ENVIRONMENTAL MITIGATION OF SEDIMENT ACCUMULATIONS AT DRINKING WATER STATIONS INTAKE IN EGYPT

By

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B.Sc of Mechanical Power, Faculty of Engineering,

Menofia University, 1985

M. Sc. Of Environmental Engineering, Institute of Environmental Studies

and Researches, Ain Shams University, 2007

A thesis Submitted for the Partial Fulfillment
Of
The Requirements for the Doctor of Philosophy Degree
In
Environmental Science

Department of Engineering Science
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APPROVAL SHEET

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ABSTRACT

The Egyptian government has paid a lot of attention to mitigate the effect of sedimentation at drinking water intakes on River Nile. One of the main problems of the drinking water stations is blockage of intakes, which need to make either hydraulic or mechanical dredging in the entrance area around the drag pipe with high cost; where the sedimentation problems are relatively common in Egypt, especially in the case of drinking water station intakes on River Nile. Excessive sedimentation at water intakes on rivers causes interruption in water supply and serious abrasion of pumps with consequent high operating costs. Sedimentation in the catchment area around the intake mouth causes a lot of problems such as reducing the amount of drawing water and decreasing the station efficiency. There is a need for the removal of sediment from the intakes to ensure water supply and to protect the pumps against damage and sediment clogging, respectively. the objective of this research is to develop a reliable and simple device; that has the capabilities of removing the accumulated sediment at front of water intakes early without causing blockage and to ensure supplying water continuously it can be fabricated from local materials and components with low cost.

Finally, the new device is the best solution to remove sediment and applied at the drinking water station intakes which suffer from the sedimentation at the intakes and can utilize the removed sediment in many useful fields. It can be concluded that the use of this technique is recommended because it is the cleanest and cheapest source of energy in removing sediment from front of drinking water station intakes.

SUMMRY

The construction of the Aswan High Dam (AHD) and a storage reservoir on the River Nile caused an imbalance of sediment discharges downstream of the dam. The river between Aswan and delta barrages is divided into four reaches by a series of barrages (Isna, Nag Hammadi, Assuit and delta). The regime of sediment transport was changed significantly in the reaches upstream of the barrages.

Excessive sedimentation at water intakes on rivers causes interruption in water supply and may damage of pumps with consequent high operating costs. The problems of sedimentation at drinking water station intakes on rivers could be minimized by applying a new technique that can be added within the components of drinking water station intakes. Sedimentation problems are relatively common along the River Nile. The water intakes located on the River Nile had experienced chronic problems with bed sediment buildup. The sediment, comprising a mix of silt and sand, hindered the operation of the intake's pumps. Partial blockage by sediment restricts water flow through the system's tubes, elevating turbine backpressure, and reduces the station's efficiency. it is required to remove sediment accumulated within the intake, and dredge the river bed in the vicinity of the intake periodically. at the water intakes located along the River Nile' banks which are prone to sedimentation problems, there is a need to remove sediment from the intakes to ensure continuous water supply from these intakes, and to protect the pumps against damage and sediment clogging.

This research studies the environmental impact as a result of accumulated sediment in front of water intakes, because of the dredging

process in front of these stations. For example, this can be affected on the flora, fauna, river navigation, fisheries, and water quality.

The study aims to find a technical solution suitable for using to reduce the negative impact of sediment problem in front of water intakes on River Nile, in order to improve operating efficiency. So the suggested new technology can be added within the components of water intakes that suffer from the sediment problem to overcome this problem.

Thesis components:

This study includes seven chapters as follow:

Chapter (1): *(Introduction)*

This chapter introduces the main items of this research and gives a general idea about it. The main target of this research is to mitigate the contaminated sediment at front of water intakes along River Nile. Furthermore, this chapter explains the main objectives of the research and study plan and research components.

Chapter (2): *(Literature Review)*

This chapter presents the literature review about the research topic. It introduces the main types of dredge equipment's and procedures that are commonly used in the world. Also, it discusses the limitations of the different types of dredging equipment. It explains why sediments are suspended during dredging operations and the environmental impacts of this phenomenon.

Chapter (3): *(Environmental Impacts of Traditional Dredging Methods)*

In recent years, the ecological impacts associated with the presence of contaminated sediments in front of water intakes have forced the local authorities to solve the problem. Planners and engineers responsible for designing strategies to overcome such contaminated sites have a limited number of options to choose. This section reviews the environmental impacts of traditional dredging methods. Also, it presents the environmental effects of the silt accumulated in front of the water intakes, and the environmental effects of the different ways of removing this sediment.

Chapter (4): *(Methodology)*

This section presents in detail the proposed device. It explains the main steps, for example device components that have been installed, the proposed location for installing this device, and how to operate this device.

Chapter (5): *(Experimental Works)*

This chapter explains in detail the experimental works using the new proposed device. It presents the steps of applied this model by using different types of soil. This chapter shows the measurements of water turbidity which entering water intake plants at different intervals; also it shows the way of evaluating device efficiency.

Chapter (6): *(Results and Discussion)*

This chapter contains the results of the experimental works using the new proposed device. Also, it discusses the results of the proposed

technology for withdrawal of sediment which accumulated in front of the entrances to water intakes.

Chapter (7): *(Conclusions and Recommendations)*

This chapter contains the conclusions based on the using of this new proposed device. Also, it contains the most important recommendations for future studies.

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