HUESKER SOILTAIN® GEOTEXTILE SLUDGE DEWATERING TUBES

SOILTAIN® TUBE DESCRIPTION

- Soiltain® tubes fabricated from high tensile strength 100% polypropylene woven permeable geotextile. When filled with fine grain silt or slurry the silt / slurry is dewatered as the water content permeates out thru the tubes geotextile pores, the tubes act as a permeable gravity settling container.
- Soiltain® tubes are supplied in five standard sizes, 8m, 10m, 14m, 15m, 18m and 28m circumference, non standard sizes available if site area limitations dictate otherwise.
  Tube lengths as detailed in table below
- Typically filling / pumping ports at every 25 metres or two ports minimum per tube.
- Tubes supplied longitudinally folded and rolled on to a hollow steel tube former
- Tubes typically deployed by rolling out from one end of the drainage cell.
- To minimize the footprint of an installation the tubes can be stacked vertically, ie: new tubes can be placed on dewatered tubes. NB: Tube design to specifically allow for stacking.

14 METRE CIRCUMFERENCE TUBES DEWATERING SLUDGE AT A MUNICIPAL SEWERAGE POND

BENEFITS

- Low tech system requiring minimal plant and manpower
- Cost effective when compared with traditional mechanical methods
- High dewatering rate
- Dewatered sludge can be contained on site.
- Odour free
- High retention rate of solids and many soluble pollutants / contaminants
- With testing some filtrates can be discharged to the native waterway without further treatment

APPLICATIONS

- Municipal sewerage pond sludge
- Stormwater run-off settling pond sludge.
- Watercourse silts and sludge.
- Dredged contaminated silts and sludge from waterways, harbours, marinas and rivers.
- Coal mine settling ponds, the separation and recovery of coal fines
- Mining industry and industrial sites generally, the dewatering of settling pond sludge.
- Dairy and piggery units, dewatering of wash down / effluent settling ponds.

DEWATERING PROCESS

Dewatering is a four step process : **Containment, Dewatering, Consolidation and Disposal**

- **Containment**

  Tubes are typically filled using pumps, suction dredges, cutter head dredges or similar devices.
  The pumped sludge / silt is typically mixed with a suitable polymer / flocculants injected into the delivery pipe to form water paths thru the contained solid material to allow the filtrate to permeate thru the tube wall
  Typically the tubes are re-pumped a number of times during the dewatering process until such time as the settling of the crest of the tubes has virtually ceased, typically over a 4 to 8 week period

- **Dewatering**

  During the dewatering process water is lost thru the pores of the woven geotextile tube with the initial water loss being very rapid until such time as a cake forms on it's inside face. The cake acts as the 'dominant' filter component of the system with the fabric pores taking only a secondary role.
  Typically the filtrate is collected within a lined bund system and returned to the pond or waterway being treated.

- **Consolidation**

  This is the final phase of the process, the sludge / solids continue to dry and become more dense due to desiccation as residual water vapour escapes thru the geotextile pores.
  The longer the tubes are left fallow the more they dry the solids.
  Rainfall on the tubes does not add to the moisture content of the solids inside the tube.

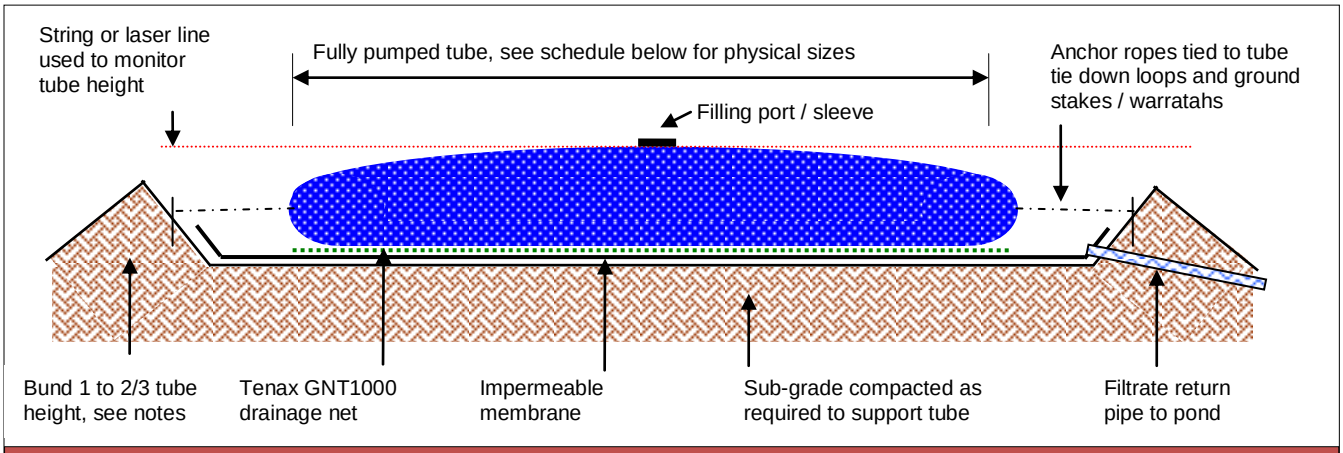
- **Disposal**

  The dewatered solids can be disposed of a number of ways

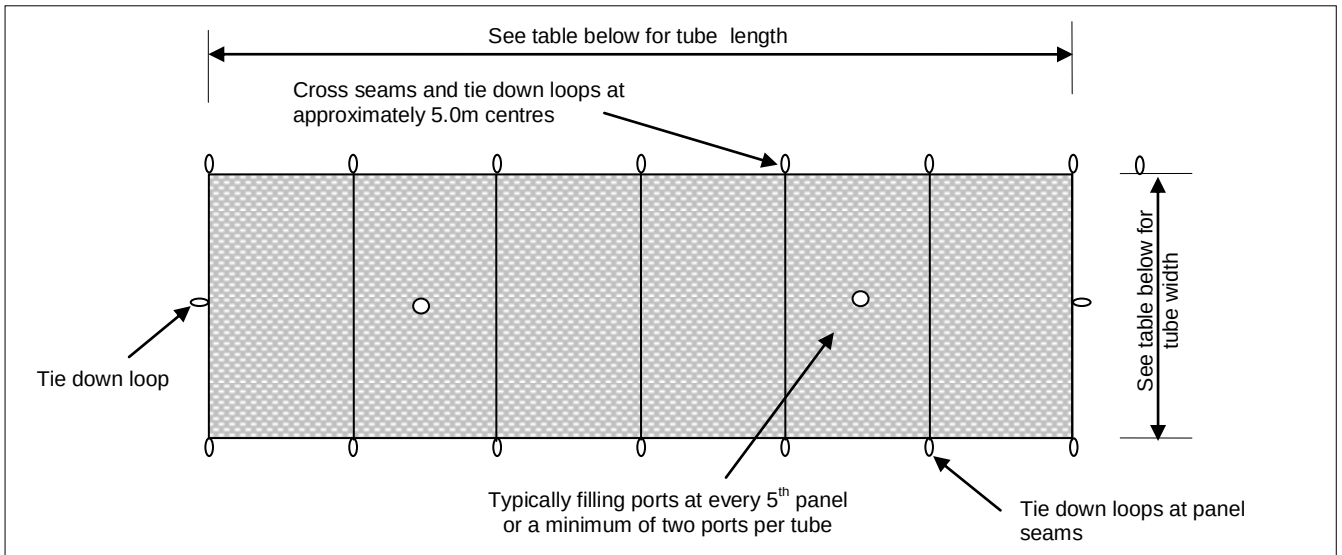
  a) Cut open the tube and truck the solids to a landfill, see photo below showing dewatered municipal sludge
  b) Cover the intact tube with soil so it grows grass and becomes part of the landscape
  c) Leave the tube exposed until such time as the dry sludge can be recovered / mined for whatever use. The exposed tube geotextile should have a UV exposed life of five or more years.

SOILTAIN® TUBE CUT OPEN AFTER COMPLETION OF DEWATERING
DRY SLUDGE READY FOR DISPOSAL TO A LANDFILL

HUESKER SOILTAIN®
SLUDGE DEWATERING TUBES
TYPICAL SET-UP / ARRANGEMENT



SCHEMATIC CROSS SECTION THRU A SINGLE TUBE DEWATERING CELL
not to scale



SCHEMATIC PLAN ON A TYPICAL SOILTAIN® DEWATERING TUBE
not to scale

SOILTAIN® TUBE PHYSICAL PROPERTIES							
Circumference	**Standard tube length**	**Net Weight of empty tube**	**Storage capacity**	**Total Storage Violume**	**Maximum pumped fill height**	**Flat lay-out width**	**Pumped width**
m	m	Kg / m	m3 / m	m^3	m	m	m
Soiltain® 8	10	~ 3.52	3.5	30	1.2	4.0	3.4
Soiltain® 10	20	~ 4.4	5.7	100	1.6	5.0	4.2
Soiltain® 15	35	~ 6.6	11.3	350	2.0	7.5	6.5
Soiltain® 18	50	~ 7.92	14.7	725	2.1	9.0	8.0
Soiltain® 28	65	~ 12.32	26.0	1500	2.2	14.0	12.9
Basis of above properties		Sludge SG of 1.4 Tubes pumped full height No stacking of tubes					

GENERAL NOTES ON TUBE DESIGN, SET-UP, DEPLOYMENT, PUMPING, MANAGEMENT & SAFETY

SOILTAIN® TUBE DESIGN / SIZING & POLYMER DOSING

It is recommended that the contractor carry out a Soiltain® hanging bag test to determine the polymer dosing rate and test to determine the specific gravity of the sludge being dewatered.
Soiltain® test bag available at a nominal cost from Geotech Systems Ltd.

For a specific gravity in excess of the I.5 (as noted in the above table) the contractor to request a specific design.
Geotech Systems Ltd will input the contractor's nominated information into their design software to check conformance or otherwise with the tube options listed in the above table.

The contractor ultimately responsible for determining the required tube volume and layout taking care to allow for the dewatering cells physical constraints.

DEWATERING CELL CONSTRUCTION

Dewatering cell plan size / bund height sized as required to accommodate the rapid surge of the 'spill' volume of a split / failed tube.

Compact and or strengthen the sub-grade as required to minimize settlement resulting from the tube surcharge.
Prepare the tube platform to a smooth, even and level surface (no falls for both the width and length under the footprint area of the tube) this is to maximize the effective tube volume, to maintain an even head along the tubes length an d to reduce the likelihood of the tube moving sideways.
Those areas surrounding the tube platform can be graded as required to drain the filtrate to the bund outfall sump / collector pipe.

Install a PVC / HDPE liner system as required by the resource consent for collection and return of the filtrate to the pond.
Filtrate return pipe sized as required to suit pump discharge / dewatering rate of the tubes.
Deploy Tenax GNT 1000 geonet drainage blanket under the tube for the full contact area of the tube and pond liner to drain its underside .
Tenax GNT 1000 geonet as supplied by Geotech Systems Ltd

DEPLOYMENT OF TUBE

Tube supplied folded lengthwise and rolled onto a steel 150mm dia. pipe former.
Deploy the tube by rolling out from one end of the dewatering platform taking care not to displace or damage the liner, geonet or tube.
Allow a nominal access gap between tube sides and ends.
Secure the tube with tie downs / anchor ropes to facilitate its set-out / alignment, to anchor it against wind uplift and control possible movement during the initial filling phase.

Install a height monitoring / measuring system set at the maximum allowable pumped height. Eg; string line or laser with an audible alarm.

PUMP DISCHARGE / FEED LINE SET-UP & POLYMER

Typically the pump discharge line incorporates a flow dependent polymer dosing system, polymer injection port, polymer mixing manifold, sampling port and return / bypass line to return effluent to the pond until such time as the correct polymer dosing rate has been achieved.
Test dosing as required to determine optimum injection rate.
Polymer mixing manifold is typically made up of a group of six to eight 90˚elbows in the pump discharge line downstream of the polymer injection port.
For multiple tube installations a manifold / pinch valve controlled system is used to regulate the tube filling rate and or balance between tubes.

Place the pump discharge feed line outlet fully down the filling port sleeve and secure with hose clips or similar.
Typically one end port is used for filing, the remaining ports can be used for sludge sampling access or utilized as an open vent / relief port arrangement to minimize over- height pumping.

Take care to ensure the filling port sleeve clamping system does not chafe or cut the tube or port sleeve geotextile, generously wrap the clamping system with PVC or Duct tape.

MANAGEMENT OF THE TUBE/S DURING PUMPING

Progressively ease off the tube tie ropes as it rises in height and reduces in width.
Generally the tie ropes can be dispensed with once the tube has reached one third of its height with a full layer of dewatered sludge for its full length and width.

Do not exceed the maximum allowable pumped / fill height,
When nearing the maximum allowable pumped height manage the height limit with an automated system warning the dredge operator or continuously observe and report back to the dredge operator.

Three common causes of tube rupture are ;

1. Low polymer dosing rates coupled with a high pumping rate, too low dosing rate can lead to premature blinding (cake build-up) of the inside face of the tube, this reduces the dewatering rate causing the tube to inflate rapidly.
2. Blockage of a section of the manifold system on a multiple tube arrangement causing the on-line tube to inflate rapidly
3. Caution re-pumping a tube some 3 to 6 months after it has been left to consolidate has some risks as re-pumping raises the tubes crest height which in turn narrows it's width, the tube geotextile may not have the tensile strength (hoop stress) to lift the outer consolidated more dense sludge even though the original design height has not been reached.

DEWATERING RATE

For municipal pond sludge the dewatering rate can vary greatly and is very dependent on the operator / contractor, polymer type, polymer dosing rates and the length of time the tube is left to settle and relax.
Typically at each pumping cycle the tube dewaters 2% input sludge to approximately 10% to 15% after 24 hours, then to 20% after 2 to 3 weeks and to 60% after 12 months.

It is the contractors choice to either maximize the tube volume and reduce the number of re-pump cycles (less dredge time / man-hours) or minimize the tube volume and increase the number of re-pump cycles (more dredge time / man-hours)
Granular sludge material eg; sludge from coal settling ponds dewaters more quickly than municipal sewerage ponds or fibrous material.

SAFETY

The rupture or rolling (like the tracks on a bulldozer) of a dewatering tube poses very real risks to workers and operators, pay due regard to the risks involved.

DO NOT ENTER THE BUND AREA WHILE PUMPING / FILLING THE TUBES

The safest time to enter the bund area is some 10 to 12 hours after pumping has ceased and the dewatering tube has had time to dewater and relax.

Typically a sludge dewatering tube rupture is the very rapid bursting of the geotextile along the tubes full length, usually at the crest (hoop stress failure), this can result in the very rapid release of the tubes sludge / liquid contents into the bund as well as the release of noxious gases when dewatering municipal waste.