EPDM Liner Failures in Irrigation Channels

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There is a lot of 'chatter' around at the moment surrounding failures of the EDPM channel liner at the Trangie Nevertire Irrigation Scheme (TNIS) in Australia.

The Trangie-Nevertire Irrigation Scheme was the recipient of funding under the Australian Government's Private Irrigation Infrastructure Operators Program of around A$642 million in 2011.

The TNIS consists of 157 km of lined channels with around 2,430,000m^2, of Firestone GeoGard® (EPDM rubber) Geomembrane liner for the irrigation supply channel network.

Without getting into specific on the failures being experienced there are general rules that apply for using flexible liners in canals and channels.

With permeable subgrade is important to consider underflow and hydrostatic uplift pressure when preparing stability and design studies. The hydrostatic pressure head is the difference between the maximum elevation of the water table and the elevation of the bottom of the canal.

For canals with flexible liners the location of the canal bottom with respect to the ground water table is especially important. Equally important is the use of stable ballast for the liner that is graded and selected for providing sufficient down force as well as the correct particle geometry to prevent rolling displacements and shifting ballast.

If the ground water table is above the canal bottom then outside hydrostatic pressure may displace the liner when the canal runs low or empty. The intrusion of ground water under

the liner may aggravate the process and allows further ground water to enter in a 'snowball" effect.

The competition between liner uplift and down drag can cause damaging strains on the liner that may results in rupture of seams and even the liner itself.

With HDPE channels liners the uplift situation "raises it head" quickly since the liner is less dense than water so obvious "whales" will appear at the waterline and corrective action can be swiftly implemented.

With EPDM liners (owing to their higher density) the situation is more of a "sleeper" issue. Only when the problem becomes severe does it visibly manifest and by then considerable damage may have occurred that is difficult to correct.

Ballast helps anchor liners, to keep them from floating in the water however the type and position of the ballast has to be carefully considered.

The following section out of the EPDM Installation Guidelines summarize the issues nicely:

"If the ground water level is higher than the bottom of the impoundment, the Elevate EPDM Geomembrane lining system will be subject to hydrostatic backpressure (i.e., uplift). Also, air may be entrapped, causing gas pressure from the groundwater as the level rises. The depth of the groundwater table must be known (both the average level and the extreme level). If the groundwater elevation exceeds the lowest elevation of the Elevate EPDM Geomembrane system, the Elevate EPDM Geomembrane risks being lifted, and the function of the gas drainage system (if installed) may be disturbed. In this case, an appropriate drainage system under the Elevate EPDM Geomembrane membrane, including ballast on top of the Elevate EPDM Geomembrane, should be provided. Groundwater issues and design of dewatering systems must be addressed and designed by a professional engineer."

Ref.
https://www.holcimelevate.com/content/dam/fsbp/migrated-document/ca/en/69/694736.pdf

Hydrostatic uplift of the liner system is a concern in conditions where the elevation of the groundwater table exceeds the elevation of the water in the channel. This condition will generate an uplift force which may exceed the confining stress on the liner. For these reasons, an unsaturated zone of at least 2 m should exist between the bottom elevation of the channel and the top of the seasonal higher water table.