

A STUDY OF MALIAO CREEK IN THE MUNICIPALITY OF PAVIA, ILOILO

ENGR. EDGAR MANA-AY & GEO 311 CLASS

By a group of Civil Engineering students taking Geo 311 – Engineering Geology under the advisorship of Edgar H. Mana-ay (Instructor)

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Abstract: *The Municipality of Pavia in Iloilo Province was declared the Agro-Industrial Center (RAIC) for Region VI by then Pres. Corazon in 1989. Even before that time, industrialization and urbanization of the town has come into a fast pace and the issue of environmental protection was not given its due attention. Maliao Creek in Pavia is one of the many areas where environmental concern should be directed in order to stop its further degradation. In view of this, a group of 4th year Civil Engineering Geology, conducted a study on the extent of the environmental degradation of Maliao Creek over the last 50 years and provided recommendations for the restoration of its ecosystem.*

► INTRODUCTION

Fifty years ago, Maliao Creek was an environmentally balance ecosystem. The waters was teeming with fishes, shells and other marine life. All along the creek's banks flourishes bamboo grooves and variety of trees and very few bank erosion occur. On these bamboo grooves and trees, thrives a variety of birds, including the night owl which is now extinct. People were fishing with the use of fishing hook and line. DC battery back pack fishing was then unknown and many people whose hobby is line fishing enjoy their pastime at Maliao Creek.

Today, Maliao Creek is in a sorry state of environmental degradation. Its balance ecosystem is badly altered, perhaps beyond restoration. Only about 30% of the bamboo grooves and trees that cover the entire length of the creek is left. Tree cover is scarce and the only thick vegetation along the banks is the unkept, unattended cogon grasses. The water itself is highly polluted that even the mudfish is seldom seen at the creek. Farmers indiscriminately construct dikes across the river bad to impound water for irrigation purposes. Carabaos are made to stay at the creek bed creating pot holes and alter the natural grade of the creek bed. Because of the alteration of its geometric and hydraulic variables, and the disturbance of the balance of its ecosystem, Maliao Creek no longer provide a year round, constant flow of clean water. Its main role as a drainage outlet for Barangays Amparo, Palagon, Maliao and part of the Poblacion during rainy season has been greatly diminished.

Maliao Creek is considered to be a "man-made" creek because it was ordered to be constructed during

the Spanish era at the close of the 18th century. The creek was intentionally built to serve as a drainage of rise lands of Barangays Maliao, Palagon, Amparo, Cabugao Sur and part of nearby town of Sta. Barbara. It also serves as a drainage outlet of a natural spring found at the boundary of Pavia and Sta. Barbara. The spring still exist and serves as the main source of water for the creek. From the Pavia-Sta. Barbara boundary and until it merges with the Aganan River, Maliao Creek has a total length of about 4 km and an average width of 10 m.

► PURPOSE OF THE STUDY

A. Ultimate Objective

To be able to present our analysis and recommendations to the Mayor of Pavia and its Municipal Council on how to restore Maliao Creek to its original environmentally balanced condition fifty (50) years ago. This will result in a year round flow of clear and clean water, a creek swarming with marine life and a habitat for birds and other wild life. We will also aim to establish a stream at grade or a stream at equilibrium where the hydraulic variables (water velocity, discharge and load) is balanced with its geometric variables (width and grade of bed, depth of water filled channel). Once this is attained, the creek can naturally adjust itself to achieve stable form ad profile appropriate to the available flow and sediment load.

B. Specific Objectives

1. Identify areas that need tree cover.
2. Identify eroded banks that need restoration work and determine the type of restoration work required.

3. Identify areas that requires erosion protection and determine the type of protection work.
4. Locate areas in the river bed requiring restoration work to return it to its natural gradient.
5. Identify meander sections requiring correction/restoration so that expenditure of water energy during flood is best distributed.
6. Identify areas where channel width will require restoration to return it to its natural geometry.
7. To conduct a household survey of houses located within 10 meters of the river bank.
8. To identify all lot owners adjacent to creek's bank so we can establish a system of responsibility in the protection and maintenance of the channel bank.

► DISCUSSIONS

A. Maliao Creek as an Ecosystem

An ecosystem is a community of organisms and its nonliving environment in which matter cycles and energy flows. Understanding Maliao Creek as an ecosystem requires us to consider the physical, biological and hydrological processes involved in the area such as:

- Farming alongside the stream causes changes in supply of water and sedimentation to the stream system.
- Cutting of trees along the stream eliminates shading and cover for fish, while exposing the stream to the sun, which result in damage to plant life and heat-sensitive aquatic organism. It also eliminate the habitat of many animals and birds and also facilitate erosion and siltation.
- Straightening and modifying the stream bed destroys diversity of flow patterns, changes peak flows and destroys feeding and breeding areas of aquatic life.
- Conversion of a meandering stream to a straight, open ditch causes more Erosion downstream because energy of flow is not properly expanded.
- Indiscriminate and wanton dumping of garbage and waste into the stream Increases the Biological Oxygen Demand (BOD). Useful organism like fishes and shells will be starved out oxygen because of competition from bacteria.

B. The Concept of a Stream at Grade or at Equilibrium

Streams and rivers far from the constant reach and influence of man has over the years naturally adjusted itself to achieve stable form and profiles

appropriate to the available discharge and sediment load. Such stream is in a state of equilibrium and is considered to be at grade. In such a system, a continuous inflow of sediment and water is discharged downstream, while the channel itself adjusts to slight variations in the contributing environment. The rates to import and export of material and energy become balanced, resulting in a channel that is essentially stable over a long period of time.

A graded stream does not presuppose a smooth unbroken longitudinal profile, rather it implies an adjustability of the channel, reflected by short periods of scour and fill, in response to variations in the independent variables affecting the stream. A stream at grade will strive to maintain its capacity and competence so that they are just sufficient to transport the load provided with available discharge. It does this by mutual adjustment in its longitudinal profile and cross-sectional characteristics.

Based on the above concept, the recommendations made by the group who studied Maliao Creek is geared towards the return of Maliao Creek towards a graded stream or a stream at equilibrium.

C. Hydraulic Geometry of Stream Channels

The descriptive relationship among the variables (velocity, discharge, etc.) and geometric variables (width, depth, etc.) has been termed as the hydraulic geometry of a given stream. These interdependent factors interact with each other to produce the resultant channel form. Changes in the variables controlling length of the stream for the same flow conditions over a period of time. At different discharges, the measured average velocity, depth, and width of the flowing water reflect channel changes and provide insights into the factors which affect stream flow.

At Maliao Creek, a more detailed study (hopefully t be assigned to the next CE class) at different sections of the creek length will have to be made to determine which geometric variable will require correction to place the stream on grade.

D. The Channelization Controversy

Channelization of streams consists of straightening, deepening, widening, clearing, or lining existing stream channels. Basically it is an engineering technique, with the objectives of controlling floods, draining wetlands, controlling erosion, and improving navigation. Of the four objectives, flood control and drainage improvement are the two most often cited in channelization projects.

Experience in the U.S. showed that channelization while a necessity, has created considerable controversy and justifiable anxieties because of more adverse affects than benefits that it has created.

In the past, Maliao Creek had undergone some form of channelization as follows:

1. In 1980, during the construction of the IBRD Diversion Road which traversed the creek, portion of the creek where a bridge was constructed was straightened and its banks ripped.
2. In 1985 when the Kabasaka Road was constructed to connect Barangay Amparo to Cabugao Sur the same channelization work was made at the portion where the bridge was constructed.
3. In 1992 the meandering portion before the 1st Maliao Bridge was straightened and concrete lined to prevent further erosion to a barangay road and to the bridge itself.

Adverse Effects of Channelization:

1. Increases bank erosion downstream from the straightened and protected section. In No. 3 above, very serious bank erosion is being experienced down stream of Maliao Creek from the 1st Maliao bridge. Straightening of the meandering portion increased the velocity, hence the energy of the water flow to cause serious bank erosion.
2. It is commonly believed that channelization increases the flood hazard downstream from the modified channel. Although this is not an established fact, experience at Maliao Creek shows that there was in fact increased flood hazard/frequency after the three channelization work although other factors could have certainly contributed to this increase flood frequency.
3. Loss of biological aquatic life because feeding and breeding areas are Destroyed. In portions of Maliao Creek which was straightened and banks concreted, trees cover were destroyed and this has greatly diminished marine life.
4. Aesthetic degradation of a natural area.

Guidelines in Future Channelization:

1. When the primary objective is drainage improvement in areas where natural flooding is not a hazard, then there is no need to convert a meandering stream into a straight ditch.

2. Consider first the cleaning of the channel and maintaining a sinuous stream.
3. A reasonable trade-off will be to straighten the channel less, still providing a measure of flood protection without causing serious erosion down stream and rapid environmental degradation. A sample of an ideal channel profile to induce scour and deposition at desired location is shown below:

E. DENR ADMINISTRATIVE ORDER NO. 97-05 dated March, 1997

SUBJECT:

PROCEDURE IN THE RETENTION OF AREAS WITHIN CERTAIN DISTANCES ALONG THE BANKS OF RIVERS, STREAMS, AND SHORES OF SEAS, LAKES, AND OCEANS FOR ENVIRONMENTAL PROTECTION

This is the implementing procedure of the provisions of R.A. No. 1273. P.D. No. 705 (as amended) and P.D. No. 1067. Pertinent portions of this Administrative Order are listed below to show that the citizenry and more so with the local Municipal Officials are mandated by law to protect rivers and streams:

1. Sec. 1.1 – Areas needed for the forest purposes shall be twenty meters strip of

Land along the edge of the normal high water line of rivers and streams with channel of at least 9 m wide.
2. Sec. 1.3 – The banks of rivers and streams throughout the entire length and within a some of 3 m in urban areas are subject to the easement of public use.
3. Sec. 1.4 – This strip of land shall be retained and preserved as permanent forest for stream or river bank protection and are non-alienable.
4. Sec. 2.1.2 – This strip of land shall be demarcated as separate lot and to be retained as permanent forest. This may form part of open space for parks and recreational areas which shall likewise be planted with trees.
5. Sec. 2.3.1 – The boundary lines of survey shall be 40 m in forest areas, 20m in agricultural areas and 3m in urban areas measured landward from each side of the bank of the river or stream.
6. Sec. 2.3.4 – The strip of land for stream or bank protection shall be kept with vegetative cover

and planted with trees. Sufficient measures shall be undertaken to prevent soil erosion.

► RECOMMENDATIONS

1. Passing of municipal ordinance on water impounding and pumping.
 - a. There shall be no building of earthen dike across the river bed for water impounding purposes.
 - b. Pumping of water will be for irrigation/farm purposes only. Suction line should not exceed 3" dia. And a suction hole at the river bed should not exceed 1 x 1 x .5m size
2. Declaring the creek and its adjacent surrounding within 10m from the bank as a bird Sanctuary and a mini forest and public recreation area. This in line with the program of Sen. Loren Legarda of establishing a mini forest in all municipality. Pavia, being an urban and highly industrialized town will have no other area to fulfill this requirement except along the banks of Maliao Creek. The Municipal Council should pass laws imposing punishment to bird hunters within the prescribe sanctuary and also to those who would cut and burn trees and vegetative cover.
3. Regulation of fishing at Maliao Creek. Impounding of water for fishing purposes should not be allowed. Use of chemicals such as "Decis" and use of DC electricity in fishing should be strictly prohibited. The municipal council should pass laws to this effect and impose punishment to violators. Only hook and line fishing will be allowed.
4. Prohibiting the throwing of garbage into the creek and its adjacent areas. There is already an existing anti-littering law and all that is needed is the strict implementation by the local government. As shown in earlier discussion, garbage in the creek increases biological oxygen demand (BOD) thereby starving the fishes of its oxygen requirement.
5. Planting of trees and establishing a healthy vegetal cover within 10m on both sides of the bank. 50 years ago the entire bank was covered with bamboo grove planted from way back the beginning of the century. The 70% which is now gone should be restored. Bamboo grooves will cover from the bank up to 3m and then mahogany trees from the 3m line up to 10m.
6. Restoration of badly eroded banks and pot holed river bed. Because of time constraint,

the first study group have identified portions only of areas of severe bank erosion and irregular river bed surface as indicated in the attached map. The second batch of CE students will continue the survey and complete the identification of all geometric variables which needs restoration. Future channelization work on Maliao Creek should be studied carefully and should be referred to expert on hydrology and geology before implementation to assess its adverse effects.

7. Endorsing of responsibility of protecting and maintaining the creek to the lot owners directly adjacent to the creek. Based on the Municipal Assessor's record, the 1st study group have listed 50 land owners adjacent to the river bank. Personal verification of these lot owners will be done by the 2nd study group. After verification, it is recommended that the Mayor call these owners and endorse to them the responsibility of protecting and maintaining Maliao Creek adjacent to their respective lot.
8. Creation of a permanent governing body (Example: MCA-Maliao Creek Authority) who will be given the authority and responsibility to plan and implement short and long range programs in the restoration and maintenance of Maliao Creek. The Municipal Council should initiate the creation of this body and provide it with an operating budget.
10. Lastly, involving the civic, religious and non governmental organization in Pavia to take part in the restoration and maintenance of Maliao Creek. Pavia, being a growing industrial town, has many of such organization. They can adopt some portion of the creek as their project.

► REFERENCES

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