



## MATHEMATICAL MODEL STUDIES FOR SURGE ANALYSIS OF WARDHA BARRAGE (HADGAON) LIFT IRRIGATION SCHEME-2 TALUKA: BABHULGAON; DISTRICT: YAVATMAL, MAHARASHTRA



### STUDY OVERVIEW

The Wardha Barrage Lift Irrigation Scheme-2, located near Yarandgaon in Yavatmal district, Maharashtra, aims to irrigate 7,855 hectares by pumping water from the Wardha barrage. The intake structure houses five vertical submersible centrifugal pumps, pumping water through a 930 mm diameter, 9945 m long rising main. The total discharge is 1.41 m<sup>3</sup>/s, with a static lift of 52.33 m and a total pump head of 84.85 m.

### APPROACH

- **Evaluate Transient Pressure Responses:** Assess system reactions to sudden flow changes, focusing on high and low transient pressures.
- **Analyze Worst-Case Scenarios:** Identify severe conditions without surge protection.
- **Effectiveness of Surge Protection Devices:** Evaluate how surge protection devices mitigate transient pressures in worst-case conditions.

#### Transient Modeling:

- **Without Surge Protection:** Simulations established baseline transient pressures under critical scenarios.
- **With Surge Protection:** Simulations assessed the effectiveness of surge protection devices in reducing transient pressures.

### KEY FINDINGS

Based on transient modeling simulations, the study recommends two surge protection options for mitigating transient pressures during pump tripping due to power failure:

1. **Option 1:** A 60 m<sup>3</sup> compressed air vessel near the pump, paired with fifteen 100 mm double-acting kinetic air valves.
2. **Option 2:** A 55 m<sup>3</sup> bladder-type air vessel near the pump, also paired with fifteen 100 mm double-acting kinetic air valves.

### IMPACT

Surge protection studies in lift irrigation projects enhance the effectiveness, safety, and sustainability of water management systems. These measures improve economic and environmental outcomes, supporting long-term irrigation sustainability, boosting agricultural productivity, and promoting water conservation.

