From the Board

Water Treatment Plants Overcome Nature's Unexpected Behavior


Shirish Kardile

The earthfill Hatnur Dam located on the Tapi River in Jalgaon, a district of Maharashtra bordering the state of Madhya Pradesh (MP), was completed in 1982. The Tapi flows from MP and, after briefly traveling west through Maharashtra, passes through the southern region of the state of Gujarat to meet the Arabian Sea.

About 7 km upstream of the dam, the Purna River flows into the Tapi. Because both of the nonperennial rivers travel through a region of alluvial soil, they're highly turbid during monsoon season (June–September), with turbidity occasionally reaching 3,000 ntu.

A 4.0-mld water treatment plant in the village of Varangaon was completed in 1977, with an intake well on the downstream left bank of the Tapi about a kilometer from the dam's embankment. Approximately five years later, a 1.5-mld plant was completed in the village of Edlabad, with its intake well on the Purna, about 2 km upstream of the Tapi–Purna confluence. The treatment process for both plants consisted then of a pebble gravel bed flocculator, a tube settling tank, and a dual media filter per the practices of the Maharashtra Jeevan Pradhikaran, the Maharashtra state statutory body.

Years later, between 2000 and 2005, both plants reported heavy turbidity during monsoons. The silt content in the raw water was especially high at Edlabad (10,000 to 20,000 mg/L). The situation became so bad that the plant was required to operate at half its normal capacity to treat the water effectively. The pebble bed flocculators were often choked with heavy silt.

Normally a dam stores heavy silt and acts as a kind of settling basin. However, the reverse was happening at Hatnur. An investigation at the Varangaon intake site revealed that the dam authorities opened the sluices at the bottom of the wall during a monsoon. The heavily silted water found a natural path through the river and intake, causing turbidity to exceed 5,000 mg/L. Gravel from the Varangaon flocculation tanks was removed, and electrically operated mechanical agitators were installed. Because the plant was built with masonry construction, it had also reached the end of its serviceable life. Still, despite a bit of difficulty during monsoons, the plant continued to function until 2010.

At the Edlabad intake, the well was heavily silted in the surrounding area. Over the years the high-flowing Tapi River had suppressed the smaller Purna River flows, causing silting from the confluence to the backwaters where the intake well was located. As a remedial measure, a presettling tank with a 4-hr detention time was constructed at a site before the water treatment plant. The presettling tank proved to function well, reducing turbidity to below 500 ntu, and the Edlabad water treatment plant continues to operate today.*

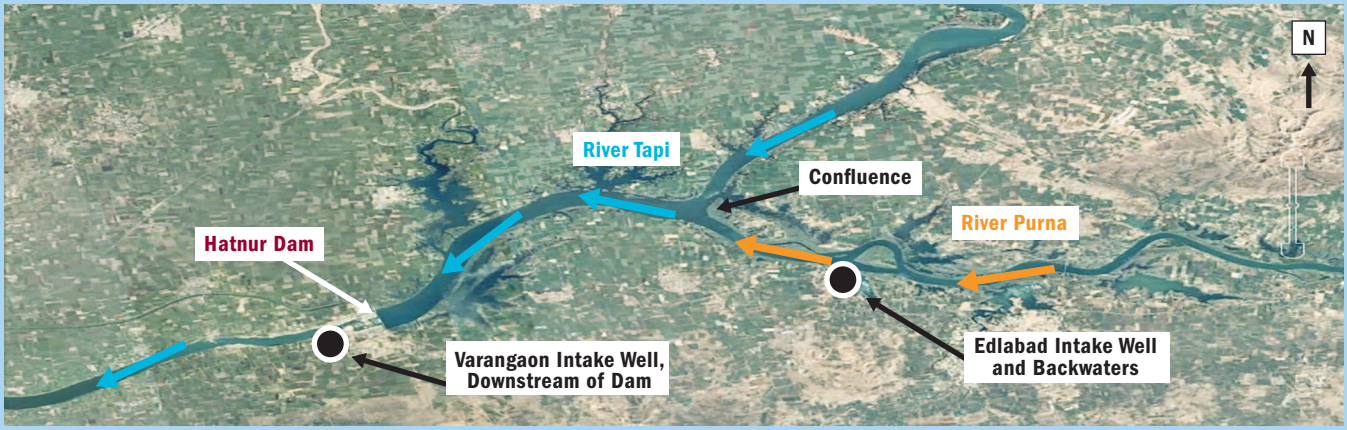
At both Varangaon and Edlabad, these were unanticipated problems. However, the difficulties were solved through analysis, ingenuity, and perseverance—valuable lessons for water treatment plant operators across India and around the world.

—Shirish Kardile,
AWWAIndia Strategic Board Chair

** Normally a conventional water treatment plant operates efficiently up to raw water turbidity of 500 ntu. If there's consistent high turbidity (more than 1,000 ntu), a presettling tank may be an appropriate solution because it reduces the suspended solids load as well as chemical consumption.*

A Satellite View of the Situation

Satellite imagery reveals the location of the Hatnur Dam, the Tapi River, and the Purna River, as well as the confluence of the two rivers, in relation to the Varangaon and Edlabad intake wells. High turbidity during monsoon season posed problems at the intakes.



SATELLITE IMAGE: GOOGLE EARTH