Properbase welltest guideline
optimal and cost effective data acquisition

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TKI Properbase

Welltest guideline: optimal and cost effective data acquisition*

Goals of SCAN welltests:

1. Determination of **reservoir properties** ('white spots')

2. How to improve data **quality**
   - Downhole shutin, PLT, how to get more information out of existing datasets, etc.

3. How to reduce the **costs** of welltesting
   - Alternative artificial lift, CT instead of drillstring, etc.
   - Less production water

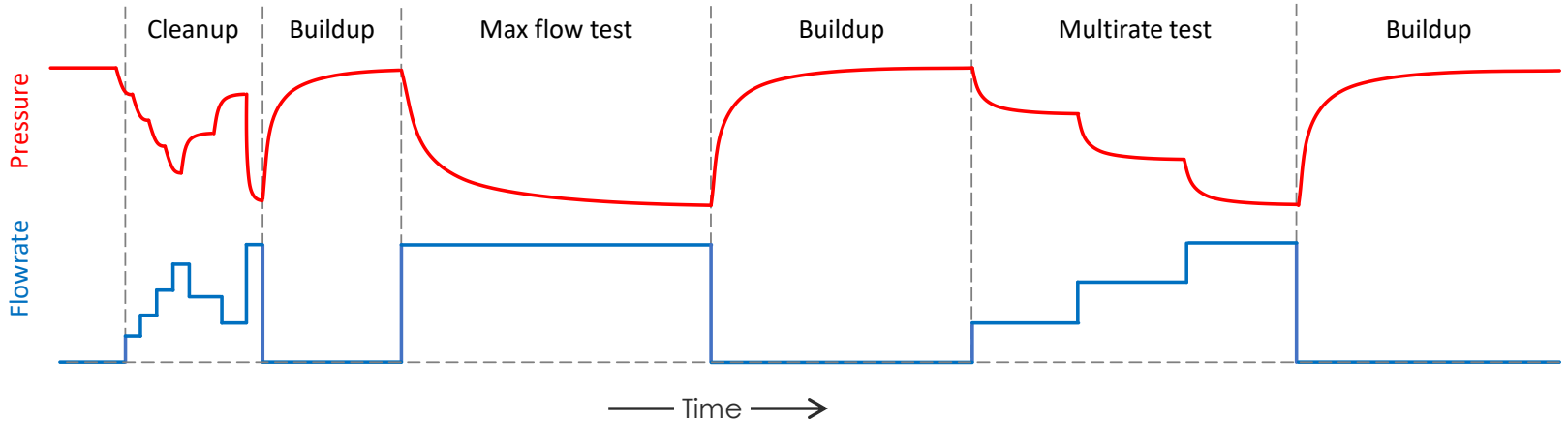
This presentation

Reported in Properbase

** https://www.ebn.nl/wp-content/uploads/2026/06/Recommendations-for-improved-geothermal-well-testing-Properbase-1.pdf*

Less production water!

Historically, excessive amounts of water have been produced during welltests: generally, **3000 m³** per test, while up to **6000 m³** has been reported. This leads to very high costs, which can easily add up to >> 1 million € (rig time, production - , process - and storage capacity, transport and disposal at industrial waste company, etc.)



Challenge: how can we produce less water, while still reaching the welltest objectives and maintaining the level of data quality/quantity?

1. **Lower flowrates**
2. **Shorter flow periods**
3. **Fewer flow periods**

1. Lower flow rates

What is the impact of lower production rates on the buildup?

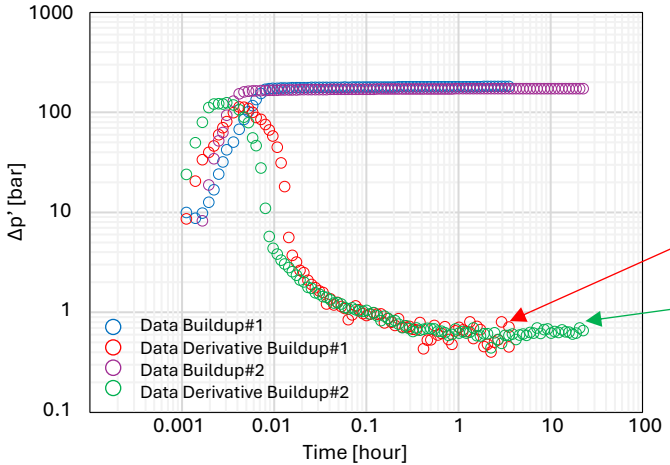
Theory: lower production rate does not result in different buildup

Practice: welltest **Stad van Gerwen-01:** two different flowrates (9.0 m^3/h and 18 m^3/h), each one followed by a buildup

Observation: the resulting Bourdet derivatives are identical

Conclusion: lower flowrates do not result in different interpretation

Recommendation: low flow rates suffice to reach welltest objectives; no reason to flow at high rates



Red: buildup preceded by a production rate of 9.0 m^3/h.

Green: buildup preceded by a production rate of 18 m^3/h.

2. Shorter flow periods

What is the impact of shorter flow periods on the buildup?

Theory: mathematical '<u>principle of superposition</u>' states that

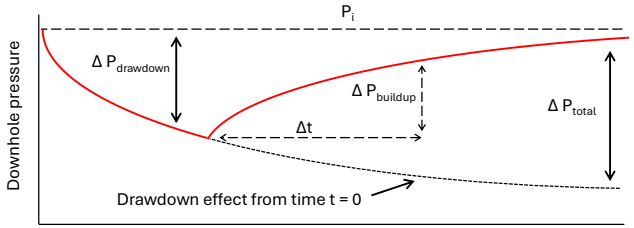
- It is the <u>sum</u> of the duration of the production and injection period that determines what the radius of investigation of a welltest is.
- The production period can be brief, as long as the buildup is sufficiently long (how long? That can be modelled upfront!). Steady state production is not necessary

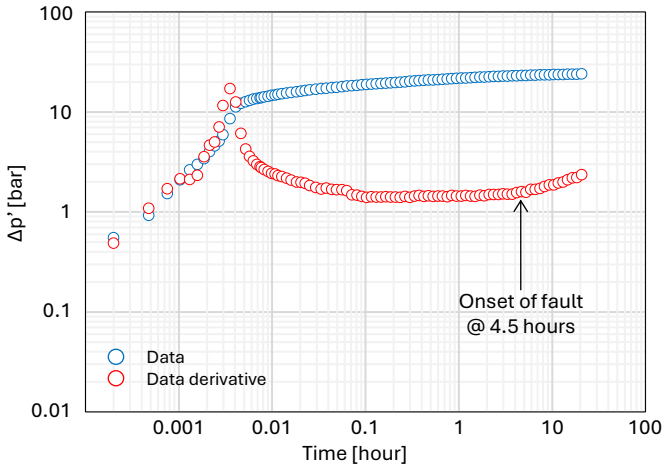
Practice: welltest **De Bilt-01**. Production period was 3 hours, followed by 24 hours shutin.

Observation: fault is visible in buildup at 4.5 hours

Conclusion: it is the duration of the *buildup* that determines whether the derivatives shows distant geological features, not the duration of the production period.

Recommendation: short flow periods suffice to reach welltest objectives; <u>no reason to flow for long time</u>.





2. Shorter flow periods

How to determine the *steady state* values (based on *transient* values)

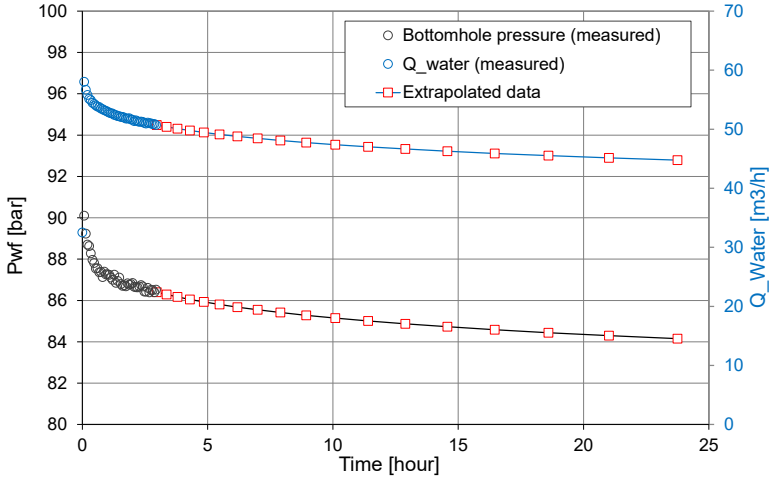
Theory: mathematical extrapolation (e.g. Horner method)of transient data results in steady state values

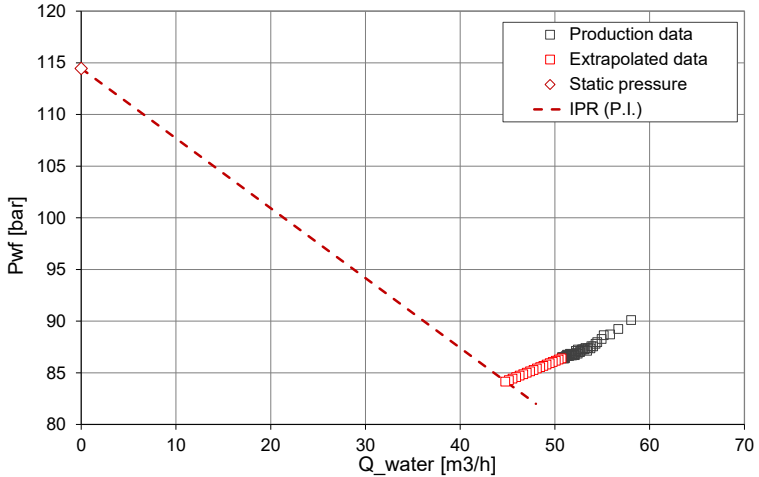
Practice: welltest **Ede-01**: short flow period (3 hours) resulting in transient data only.

Observation: Data are extrapolated to (semi) steady state values.

Conclusion: *extrapolation* to 'infinity' allows for the determination of P.I., no need to *flow* to 'infinity'

Recommendation: short flow periods suffice to reach welltest objectives; no reason to flow for long time.



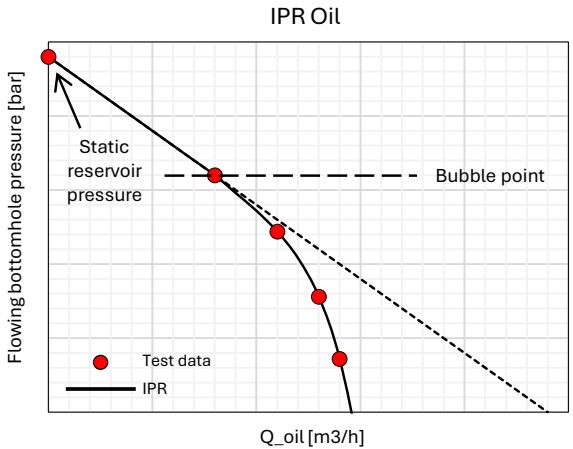


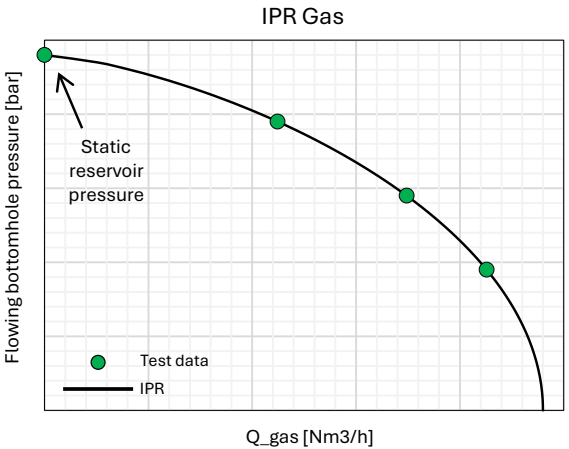
3. Fewer flow periods

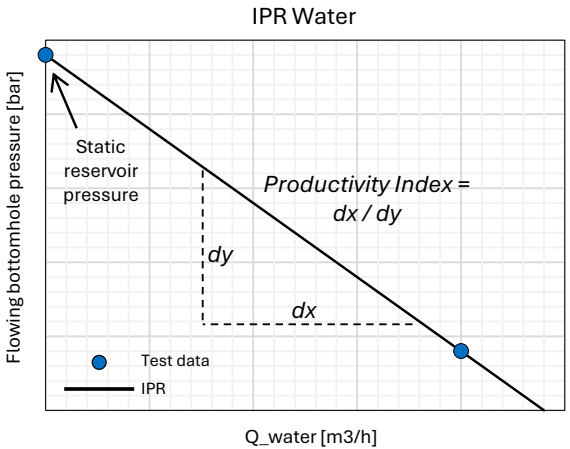
The (non)sense of multirate testing

Theory:

- Multirate testing is a method to determine the rate-dependent skin. A rate dependent skin is present in gas wells or in oil wells below the bubble point; not in water wells.
- Consequently: the IPR of water wells is a straight line.
- How many data points do you need to draw a straight line? Answer: **two** (of which the shutin pressure is one, so only **one** additional flow point is needed)







3. Fewer flow periods

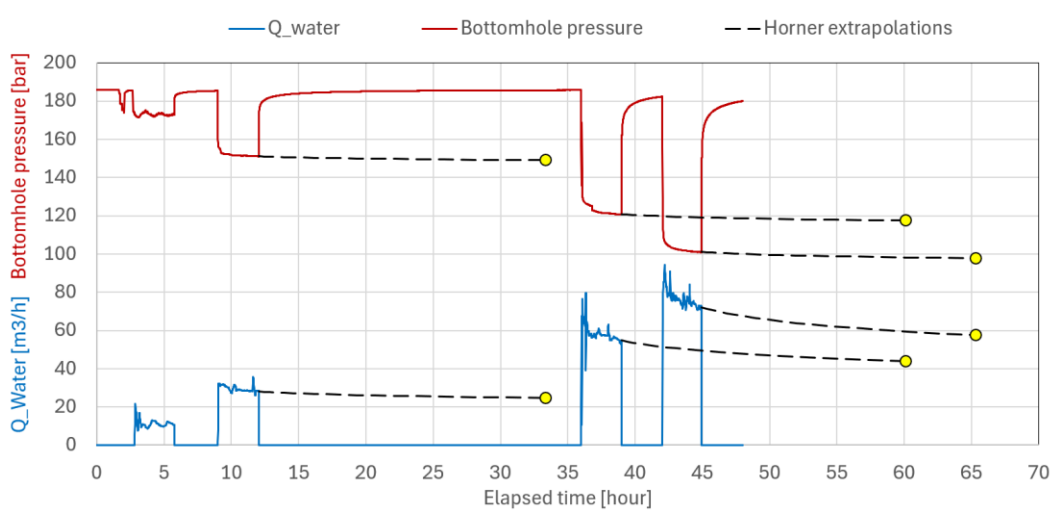
The (non)sense of multirate testing

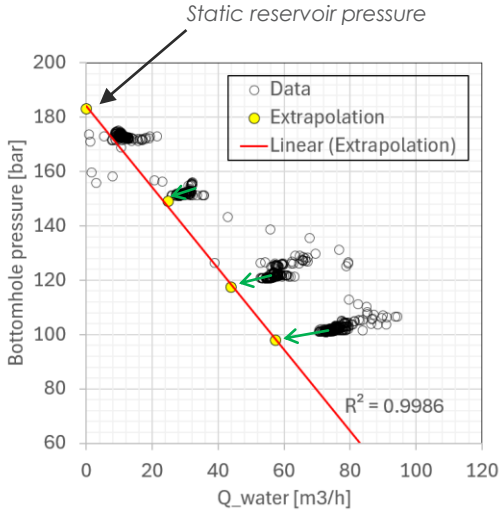
Practice: Multirate testing (4 rates) performed in **Heesch-01** (Nederweert formation) → transient data extrapolated to steady state data ('Horner method') → plot on PQ plot

Observation: straight line IPR (= Productivity Index)

Conclusions: 1) rate dependent skin is absent. 2) multiple rates are not necessary to determine the P.I.

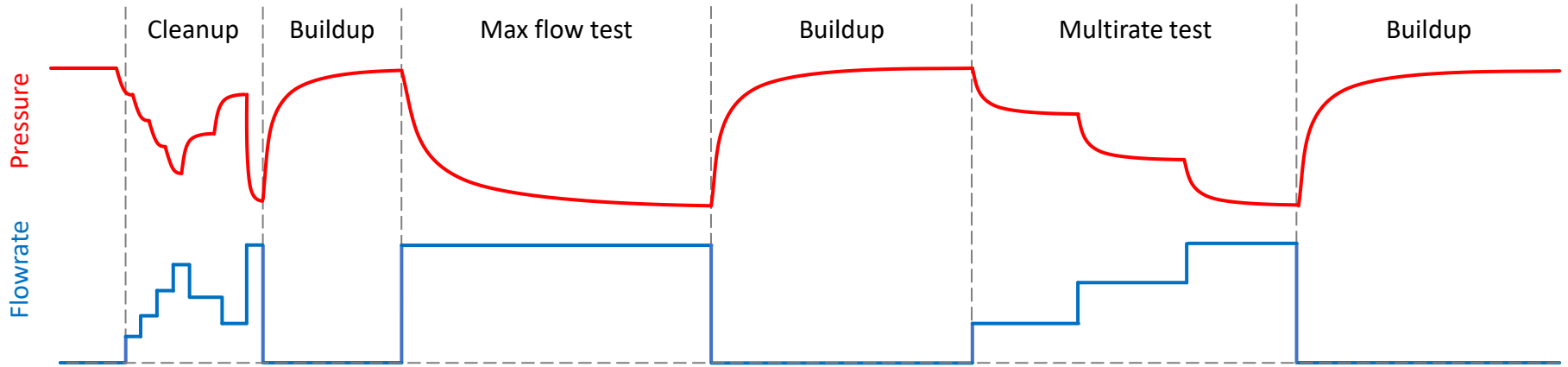
Recommendations: skip multirate test; no reason to flow at various rates.





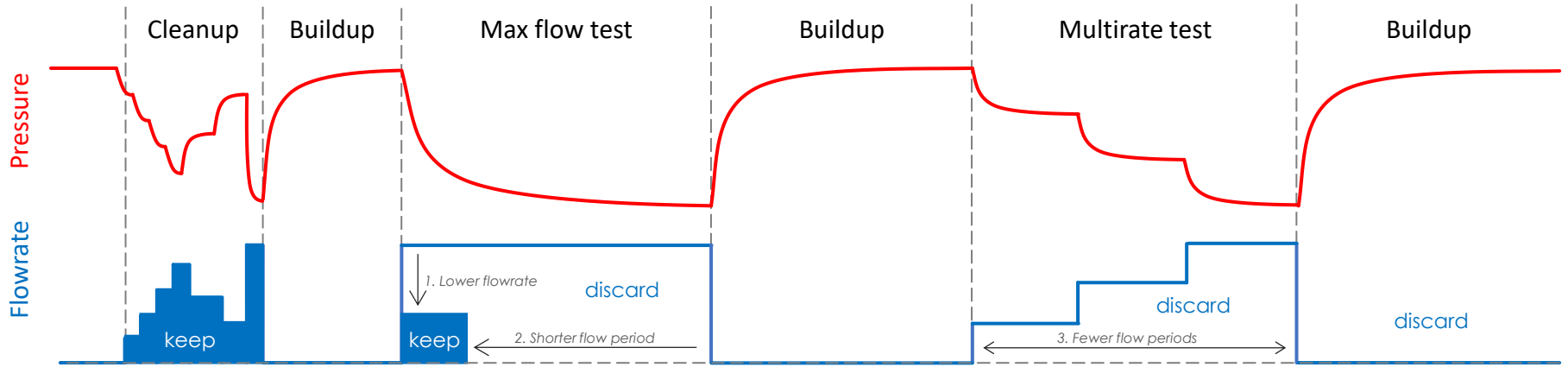
Welltest sequence

Conventional test sequence



Welltest sequence

Proposed test sequence



Reconsider operations (lift method, perforation method, acid job, etc.)

Keep

- Reconsider lift method
- Reduce flow rate
- Reduce flow time
- No more 'max' flow test

Model upfront to determine the length of the buildup, in combination with the length of the flow period

Discard

Discard

SCAN welltest results

#	Well	Formation	Flowrate [m3/h]	Cumulative production water [m3]	Geological welltest objectives met?	Mechanical skin *	Note
1	Amstelland-01	Rotliegend	75	999	partly	40	OBM invasion + no downhole shutin
2	Oranjeoord	Brussels Sand	110	913	yes	2	
3	Heesch-01	Trias Nederweert	80	520	yes	2	
4		Main Buntsandstein	30	177	yes	2	
5	De Bilt-01	Rotliegend	60	166	yes	0	
6		Main Buntsandstein	55	260	yes	2	
7	Stad van Gerwen-01	Upper Breda - Lower Interval	5	10	yes	1	
8		Upper Breda - Upper Interval	18	84	yes	3	Injection skin
9	Ede-01	Rotliegend	47	173	yes	2	
10		Zechstein	55	204	yes	1	
11	Amsterdam-01	Rotliegend	51	329	yes	0	
12		Breda	15	80	yes	8	Fines migration (?)
13	Milheeze-01	Trias Nederweert	70	350	yes	0	
14		Chalk	10	135	yes	?	Screens plugged

** Mechanical skin = reservoir damage only . This excludes other skins (perforation skin, sandscreen skin, geometrical skin, etc.)*

Quantification of costs

Note: based on SCAN assumptions, contracts, etc.

Item	Details	Cost estimate - subtoptimal	Optimisation opportunity	Cost estimate - optimised	Cost reduction
Welltest package	MOB-N/U-WT- N/D-DEMOB +staff	Large welltest package: **300 k€**	Smaller welltest package due to lower production rates	Small welltest package: **175 k€**	**125 k€**
Storage capacity	Rental costs to temporarily store production water in tanks: 2.8 €/day/m3	Based on 15 days rental and 3000 m3 production water: **125 k€**	Less storage capacity due lower cumulative produced water (lower rates, no multirate steps, shorter production periods)	Based on 15 days rental and 500 m3 production water: **25 k€**	**100 k€**
Production water disposal	Disposal to industrial waste processing company, including transport: 210 €/m3	Based on 3000 m3 production water: **630 k€**	Less disposal water due lower cumulative produced water (lower rates, no multirate steps, shorter production periods)	Based on 500 m3 production water: **105 k€**	**525 k€**
Rig	Burnrate rig: 100 k€/day	Based on 5 days rig availability during welltesting: burnrate rig: **500 k€**	Shorter production periods, no multirate test, no splicing of ESP cable, etc.	Based on 4 days rig availability during welltesting: burnrate rig: **400 k€**	**100 k€**
Artificial lift	ESP v.s. jetpump	ESP rental + running: **200 k€**	Jetpump instead of ESP	Jetpump + downhole shutin valve + packer + PT gauge + sampler tool: **120 k€**	**80 k€**

Grand Total **930 k€**

Summary and recommendations

Methods to reduce the costs of welltesting:

1. Lower flowrates
2. Shorter flow periods
3. Fewer flow periods (no more multirate testing)

This results in a cost reduction of welltesting of up to 1 million €, without compromising on the quality of the data

* *https://www.ebn.nl/wp-content/uploads/2026/06/Recommendations-for-improved-geothermal-well-testing-Properbase-1.pdf*