NOAQ Tubewall

Fact sheet

FOTO: JAN STRÖMBERG

NOAQ Tubewall is a temporary flood barrier. It consists of a number of air inflated sections (”tubes”) that are interconnected by ordinary zips to form a continuous protective barrier.

- *AIR INFLATED FLOOD BARRIER*
- *SELF-ANCHORING*
- *EASY TO HANDLE*
- *ADAPTABLE TO UNEVEN SURFACES*

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AIR INFLATED FLOOD BARRIER

NOAQ Tubewall is a temporary flood barrier. It consists of a number of air inflated sections (”tubes”) that are interconnected by ordinary zips to form a continuous protective barrier.

SELF-ANCHORING

Each tube is furnished with a skirt which lies on the ground on the flood side. When flood water enters the skirt, it is squeezed against the ground because of the water’s own weight. The friction against the ground is anchoring the skirt, and hereby the entire tubewall. The higher water levels, the better anchoring, and the tubewall remains stable even if the water should rise to its top.

The NOAQ Tubewall comes in three sizes, TW50, TW75 and TW100 see technical specification.

Technical specifications	TW50	TW75	TW100
Tube diameter	50 cm	75 cm	100 cm
Max water level	50 cm	75 cm	100 cm
Tube length*	10 m	10 m	10 m
Width (skirt included)	1,7 m	2,4 m	3,2 m
Weight	3,5 kg/m	5,0 kg/m	7,0 kg/m
Inflation time	ca 2 min	ca 3 min	ca 5 min
Material	Reinforced PVC		
Temperature resistance	-30°C - +70°C		
Connection angles	Up to 90° in both directions		

**Other tube lengths on demand, minimum length 5 meter*

ACCESSORY TO THE NOAQ TUBEWALL

Pressure Guard - Technical specifications	
Pre-set output pressure	7 kPa (70 mbar, 1 psi)
Max. supply pressure	1,720 kPa (17.2 bar, 250 psi)
Flow*	0.8 m^3/min
Supply side coupling**	Plug-in nipple Rectus ser. 25 SFIW 21
Tubewall side coupling	Monsun XG Ø 70 mm
Total weight	1.5 kg
Length of hose	2.0 m

**at a supply pressure of 900 kPa.*
***other coupling standards on demand.*

THE NOAQ PRESSURE GUARD is an accessory to the NOAQ Tubewall. It makes it possible to connect the tubewall to a compressor or a compressed-air installation. The device includes a pressure reducing valve that maintains the air pressure in the tubewall within the recommended interval, close to 7 kPa (70 mbar or 1 psi).

If an air leak should occur the pressure guard will immediately restore the pressure. The capacity of the pressure guard depends on that of the compressed-air system. With a sufficient compressed-air supply the maximum flow will be at least 0.8 m^3/min. Still it is recommended that the ordinary handheld electrical blower is used for inflating the tubes, as it has a much higher capacity.

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User Instructions

NOAQ Tubewall TW50, TW75, TW100

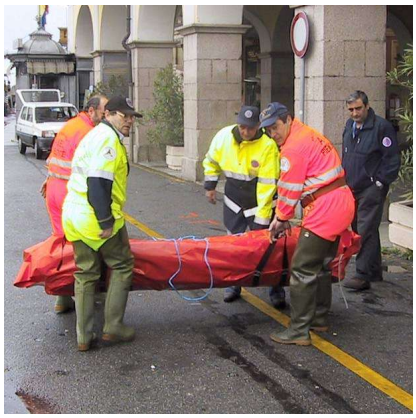
model 4.0 (with blue edge)

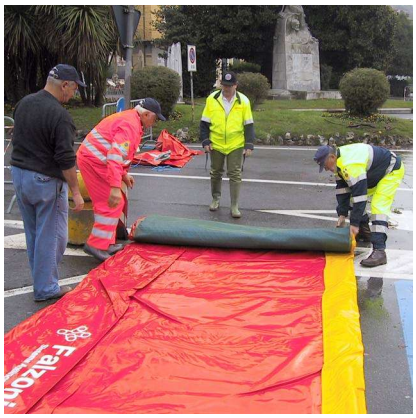
A NOAQ Tubewall is a self-anchoring, mobile wall that provides flood protection. The TW50, TW75 and TW100 models can dam water to a height of approximately 50, 75 and 100 centimetres, respectively. The tubewall is patent-protected in a large number of countries.

As the tube wall is so light, it can be quickly set up to protect buildings and other property against water damage. It is intended for temporary use, and after use the sections (tubes) must be dismantled, cleaned, dried and tested for leaks.

Each section consists of a damming part (the air-filled tube), an anchoring part (the skirt that lies against the ground on the flooded side) and a sealing part (the outermost blue edge of the skirt). The sections also have a drainage layer on the underside, consisting of sheets of shaped plastic and a net holding the sheets in place. Each tube has three connections for filling the tube with air, one at each end and one in the middle.

Two sections are connected by zipping a joint cover between them. The tubes themselves are not connected directly, but they need to be put so tight together that the ends of the tubes press firmly onto each other, in order to prevent the joint cover from being pressed out between them when the water rises.

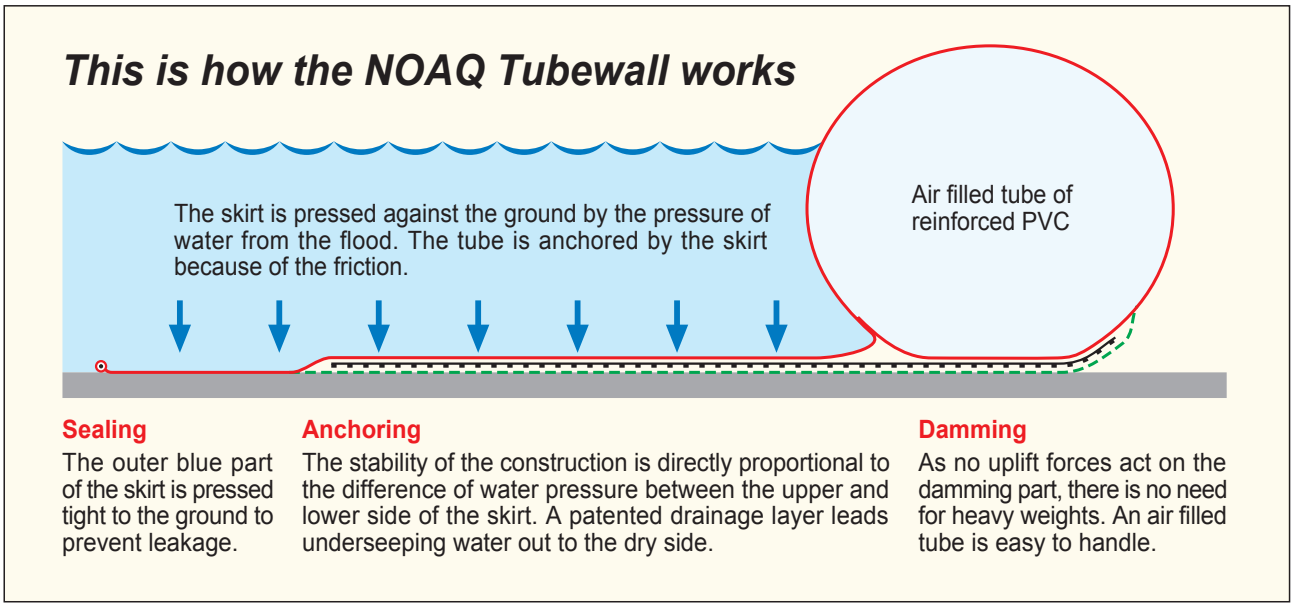




A tubewall is constructed by connecting the tubes so they form a chain. You begin building from one end of the intended barrier, or from somewhere in the middle. You should avoid working from two directions, as it can be difficult to make the two wall sections meet in the middle at the same point.

The best place to set up the tubewall is on dry land, before the water reaches it, although it can also be laid out in shallow water. In that case the depth of the water should not be more than half the diameter of the tube. It is also important to find out the ground conditions (if the ground cannot be seen through the water), so that the tubewall is not placed on an un-suitable surface (see p. 1 below).

A laid-out section, empty or air-filled, can easily be moved as long as the water has not begun to press the skirt against the ground. You should, however, avoid dragging a tube section over long stretches of gravel or asphalt, as the net on the underside can be damaged by the wear.

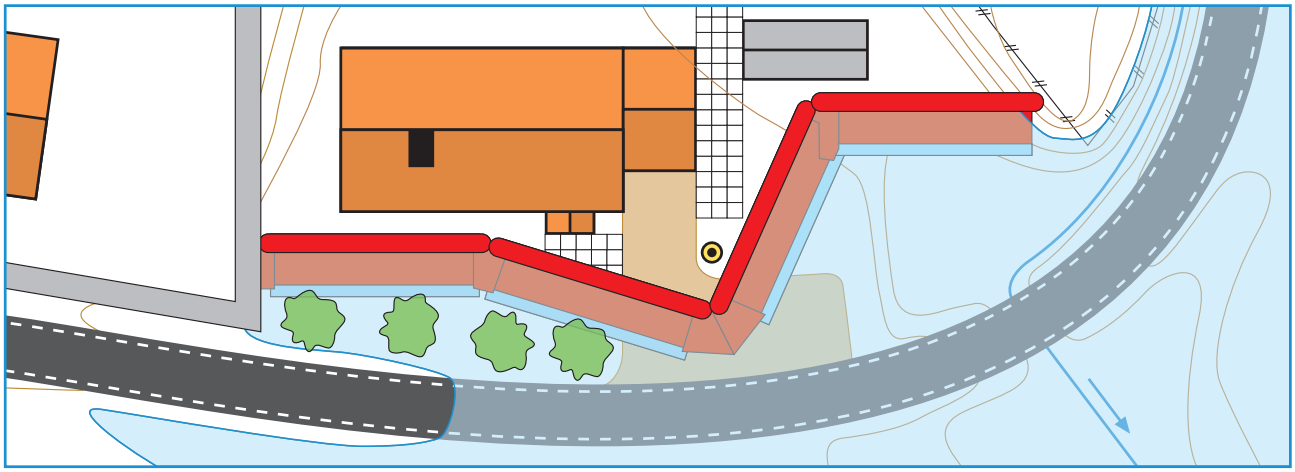


This is what you do:

1. Inspect the stretch of area where the tubewall is to be erected.

The NOAQ Tubewall can not only be pulled straight forward, but can also be dragged in zig-zag fashion around obstacles, along curved roads, etc. The individual tubes must be straight, but the joints between them can be freely angled up to 90° in both directions. A tube section can also be folded, towards the water. To determine where and how a tubewall can be used, we have made a **check list**, which is available on NOAQ's web site (www.noaq.com).

The tubewall works well on most surfaces. Gravel and asphalt paths are acceptable, as are lawns and meadows. Sand on top of tarmac, however, must be brushed away from under the skirt. Ground that is prone to erosion, such as uncovered sand, as well as uncovered mud and clay, which may clog the drainage layer, should be avoided. Permeable surfaces, such as Macadam, should obviously be avoided. Any cavities or depressions should be filled in order for the entire tubewall to dam to the same level.



The ground under the tube and the skirt doesn't have to be exactly even, but the blue outer sealing edge of the skirt must lie on an even surface to allow continuous close contact between the fabric and the sub-surface. Irregularities beneath the blue sealing part, such as kerbs, can be filled in to reduce leakage.

The NOAQ Tubewall requires a strip of land of sufficient width (some 1.8 metres for TW 50, 2.4 metres for TW 75 and 3.2 metres for TW 100). This area must be free of obstacles such as trees, stumps, posts and so on. **In order that the whole surface of the skirt can contribute towards anchoring the tube, it must lie flat on the ground.**

If the strip of land is too narrow at any place (because of the corner of a building or inconveniently located poles or trees), it is still possible to get past. If you can plan where the individual tubes are to be positioned, you can make sure that you have a joint right next to the obstacle. The joint covers on the larger models do not stretch out as far from the tube as the skirts (see illustration below p. 8). This results in the obstacle standing in the open area between two skirts.

The air-filled tube should not lie too close to the corner of a building or other hard or sharp objects of any kind, as it will be forced outwards as the water rises. If it does lie against an obstacle, it can be worn through if waves make the tube move for a great length of time. The air-filled tube can be protected with a joint cover or the like where wear and tear may occur.

It is also important to ensure there are no sharp stones or other objects protruding from the ground underneath. If you have to remove bushes where the tubewall is to be dragged along, you should not cut them just above ground level, but rather pull them up by their roots.

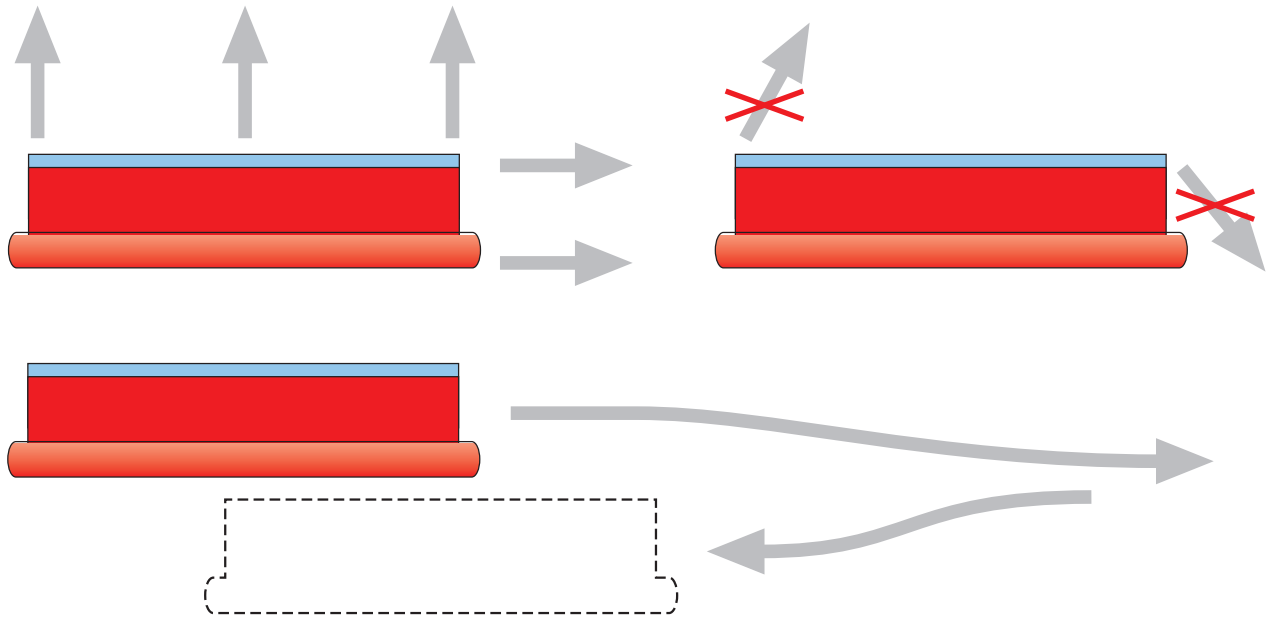
If there are drainage systems in the ground, that may lead flood water under the barrier and up through gullies or manholes in the protected area, these must be blocked.

2. Bring the folded tube section to the proposed location.

Tube sections are delivered on standard wooden pallets and may be transported on such to the proposed location. The sections may also be carried by hand. Depending on the model, 2-4 people are required to carry a 10-metre tube, and 4-6 people for a 20-metre tube.

3. Unfold the tube section and adjust its position precisely.

A tube can be moved by dragging it along the ground. If you need to move a section sideways, the easiest way is to pull it up into a slight arch along its length and then pull it backwards again into the desired position (like moving a car sideways by moving it back and forth).



4. Inflate the tube using the hand-held blower provided.

The blower makes use of ordinary 220V current (or 110 V). Attach it to an electrical outlet, together with an extension cord, if needed. If the cord doesn't reach the tube, it could be inflated at one place and then dragged over the ground to its proposed location. Please note that at least one of the tubes in the constructed wall should be reachable by the cord, in case the air pressure has to be maintained later on.

The valves of the tubes include a backflow prevention function. To set a valve to the open position, press the lid inside the valve and twist it clockwise. Make sure that other valves in the tube are closed. Add air until the pitch of the blower rises, meaning that it's unable to raise the pressure any higher. This will take approx. 1.5 minutes for a (10 metre) TW 50, approx. 3 minutes for a TW 75 and approx. 5 minutes for a TW 100. Remove the blower and close the valve by pressing the lid and turning it counter-clockwise. **Make sure that the blower and any other electrical connections do not come into contact with the water.**

The pressure should be around 7 kPa, or within the interval 5–10 kPa (50–100 mBar, 0.5–1 metre water column or 0.7–1.4 psi). If you use another type of air pump, such as a compressor, you must ensure that you stop pumping air in before the pressure becomes too great. The maximum permitted pressure is 15 kPa (150 mBar, 1.5 metre water column or 2.1 psi).

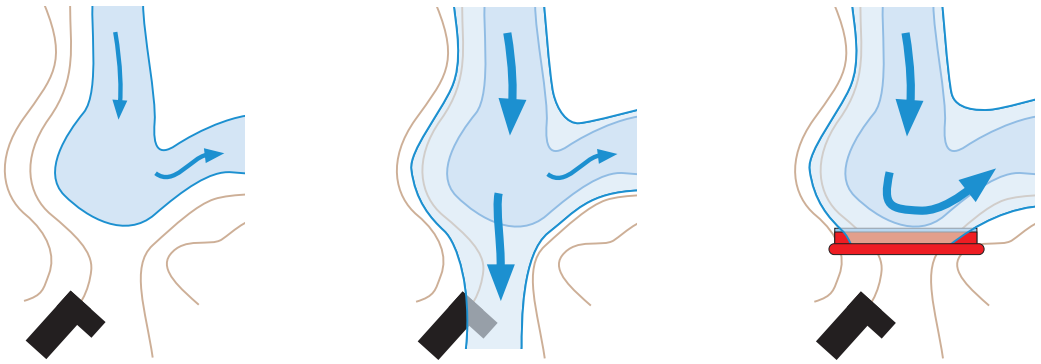
5. Secure the tube if necessary.

If there is strong wind, the tube may need to be secured by laying stones, some gravel, concrete slabs, metal panels, a chain or other weights along the edges of the skirt, and/or by

the tube itself. This may also need to be done if the skirt is lying in water, but the tube has not yet started to dam up (only once a difference in water levels has been built up between the two sides of the tubewall does the skirt start to be pressed firmly against the ground). When the tube section is placed on heavily sloping ground, it may also need to be secured.

If the water is rapid-flowing it is especially important to secure the edge of the skirt so that the flowing water does not have a chance to flap it up. Ideally use weights with a low profile, such as iron panels or concrete slabs. However, please note that the tubewall is mainly intended for still or slow-flowing water. It can be used to dam water that is flowing in the same direction as the tubes, but must never be used for the purpose of trying to brake or stop a water flow. (For this purpose the NOAQ Boxwall may instead be used).

Streaming water



The normal situation.

The situation feared with rapidly flowing water. In this situation it is very difficult to stop the water because of the dynamic forces.

A tubewall that is set up **before** the water starts to flow out has no difficulty in withstanding the force of the rising water and can then even force it down.

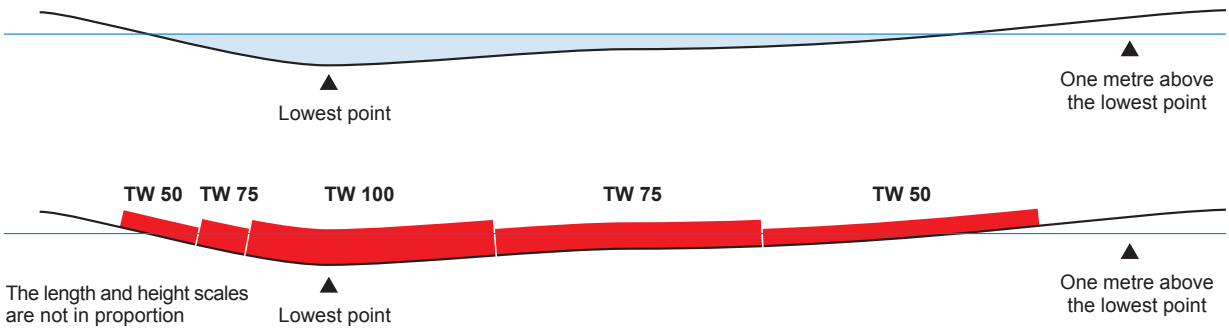
There is a special joint cover (see p. 8) for use in flowing water, although the normal joint cover can also be used if you secure the edge of the skirt as described above.

6. Next tube...

Lay out the next tube by repeating points 1 - 4 above.

Tubes of different sizes can also be used together, which is suitable if the height conditions vary along the wall. In this instance the tubes are laid so that their centre lines meet.

Varying height



7. A tube section can be folded - but only in one direction

Normally a number of tube sections are connected to form a continuous chain, where the individual tubes are straight (they become straightened when inflated). See illustration p.3. However, a tube section can be folded in the middle, but only in one direction, towards the flood. This must be done before inflating it. The skirt will then get excess fabric, which must be arranged in a neat fold. Fix the position of the skirt (and the fold) on the ground by ballasting it with something heavy in order to maintain the desired angle once the tube is inflated.

8. Connect the tube sections by using a joint cover.

The tubes do not need to be directly connected as there are no longitudinal forces trying to pull them apart. If the tubes are lying in line with one another they will be forced slightly backwards as the water rises, and move together if waves strike the wall.

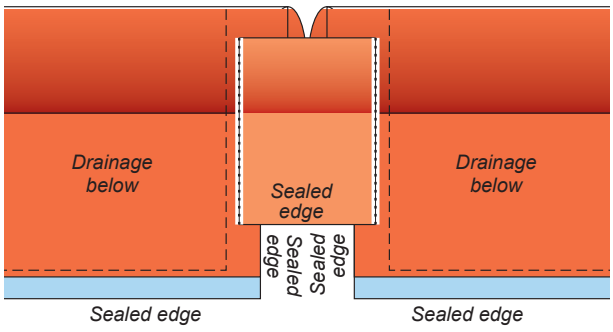
If the tubes are at an angle to one another, with the water in the outer angle, the tubes will be forced more tightly against one another as the water rises. In the opposite direction, with the water in the inner angle, they may instead try to roll slightly apart from one another as the water rises. If the gap is allowed to widen too much the joint cover will become forced into it by the pressure of the water. To avoid this it is important to put the tubes as tight together as possible from the beginning.

The same joint cover is used for all sizes of tubewall. It can also be used to join together two tubes of different heights. The joint cover is connected to both skirts by means of zip fasteners. If the joint is straight, i.e. the tubes are aligned, only one joint cover is required. The same applies if you fold the joint **towards** the flooding. You will then have excess cover in the inner angle, which will have to be arranged in one or more neat folds. These will later be pressed flat by the increasing water pressure, but initially you should press them together by placing sandbags, stones or other weights on them. If the joint is twisted **away from** the flooding, two or more joint covers are required to cover the whole outer angle.

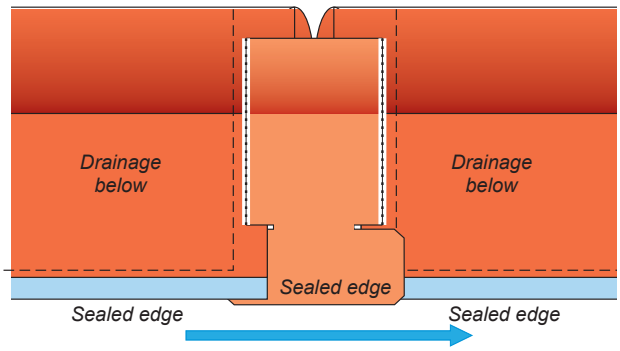
A joint cover must not be stretched between the zips of the skirts. If it is stretched, a further joint cover must be used. **The zip must be protected from forces that will tear it apart.**

To not let the joint cover hang down between two tube ends it is supplied with a strap on its underside. By tightening the strap the joint cover is held up. The strap can be attached at three different positions, one for each of the tube sizes.

Standard joint cover



Joint cover for rapidly flowing water



For the largest two tube sizes TW75 and TW100 there is a special joint cover for rapidly flowing water. It is designed so that the edges of the skirts are protected against being forced open. It is wider than a normal joint cover, and is laid overlapping each skirt: below the skirt is upstream and above the skirt is downstream. The smallest model TW50 has no edges that need to be protected.

9. Connect the tubes, using the air hoses.

This is optional but enables you to monitor the air pressure from one point when a number of tubes forms a continous air volume. See NOAQ Pressure Guard, p. 13.

10. Pump away the leaking water from the dry side.

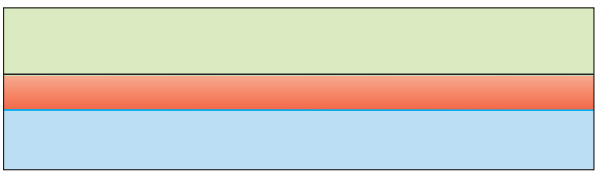
Some water will always leak beneath the wall. There is also the water that leaks through the actual ground, rainwater, etc. The ground usually slopes towards the flood, which means that all of the water gathers next to the tubewall. This water must be pumped away before the level rises. If the water level on the "dry" side is allowed to rise, the tube will gradually attempt to float and lift its skirt with it. If the ground instead slopes away from the flood (e.g. on the crown of a protective wall), the leak water will run away without the need for pumps.

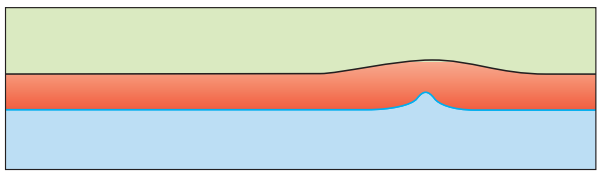
11. If necessary, ballast the edge of the skirt.

When the water level is low the resultant water pressure is low against the skirt. If the ground is uneven at the time, or if the turf is thick, the edge of the skirt will not remain pressed tightly against the ground. To reduce ground leakage, you can weigh down the skirt's blue sealing edge using something heavy e.g. a chain, brick, stones, sandbags, sand or gravel. This may be necessary if your pumping capacity is insufficient to cope with the water leakage. Once the skirt starts to "seal" to the ground, the leakage will diminish. The higher the floodwater rises, the better the seal will be. To further reduce the amount of water leaking through the wall you may also cover the zips with tape.

12. Monitor the tubewall.

It is particularly important, of course, for the tubes not to leak air. It is important to be aware that **if a leak does occur it does not become evident by the tube starting to deflate.** The water pressure from the flooding will cause the tube to still appear swollen. The first sign of an air leak appears as a change in the shape of the tube, i.e. the straight tube gets a bend or begins to look sway-backed. See illustration below.





Temperature differences also cause pressure changes. When the temperature falls at night, the pressure in the tubes also falls a little. By the same token, a tube that is filled at the correct pressure on a cold morning can reach a pressure that exceeds the recommended maximum when the sun is at its strongest. However, the tubes can withstand this overpressure.

13. NOAQ Pressure Guard

To monitor the pressure in a tubewall, we have developed a special pressure guard. It should be connected to a compressor or canister of compressed air, and to one of the valves of the tubewall. The pressure guard is based on a reduction valve, which makes sure that the air pressure in the tubewall is kept close to the recommended level of 7 kPa (70 mbar or 1 psi). If there is any leakage of air anywhere, the valve opens immediately and restores the pressure.

The capacity of the pressure guard depends on that of the compressor. If there is a sufficient supply of compressed air, a maximum flow of 0.8 m^3/min is achieved. To fill the tubes with air, however, we recommend instead the hand blower supplied, which has even greater capacity.

A pressure guard should always be used, particularly when you are not able to monitor the tubewall continuously. At night time, with noises from pumps and electrical power sources, it can be difficult to maintain reliable manual super-vision of the system. There is a separate fact sheet for the NOAQ Pressure Guard.

14. Connecting the tubewall to a wall or façade.

A tubewall can easily be connected to (and finish against) a wall or the façade of a building. Make sure that the end of the tube rests directly against the wall. Depending on the connection angle, use either one or two joint covers to achieve a securely sealed connection. From the beginning, the joint cover must be held up against the wall with the aid of a support (e.g. a pallet leaning against it or a pile of sandbags), or by being secured to it. As the water rises, the joint cover will then be held in place against the wall by the water pressure.

15. Combine boxwall and tubewall.

A NOAQ Tubewall can be combined with a NOAQ Boxwall. The walls are laid so that they overlap by a metre or so, ideally with the tubewall closest to the flood and the boxwall beneath and behind the tubewall. One or a pair of the tubewall's joint covers is used to form a seal between the two wall sections. The joint covers are used in the same way as when the tubewall is connected to a wall.

16. Damage and repair.

If an air leak occurs during service and no measures are taken, the tube will gradually lose its damming shape and the tubewall will eventually fail whether the leak is on a dry part of a tube or underwater. The amount of time elapsed for this course of event to occur will depend upon the size of the hole and the actual water level.

A small leak may not be possible to locate and may not need to be repaired at all as the pressure guard compensates for the loss of air. Should a major leak occur, it is necessary to plug it. The measures to be taken in this case are, in order:

Step 1 - Add air continuously

The blower has the capacity to prevent the pressure from dropping, even if there is a major leak. This will allow you to restore the pressure before mending the hole. A steady air supply will stabilize the situation, allowing time for inspecting the damage, deciding what to do, fetching the repair kit, etc. The fabric is reinforced so there is no risk of a tear to increase in size due to increased strain on the fabric.

Step 2 - Plug the hole

The easiest way to reduce the air leakage from a major tear is to block the hole with anything that is to hand. A piece of sponge works well, and one is included in the repair kit. Cut a piece that is sufficiently big for it to fit into the whole and then expand both inside and outside the hole. By this simple action the airflow will be reduced by more than 90%. This method works equally well for leaks above and below the water level. For minor leaks, skip this measure and go straight to step 3.

Step 3 - Repair the damage

Wipe away dirt from around the hole and cover it with plastic-coated tape (which works under water as well). A roll of such tape is included in the repair kit.

17. After use.

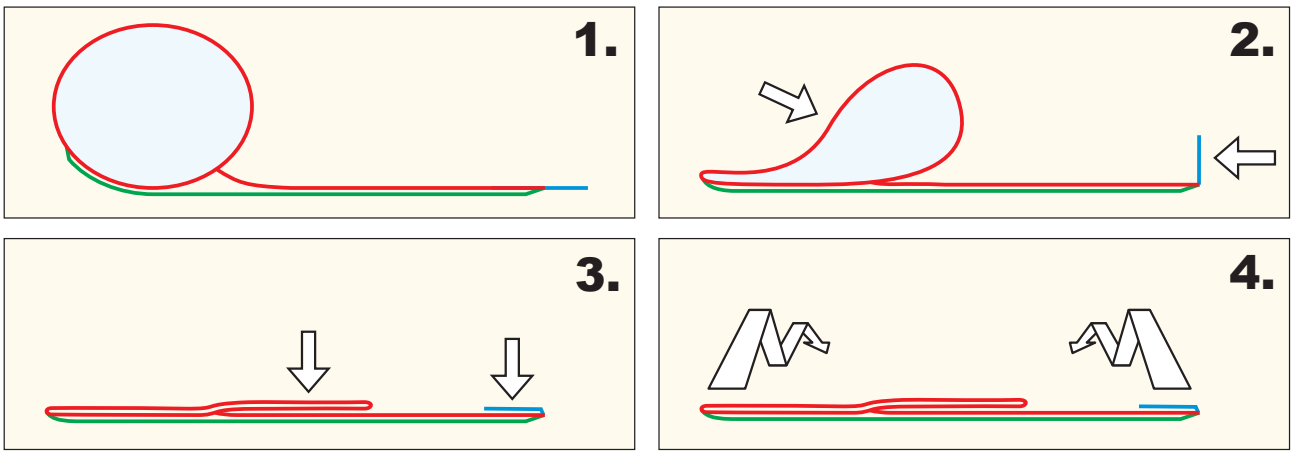
Before the tubes are stored away they need to be inflated and washed clean. A good idea is to do this on sloping ground to allow the water to run off the skirt. The drainage layer's plastic sheets may be pulled out of its net pockets and cleaned separately from the skirt. It is important that you make sure that the side of the sheet with studs faces downwards.

Make sure the tubes are airtight by letting them lie inflated for some hours. If a tube is leaking, you locate the leak by listening for a hissing sound or by spraying a little soapy water on the suspected area. Mark the leaking area with a pen.

Once the area around the hole is cleaned and dried, it can be repaired with LiquiSole™, Aqua-Guard™ or other kinds of urethane-based glue. There is one in the repair kit. Follow the instructions for each product.

Should one of the valves be leaking there is a tool in the repair kit to untie or tighten the valves. It consists of two parts. Remove the white support ring and put the inner adjusting tool in the opening. Use the outer hexagonal part to prevent it from rotating. Put a screwdriver or the like through the tool's holes and tighten the valve.

When the tubes are dry, they should be folded together and stored in a dry place where they will not be exposed to direct sunlight or temperatures below -30° or above +50°C. This is how a tube section is packed together:



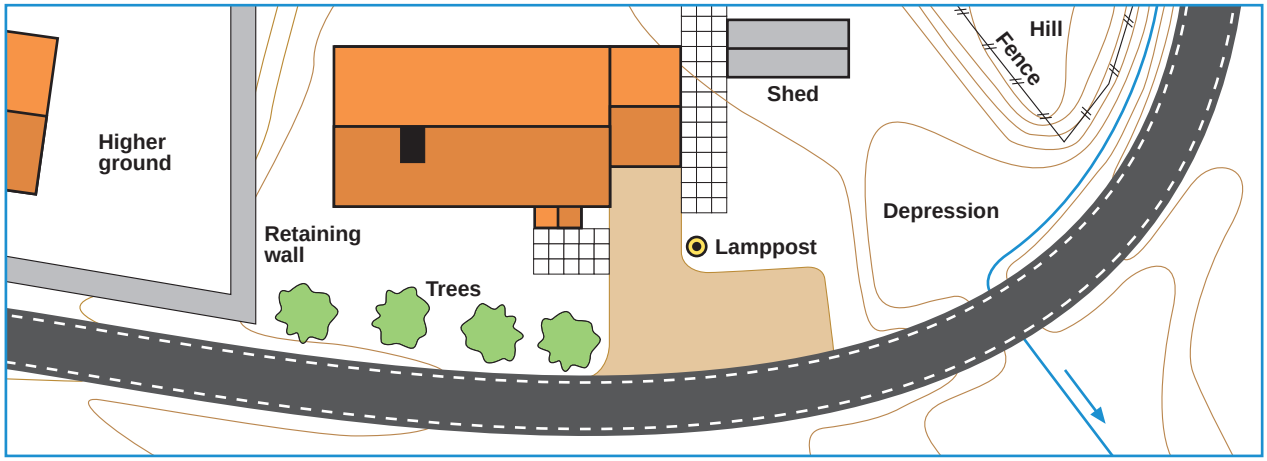
If the equipment is not used for an extended period (more than 6-9 months) it should be inspected to ensure it is in good working condition. Complementary devices such as pumps, cables, etc. also need to be checked. Regular training for those using the equipment will ensure they are familiar with proper use of the tubewall.

Important!

Flooding is a course of events ruled by natural forces that man can only manipulate and control to a certain degree. Furthermore, no two events are alike. All protective equipment must be handled not only in a professional way according to the instructions laid out in this user guide, but also with a great deal of common sense. Manufacturers, retailers and renters of this equipment cannot be held liable for damage to people or property that may result from its use.

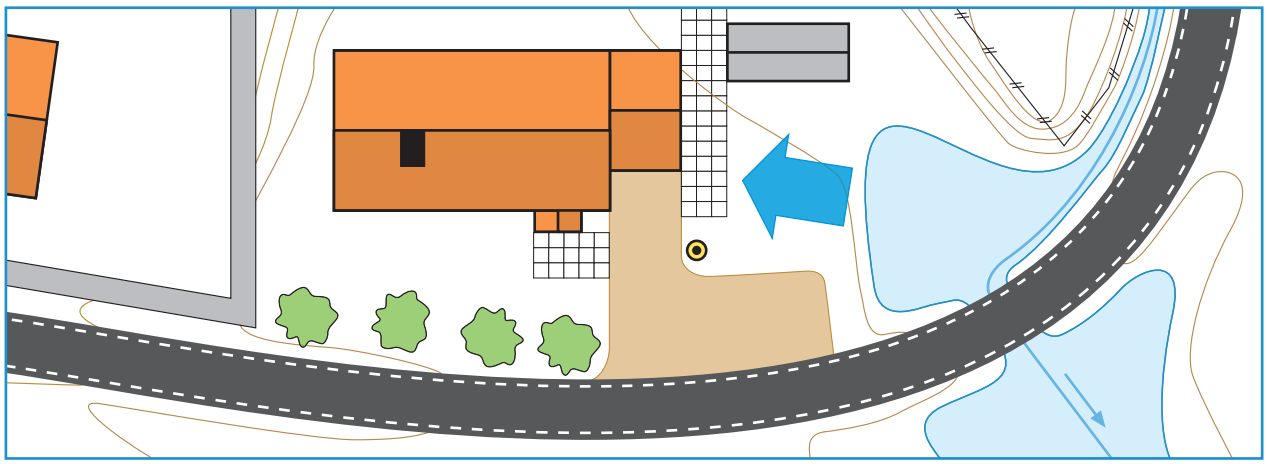
NOAQ
Flood Protection AB

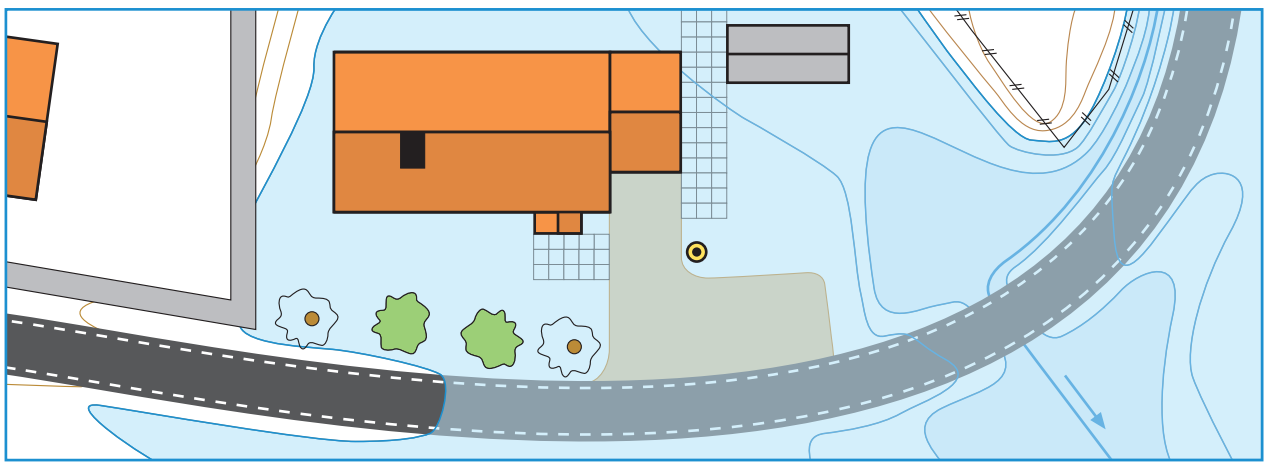
TUBE WALL CHECK LIST



1. Identify the most vulnerable side of the object

From what direction is it most likely that the water will approach?
From what direction will the water first reach the object?
Most often this is obvious, but sometimes it is not.



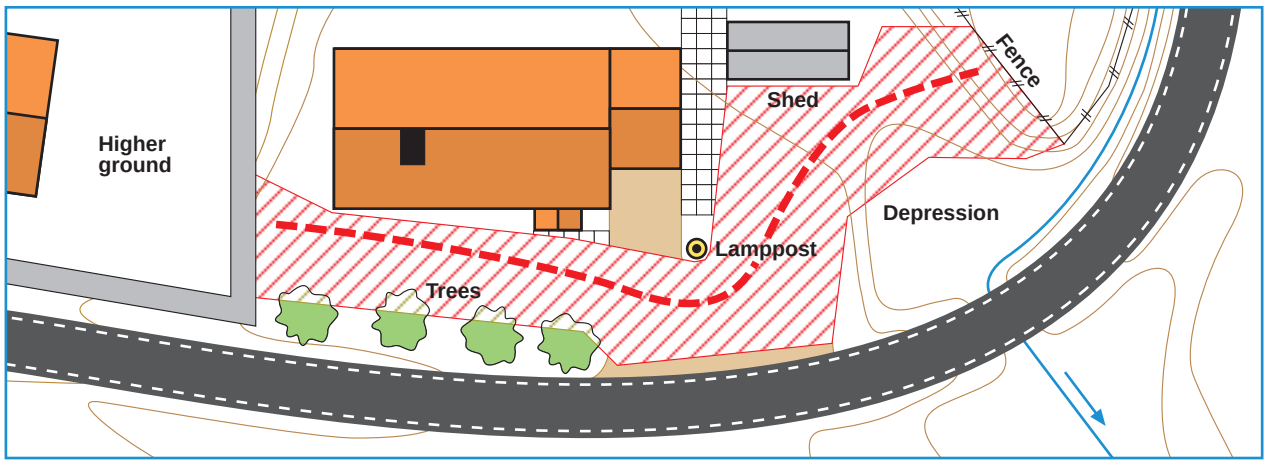


2. Find a flood defence line in front of this side

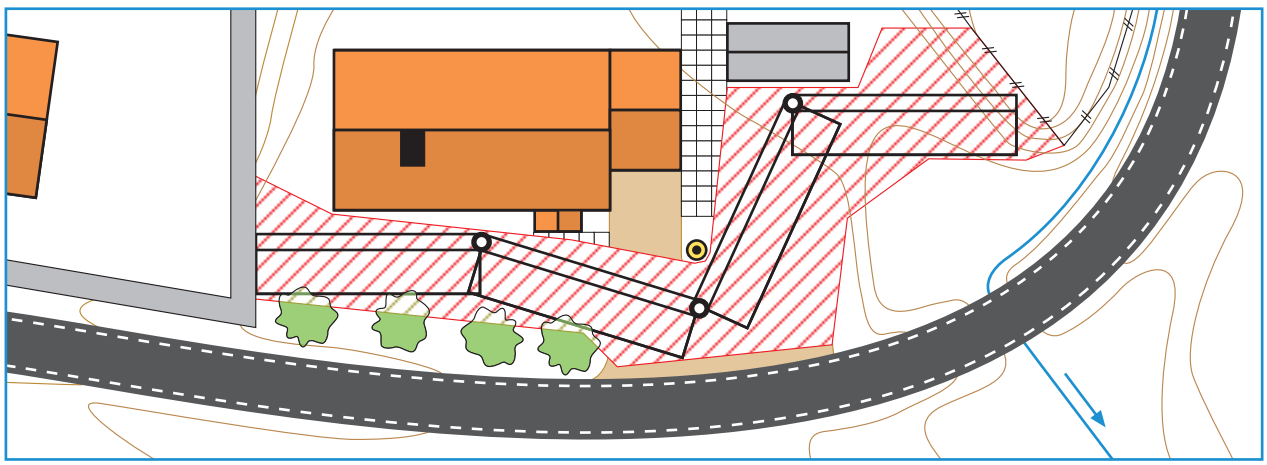
A flood defence line is a path along which a mobile flood barrier can be deployed. It should be chosen as high as possible; if the ground slopes downward from the object, the flood defence line should be chosen as near the object as possible.

For the use of a NOAQ Tube Wall, a flood defence line must meet the following requirements:

- Along the line, there must be a strip of land free from firm obstacles like trees, posts, fences etc. to a width of at least 1.8 m (TW50), 2.4 m (TW75) or 3.2 m (TW100).



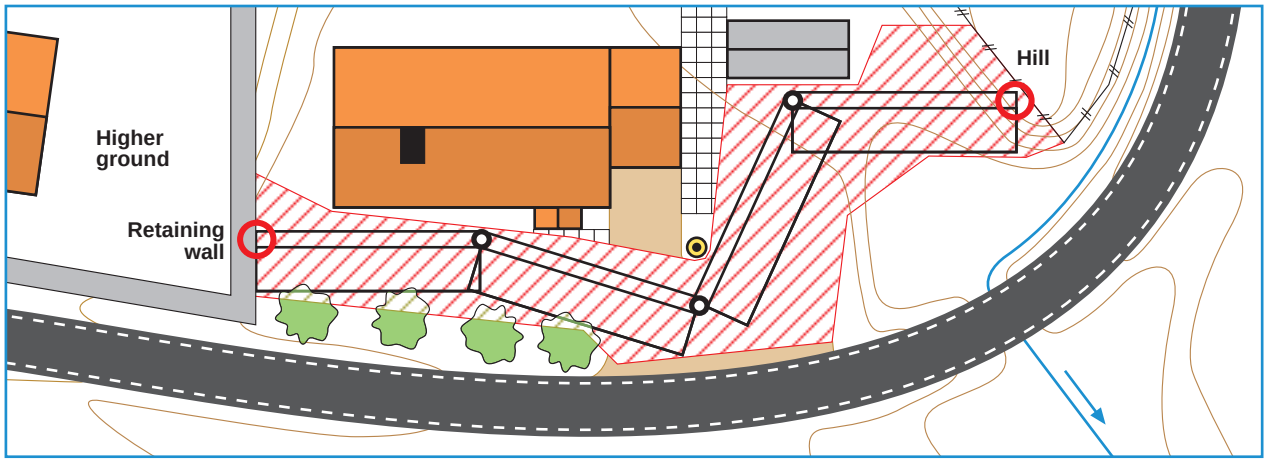
- As the footprint of each tube section (including the skirt) will form a rectangel, a chain of such rectangles must be possible to fit within the area of the strip. The connecting point, the ”hinge”, between two adjacent rectangles, is located where the tube ends will meet.



- The ground must be reasonably even, especially along the outer edge of the strip, where the outer part of the skirt is supposed to seal tightly against the ground surface.
- If the ground consists of erodable material (like sand or loose soils) it has to have a non-erodable surface (like turf, slabs etc.)

3. Find two secure ending points

A barrier protecting this side of the object must reach from one secure ending point to another, the secure ending points being either a place where the ground is high enough not to get flooded or a vertical wall or facade against which the tube wall end could abut tightly (by using a joint cover).



If no secure ending points are found near the object the tube wall will have to encircle it. If other threatened objects are too close (like terrace houses) the tube wall may have to be extended to protect the whole group of objects.

4. Is there a need for complementary flood protection?

Will one tube wall do, or are there other flood threatened sides of the object, that need to be protected separately? If so, repeat p. 2 - 3 above.

Are there other ways for water to enter the protected area, from drains, manholes etc? Does the ground contain water permeable layers that could lead water under the barrier to the protected area behind it?
If so, these routes have to be blocked too, by using appropriate techniques. Also drains or manholes covered by the skirt needs attention as they may lead water to the drainage layer.