafe.org/

WebSAFE is a new tool based on InaSAFE developed by Project NOAH to meet the DRRM needs of the Philippines. It provides simple impact analysis through a webportal using the high-resolution hazard data on landslides, flood, and storm surge produced by Project NOAH technical experts. http://noah.dost.gov.ph/

Lessons Learned

When Typhoon Glenda struck we were able to use the updated maps to support evacuations in our coastal barangays. The community mapping process helped us to identify better access roads and to capture this in our maps.
- **Edgar Dabu, DRRM Officer of Lubao**

The following lessons have been learned from the project implementation experience in the pilot municipalities of Pampanga:

- OSM data and associated community mapping tools are effective at providing rapid support to LGU efforts in disaster risk reduction and management, including strengthening of contingency plans and risk-sensitive land use plans.
- Strong commitment of LGUs is required to train the staff who will embody the capacities to oversee and coordinate these new DRRM activities.
- Support of the local OSM volunteer community is needed to enhance training and workshop activities, online support, and quality checking the edits to ensure the reliability and accuracy of the data produced in OSM.
- Continued monitoring and capacity building is needed especially on the use of InaSAFE and WebSAFE to support integration in the disaster risk reduction and land use planning processes.
- Planning for local DRRM actions needs to include a broader understanding of the dynamics of the hydro-meteorological context within the watershed and consider coordination at the provincial level as the central management unit that could promote collaboration between municipalities.
- Partnerships are needed with technical experts, including Project NOAH, to share updated and accurate map data on flood and other hazards.

6 Simple Steps for DRRM Planning

1. **Review current disaster plans and set inclusive goals.** Through a participatory process, consolidate current CLUP, DRRM plan, contingency plan and other DRRM initiatives. Consolidate data inputs and maps from various departments, and check with technical agencies to find updated data and information about hazards. Agree on priorities and goals for new plans.

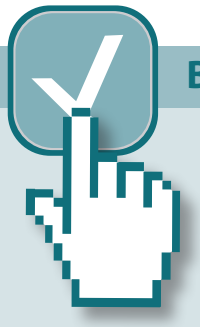
2. **Organize multi sector teams and expand local capacity.** Form a core team to assess gathered information and identify the gaps. The team should include representatives from various government departments such as DRRMO, planning, engineering, agriculture, social welfare, human resource, as well as Barangay representatives, civil society groups, and academia. Identify training needs for mapping and planning to target capacity building activities.

3. **Conduct community mapping.** Use community mapping tools and collaborate with experts from the OSM community to improve mapping of critical infrastructure and community assets.

4. **Analyse disaster impacts.** Freely available tools such as InaSAFE and QGIS can be used to analyse the new map data and hazard information to show risk impacts. Integrate the results to enhance the DRRM and contingency plans in existing land use and development plans.

5. **Achieve policy actions through consultation.** Present draft plans through public consultations with various sectors to get approval of **local Sanggunian**. Seek the approval of the local legislative body for formulation of new policies needed to carry out the plan. Complement the regulatory measures through the implementation of programs and projects that will improve the general welfare of the community. Collaborate with LGUs in the same watershed area for collective and integrated actions.

6. **Engage in a dynamic process.** Actions for building resilience to disaster and climate change should be dynamic and respond to changing hazards and changing needs of the communities they impact. The tools and approaches presented in this brochure offer a starting point to be improved as more LGUs are empowered to use and adapt them for their needs.



Box 5. Minimum Requirements for LGU Community Mapping

To replicate the process, you need to have:

- ✓ Basic computer literacy
- ✓ Access to internet connections and electricity
- ✓ Computers with minimum RAM of 2GB
- ✓ Installed QGIS - *free and open source QGIS software can be easily downloaded at http://www.qgis.org/*
- ✓ Geospatial datasets - *data on flood, landslides, and storm surge can be found on Project NOAH webportal at http://noah.dost.gov.ph/*
- ✓ *Basic orientation and training on mapping tools (ie. OSM, InaSAFE, etc.). Self-instruction materials are here: http://learnosm.org/, http://inasafe.org/, Experts to help with training can be found here: https://wiki.openstreetmap.org/wiki/WikiProject_Philippines/Services#Training*
- ✓ *Commitment to regularly update the maps*

About the Project

In May 2013, the World Bank, the Department of Interior and Local Government, and the Institute of Environmental Science for Social Change launched a project on Community Mapping and LGU Decision Support Tools for Disaster Risk Reduction and Management.

Through ESSC, the project provided training and capacity building using OSM and InaSAFE including development of learning materials, assistance in monitoring data edits and online forum support. The Provincial Government of Pampanga and the municipalities of Candaba, Lubao and Guagua actively participated in the series of workshops and consultation meetings, shared their time and resources especially in data collection, collaborative editing, impact analysis and contingency planning. Technical assistance was also extended by DILG and Project NOAH.

The contributions of LGU officials, community members, and expert OSM volunteers are gratefully acknowledged as part of the success of this pilot.

This project was supported by funding from the Australian Aid Infrastructure for Growth Trust Fund.

Endnotes

[1]World Risk Index 2011, United Nations University - Institute for Environment and Human Security

[2]Management, 3rd AIPA Report. http://www.aipasecretariat.org/wp-content/uploads/2011/07/3.Disaster-Response-Management.pdf.

[3]NDRRMC, April 17, 2014, NDRRMC Update, Updates re Effects of Typhoon Yolanda, NDRRMC, Quezon City.

[4]DILG. Program Briefer: Enhancing LGU Capacity on Disaster Risks Reduction and Management and Climate Change Adaptation. http://www.dilg.gov.ph/PDF_File/transparency/DILG-Transparency-2012127-3c399b2296.pdf.

[5]CSCAND refers to Collective Strengthening of Community Awareness of Natural Disasters which is composed of the Philippine Institute of Volcanology and Seismology (PHIVOLCS); the Mines and Geosciences Bureau (MGB); the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA); the Office of Civil Defense (OCD); and the National Mapping and Resource Information Authority (NAMRIA).

[6]ESSC or Institute of Environmental Science for Social Change is a Jesuit research organization that promotes environmental sustainability and social justice through the integration of scientific methodologies and social processes. http://www.essc.org.ph

[7]Environmental Science For Social Change, February 2014, Project Completion Report on Community Mapping And Local Government Decision Support Tools For Disaster Risk Reduction Candaba, Guagua, and Lubao In Pampanga Province (May To December 2013), Quezon City, Philippines.

Credits

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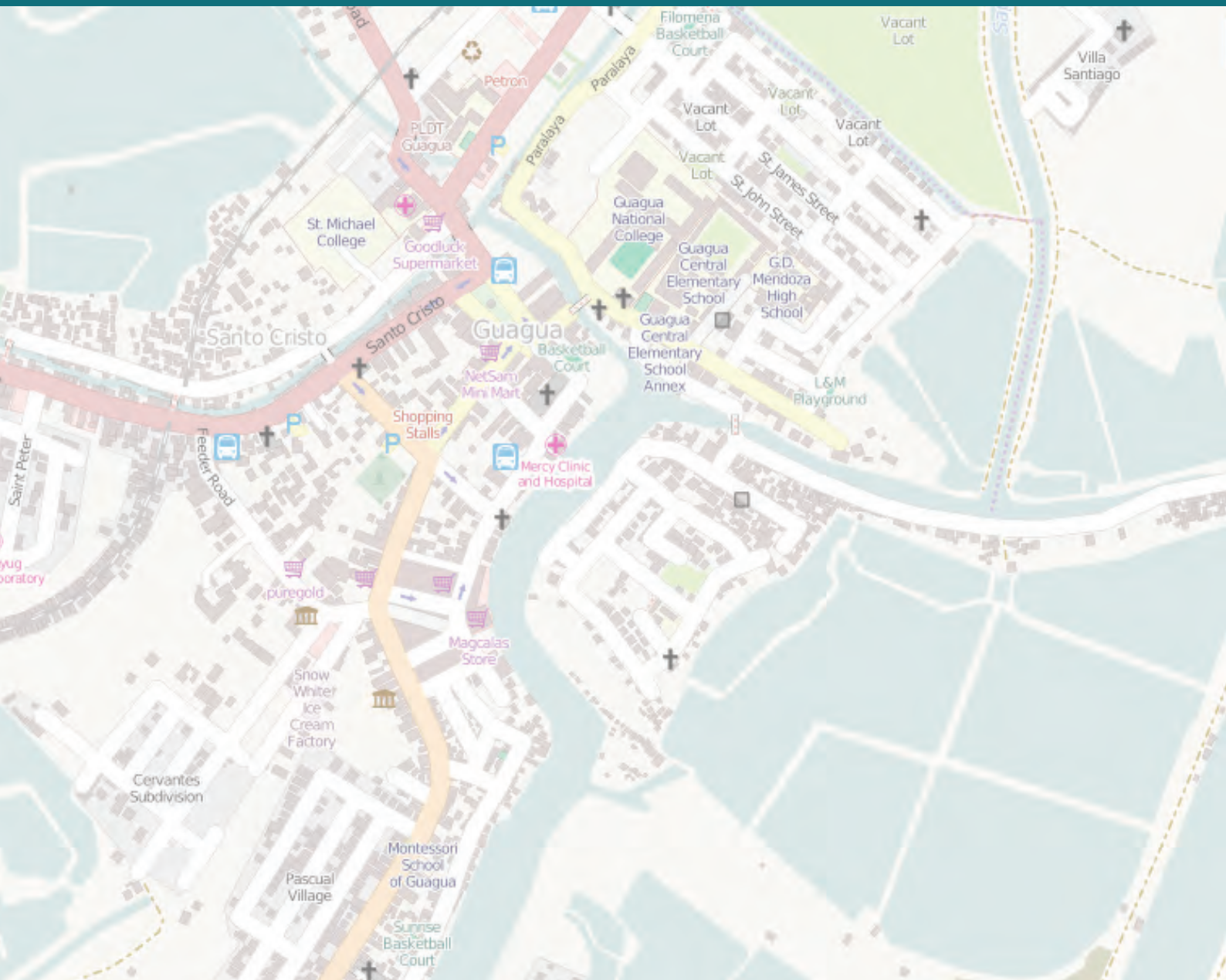
Filomena Basketball Court
Vacant Lot
Villa Santiago
Petron
Paralaya
PLDT Guagua
Vacant Lot
St. James Street
St. John Street
St. Michael College
Goodluck Supermarket
Guagua National College
Guagua Central Elementary School
G.D. Mendoza High School
Santo Cristo
Guagua
Basketball Court
Guagua Central Elementary School Annex
L&M Playground
NetSam Mini Mart
Shopping Stalls
Feeder Road
Mercy Clinic and Hospital
puregold
Magcalas Store
Snow White Ice Cream Factory
Cervantes Subdivision
Montessori School of Guagua
Pascual Village
Sunrise Basketball Court