ADIGUDEM SURFACE IRRIGATION PROJECT (GUMSELASA DAM, NORTHERN ETHIOPIA)

Enhancing Agricultural Productivity Through Sustainable Irrigation Infrastructure.

ABSTRACT

Implementation of surface irrigation infrastructure to enhance agricultural productivity in Northern Ethiopia.

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Adigudem Surface Irrigation project

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The Adigudem Surface Irrigation Project, centered around the Gumselasa Dam in Northern Ethiopia, represents a transformative initiative aimed at enhancing agricultural productivity in the Tigray region. Completed between February 1996 and November 1996, the project involved the construction of a comprehensive surface irrigation system spanning 136 hectares of farmland. Designed and implemented under the Sustainable Agriculture and Environmental Rehabilitation in Tigray Region (SAERT), the project incorporated an intricate network of primary, secondary, and tertiary canals to optimize water distribution for year-round farming.

Key structural elements included 400 concrete drop structures and three culverts, which facilitated efficient water flow and accessibility across the fields. The project also employed two large drop structures with stilling basins to manage water energy, reduce erosion, and maintain the integrity of the canals. Innovative design considerations and the extensive use of manual labor highlighted the resourcefulness and community-driven approach of this endeavor, minimizing reliance on machinery while fostering local engagement.

The project's cost, estimated at over 3.5 million Birr (approximately $500,000), was primarily allocated to labor, design, and supervision. Site engineers played a pivotal role in translating designs to the field, ensuring the precise implementation of layouts and monitoring the construction process. While the project successfully enabled the local community to cultivate crops and vegetables, challenges such as silt accumulation in the dam reservoir have since impacted irrigation capacity.

The Adigudem Surface Irrigation Project serves as a model of sustainable development, demonstrating how efficient water management and infrastructure can drive agricultural growth and community resilience in arid regions.

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This document provides a detailed account of the Adigudem Surface Irrigation Project, constructed as part of efforts to enhance agricultural productivity in the Tigray region of Ethiopia. The project, completed between February 1996 and November 1996, was overseen by Sustainable Agriculture and Environmental Rehabilitation in Tigray Region (SAERT), a semi-governmental institute based in Mekele City.

Prepared by: Mesfin Hagos Tewolde, Site Engineer

Date of Construction: February 1996 – November 1996

Figure 1 depicts the irrigation site clipped from Google Maps, providing a geographical context for the project location.

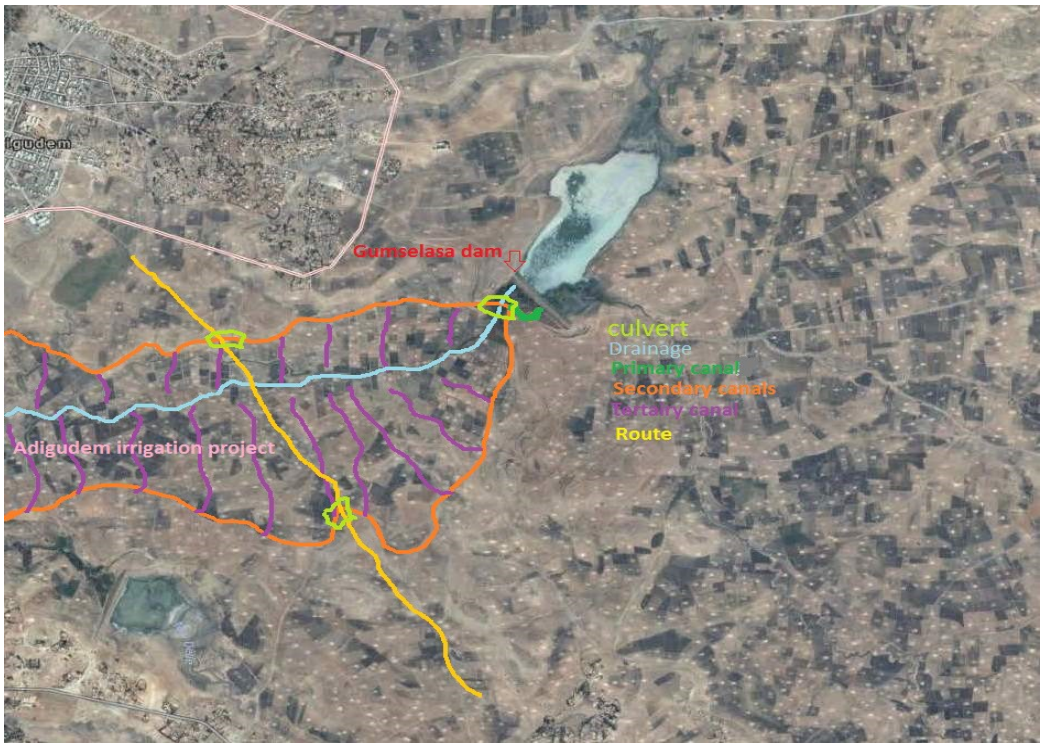

Figure 1 Adigudem Surface Irrigation Project (GumSelasa dam), Tigray, Ethiopia

1.1 Overview of the Adigudem Surface Irrigation Project

The Adigudem Surface Irrigation Project involved the construction of irrigation canals below the Gumselasa Dam. Spanning a total area of 136 hectares, the project implemented a surface irrigation system consisting of primary, secondary, and tertiary canals, designed to optimize water distribution to the farmland. The canals incorporated 400 concrete drop structures and three culverts to facilitate efficient irrigation and ensure accessibility across the fields. Figure 2 illustrates a representation of the drop structure constructed at the Adigudem site. While not an actual photograph from the project, this image serves as a visualization to convey the design and construction characteristics of similar drop structures implemented at the site.

Figure 2 An example of a typical drop structure: a drop structure on the Boulder Feeder Canal, sourced from NorthernWater.org.

1.2 Turnouts (Division Boxes)

Several turnouts, also referred to as division boxes, were constructed at the junctions of secondary and tertiary canals. These structures featured small gates to control water flow and distribution. The turnouts were vital for ensuring an equitable and efficient water supply to different sections of the farmland. Figures 4 and 5 depict examples of division boxes.

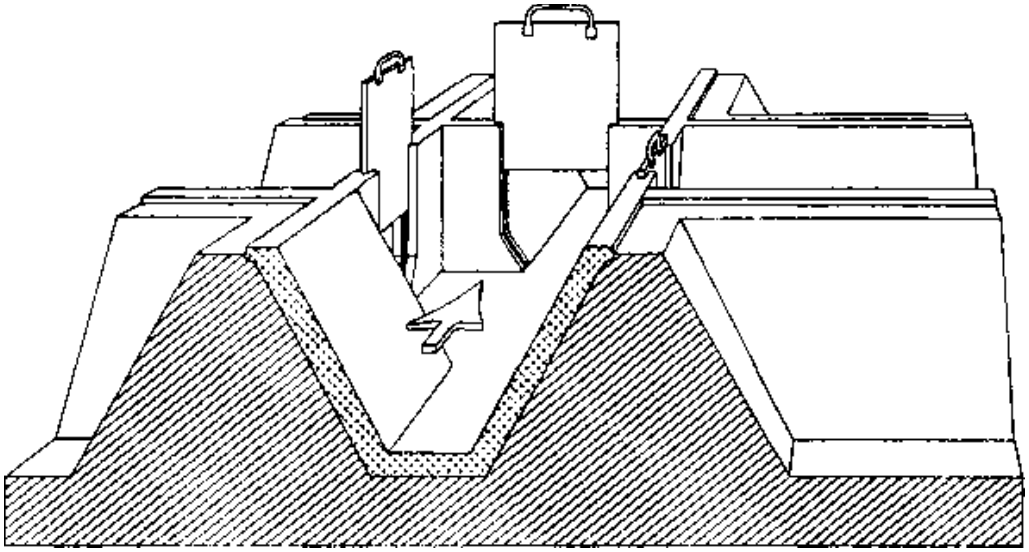

Figure 3 Division box /turnout (FAO).

Figure 4 Turnouts FAO.

1.3. Stilling Basin

The project included two large drop structures equipped with stilling basins. These basins, measuring approximately 3m x 2m x 0.4m, were designed to dissipate energy from the water flow, preventing erosion and maintaining the structural integrity of the canals. Figure 5 presents typical stilling basin drawings.

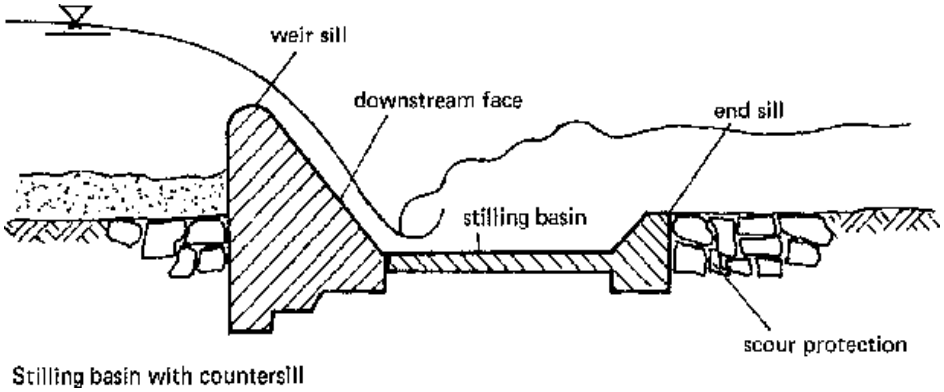

Figure 5 Typical example of a stilling basin (www.nzdl.org).

1.4 Project Cost Estimation

The project cost was primarily incurred through labor and operational expenses, with over 1,000 laborers, two tractor operators, two foremen, an engineer, and a co-engineer contributing to the construction. Excluding material costs, the estimated expenditure exceeded 3,500,000 Birr (approximately $500,000 at the exchange rate of 1 USD = 7 Birr).

1.5 Role of the Site Engineer

The Site Engineer played a pivotal role in translating design layouts onto the ground, using surveying instruments such as theodolite. Key responsibilities included identifying the

placement of drop structures, monitoring the construction process, and ensuring the project adhered to design specifications.

1.6 Key Project Highlights

- Location: Adigudem, Tigray region, Northern Ethiopia,
- Irrigation Area: 136 hectares of farmland,
- Canal Types: Primary, secondary, and tertiary canals (earth canals),
- Structures: 400 drop-structures (~1.7m x 1.20m x 0.3m), 3 culverts,
- Stilling Basins: 2 grand drop structures with stilling basins (~3m x 2m x 0.4m), and
- Construction Method: Predominantly manual labor with minimal machinery use.