
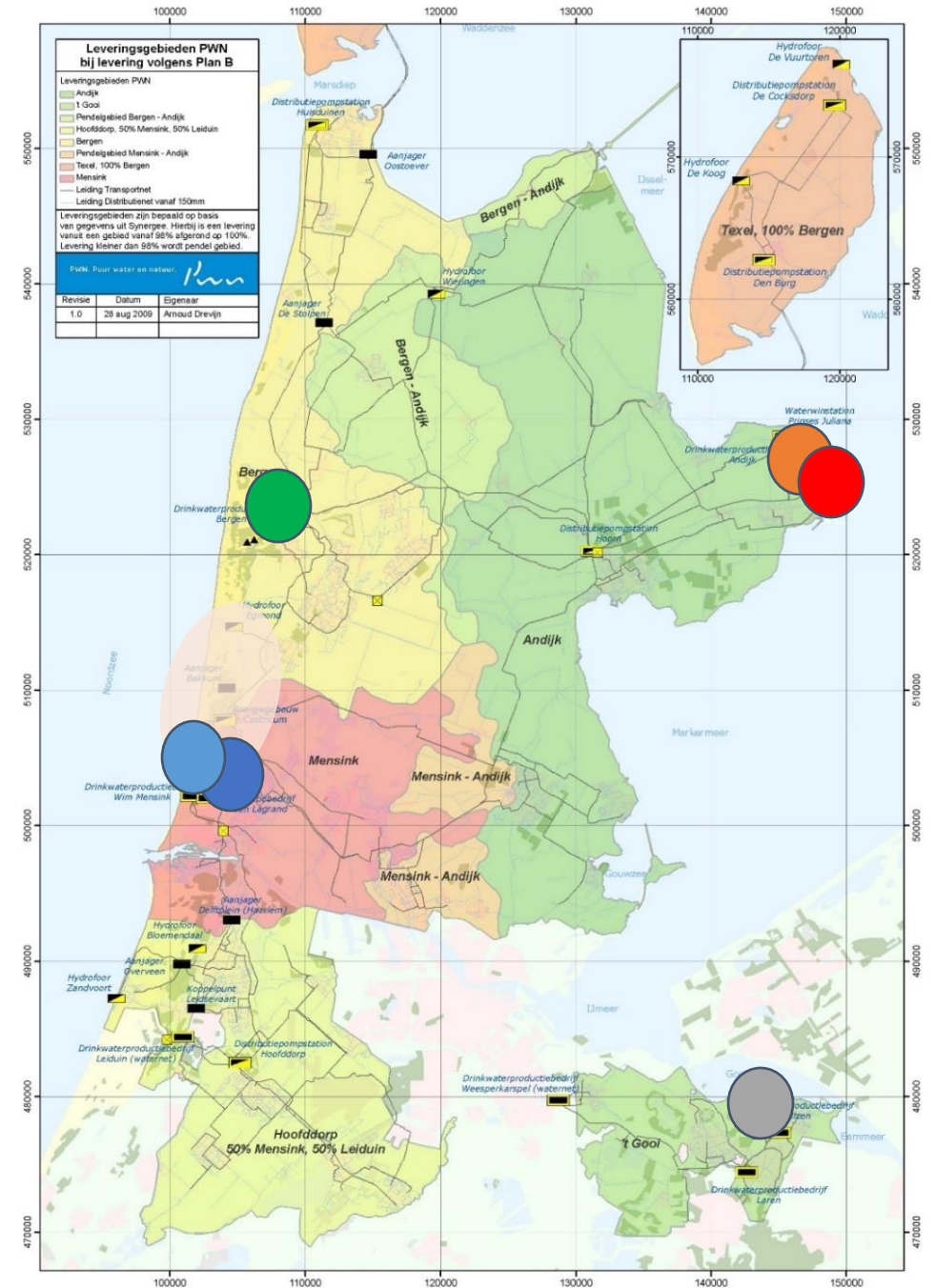




PWN drinking water distribution

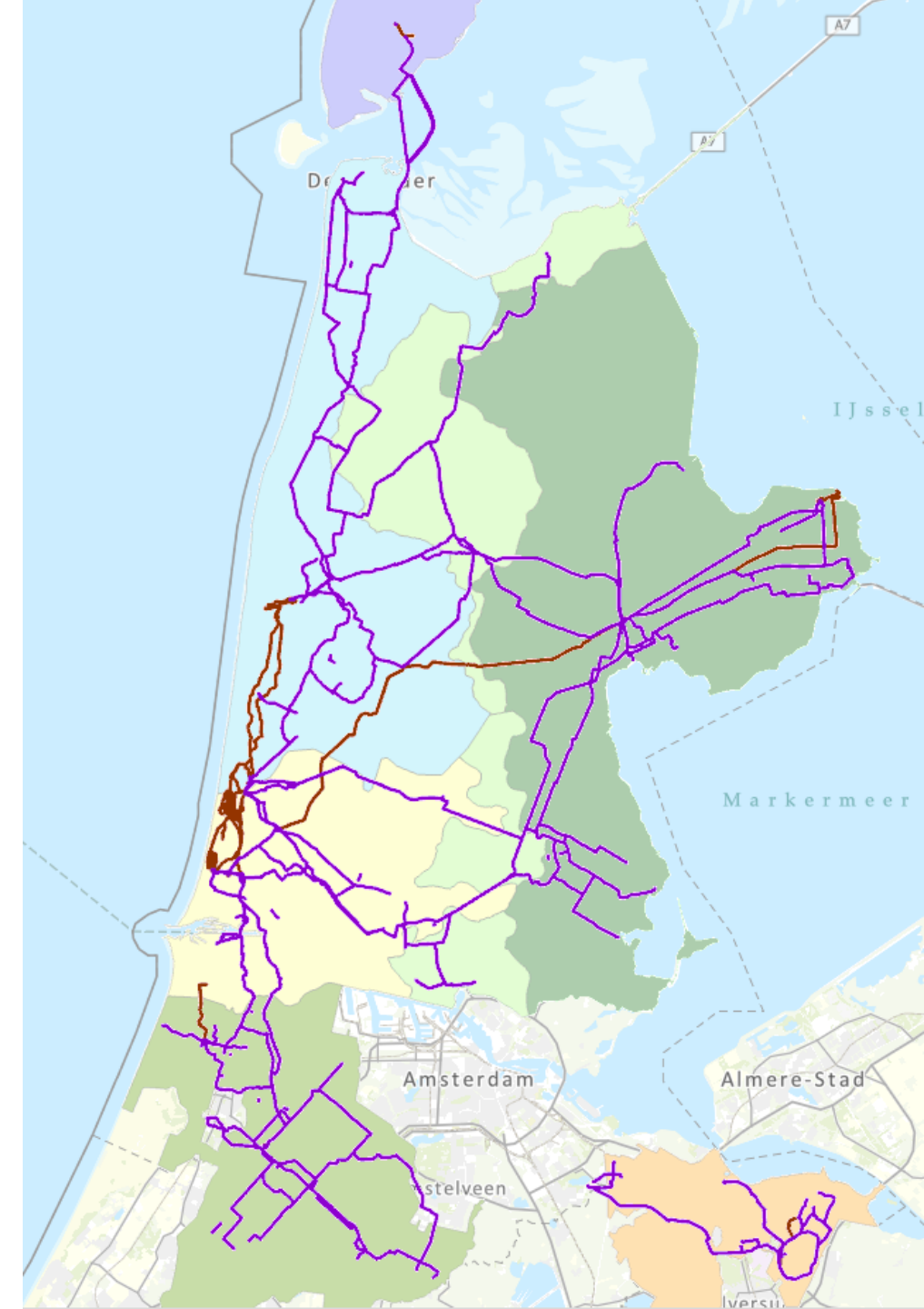
Production locations

-  WTP – Laren
(ground water)
-  WTP – Martien den Blanken
(direct surface water treatment)
-  WTP – Princess Juliana
-  WTP – Jan Lagrand
-  Dune infiltration area
-  WTP – Wim Mensink
-  WTP – Bergen



Distribution network

- Connected distribution regions
- Mixing zones



Transport and distribution pipes

Material	Pipe length (km)	Pipe length (%)
Asbestos cement	3 960	38
PVC	2 730	26
PE	1 940	19
Grey cast iron	590	6
Nodular cast iron	520	5
Concrete	350	3
Steel	230	2
Else	70	1
Total	10 390	100



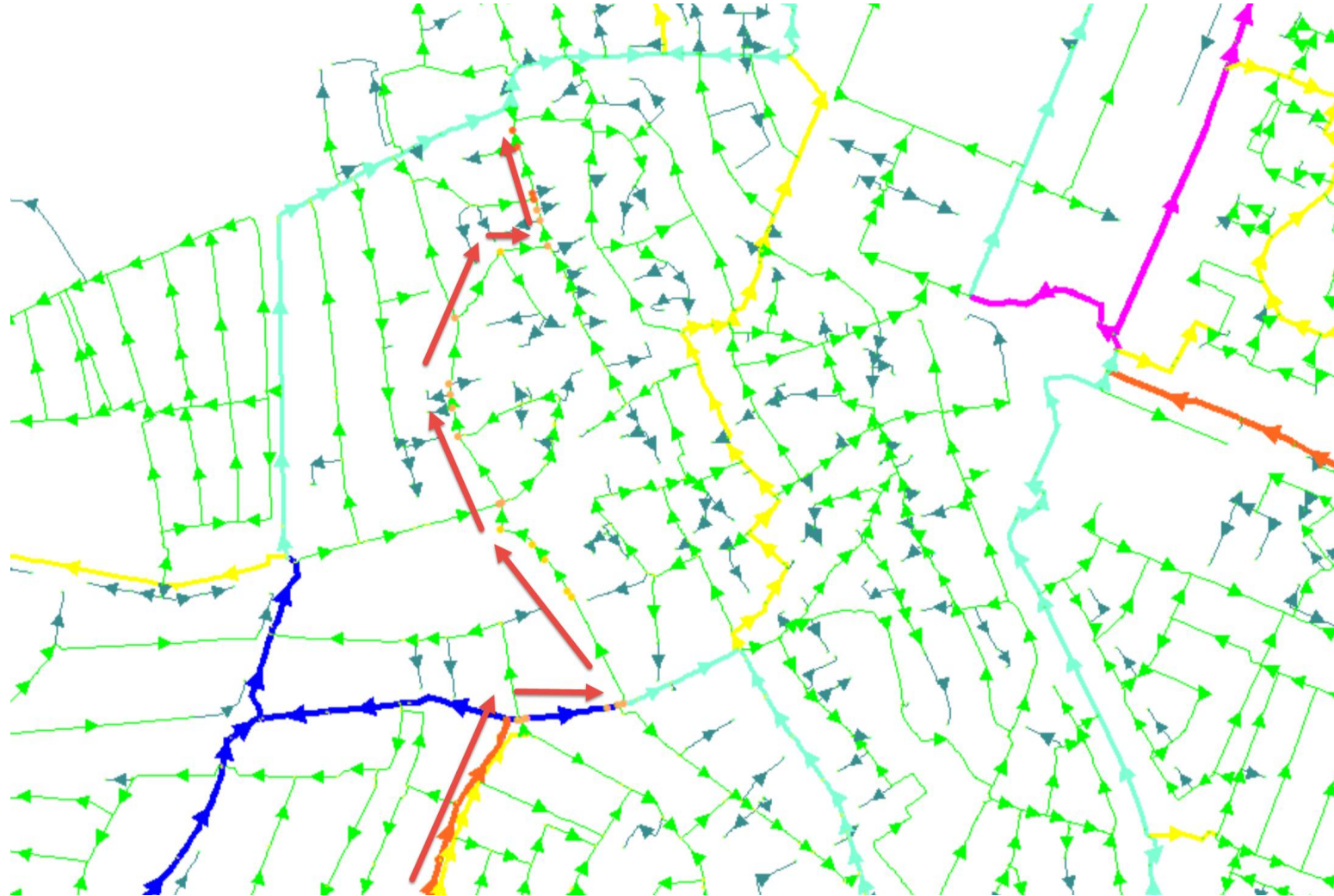
Hydraulics

- Pressure:
 - Maximum 650 kPa at pumping station
 - Setpoint 300 kPa in network
 - To reach minimum of 200 kPa at 1.16 m³/h at customer
- Residence time:
 - Minimal ½ day
 - Maximum 10 days
 - Usually 2-3 days



Hydraulic model

- Synergi

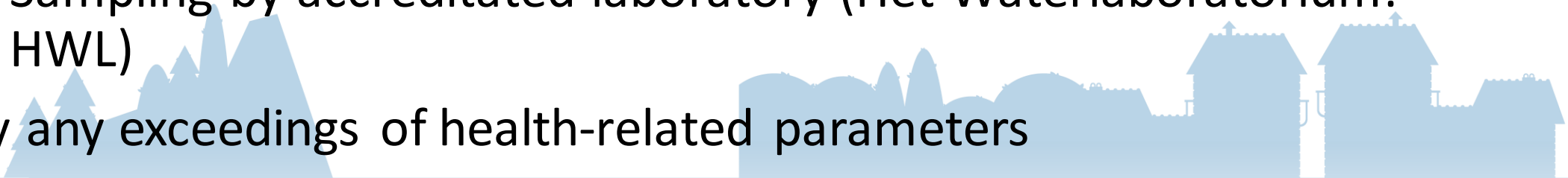


Leakage

- Non-revenue water ~6%
- $ILI = CARL / UARL$
- $CARL = \text{Current Actual Real Losses [liter/day]}$
- $UARL = \text{Unavoidable Actual Real Losses [liter/day]}$
- $UARL = (18 \times \text{length DN+TN [km]} + 0.8 \times \# \text{ lateral connections} + 25 \times \text{length LCN [km]}) \times \text{pressure [mwk]}$
- $ILI = 0.52$

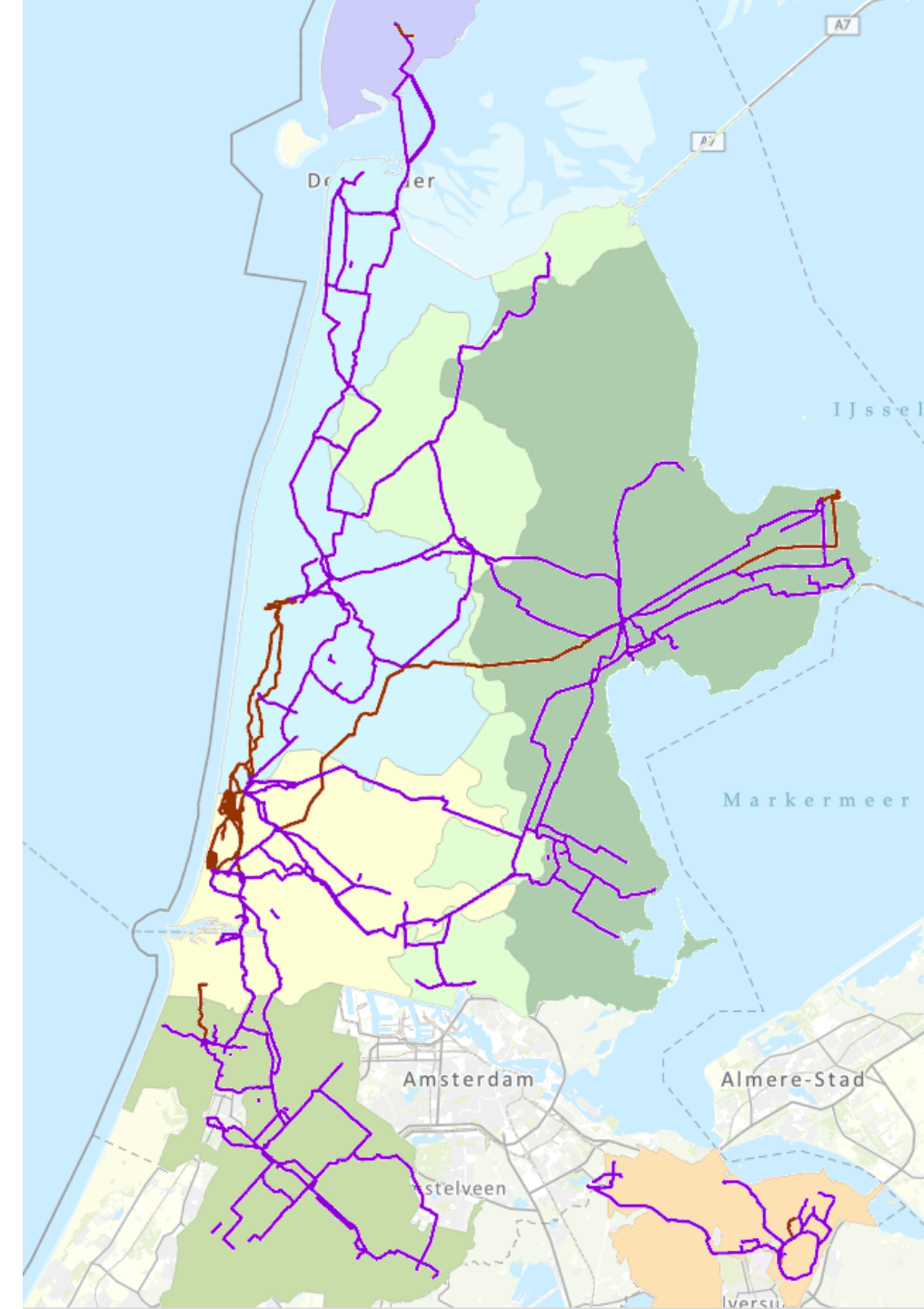
Monitoring water quality in distribution system

- Hardly any online monitoring in distribution network
- Tap samples ~4000 per year
 - Sampling by accredited laboratory (Het Waterlaboratorium: HWL)
- Hardly any exceedings of health-related parameters

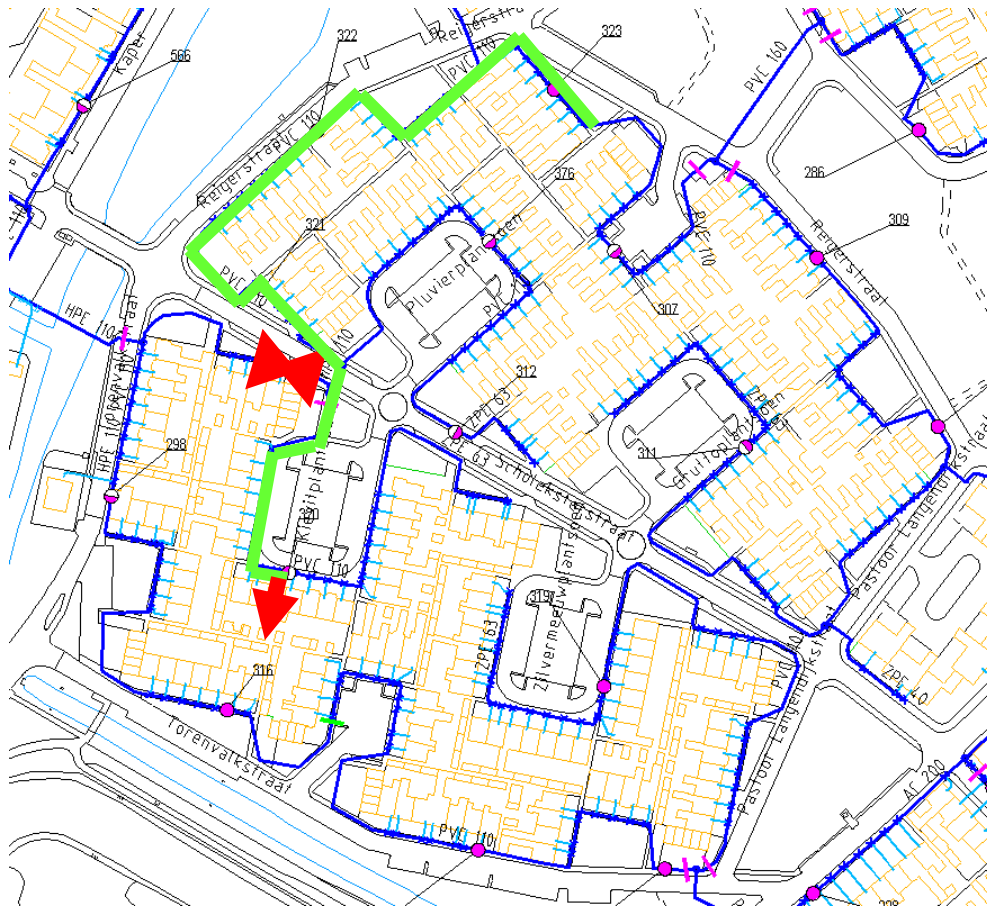


Brown water issues

- Biological unstable water
- Cast iron



Flushing



Flushing



So...

- The extensive distribution system of PWN...
- Has very limited water losses and provides drinking water of good quality...
- Although the hydraulics are only partly known...
- And has some challenges in coping with brown water at some locations.