



Department of Environment and Natural Resources

RIVER BASIN CONTROL OFFICE

**Formulation of an Integrated River
Basin Management and Development Master Plan
for Iloilo-Batiano River Basin**

FINAL REPORT

Volume 1

EXECUTIVE SUMMARY

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**CENTER FOR
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A. Rationale/Background

1. The River Basin Control Office (RBCO) of the Department of Environment and Natural Resources (DENR) was created by the President of the Philippines through Executive Order (EO) No. 510 on March 5, 2006, as a coordinating body, which is mandated to rationalize various river basin projects and programs in the Philippines. On July 6, 2009, Executive Order No. 816 was issued which declared that RBCO is the lead government office for integrated planning, management, rehabilitation and management of the country's river basins.
2. Subsequently, Resolution No. 2012-001 dated May 2, 2012 was passed by Cabinet Cluster on Climate Change Adaptation and Mitigation on the adoption of river basins in mainstreaming climate change. Furthermore, in line with Philippine Development Plan, integrated river basin management (IRBM) approach will be applied in the preparation for river basin planning.
3. In this regard, the plans and directions of RCBO are the development of an integrated river basin master plan for various river basins nationwide, which include Iloilo-Batiano River Basins (IBRB). With this direction, RBCO tapped the services of Center for Environmental Studies and Management Inc. (CESMI) to carry out the Master Planning of IBRB.
4. The main objective of the project is to formulate an Integrated Iloilo-Batiano River Basin Management and Development Plan that is consistent with national development objectives and sound water resources development and management practices.
5. The study area covers the entire Iloilo-Batiano River Basin, which transcends from ridge to coast. Although with limited resources, primary information were gathered from stakeholders and ocular observations, while bulk of inputs are secondary data from current plans, reports, literatures and other documents. However, in view of the suggestion of the steering committee, other river basins with direct impact to the study area were considered in the analysis, such as the Tigum-Aganan-Jaro River Basin.
6. The study area is Iloilo-Batiano River Basin, which lies in about north latitude 10 degrees 40 minutes 49 seconds to 10 degrees 46 minutes 40 seconds, and east longitude 122 degrees 26 minutes 23 seconds to 122 degrees 35 minutes 9 seconds. It is bounded by Tigum-Aganan-Jaro River Basin in the north-east, Sibalom River Basin in the west, and Iloilo Strait in the south. The rivers are sandwiched by sandbar and alluvial plain formed by its tributaries, which flows about 16km along the coastal line from west to east with a drainage area of 107 km² and gentle gradient of 1/4,000. It has four main tributaries flowing into Iloilo River which run almost in parallel from north to south, namely Cabaluan River, Mambog Creek,, Calajunan Creek, and Dungon Creek. While, the administrative coverage are large parts of Iloilo City and Oton and portions of Pavia, Sta. Barbara and San Miguel in the province of Iloilo.

7. In recognition, Iloilo River claimed international awards, while it was inspiring to note that the general objective of first Batiano Summit is to “Place Batiano River on the Map.”

B. Natural and Physical Condition

1. Geomorphology is the scientific study of landforms and the processes that shape them. It is the large part of study on the formation of terrain or topography, while terrain is the vertical and horizontal dimension of land surface. In fact, geomorphology is one of the many branches of the science of geology. The DPWH 2000 report for Iloilo Flood Control Project (IFCP) describes the geology in the area, its topography which ranges from mountains to flood plains and coasts, as well as slope gradient which ranges from 50 per cent in the mountain area to relatively flat in flood plains.
2. The area is monsoonal and governed by two (2) types of climate with southern portion as classified under the Type 1 climate with two pronounced season, which is dry from November to April and wet during the rest of the year. The other half of the said area belongs to Type III in which the seasons are not very pronounced. The average annual rainfall is estimated at 1, 954 mm on the basis of measurement record from 1903 to 2002. The highest mean monthly rainfall is 365.7 mm in August while the lowest mean monthly rainfall is 21.5 mm in February. The mean annual temperature in Iloilo City is 27.6°C, the highest monthly mean temperature is 29.1°C in May, and the lowest mean temperature is 26.2°C in January. While the monthly relative humidity ranges from 73 per cent to 85 percent.
3. Iloilo City a first class city and its neighboring municipalities have been subjected to flooding, especially during the passage of tropical cyclones that bring heavy rainfall, and one of these is Typhoon Frank on June 20, 2008. The recurring inundation of extensive areas in the city has disrupted the lives of people in the community and inflicted damage to crops and property, and regrettably, has caused deaths to human lives. Under these circumstances, Iloilo Flood Control Project was implemented to attain a safer and a more pleasant urban environment for the city.
4. The manifestations of climate change consist of rising temperature; variability of rainfall; frequency and intensity of typhoons; sea level rise; risks of more drought, floods, heat waves, forest and grassland fires; impact on economy, environment and communities. The baseline data of PAGASA for observed average seasonal mean temperature from 1971-2000, as well as seasonal rainfall projected in 2010 the changes in annual mean temperature and rainfall for 2020 and 2050. Based on these, the MDG reported that it is very likely that hot temperature and heavy rainfall will continue to become more frequent in the future. The number of days with maximum temperature more than 35 degree centigrade is expected to increase in all parts of the country and extreme rainfall is projected to increase in Luzon and Visayas in 2020 and 2050.

5. The current land use of the study area as identified by DENR-EMB consists mainly of agricultural areas of about 45 percent, residential of about 37 percent, including minimal percentage of commercial, industrial, fishponds and others. In terms of land use, Iloilo City has low level and flat features, 90 per cent of land mass has an elevation of 2.637 m above sea level, while the municipality of Oton varies from plain to rolling hills.

C. Socio-Economic Condition

1. Western Visayas has a fast-growing population especially in the highly urbanized cities of Bacolod and Iloilo, increasing population density given the limited land area. The region's economy was fueled primarily by agriculture with palay, corn and sugarcane as major crops. Unemployment was low but underemployment was rather high. With this backdrop, the people from rural agricultural areas in the six provinces of the region tend to migrate to the highly urbanized cities in search for more lucrative employment outside the agricultural sector. In-migration to cities have led to the sprouting of settlements along river banks including the Iloilo-Batiano River Basin.
2. The socio-economic context of the Iloilo-Batiano River Basin is that of urbanized areas with a growing population and increasing population density, relying both on commercial/industrial as well as agricultural production. The province of Iloilo had a population growth rate of 1.48 while Iloilo City had a growth rate of 1.49. Iloilo City has a population of 418,710 in 2007, and increased to 424,619 in 2010. However, the Municipality of Oton has a total population of 82,572 based on the 2010 census and a very slight increase from its 82,525 population in 2007.

D. Water Resources

1. The main river systems near the study area are Jaro River, Tigum River, Aganan River, Sibalom River and Jalaur River. However, the study considered in the analysis the adjacent river systems of Jaro River Basin and that flow through Iloilo City and neighboring municipalities. The Jaro River Basin is larger than Iloilo River Basin and is composed of two sub-basins, namely the Tigum Sub-River Basin and Aganan Sub-River Basin.
2. At present, there are no functional stream-gauging stations within the area, both in Jaro and Iloilo River basins. The discharges of the Tigum River and the Inabasan River, a tributary of Aganan River, were previously monitored by former Bureau of Public Works. However, the flow capacities of Jaro and Iloilo Rivers as well as for a short reach of the Tigum and Aganan Rivers upstream of their confluence of Jaro River were obtained from available report. Furthermore, the Iloilo-Batiano rivers are being studied by DENR.

3. The Iloilo-Batiano River System Water Quality Management Area (IBRS WQMA) was designated by virtue of DENR Administrative Order No. 11, Series of 2009. This Order reflects the basic objectives and policies for the proper management of the Iloilo-Batiano River System. Through this an assessment of water quality condition is being spearheaded by the Environmental Management Bureau of DENR for Iloilo-Batiano River System WQMA.
4. Iloilo City's drainage/sewerage system receives both untreated wastewater and storm water. Concomitantly, most of solid waste and domestic garbage from upstream, ocean vessels, residents along its embankment find its way to the river system and those carried by the ocean current intrude into this body of water during high tide. . It is also the main drainage and depository of most of the sewage from residential and commercial areas.
5. The assessment of former National Water Resources Council (NWRC) now National Water Resources Board (NWRB) in 1980 of groundwater study indicated an evaluation of well data. The evaluation of the well data from report and information by various agencies show well depths, static water levels, discharge capacities and other groundwater parameters in the Province of Iloilo.

The aerial extent of groundwater areas as reported in the groundwater map of Iloilo shows the actual extent of shallow well, deep well and difficult areas in the province. Included are the relevant data on average static water average capacities and average well depths of specific areas.

6. To refine the findings of the said rapid assessment, it was followed by Groundwater Resources Investigation which was conducted in 1980's by NWRC and the National Hydraulic Research Center (NHRC), College of Engineering of the University of the Philippines. One of the aims of this groundwater survey was to determine approximately the occurrence of groundwater and the possible extent of salt water intrusion in the study area, which would serve as inputs in the management of groundwater resources.
7. The water resources in the study area are used for varied purposes. The groundwater resource is basically utilized for domestic water supply through wells equipped with either hand pumps or motor-driven pumps. The resources are also used for irrigation of dry season crops through shallow tube wells. Surface waters are used for purposes of irrigation, fisheries, and industries. The water rights are being granted by the National Water Resources Board (NWRB) for the use of surface or ground waters in the area.
8. The Metro Iloilo Water District (MIWD) provides potable water to Iloilo City as well as to the municipalities of Maasin, Cabatuan, Sta. Barbara, Pavia, San Miguel and Oton. MIWD extracts its supply from Tigum River through an intake dam constructed in Barangay Daja, Maasin with a capacity of about 30,240 cubic meters of water per day.

9. The Aganan River Irrigation System, built in 1925 with its diversion dam at Igtambo, San Miguel has a service area of 4,506 ha. serving the Municipalities of San Miguel, Oton, Pavia, and some parts of Sta. Barbara and Mandurriao, Iloilo City.
10. Water rates are administered primarily by Metro Iloilo Water District for domestic, commercial and industrial consumption water supply. While irrigation service fee is administered by NIA. The NWRB's water fees and charges are based on resolution adopted by the Board with the amended Implementing Rules and Regulations (IRR) of the Water Code of the Philippines as guide.
11. Water balance in this case is an estimate of water availability and demand in terms of surface and ground water, as well as their usage based on available data/information.
12. For water resources accounting, the study that should be looked into are the initiatives conducted by various agencies. The National Statistical Coordination Board (NSCB) in 1999 in partnership with the regional offices of the Department of Environment and Natural Resources (DENR), National Economic and Development Authority (NEDA) and other concerned agencies, adopted and piloted the Philippine Economic-Environmental and Natural Resources Accounting (PEENRA).

E. Current Issues and Concerns

1. Meetings/discussions with relevant institutions were conducted to assess current status in terms of policies and strategies for the water sector and future plan. The summarized issues and concerns raised are:
 - Major problem of Iloilo City is on water scarcity and water security in terms of water quantity and quality;
 - As predicted by 2020, there will be too much of water or no water at all;
 - Preservation of water for the future generations;
 - Flood is still occurring, but not in the study area, due to flood control project;
 - Suggested that a scientific study be conducted on how to develop the Iloilo River;
 - Problem on informal settlers and encroachment;
 - Mitigating the impact of environmental degradation and climate change to avoid flooding;
 - Land use is the driving force to destruction and has a direct impact to climate;
 - Oton needs to update their CLUP, because .their CLUP was made last 15 years ago;
 - No ground water use in the irrigable area, because their irrigation is more on surface water;
 - Over extraction of ground water;

- Another problem is salt water intrusion, because the area is below sea level;
- Watershed conservation for a better water quality;
- Protection of endangered species, such as Bagtis and Puyo;
- Sanitation mapping should be considered;
- Pollution load should be identified and water quality updated; WQMA has no improvement in the quality of the water; Water quality aspect for fishery;
- Role of Water District on setting parameters on water quality management;
- Raw water main source is from Tigum-Aganan River Basin, including bulk water from another basin; and Pototan was constructed recently by private firm, Florete Group of Company;
- Advantages and disadvantages of using the resources should be taken into consideration;
- Balance between the economy and the preservation of the environment;
- Projects and activities were not sustained due to lack of funds; and
- Classification of priority areas for government interventions.

2. In the SWOT analysis, highlights of the output indicated that their strength is the presence of local champion with strong political leadership leading to good governance, and with adequate policy it can attain international recognition, as well as tourism attraction. While its opportunities are the donor support and investment for livelihood, economic development, tourism with the help of academic community in terms of studies. However its weaknesses and threats are as follows:

- On water resources, insufficient water supply; salt water intrusion in coastal areas and its expansion is irreversible; limited data on ground water; improper disposal of liquid/solid/waste; build-up of industrial pollutants; mismanagement of solid waste disposal; and lack of septage and sewerage system, but feasibility study for septage management program is already completed.
- On its watershed, competing land use pressures/needs around and within the watershed; conversion of irrigated land into residential or subdivision; indiscriminate land utilization; rapid urbanization; poor agricultural practices; improper aquaculture practices; and erosion.
- On river and its banks, unprotected river banks; siltation and sedimentation; silted canal outfalls; huge river sediments in delta and in river banks and at the center; fish pens and nipa clamps are easily accumulated that causes siltation; encroachments and obstructions; massive growth of mangroves, but there are clearing of natural constrictions; encroachment of illegal settlers in mangrove areas; river encroachment of structures both permanent and semi –permanent causing thinner water way; existence of illegal fish pens in the river; illegal encroachments on river banks resulting to siltation; illegal encroachments/

structures along the river banks; population increase resulting to presence of informal settlers along Iloilo- Batiano River; and loss of biodiversity;

- On climate change adaptation and hazard management, global warming resulting to climate change; natural damming at upstream trans boundary; disaster risks and flooding was reduced due to the presence of floodwater channel; and inadequate/absence of drainage system.
- On institutional aspects, change of local, political situation due to change in administration; lack of community awareness; apathetic community; poor implementation of existing policies; uncoordinated policy enforcement and plan implementation; lack or poor compliance of barangay communities to RA 9003 or Solid Waste Management Act; and inadequate technologies.

The action needed after identifying the SWOT of the Iloilo-Batiano River Basin is to maintain the strength, remedy and stop the weakness/problems, prioritize and optimize opportunities and counter/mitigate threat, such as climate change due to global warming, which lead to disasters.

3. The workshop session on Problem Tree Analysis conducted was direction building exercise, taking off from the perceived problems, weaknesses and threats, the participants probed into the identified problems, causes and effects or implications. The summaries of perceived problems as per stakeholders' matrix are as follows:
 - The Water Resource Management group perceived problems are on the presence of illegal or informal settlers along the river banks; Non-implementation of buffer strips or setbacks as mandated under PD 1067 (Water Code of the Philippines); high level of domestic pollution due to lack of sewage facility that was intensified by dumping of solid waste into the river; loss of biodiversity; Encroachment/obstruction along water line; Failure to regulate utilization of public land along Iloilo-Batiano river; Lack of technical data particularly of river assimilation carrying capacity; Impacts of climate change particularly to low lying areas.
 - The Watershed Management group identified problems on water quality; Siltation on the river; Waste Disposal; Informal Settlers along the river banks; Flood problems in the service area particularly in Oton, Pavia San Miguel and partly of Sta. Barbara area; Natural and manmade constriction; Encroachments; Inadequacy of updated data; Inadequacy of multi stakeholder representation; Possible overlap/duplication with other similar on-going river master plan formulation.

- The problems perceived by the Climate Change Adaptation and Hazard Management group was the flood from the Batiano river caused by the surplus water coming from the Aganan Dam; Diminishing water supply due to the denuded watershed/climate change; Siltation; Lack/poor compliance of Barangay communities to R.A. 9003; Absence or inadequate drainage system; Sited canal outfalls; Rehabilitation and protection of the Iloilo river is a less priority of LGUs.
- The River and River Delta Management group perceived problems on continuous flooding caused by the obstruction of solid waste; Informal settlers and other structures in Batiano River; Sea level rise and exploration of mangrove resources.
- The Institutional and Community Participation group perceived problems on Encroachment; Illegal settlers along the river banks; Flood and flood monitoring system; Lack of barangay risk reduction management committee, Hazards, Climate Change and water pollution; Local political situation/administration in the LGUs were there is a resistance of some LGUs to take part in the project (if there are some officials who are hesitating); Conflicting interest of stakeholders on the river; Sustainability of interventions (changes in the political leadership); Removal of extended fish pond on the river.
- The Economic Development group identified problems on community participation; Involvement and sharing of resources by all stakeholders; Flooding; Siltation of the river; Disposal of household garbage and Illegal settlers.

F. Institutional Aspects

1. A river basin organization (RBO) is defined in this report as a societal entity created to manage, develop and/or monitor natural water resources in a watershed. RBO's vary considerably in form and function and there are many types of river basin organizations in the world today, such as Advisory Committee, Association, Authority, Commission, Council, Corporation, Tribunal, Trust, Alliance, Federations/Consortium, etc.
2. On the assessment of RBO to ensure a functional organization in managing the basin, the general principles will guide policy and decision makers in the creation and institutionalization of RBO in an integrated management approach. The principles were derived through review of materials published on current IRBM, past practices, and literature on evaluation of river basin management.
3. The Philippine IWRM Plan Framework is a directional plan, which is intended to guide the different stakeholders involved in water resources management, at different levels, to either prepare their respective IWRM plans, update/enhance their existing IWRM related

plans or make IWRM an integral part of their development plans/programs wider adoption and localization of IWRM across different stakeholders at different levels.

4. The major components of water resources management in the country are vested in the mandates of several government agencies. Sectoral agencies are decentralized at the regional and provincial level in varying degrees and in some instances the planning, programming and decision making of development projects may be done by concern regional agencies. Provincial government has powers to generate development funds and work in partnership with national agencies and other entities in improving social conditions and development of infrastructures as provided in the decentralized local government code. Municipal and barangay governments are the local population, which are the usual target beneficiaries of development projects.
5. The study area is Iloilo-Batiano River Basin, however within the said area, there are related organization like Iloilo-Batiano River Development Council (IBRDC), Iloilo-Batiano River System - Water Quality Management Area Board (IBRS- WQMA), Iloilo Watershed Management Council (IWMC), and Tigum-Aganan River System WQMA. While in other areas there are relevant RBO that are currently being established and on-going implementation, such as Central Cebu River Basin Management Council, Davao River Basin Management Alliance, Cagayan de Oro River Basin Management Council, Cagayan River Basin Management Council, and Pampanga River Basin Committee.

G. Review of Policies

1. The water, land and related policies are based on compendium of laws, statutes, decrees, orders, issuances, rules and regulations of appropriate authorities, like Climate Change Act, Philippine Disaster Risk Reduction and Management Act, Water Code of the Philippines, Philippine Clean Water Act, Philippine Environmental Code, Agriculture and Fisheries Modernization Act, Local Government Code, An Act Providing for an Ecological Solid Waste Management Program, Executive Order Creating the Iloilo River Development Council (IRDC), Iloilo City Environment Code, and Ordinance on Environment and Natural Resources of Oton.
2. Based on CLUP (2011-2020) of Iloilo City, some of related land use policies are for Agricultural zone and Expansion; Network of Green and Open Spaces; Land Areas Along the Coastlines, Rivers, Creeks, Estuaries; Zones for Mangrove Forest, Water, Sanitary Landfill, Fishponds and Saltbeds; and Flood Overlay District.
3. The national framework strategy on climate change spells out the climate change drivers, its impacts and vulnerabilities leading to sustainable development, while broad collaboration is a key in the formulation of strategy on climate change adaptation.

Among the major groups organized are agriculture, biodiversity, coastal and marine, energy, fishery, forestry, health, infrastructure and water.

4. The integrated ecosystem-based management is required in addressing the country's multiple vulnerabilities to climate change. It acknowledges the interrelationships across the country's ecosystems, while strengthening the integrity of decision-making process towards the formulation of comprehensive adaptation strategies from ridge to reef.
5. On water governance and management, the success of country's adaptation efforts are seriously dependent on how the country's water resources are governed and managed. Therefore appropriate mechanisms must be established towards protecting and enhancing the integrity of water resources towards environmental flows for various users. The objective is to reduce water sector vulnerability to climate change through participative water governance, resource management and policy reform, such as enhancing institutional and community capacity for Integrated Water Resources Management (IWRM).
6. In view of the need for climate change adaptation and mitigation, some of the strategic priorities are instituting comprehensive river basin management governance and enhancing ecosystem services to control droughts, floods and landslides. While one of the adaptation pillars of combating the effects of climate change is on disaster risk reduction. The framework strategy spells out expanding and upgrading the country's capacity to address disaster like typhoons, floods and landslides. The objective is to reduce disaster risks from climate change-induced natural hazards.
7. The strategic priorities are adoption of a responsive policy framework to serve as an enabling environment for reducing losses from natural disasters, including climate change-related risks; enhancement of national monitoring, forecasting and hazard warning systems, and improve effectiveness of early warning systems available to communities; and mainstreaming of climate and disaster risk-based planning in national and local development and land use planning thru the application of disaster risk assessment and by further supporting capacity development, including the preparation/gathering and dissemination of appropriate data and maps necessary for national, regional and city/municipal planning.

H. Strategy Formulation

1. The problem tree analysis on development of strategy was direction building exercise, taking off from the perceived problems, weaknesses and threats, these probed into the identified problems, causes and effects or implications. While objective tree analysis done in all groups translated the problems, which are negative in nature into positive to formulate the objectives. From the objective tree analysis the alternative or scoping analysis were determined as policy, institutional and technical intervention.

2. Some of the current vision/mission of concern institution was based on available information during the coordination phase, which was used as guide in the development of strategies of an organization in the study area. While the development of strategy for Iloilo-Batiano River Basin was based on workshop results and analysis which were enhanced.
3. On climate change adaptation and hazard management, the policy and strategy shall be to device appropriate and effective flood control, drought mitigation and hazard management scheme. To be able to do so, a variety of structural and non-structural planning measures shall be incorporated, which shall include flood plain management, flood control maintenance activities, storm water management, shoreline management, protection of frequently flooded growth areas.
4. On water resources management the policy and strategy shall focus on dealing with the promotion of coordinated development and management of water, land and related resources within hydrological boundaries or basin unit, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. The strategy shall recognize that fresh water is a finite and a vulnerable resource essential to sustain life, development and the environment; has economic value in all its competing uses and is an economic good and, therefore, should be developed and managed collectively by all stakeholders with particular focus on the role of women as major participant in safeguarding of water resources.
5. On watershed management the policy and strategy shall gear towards the organization and planning of human activities recognizing the links between these activities and the watershed's health, and aimed at restoring and protecting water. Watershed restoration shall focus on monitoring and minimizing pollution, setting out regulations accordingly. More importantly, the strategy shall consider the core task of reforestation to repopulate the watershed with its native plant and animal species, and to ensure sustainability of fresh water resources for water supply.
6. On river and river delta management the policy and strategy shall focus on the tackling of issues on water for agricultural, industrial/commercial, and domestic purposes, soil and water management, and water management for ecosystem services.
7. The policy and strategy for institutional are cross cutting concerns wherein they shall be addressed in attaining sustainable management of basin resources, which may include development of an institutional framework for integrated related resources management, addressing policy weaknesses, clarifying roles of national government agencies concerned and local governments, and addressing their capacity-building needs.

8. While for economic the policy and strategy includes improvement of water supply, sanitation, and solid waste management; and provision of infrastructure and non-structural facilities for climate change mitigation and adaption among others.
9. The specific strategies presented are based on the group outputs during the consultation and workshop. These strategies were formulated based on thematic classification. Each strategic theme was supported by several objectives which were supported by enabling policies and strategies leading to several key actions. These key actions were the major steps or initiatives required to accomplish the objectives. The specific programs, projects and activities, including other parameters were defined through the different operational plans as prepared by different agencies and stakeholder groups at different levels.

I. Programs, Projects and Plans

1. **IBRDC Master Planning.** The Iloilo-Batiano River Development Council master planning identified challenges and strategies, while the key elements of the master plan are conservation and restoration areas, overlay spatial planning, eco tourism, signage as interpretive elements, management of waterways, and land use management. The IBRDC directions include common vision of goals and guiding principles of the stakeholder's, political will of leaders, stakeholder's involvement and participatory management that include the community, and inclusive growth approach on target.
2. **Flood Control and Mitigating Measures.** The DPWH is spearheading flood control and mitigating measures in the area focusing on sub-river basin approach of Iloilo River, Batiano River, Cabatuan River, Bauan River, Dungon Creek, Calajunan Creek and Rizal Creek. The project consists of creek improvements, dredging and excavation and channel restoration. These projects are for funding, which includes Calajunan Creek and Dungon Creek, while others needs further study and evaluation.
3. **Development of Groundwater Management Plan.** The NWRB has a current study on Development of Groundwater Management Plan for Highly Urbanized Water Constraint Cities, wherein the pilot area is Iloilo City and surrounding areas. The project objectives are the Development of groundwater management plan for the study area that considers impact of climate change; Provide framework and decision support tools using science-based methodology; Design groundwater monitoring network; and Capacitate NWRB and other concerned staff in the region. The outputs of these groundwater study consist Groundwater management plan for Iloilo City and surrounding area; GIS maps generated using groundwater modeling; Groundwater monitoring network; Operation manual on the use of the groundwater model; Report of the stakeholder consultations and training conducted; and final report.

4. **Aganan River Irrigation System.** *Aganan-RIS is the only irrigation system that discharges to Iloilo River and Batiano River as reported by NIA Region 6.* It has a designed service area of 3,867 hectares and has a discharge (Q) of 5.80 cms of which, 2.80 cms is conveyed to the service area along main canal and laterals and excess water discharges to Tagbac and Lambuyao Creek. About 1.30 cms is also distributed to the service area of some laterals and excess water discharges to Calajunan Creek . Furthermore, 1.70 cms is distributed to the service area of other laterals and excess water discharges to Dungon Creek.

The recommendations from concern agencies emphasized the dredging of Iloilo River and Batiano River which include the clearing of the channel to address clogging and constriction of the flow of water of the said rivers. It also includes the proposed cut-off channel from Iloilo River to Batiano River towards the Iloilo Strait, as well as increasing the design slope of the channel to prevent siltation.

5. **Iloilo River Rehabilitation Program.** This IRRP is being spearheaded by DENR as an action plan in compliance with IBRDC, which consist of removal of obstructions along Calahunan Creek, including i) the creation of mangrove inventory teams wherein the activity include easement subject to the conduct of delineation survey by Regional LMS; ii) Fish Pens Inventory Team; and iii) Islets Inventory Team. Another action plan are inventory of mangroves, non-mangrove and nipa along Iloilo River, upstream of Brgy. Sooc, Arevalo, Iloilo City; and inventory of fish pens and other obstruction, such as on the existence of nine (9) units of fish corral “punot” and other obstruction from the junction of Iloilo River and Calajunan Creek.
6. **Geo-hazard Assessment.** The Mines and Geosciences Bureau (MGB) published a geo-hazard map which shows the land susceptibility of Iloilo quadrangle, the map indicates that there is no indication of land susceptibility in the study area. While MGB-Region 6 generated a rapid geo-hazard assessment for the province of Iloilo which include landslide ratings detailed by barangays. The summary of assessments consist of covered municipalities and barangays, landslide susceptibility rating and corresponding remarks.
7. **Development of Iloilo River Sediment Load Model.** This sediment model as a critical tool in predicting rate of sedimentation was implemented by Ecosystems Research and Development Services of DENR Region 6 through RBCO funding. The general objective is to rehabilitate the Iloilo River from pollution and sedimentation, while its specific objectives are to i) determine the source and rate of sedimentation; ii) determine the trend in sediment depth through time and space; and iii) recommend rehabilitation measures to lessen sedimentation in the river beds and to prevent further sedimentation.

- 8. Gender and Development.** The DILG Region 6 has an activity on gender and development which i) Include women on planning and evaluation; ii) Encourage participation of women in all activities including decision making; iii) Sensitivities of facilities to men and women like separate comfort room for men and women in evacuation centre's; and iv) Areas for lactating women in evacuation centers.
- 9. Disaster Risk Reduction and Management Plan.** The plan shall be preceded by a disaster risk assessment and shall define ways at integrating DRR measures in the city's plans and programs. It shall support the Five Priorities of the Hyogo Framework for Action 2005-2015 through the 10-Point checklist for making cities resilient to disaster.
- 10. Comprehensive Urban Drainage and Sewerage Master Plan.** The master plan will build on the existing studies made by the DPWH 6 on the city's existing drainage system at the city center. This proposed plan shall also be based on the initial efforts made by the City Engineer's Office in profiling the city's existing drainage system. The establishment of a sewer line (whether combined or separate with the drainage system) shall also be incorporated in this plan together with septage management.
- 11. City Coastal Resources Management Plan.** The plan shall be prepared in close coordination with BFAR, DENR and other concerned national government agencies, barangays, and other concerned civil society organizations. It is a plan that shall include tourism development, waterfront development, river development, and provision of support like livelihood and resettlement areas to fisherfolks displaced as a result of the implementation of development projects designed to protect the city's coastlines. The plan shall include the study of the city's existing coastal mangrove cover and rehabilitation/restoration of lost cover in close coordination with BFAR and the DENR-LMS.
- 12. Overall Flood Control Plan.** The overall DPWH Iloilo Flood Control Project is to be implemented in two (2) stages; namely, Stage 1 and Stage 2. In case of flood control, Stage 1 was carried out basically to attain the flood control works with a scale of a 20-year return period, while Stage 2 will be undertaken and upgraded to the project scale of a 50-year return period. For the drainage plan, the Upper Incore Creek improvement works was implemented under Stage 1, whereas, the improvement works of Lower Incore Creek, Rizal Creek and Bo. Obrero Creek shall be undertaken under Stage 2, all at the scale of a 5-year return period. An alternative plan for retarding basin was considered as an option.
- 13. Enhancement of Capabilities on Environmental Data.** The Advance Science and Technology of the Department of Science and Technology (DOST-ASTI) has embarked on a number of projects to enhance capabilities in the observation, collection, and transmission of environmental data. The emergency distribution of Hydro-Meteorological (Hydromet) devices in hard hit areas in the Philippines is one of the components of the Nationwide Operational Assessment of Hazards (NOAH) Project, which focuses on

better disaster management, particularly in high risk areas of the country. The Project NOAH of the DOST was used for early warning through rain gauge situated at Brgy. Lambuyao, Oton, Iloilo

J. Plan Priorities

- 1. Institutional Arrangement for the Iloilo Batiano River Basin.** There are existing institutions in the Iloilo-Batiano River Basin and within its immediate vicinity which seek to address ecological, touristic, productivity, disaster risk reduction and other social and economic issues and problems pertaining to the basin, either in whole or in part. Three of the institutions focus on the quality and sustainability of the Iloilo-Batiano River basin, such as Iloilo-Batiano River Development Council, Iloilo-Batiano Water Quality Management Area and the adjacent Tigum-Aganan Water Quality Management Area.

An integrated water resources and river basin management requires a holistic rather than disaggregated approach. Already, there is question and concern as to the possible duplication between the Iloilo-Batiano River Development Council and the river basin planning that is currently being done for the Iloilo-Batiano River System. But there need not be. Both have the same universal objectives – making the river create benefits for the people in the river basin.

It is not necessary to create a new RBO for the Iloilo Batiano River Basin. It is more appropriate to build on existing institutions, strengthen them and providing them support to build their capacity. The Iloilo-Batiano River Basin Development Council has been very active and effective and has been able to muster significant participation and support from government agencies, private sector (business and industry), non-government and people's organizations and from the academe, particularly in activities pertaining to the rivers.

The IBRDC should remain as the RBO, considering its remarkable accomplishments and effectiveness. The IBRDC as the river basin organization may restructure itself into sectoral committees or working groups to handle technical, economic, environmental and social concerns to sharpen its focus on the various issues confronting the Iloilo-Batiano River Basin.

- 2. Database Management.** A website for the Project at <http://ibrb.geoindex.com> was created since the start of the project last June 2013 and is continuously being updated until the project ends this 2014. It is currently being hosted at the GIS Specialist domain (<http://geoindex.com>). This can be transferred to the RBCO hosting facility at <http://rbco.denr.gov.ph>.

The IBRB Project Site provides information for the project, such as the current data / articles came from the IBRB Master Planning report, while actual reports can be inputted

as articles in the website. This portion of the website is intended for the featured River Basins across the country, however in the mean time it would only have information about the IBRB. The River Basin Module can be duplicated and reflect individual river basins. Each river basin shall have a homepage, basin blog, image gallery and basin links. More menus can be added to customize the module.

Available maps provided in the website were generated from GIS files in shapefile format. The shapefiles can be uploaded to the website in ZIP files and can be downloaded. Restricted access to website users may be provided.

- 3. Water Resources Assessment Study.** The project proponent is the National Water Resources Board in coordination with concern agencies, like NEDA, DENR, LGUs, etc. The objective of the study is to address the lack of knowledge on the availability of water (supply and demand) in the different river basins. Its over-all goal is to have a scientific report of the available water that will be the basis for policy, planning, programming and project implementation.

The study area will cover different river basins and will be accomplished from 2015-2018. The study is intended for development planners, policy makers and project implementers and shall lead to protection of water resources and water use regulation. Upon completion of the study, a draft regulatory policy shall be pushed forward and implemented in the region.

To be able to sustain the gains of the project, competencies of the main implementing partners will have to be strengthened. The NWRB and other concerned staff from different agencies shall be capacitated (RBCO, etc.). The draft regulatory policy shall be implemented upon approval of the NWRB Board and the NEDA- INFRACOM Sub-Committee on Water Resources.

4. IBRS-WQMA Action Plan

The 10-year WQMA Action Plan by DENR-EMB 6 for the Iloilo-Batiano River System incorporates short term and long term options for reducing BOD loading in the river systems by sub-basin. Target for BOD reduction is pegged on a short term time frame (2015) and a long term time frame (2020).

Particularly for Domestic BOD reduction interventions, targets to 2015 can be achieved through septage management, if implemented separate sewer systems for sub-basins 4 and 5 would have the greatest reduction in BOD. The 2020 targets have a larger estimate of per cent BOD reduction, assuming that sewerage and sanitation practices are maintained for ten years, up to year 2020.

The advantages and disadvantages of each investment option, with respect to cost, environment, operation, and health were presented, including the cost estimates and benefiting populations for each option.

- 5. Proposed Local Flood Warning System.** A local flood warning system (LFWS) for Jaro River Basin covering Iloilo City in the province of Iloilo is being proposed by PAGASA. The proposal is a simplified operational local flood warning set-up in the area in order to address and mitigate the disastrous effects of flooding. The system is a locally based flood disaster mitigating activity, simple to operate at local levels, relatively easy to sustain and the social and moral responsibilities of the community through its LGU and its disaster groups are enhanced through their direct involvement and participation in the system.

The system will be composed of an automated rainfall monitoring and river alarm system, coupled with a set of manually observed digital rain gages and staff gages (water level or river stage gages) that are installed strategically within the target area. An automatic weather station (AWS) will be part of the system in order to provide the disaster operations center relevant information on the weather system that is likely to affect the area. Flood markers will also be placed within the target area for flood hazard mapping and for related studies with regards to community planning, etc.

Data gathered from manually observed instruments will be relayed, at near real-time, by the assigned community personnel / volunteers through dedicated radio communication sets for data and warning information. The forecast of an incoming weather disturbance may be provided by PAGASA but a localized flood warning specific for the City will be issued by the Operations Center in coordination with the respective MDCC/BDCC whenever the river has reached the pre-designated assessment levels or whenever a significant rainfall amount due to local weather systems has been observed at any or all the rainfall stations within the basin.

- 6. Water Resources Master Plan for MIWD.** The Local Water Utilities Administration (LWUA) and SWECO under UNDP assistance had prepared a Water Resources Master Plan for Metro Iloilo Water District (MIWD) in 1997. The summarized results are presented, which may be useful in this undertaking. The Planning Area consists of the two (2) sub-basins of Tigum River and Aganan River, and Sibalom River Basin, as well as the Plain. MIWD area of jurisdiction covers Iloilo City, municipalities of Oton, Maasin, Cabatuan, Santa Barbara, Pavia and San Miguel with a total area of 553.4 sq km.

On hydrology, the total area considered in water resources evaluation covers about 455.2 sq km and coincides with the Upland area of the three (3) river basins. The Upland is located in a hilly area, with elevations ranging from 60 to 6000 m amsl. The Plain

covers 311.8 sq km and extends over about 30 km from East West, with elevations from 60 m amsl zero at the coast.

The total water demand is projected to increase from 74,899 cum/d in 2000 to 332/448 cum/d in 2030

- 7. Iloilo Integrated Bulk Water Supply Study.** The LWUA's Iloilo Integrated Bulk Water Supply study in 2010 was conducted to determine the most technically feasible and economically sound surface water utilization scheme to meet the growing water needs of Iloilo City and its adjacent municipalities up to design year 2025. The study area occupies the southeastern portion of Panay Island comprising water districts of Metro Iloilo, Dumangas-Barotoc Nuevo, Zarraga, New Lucena, and Leganes all in the province of Iloilo.

The Jalaur River is one of the potential water supply sources to meet the 50 MLD required to meet the 2017 water demand in the service area. The bulk of Jalaur supply will augment water supply to meet the water needs of the Metro Iloilo Water District, whose primary source, the Maasin Watershed which has a declining yield, as well as the present ground water sources.

The Bulk Project is proposed to be in two phases: Stage 1 to be implemented by last quarter of 2011 and be operational by mid-2012, and Stage 2 to be implemented in mid-2016 to be operational by year 2018. For this Study, the main assumption is that the bulk water supply will be developed and operated by a private entity and that the five subprojects will purchase their water from this private operator.

- 8. Intervention of Jalaur River Multi-Purpose Project Stage II.** The National Irrigation Administration (NIA) is spearheading the Jalaur River Multi-purpose Project Stage II (JRMP II) which has an intervention to IBRB study area. It will be the biggest water reservoir outside Luzon area and shall rise in the Municipality of Calinog, Iloilo. As a multi-purpose project, it will provide potable water to Iloilo, development of irrigation, power generation and give environmental benefits, including flood mitigation and control.

K. Conclusions and Recommendations

Based on the review of related documents, consultations, discussions, and workshop with stakeholder, following are findings, conclusions and recommendations:

1. On recognition, Iloilo River claimed international awards, while it was inspiring to note that the general objective of first Batiano Summit is to "Place Batiano River on the Map."
2. Another milestone that is worth mentioning was the multi billion peso project in Iloilo, such as the impact of Iloilo Flood Control Project in relation to economic development.
3. It was proposed by the Mayor of Oton to re-organize their activities, such as Coastal clean up; Plant fruit bearing trees; River characterization; River survey, (e.g. profiling,

elevation); Provide livelihood to the informal settlers (e.g. hog raising, vinegar making, hablon weaving; and Urban greening /Tree planting. He proposed to include other LGUs in water quality study areas, such as Mayor of Pavia, San Miguel, and Sta. Barbara.

4. The proposals include the mapping of water users, such as deep well competing use on agriculture/ irrigation, informal settlers, and fish pens voluntary removal while giving alternative livelihood for person affected. On the issues about the salt water intrusion in ground water well, it was correlated to unregulated ground water extraction. Parallel to this the CENRO is looking forward for the NWRB to recognize them as partner in water regulations
5. Since Iloilo City's main source of ground water is coming from portion of Oton and San Miguel, it was proposed to include in the study on restoration of watershed; measurement of stream-flow, including sediment load of the river. It was also recommended to include Jaro River in the study, like the bio physical and chemical properties of the said river. In addressing these, it will harmonize the upstream and downstream relationship.
6. Meetings and discussions with relevant institutions were conducted to assess current status in terms of policies and strategies for the water sector and their future plan. One of the suggestions was to create a NWRB satellite office in Iloilo City.
7. The stakeholder's consultation of the National Water Resources Board (NWRB) paved the way for the understanding of the Water Code of the Philippines, which is one of the main policies in the water sector. While as policy recommendation, the Regional Development Plan is updating the creation of Regional Water Resources Board, wherein NWRB recognized the need of establishing a super body in the region.
8. The assessment of the current situation in Iloilo-Batiano River Basin (IBRB) has been made through the process of collecting and analyzing data from available secondary sources, as well as some primary information through the conduct of interviews, discussions and observations. Rainfall data from some stations for the past years of concern agencies were considered to determine the variation of mean annual rainfall in the study area.
9. The stakeholders' consultation and workshop was conducted to have a picture of the current situation in the Iloilo-Batiano River Basin, as well as to validate and/or update the information/data gathered, based on available reports, discussions and observations.
10. The workshop was designed to capture and better understand the multi-dimensional issues and problems. These issues and problems served as bases in formulating policies and strategies, as well as alternative analyses for future desirable situations. It

was then become the basis for developing institutional reforms and identifying programs, projects and activities for Iloilo-Batiano Integrated River Basin Master Plan.

11. The Water Resources Master Plan for Metro Iloilo Water District (MIWD) by LWUA/SWECO under UNDP identified various findings and recommendations which may still be applicable.
12. On approaches to sustained development of groundwater development MIWD and respective municipal authorities should cooperate in implementation of each development stage by instituting the preparatory work for re-evaluation and confirmation of water resources potential, extent of service area, population to be served and cost for system development.
13. Whenever possible, excessive clustering of production wells should be avoided. Well survey should be completed by locating all wells within MIWD area of jurisdiction, to be able regulate groundwater withdrawal and implement timely L3 water supply system in areas affected by lowering of groundwater level from proposed production wells. Monitoring wells should be established upstream and downstream of production wells and groundwater abstraction, water quality and groundwater levels should be regularly monitored.
14. Usable water resources potential could be enhanced through conjunction use of water resources, by utilizing river bed infiltration with production wells placed on river bank of Aganan and Sibalom rivers.
15. Rules and regulations in respected watershed protection of the three (3) river basins, such as preserving and increasing forested area in the upland, safe handling and disposal of chemical and hazardous waste should be promulgated and enforced,
16. Education camping in schools and the civic institution, against wastage of potable water should be initiated.
17. On funding arrangement, the MIWD and respective Municipal Government should make necessary arrangement, for financing groundwater and surface water development and water supply system expansion, covering the period up to 2030.
18. On establishment of water data bank, the MIWD should procure necessary hardware and software for installation of the Groundwater Data Bank under LWUA guidelines. MIWD should complete survey of all wells and spring within municipality and code data into GDB, to establish baseline information for monitoring and regulation of groundwater withdrawal and water quality.
19. MIWD should organize and implement regular monitoring of streamflow in the three (3) rivers, groundwater level and water quality for periodical re-assessment and

confirmation of water resources potential prior to implementation of each development stage.

20. With regards to surface water, stream gauging station should be established in the three (3) rivers at suitable cross section, near contact with the Plain. The monitoring schedule should be as frequent as possible, to obtain reliable time series for analysis of river basin response to rainfall events. If possible stream gauges for automatic recording of river stage should be utilized and a river cross section profile should be regularly surveyed, for computation of streamflow. Water quality analysis of surface water should be performed during low and high flow conditions, to determine effluent carrying capacity of respective river.
21. Since the study area is dependent on ground water resources, while the surface waters are transported from the adjacent Tigum and Aganan rivers for water supply and irrigation, it was suggested that management of the sources of these surface water that drains on the IBRB is needed in order to achieve and be able to plan further the river basin approach.
22. Considering that the Tigum-Aganan River Basin has an influence in the Iloilo-Batiano River Basin e.g. during Typhoon Frank that aggravated the flooding in Iloilo City and surrounding areas, it is recommended that the RBCO shall conduct follow-up actions to integrate the activities in the two river basins and come up with an integrated master plan.
23. In view of the inadequacy in the ability and capacity of government agencies and communities to respond or adapt to climate variability and extreme events, there's a need for consistency of various government agencies towards climate change and also a need to downscale the projections to be relevant to local decision makers. There is a need of adequate data, such as hydro-meteorologic information for climate change studies.
24. With the identification of the Philippines as among those highly vulnerable to the impact of climate change, Filipinos should brace for typhoons with greater intensity in terms of wind speed and rainfall that could trigger flooding and landslides. Structural and non-structural measures are needed for climate change adaptation in consideration for disaster risk reduction and management on saving lives and properties.
25. One of the important components of the disaster management and mitigation to reduce the loss of lives and properties brought about by natural disasters is the DENR-MGB, Geo-hazards Mapping and Assessment Program. This geo-hazard mapping identifies various areas that are susceptible to floods, landslides, liquefaction and other ground instabilities. Local government units (LGUs) have to monitor the disaster prone areas in their respective barangays and implement what MGB recommends.

26. The disaster brought about by El Nino and La Nina needs the highest degree of cooperation and coordination among stakeholders to plan and develop strategies to minimize their impacts. There are instances where an area is inundated by floods and another time there is scarcity of water. It is necessary for an appropriate management of water resources to make it available at the right time and place. Furthermore coordinated planning is one of the factors in the proper utilization of water resources.
27. The existing active organization in the study area is Iloilo-Batiano River Development Council (IBRDC), which has also an on-going study. They have identified various challenges and looking forward to various strategies to address their concerns. Given the adaptation of the IBRB master plan, IBRDC is looking forward for the logistic support from the National Government Agencies.