

Kobberoe 'Phocus' on Leakage

Water engineers from Horsholm Kommune have been among the first in Denmark to take advantage of the benefits of Phocus2 acoustic loggers from Primayer/Kobberoe. In overnight tests these loggers were able to efficiently prove the existence and approximate location of a suspected leak, prior to location using correlation. Jens Kobberoe confirms that 'this new technology will enable water engineers to further reduce leakage levels.'

A suspect leak had been identified along the Strandvej in Alegade, which falls within the responsibility of the water engineers of Horsholm Komune. This is a well-situated road that runs along the north-east coast of the Copenhagen peninsula and which faces Sweden - making it a popular residential area. Due to the age of the properties (some of which are covered by preservation orders) leaks appear regularly. Furthermore, as the leakage problems occur on private land notices have to be served to the occupants in order to the rectify leaks. The engineers were thus understandably anxious that Phocus2 advise and predict the location of the leak.



Figure 1 Phocus noise logger installation

The operation of Phocus2 is such that the acoustic noise loudness is recorded at one-second intervals for two hours during the night. Night-time is the ideal time because background noise is lower, water usage is at the minimum and also water pressure is higher, so leak noise will travel further. The noise amplitude (loudness) will vary due to random effects such as traffic, but there will always be a consistent minimum due to any noise that is always present – for example leakage. Comparison of this consistent minimum noise level at different locations provides the approximate location of a leak.

For the Strandvej test, twelve Phocus2 acoustic loggers were spread out over an area of

approximately 600m² and programmed to record their 7,200 samples from 02.00 to 04.00 hours in the morning. The loggers were deployed at short spaces so that results would also give an indication as to the possible future logger spacing required. Figure 2 shows the positioning of loggers 8, 9 and 10.

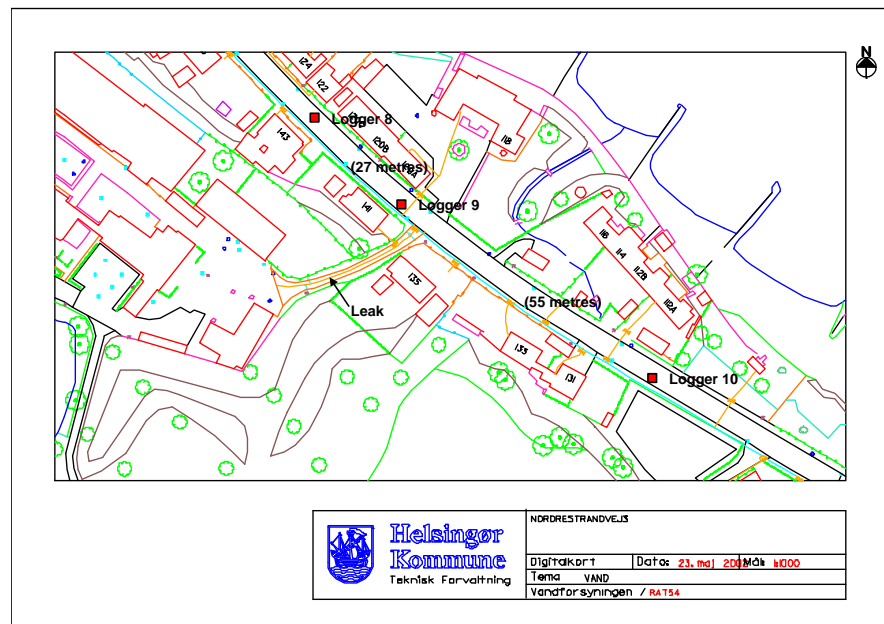


Figure 2 Map showing sample location of deployment of the loggers 8, 9 and 10

The following morning, all loggers were inspected with the stroboscopic

torch. This torch activates the logger to give an instant indication of the possible presence of a leak. Two LED's show Leakage Confidence Factor and Noise Strength, as indicated in Figure 3. Users appreciate the instant visual leak indication and found it also reliably showed where there were no leaks present (when showing a single green flash).

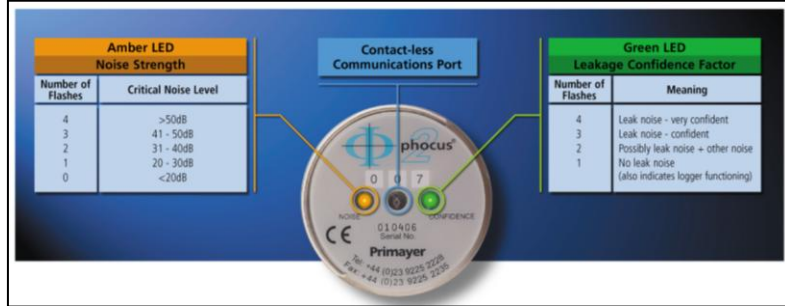


Figure 3 Phocus noise logger visual indicators

The loggers were then collected and the data transferred to a PC. The table shows the outcome of the deployment of the twelve Phocus2 loggers with logger 9 indicating maximum confidence in detected noise leak noise (level 4) and with a critical loudness amplitude (the consistent minimum noise) of 24dB. Loggers 7 and 8 are also detecting leak noise with a confidence of level 3 and a lower noise level. In the table the loggers can optionally be ranked to show those detecting leak noise at the top of the table with the others in descending order of distance from the leak.

Supply Area	Order of Log	Logger ID	Fitting Type	Pipe Material	Leak Confidence Factor	Critical (dB)	Peak (dB)	Spread (dB)	Counts at Peak (%)
	1	1			1	19	41	54	3
	2	2			1	10	18	30	29
	3	3			1	23	25	31	24
	4	4			1	20	24	51	4
	5	5			1	9	19	36	18
	6	6			1	8	19	44	13
	7	7			3	21	22	23	35
	8	8			3	19	20	25	41
	9	9			4	24	25	20	60
	10	10			1	8	11	34	12
	11	11			1	8	9	29	15
	12	12			1	11	22	44	8

Figure 4 Table of logged results

Figure 5 shows a graphical representation of the noise obtained from logger 9. The graph indicates noise amplitude measured in dB on the x-axis, number of samples (e.g. how often measured at one-second intervals) on the y-axis and time (through the two-hour window) on the z-axis. Leak noise is characterised by little change in loudness which is measured frequently (higher on the y-axis). When other, parasitic noises (such as traffic or water use) are present then skewing of the characteristic occurs, that is, the other noise is added to the leak noise so the graph becomes stretched towards the higher dB values. Logger 9 has produced a typical graph of leak noise and where there is little other parasitic noise present. It is sometimes useful to view

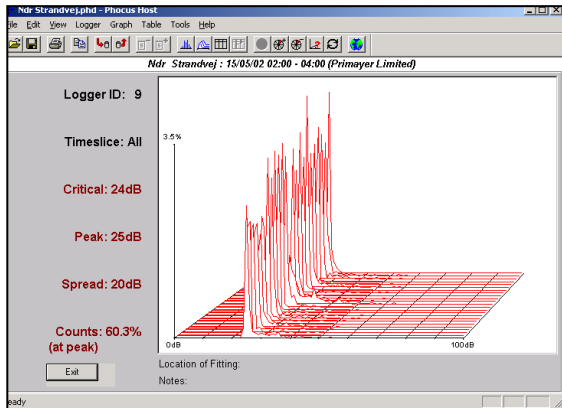


Figure 5 Logger 9 noise distribution

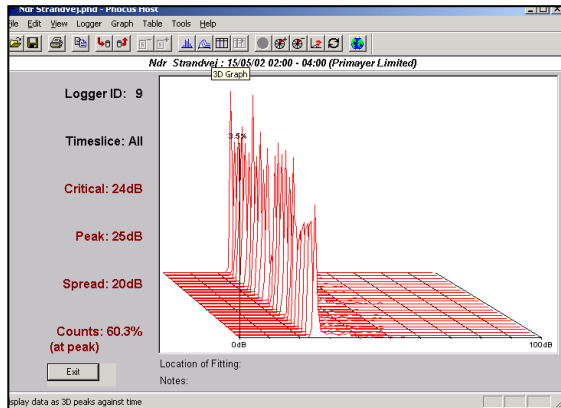


Figure 6 Logger 9 noise distribution – reverse view

the graph from the opposite angle (Figure 6). This shows the rapid rise of sampled noise values from the critical noise to the peak noise, which Phocus2 uses (together with the number of samples in this region of the curve) to determine the presence of the leak.

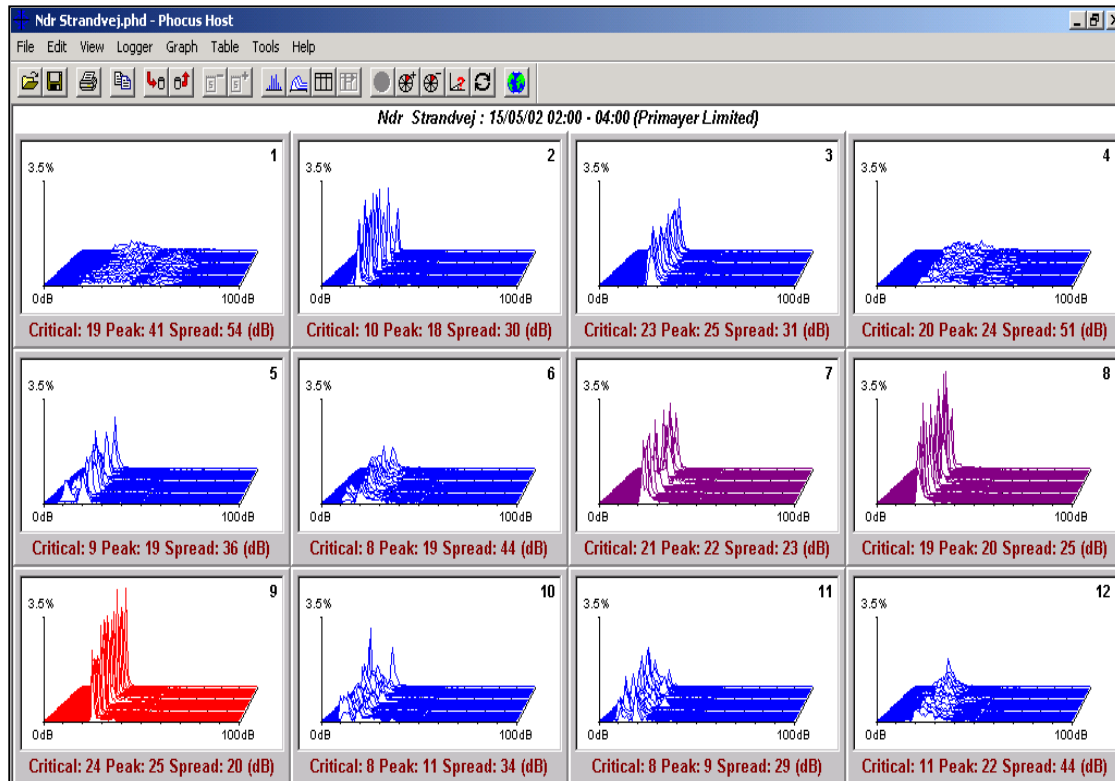


Figure 7 Three dimensional display of all twelve loggers

Figure 7 shows the noise characteristics of all loggers together. The colour coding of graphs relates to Leakage Confidence Factor; here red indicates level 4 (maximum confidence) and purple indicates level 3 (probable leak noise plus parasitic noise). Blue indicates no leak noise (level 1).

Use of a leak noise correlator and a ground microphone on valves close to logger 9 confirmed exactly the position of the detected leak on a private property. Kommune engineers were impressed that with the minimum of time and great ease of deployment and interpretation, a large area could be covered to detect leaks reliably.

It was also possible to deduce that a separation of up to 200 metres between each logger was feasible in similar circumstances; so that a full set of 15 loggers at this distance would enable a large area to be covered. Leaks can be located in different locations with reliability every night - thereby giving substantial utilisation of investment in the acoustic loggers.

Phocus2 will shortly be in regular use, reflecting their ease of use and rapid achievement of results. There is little doubt that leading edge products like Phocus2 will continue to assist Horsholm Kommune in achieving leakage targets.