CLAIMS

1. **A remote sensing device** for monitoring a condition within a water infrastructure network comprising:

an antenna unit configured to be located at or towards a top surface of a water infrastructure component in the water infrastructure network, the antenna unit comprises a flat base for engaging with the top surface of the water infrastructure component, the antenna unit having an elongate connection shaft comprising a hollow depending therefrom, the elongate connection shaft providing a mounting structure on the underside of the water infrastructure component for receiving and supporting a structure;

a monitoring unit for housing electrical components including a sensor for detecting a parameter, the monitoring unit removably mounted to the antenna

wherein the monitoring unit comprises a hub for mounting the monitoring unit to the elongate connection shaft, the hub being a region of the monitoring unit surrounding an opening of the monitoring unit, the opening configured such that the elongate connection shaft passes completely through the housing of the monitoring unit;

wherein the electrical components are located in a cavity of the monitoring unit, arranged to be spaced radially around the hub and the monitoring unit is located in a region between the top and bottom ends of the elongate connection shaft; and

wherein the antenna unit and monitoring unit are separate and individually water-tight structures.

2. The remote sensing device as claimed in claim 1 wherein the elongate connection shaft comprises an external thread for making the essentially rigid connection,

further comprising a nut associated with the threaded elongate connection shaft, the nut having a large engaging surface for engaging against the component of infrastructure to form the essentially rigid connection.

3. The remote sensing device as claimed in claim 1 or claim 2 wherein the elongate connection shaft is connected directly to the component of infrastructure to form the essentially rigid connection, and

wherein an external thread of the elongate connection shaft engages directly with the component of infrastructure.

4. The remote sensing device as claimed in any one of claims 1 to 3 wherein an electrical connection is formed between the antenna unit and monitoring unit at the same time as a mechanical connection between the units is established with one motion, and

wherein the electrical connection is a push type electrical connector incorporated with the elongate connection shaft.

5. The remote sensing device as claimed in any one of claims 1 to 4 wherein the monitoring unit comprises one or more drain ports located on the hub for water to pass through the monitoring unit, without entering the cavity housing the electrical components.

6. The remote sensing device as claimed in any one of claims 1 to 5 wherein in plan view, the monitoring unit comprises one of the following general housing profiles:

a) donut,
b) ring,
c) partial-ring,
d) horseshoe.

7. The remote sensing device as claimed in any one of claims 1 to 6 wherein the sensor is one of the following:

a) water level sensor,
b) non-contact flow sensor,
c) gas sensor,
d) temperature sensor,
e) moisture sensor,
f) tamper sensor,
g) vibration sensor, or
h) light sensor.

8. The remote sensing device as claimed in any one of claims 1 to 7 wherein the sensor is a radar sensor comprising a lens, and

wherein the lens is integrated with a housing of the monitoring unit.

9. The remote sensing device as claimed in claim 8 wherein the monitoring unit comprises a water rejecting region in a focal area of the lens, and

wherein the water rejecting region is a ramp on a housing surface of the monitoring unit for draining water downwards away from the focal area.

10. The remote sensing device as claimed in any one of claims 1 to 9 wherein electrical components housed in the monitoring unit comprises one or a combination of:

a) a controller,

b) a wireless communication module,

c) a power supply, and

wherein all the electrical components are housed within one monitoring unit.

11. The remote sensing device as claimed in any one of claims 1 to 10 wherein the monitoring unit comprises an upper housing portion and a lower housing portion, the upper housing portion comprises downwards facing shell profile and the lower housing portion comprises a substantially flat lid profile, and

wherein a single gasket is provided between the upper housing portion and the lower housing portion to seal a mating surface between the housing portions.

12. The remote sensing device as claimed in claim 11, wherein the component of infrastructure is a:

a) manhole cover

b) grate

c) cap

d) lid.

13. The remote sensing device as claimed in any one of claims 1 to 12 further comprising a connection assembly to secure the device to the water infrastructure component, the connection assembly comprises:

a primary antenna fastener to secure the antenna unit to the water infrastructure component via the elongate connection shaft to make an essentially rigid connection; and

a primary unit fastener to secure the monitoring unit to an underside of the component.

14. The remote sensing device as claimed in any one of claims 1 to 13 wherein the monitoring unit is not located below the bottom end of the hollow connection shaft.

15. **A smart manhole cover** comprising:

a manhole cover body; and

the remote sensing device as claimed in any one of claims 1 to 14;

wherein the remote sensing device is connected to the manhole cover body such that the antenna unit is located at an upper surface of the manhole cover body and the monitoring unit is located on an underside of the manhole cover body.

16. The smart manhole cover as claimed in claim 15 wherein the elongate connection shaft passes through a through-hole of the manhole cover body for a connection between the antenna unit and monitoring unit, and

wherein the elongate connection shaft extends along a longitudinal connection axis passing through the through-hole, and

wherein the manhole cover body comprises a cavity on the underside of the cover for receiving the monitoring unit and the monitoring unit has a height less than the cavity height such that the monitoring unit does not protrude below a bottom surface of the manhole cover body.

17. **A method of sensing a parameter** comprising:

providing the remote sensing device as claimed in any one of claims 1 to 14;

monitoring a parameter;

wirelessly communicating data from the remote sensing device to a remote receiver.

18. The method of sensing a parameter as claimed in claim 17 further comprising passing the elongate connection shaft through an opening of the monitoring unit and securing the monitoring unit with a hub fastener tightened against a surface of the monitoring unit.

19. The method of sensing a parameter as claimed in claim 17 or claim 18 wherein the parameter is associated with a manhole and the remote sensing device is connected to a manhole cover body to form the smart manhole cover as claimed in claim 15 or 16.

20. The method of sensing a parameter as claimed in claim 19 further comprising securing the antenna unit to the manhole cover body before securing the monitoring unit.

21. The method of sensing a parameter as claimed in claim 19 or claim 20 wherein the remote sensing device is retrofitted to an existing manhole cover body.

22. The method of sensing a parameter as claimed in any one of claims 17 to 21 wherein the remote sensing device is associated with and connected to one of the following:

a) sewers,

a) stormwater catch pits,

b) rain gardens,

c) water troughs,

d) gross pollutant traps,

e) waste tanks.