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& Nuno da Silva

Interactive environmental case

The Village hydrocarbon pollution



Verkenningboringen

Namen, 10 februari 2009

Les forages de reconnaissance

Namur, le 10 février 2009



Based on a real case...

Today, you are the experts!



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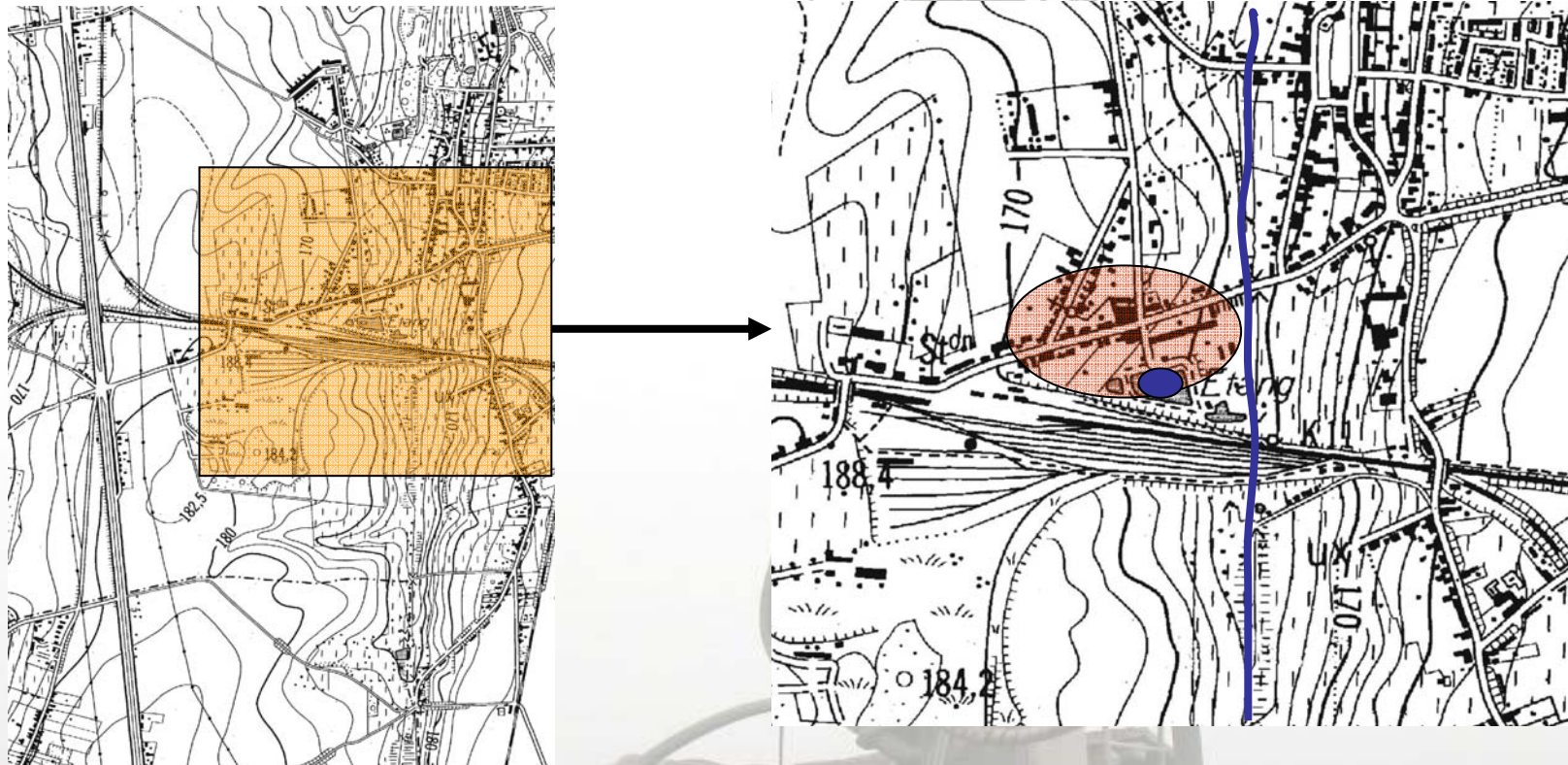
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Information available

1) Pollution location: in the village, lower down gas station (map)

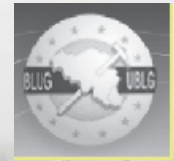


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Information available

2) Pollution indices:

- hydrocarbon strong smell in houses
- hydrocarbon in water wells
- dead fishes in fishery

3) Owners of gas station are blamed

4) Air extractors installed in houses



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Based on information available...

...first experts actions?

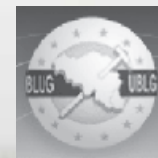


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Experts first step actions

1) Check information

- inquiry to collect information
- visual check of gas station, street, houses, wells, pond, river...

2) Collect groundwater data to draw a map of water table levels and flow



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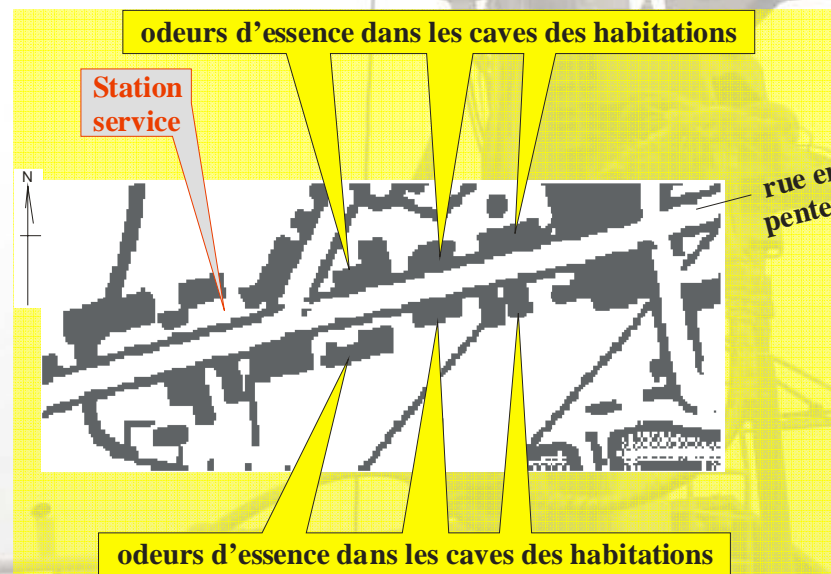
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Inquiry results

1) Hydrocarbon smell:

- mainly in mainstreet houses
- mainly from basements (springs?)
- strength depending from one day to the other
- no logical distribution(?)



Inquiry results

- 2) Few water wells with hydrocarbon floating (up to 8 cm thick)
- 3) Smell and wells pollution could have started 1 to 2 years ago (depending on witness)



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Inquiry results

4) Potential pollution causes identified:

- village gas station
- former gas station
- national road gas station
- former coal mine (gas tanks)
- former gas stock (Second World War)
- railway station (gas tanks)

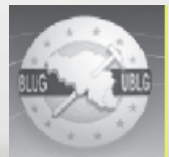


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Inquiry results: potential pollution causes

1. Gas Station
2. Former Gas Station
3. Former Coal Mine
4. W2 gas stock
5. Railway Station
6. Road Gas Station



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Water table topography and flow map

- 1) Topographic measures and local map
- 2) Water table levels data collected and measured (wells, springs, pond, river...)
- 3) Water table map drawn



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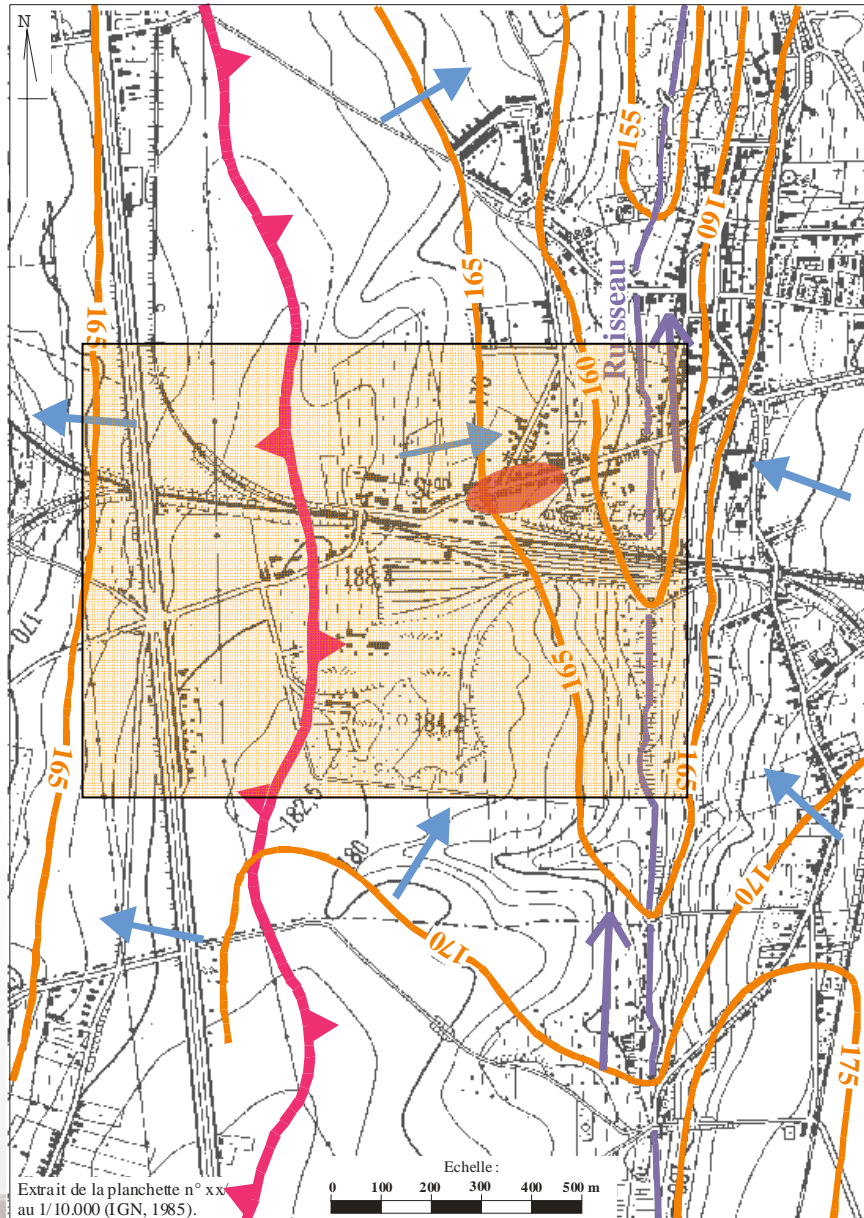
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Water table map



- : Limite de bassin versant
- : isopièze en mètre (niveau de l'eau souterraine)
- : zone litigieuse
- : sens des écoulements souterrains

A.C., 200x

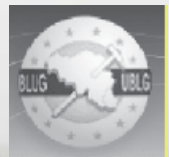


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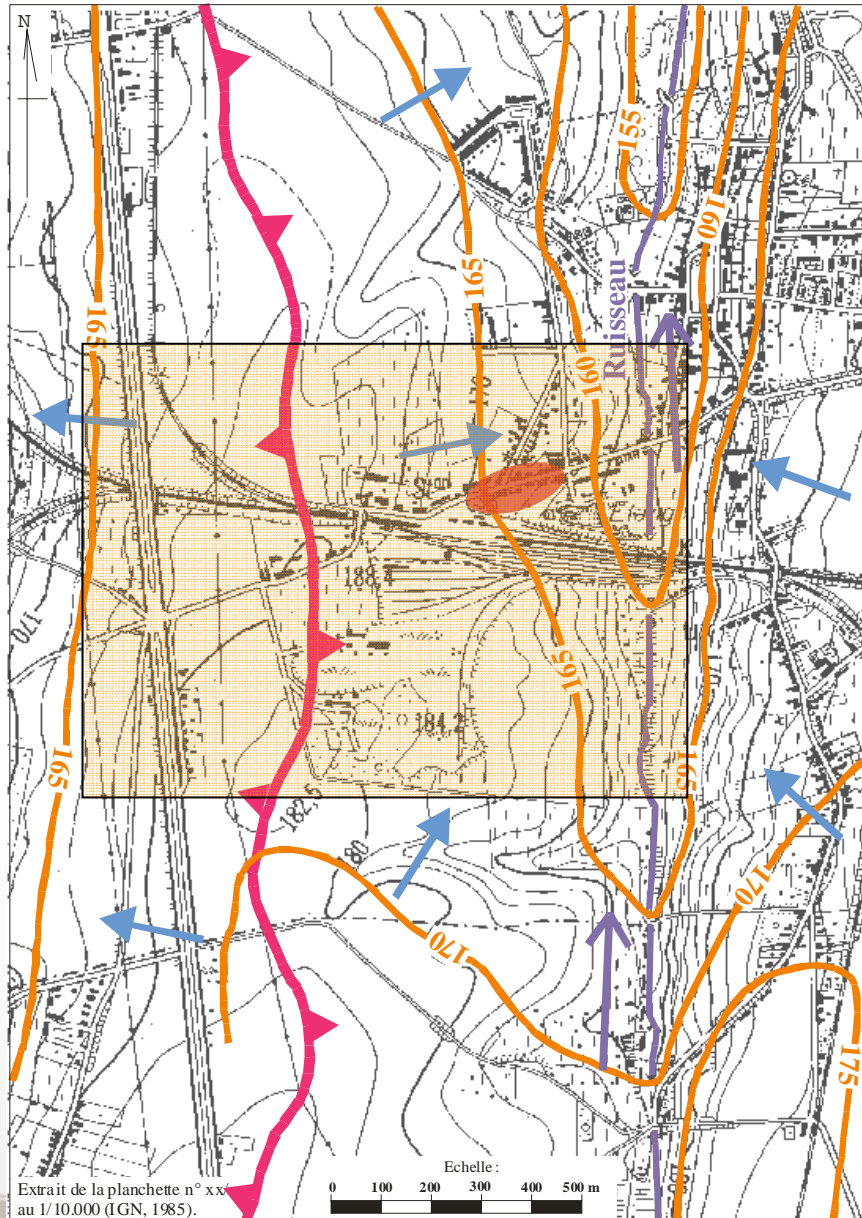
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Water table map



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Experts second step actions?

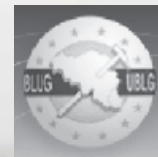


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Assessment wells to drill

Objectives:

- pollution distribution
- local detailed water table map
- hydrocarbon pollutant(s) analysis



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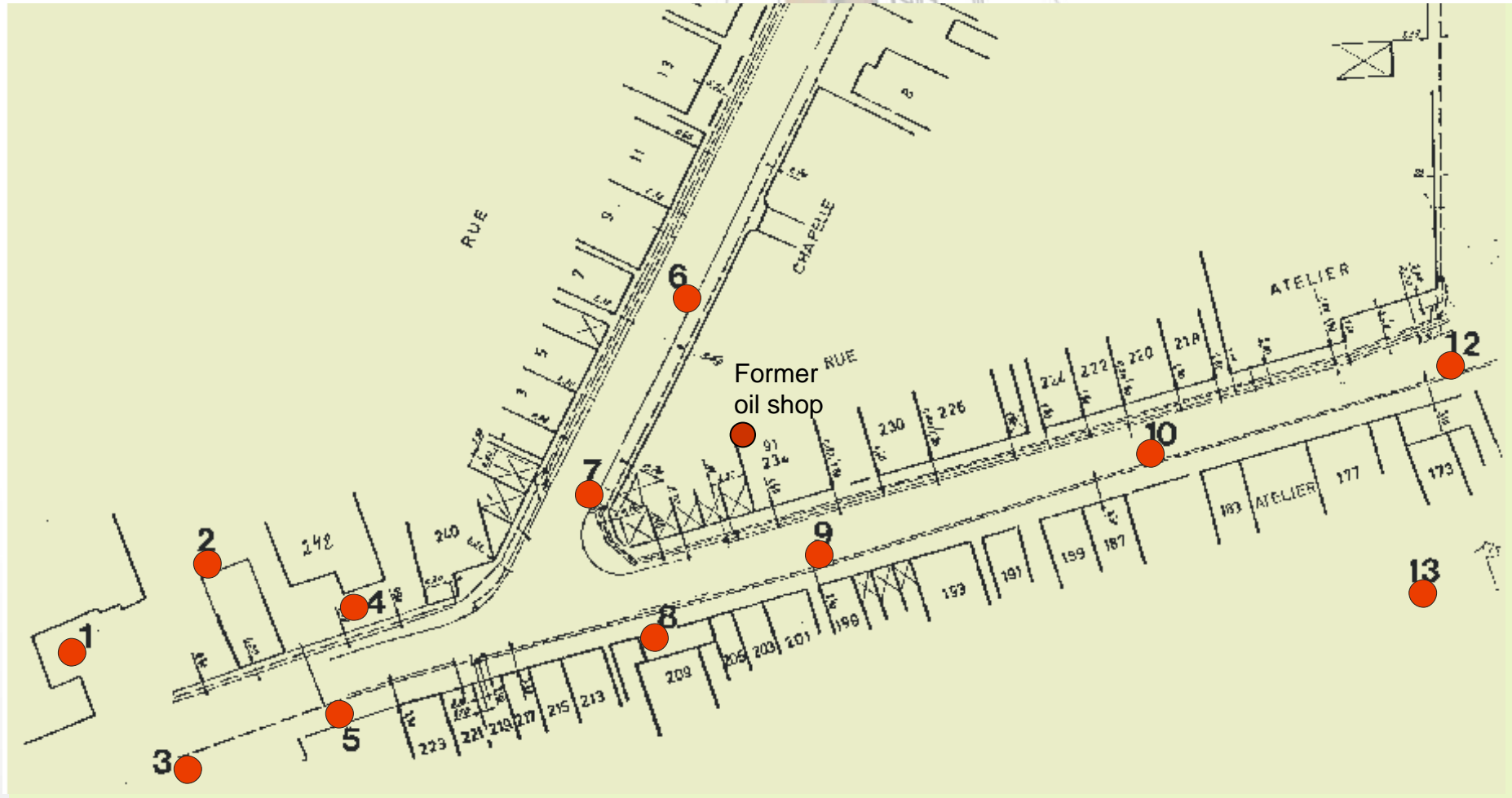
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Assessment wells location

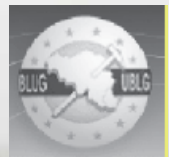


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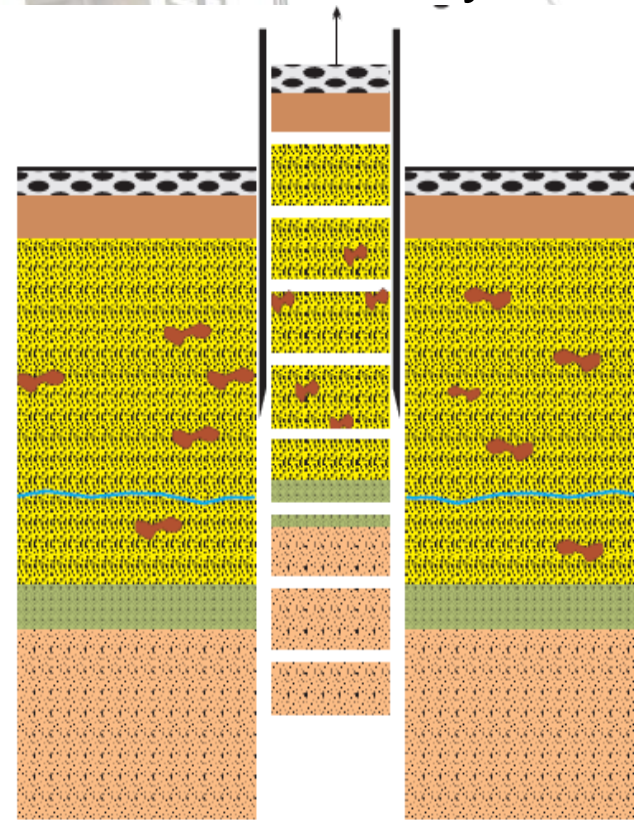


Assessment wells (non-consolidated rock)

1) Drilling techniques:

- small diameter 70 to 100 mm (cheap & fast)
- dry drilling (no contamination)
- driven wells (non-rotative hammered or hydraulic)

2) Soil sampling technique: non-disturbed core sampling

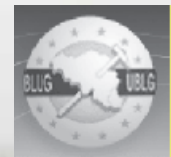


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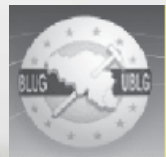
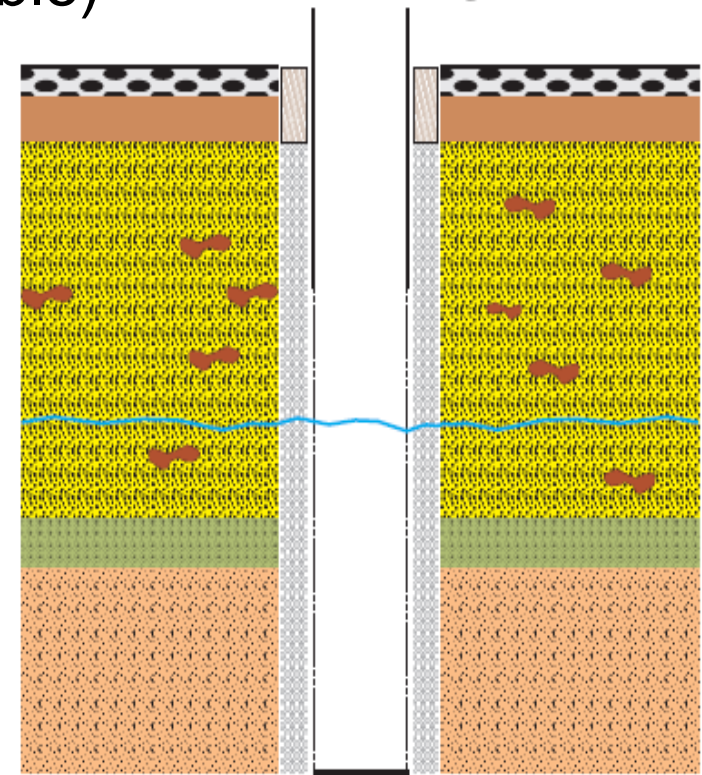
Assessment wells (non-consolidated rock)

3) Piezometer equipment:

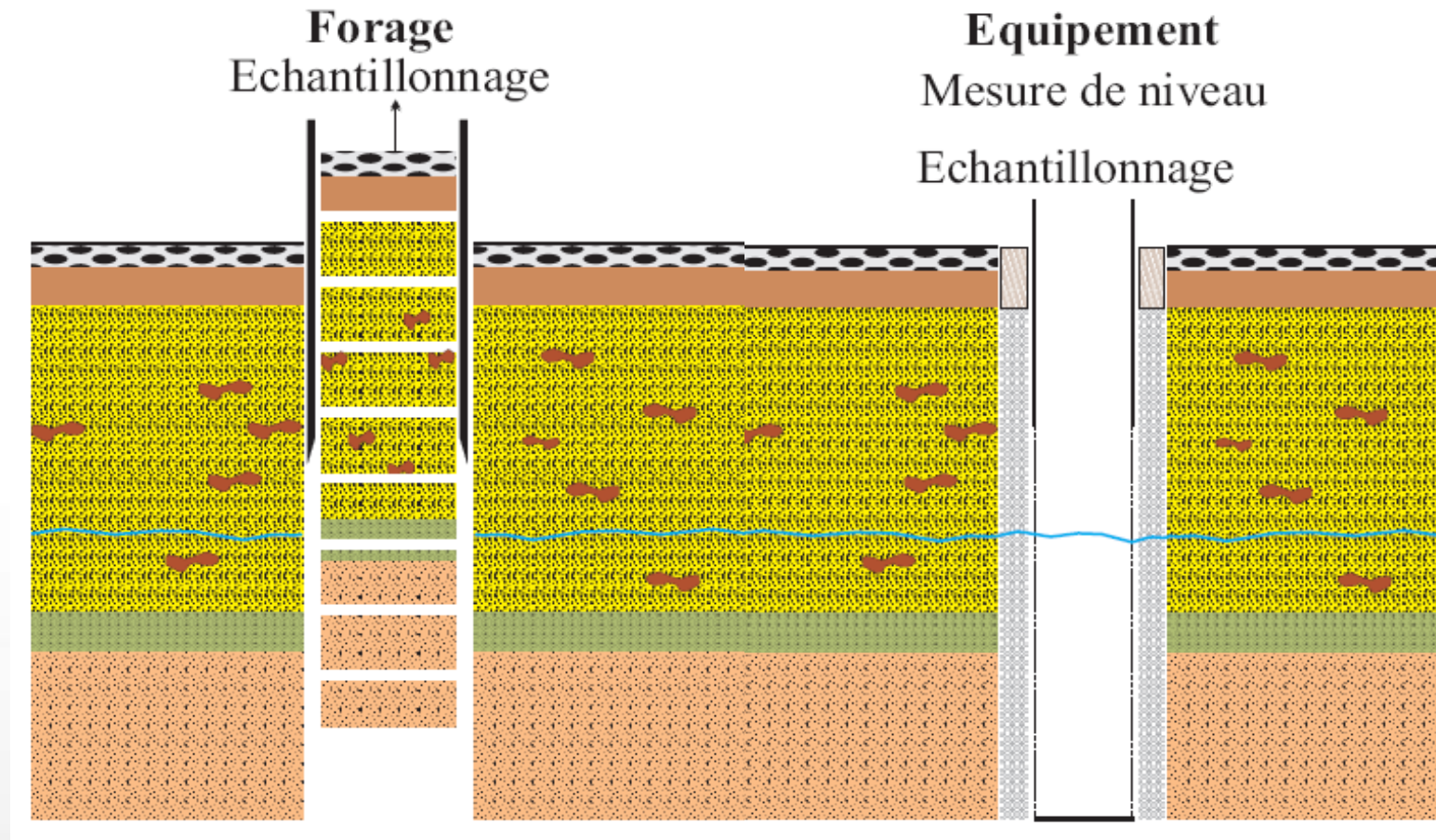
- PE tubing
- screened tube (up to water table)
- screwed tubes (no glue)
- filtering gravel pack (non-contaminating)
- bentonite clay plug

4) Water sampling:

- small electrical (low voltage) or peristaltic pump
- no 0.45 μm filter
- glass container



Assessment wells (non-consolidated rock)



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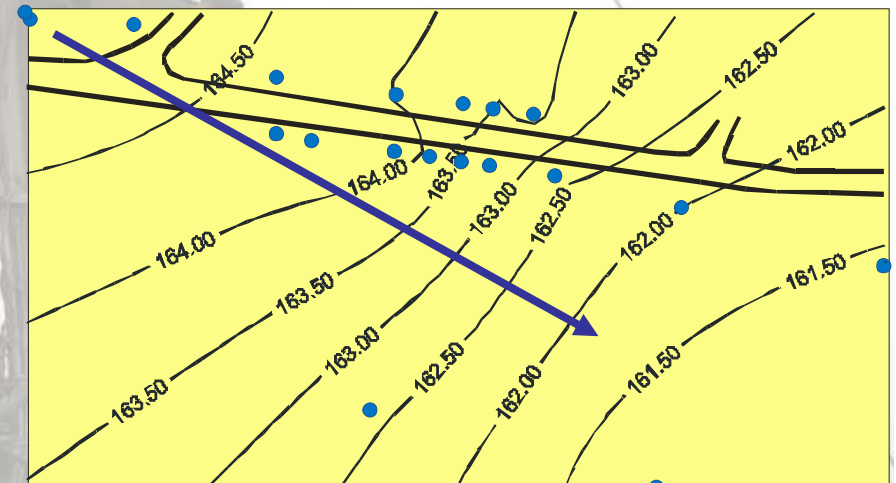
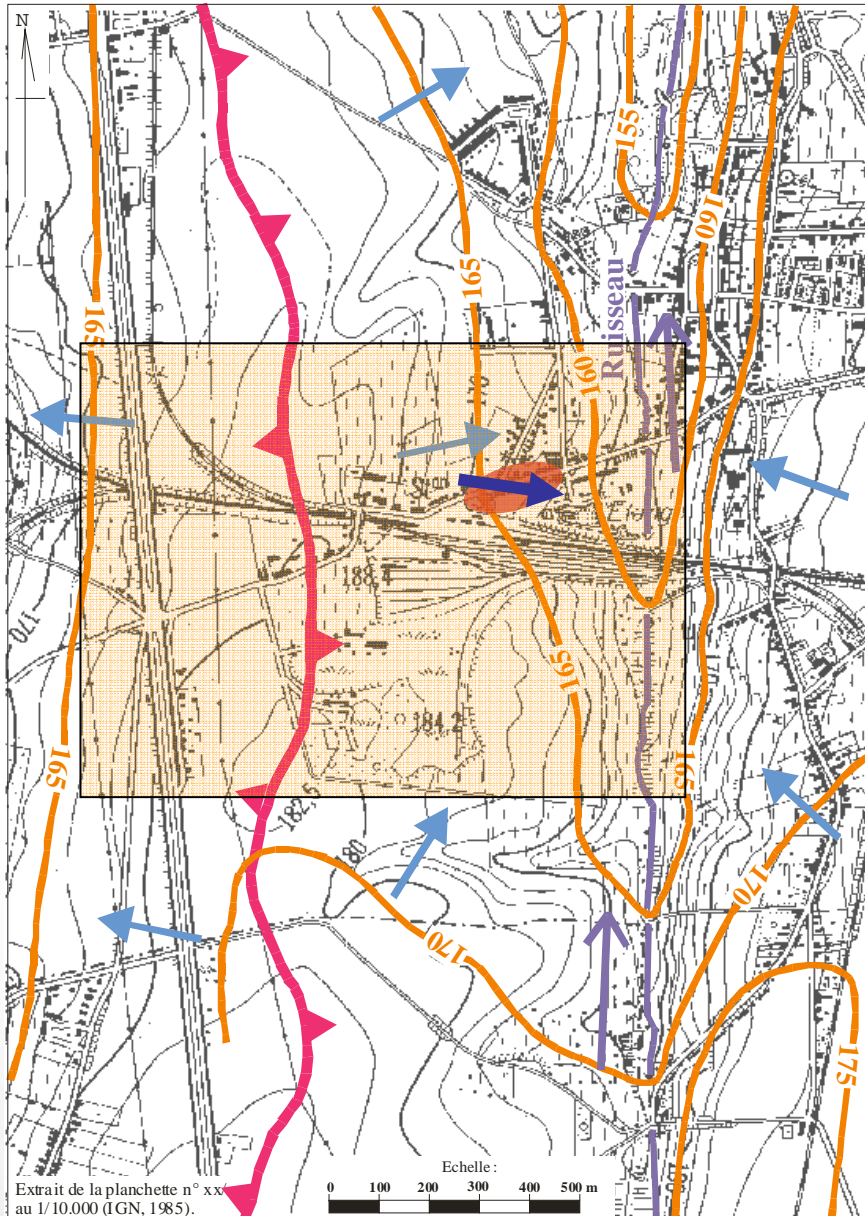
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Local water table map



— : Limite de bassin versant
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 : zone litigieuse
→ : sens des écoulements souterrains

A.C., 200x



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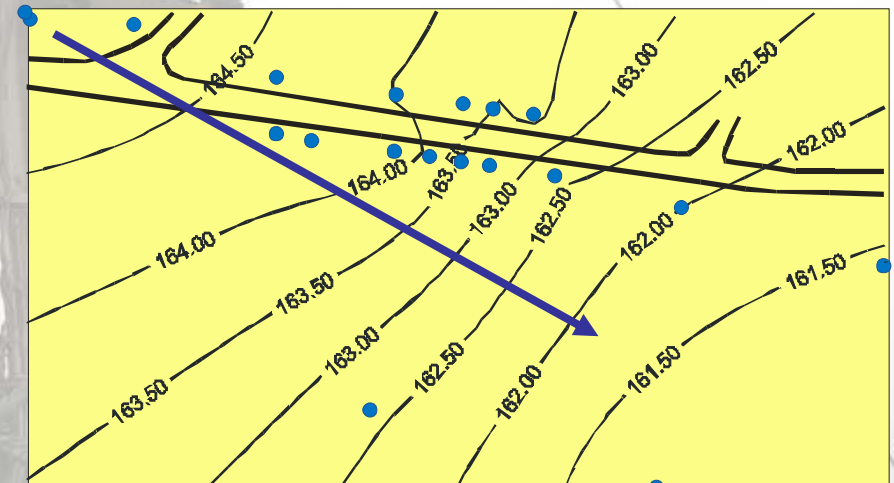
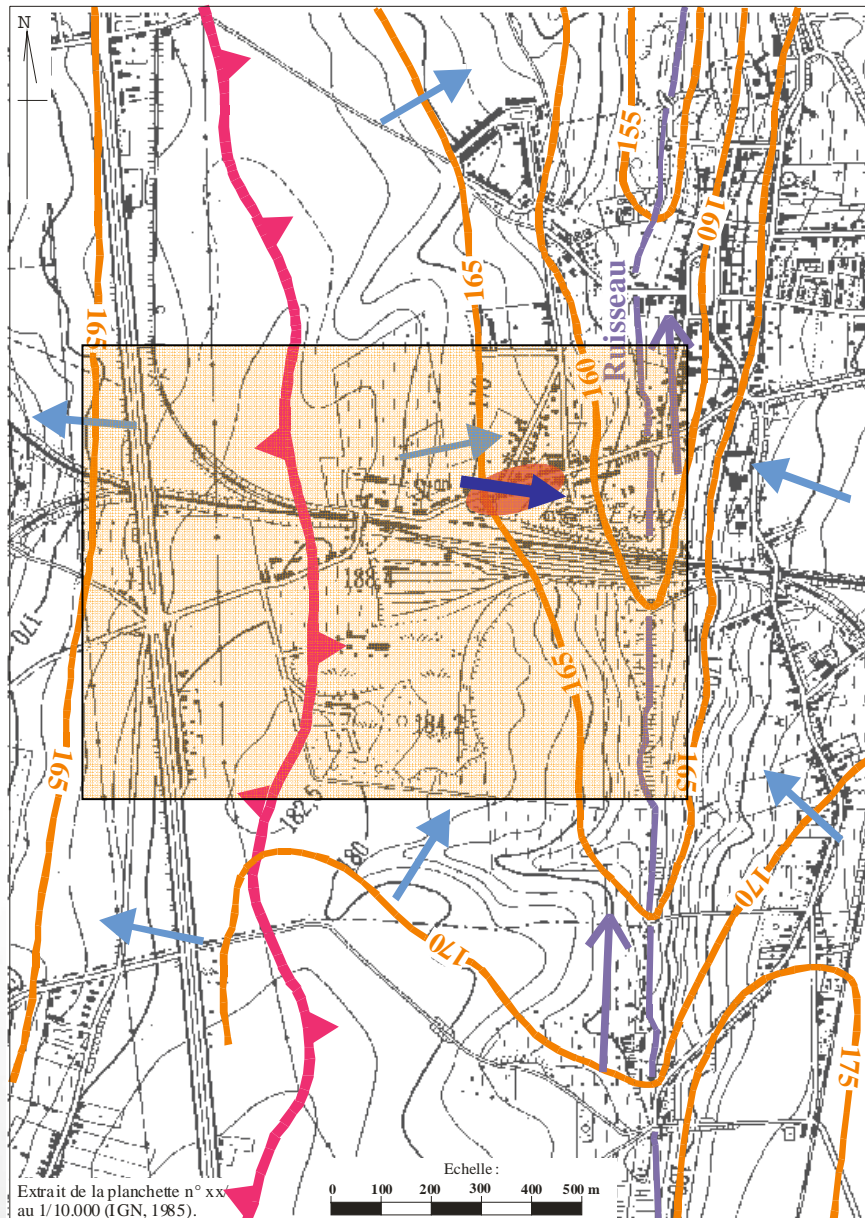
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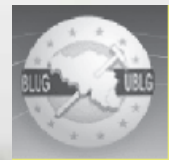


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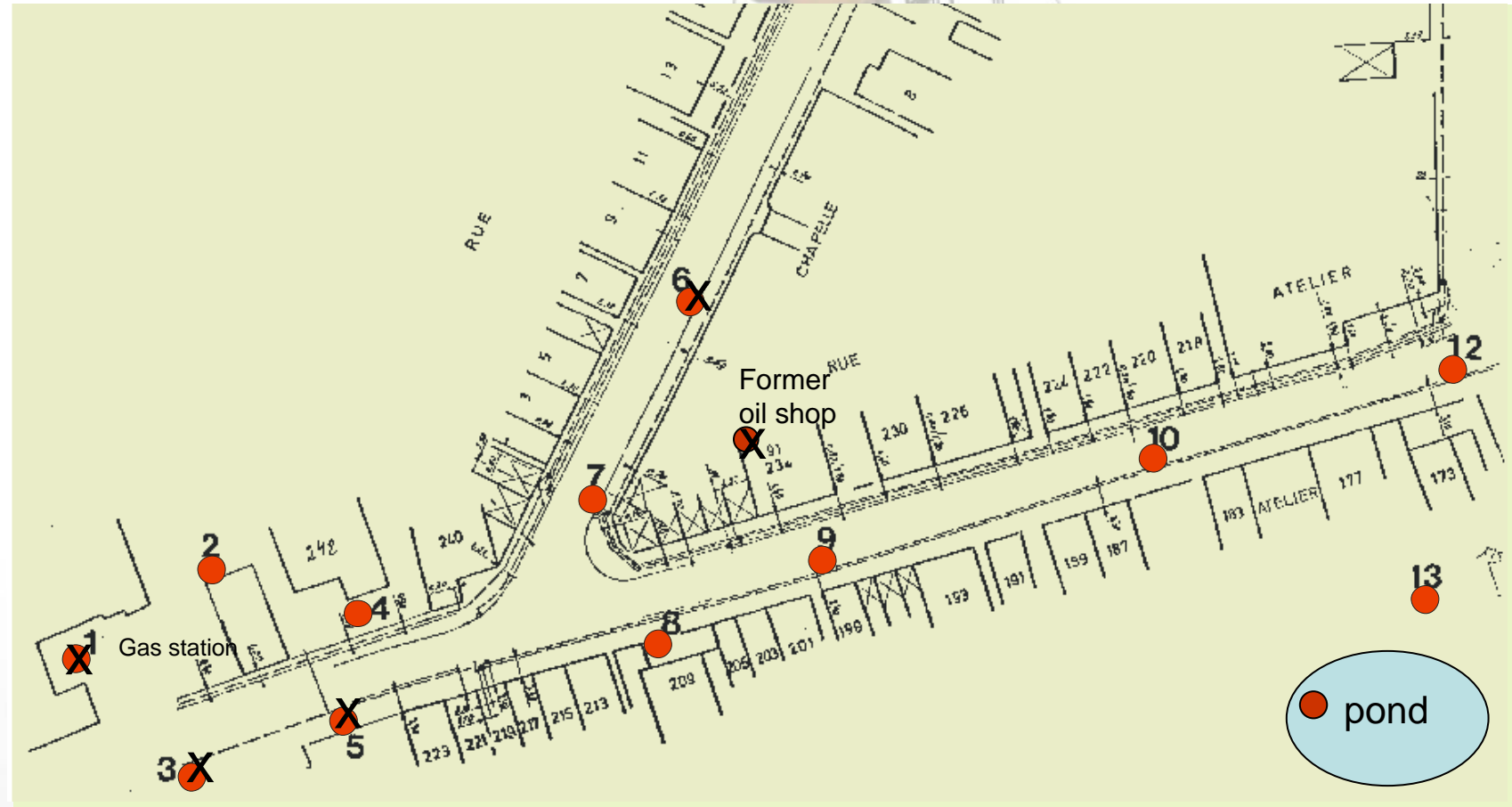
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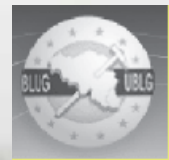
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Pollution in assessment & water wells & pond



- Smell in soil and water
- Same basic composition in all analysis (chromatography C6-C12 with Pb)



Conclusions?



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Conclusions

- 1) Gas station is most probably pollution cause
- 2) Pollutant: gas Super with lead
- 3) Fish dead root cause confirmed

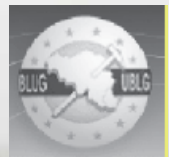


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Solution?

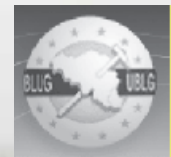


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Remediation wells to drill

Objectives:

1. reduce/stop smell in houses
2. recover gas from aquifer (as much as possible)

Solution: remediation well to pump pollutant



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Remediation wells

1) Drilling techniques:

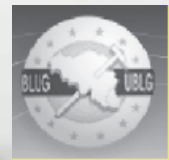
- larger diameter 200 to 350 mm
- water or air
- rotary or percussion hammer and air lift

2) Well equipment:

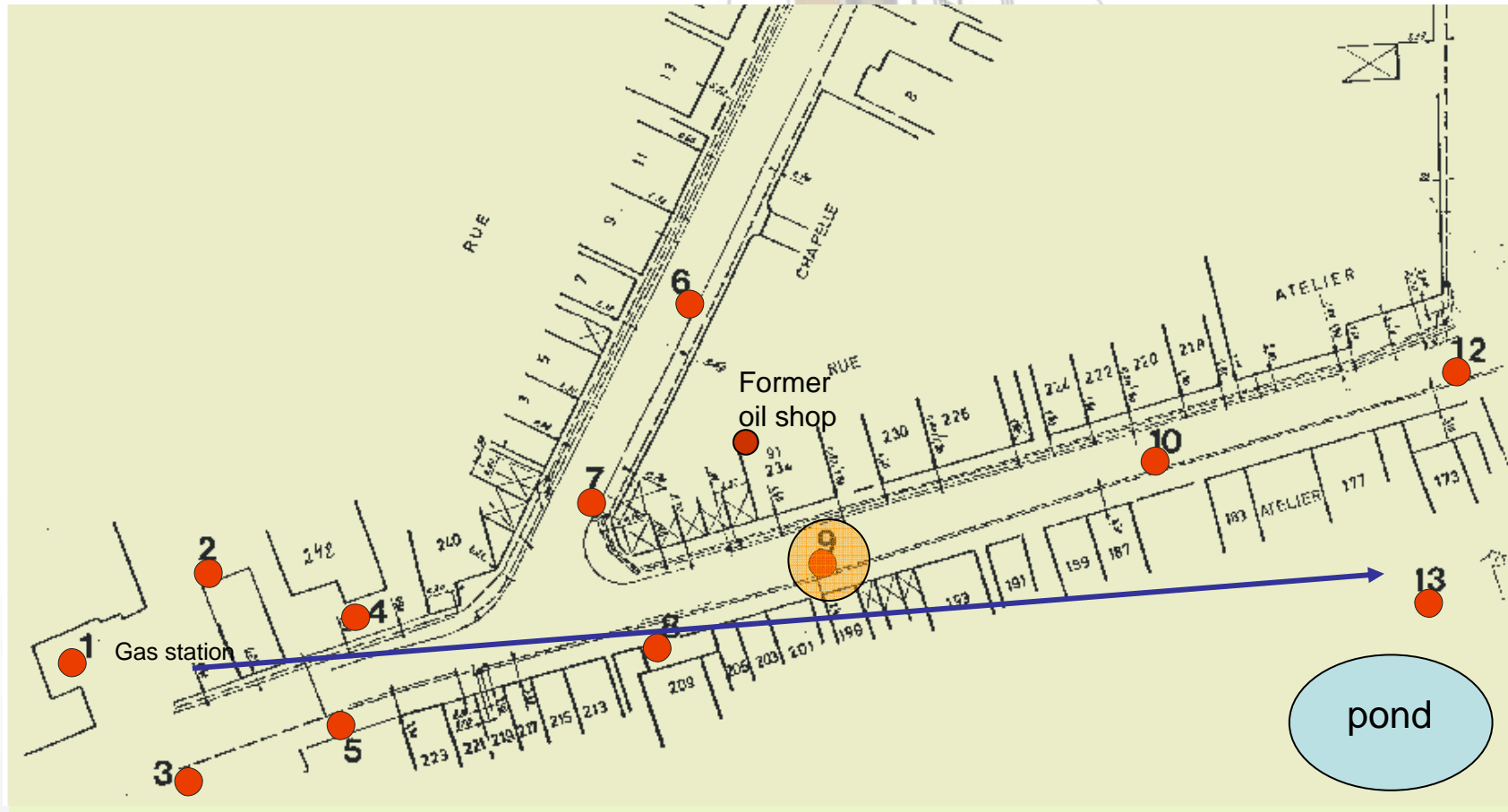
- PVC tubing
- screened tube (up to and above water table)
- filtering gravel pack
- bentonite plug

3) Pumping technique: submersible pumps and oil/water separator

- 1 well with 1 pump or
- 1 well with 2 pumps or
- 3 wells and 3 pumps



Remediation well #9

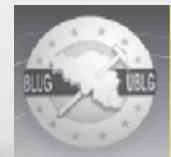


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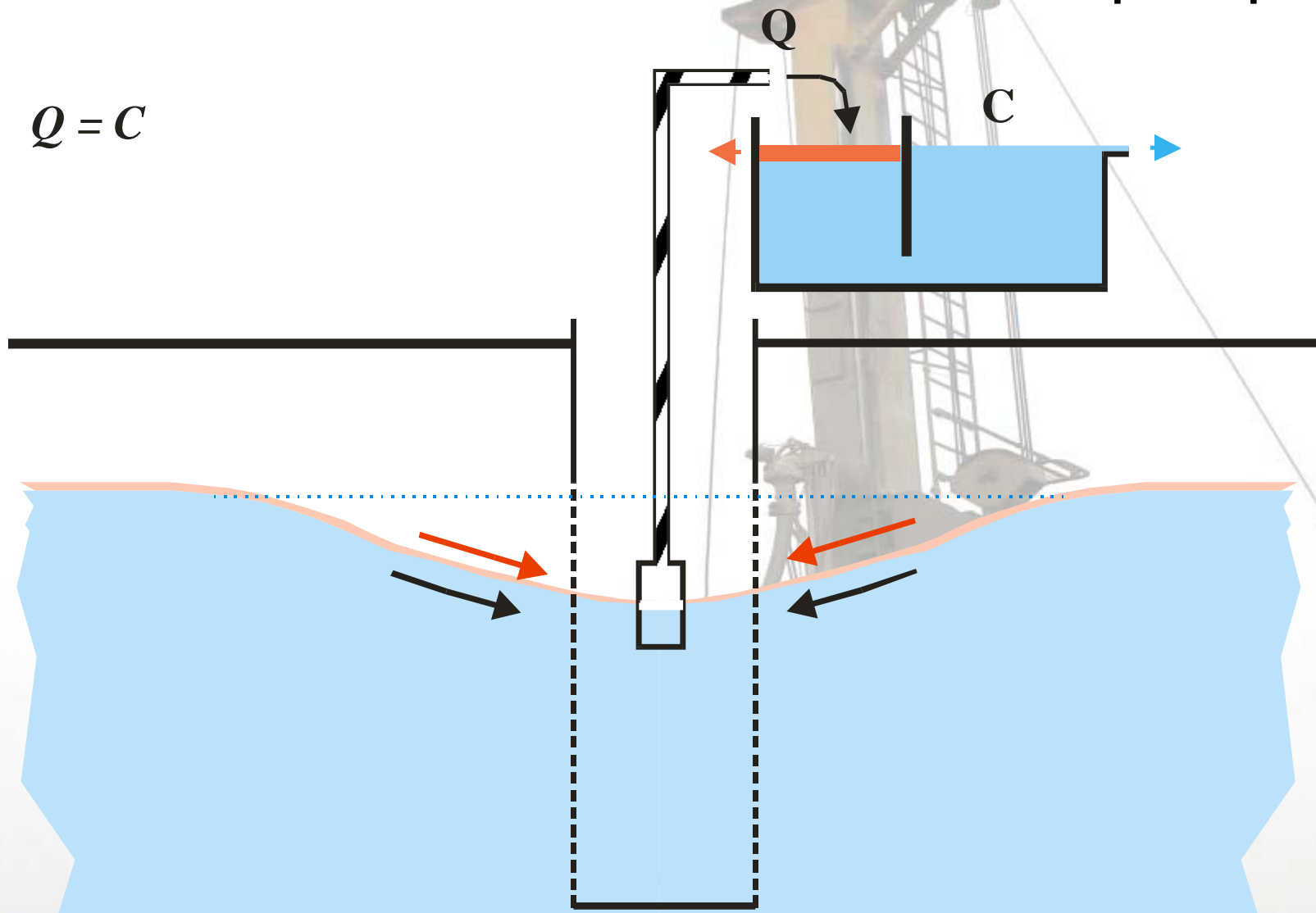
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Remediation well: 1 well & 1 pump

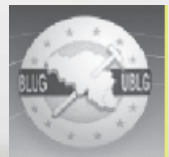


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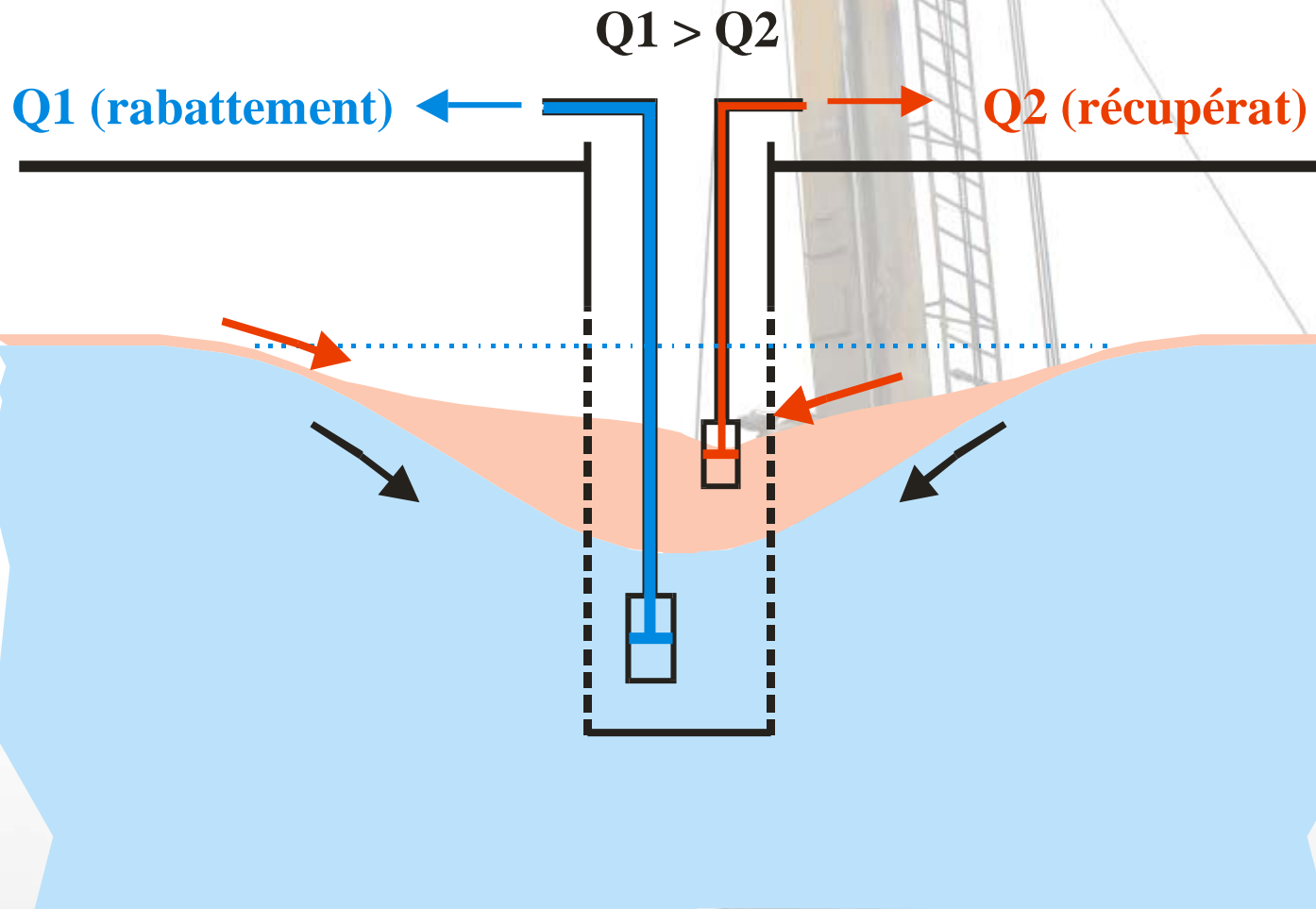
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Remediation well: 1 well and 2 pumps

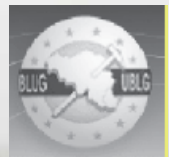


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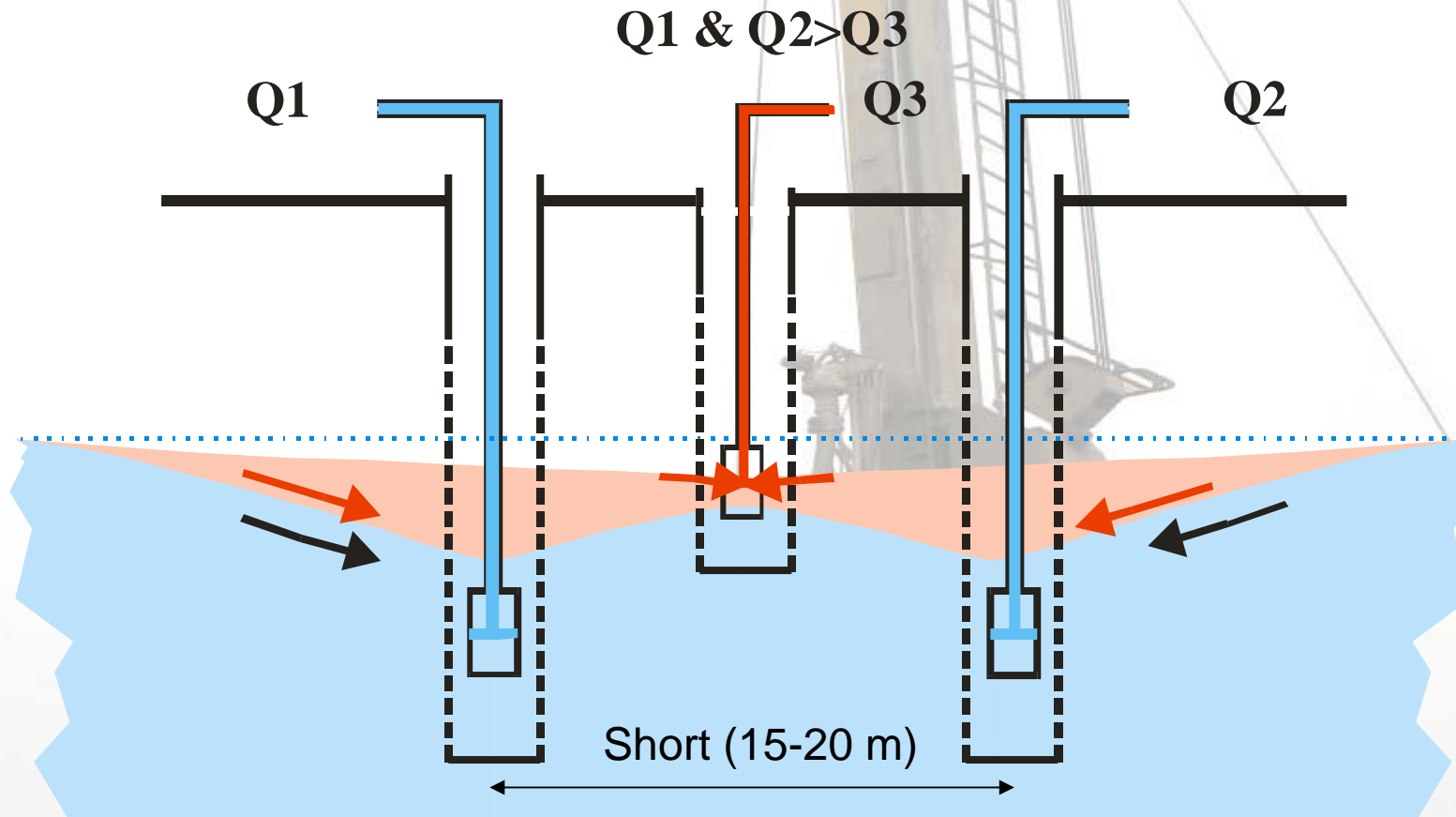
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Remediation wells: 3 wells and 3 pumps

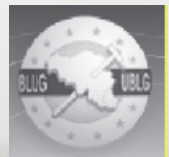


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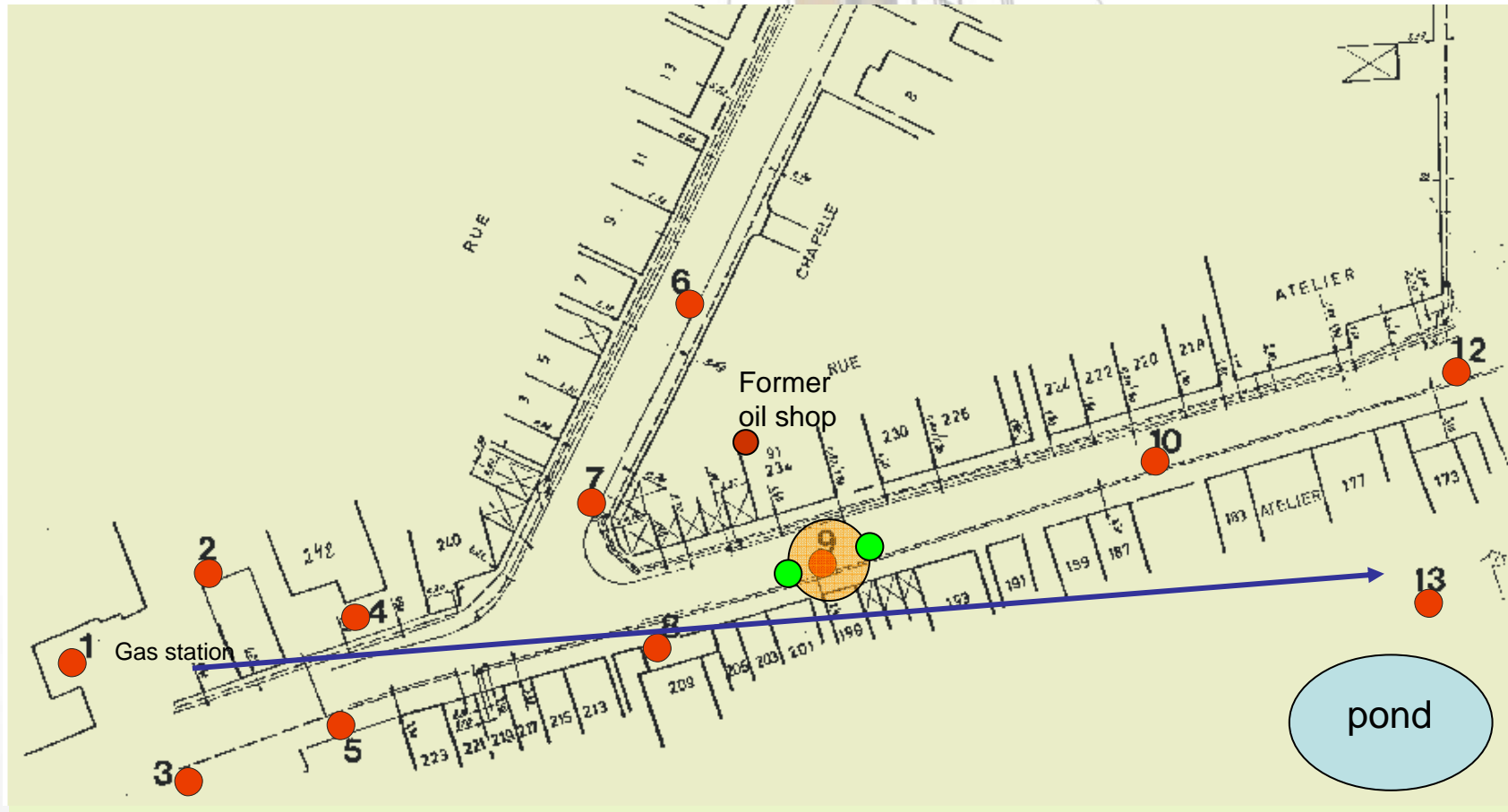
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Remediation wells 9, 10 & 12

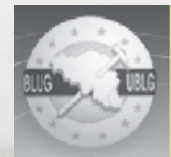


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Epilogue

- 1) One gas (super) tank leaking in village gas station
- 2) Leaking tank not used for last 10 years
- 3) Pollutants needed 15 years to reach first houses
- 4) Gas station current owners bought it 10 years ago...



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