

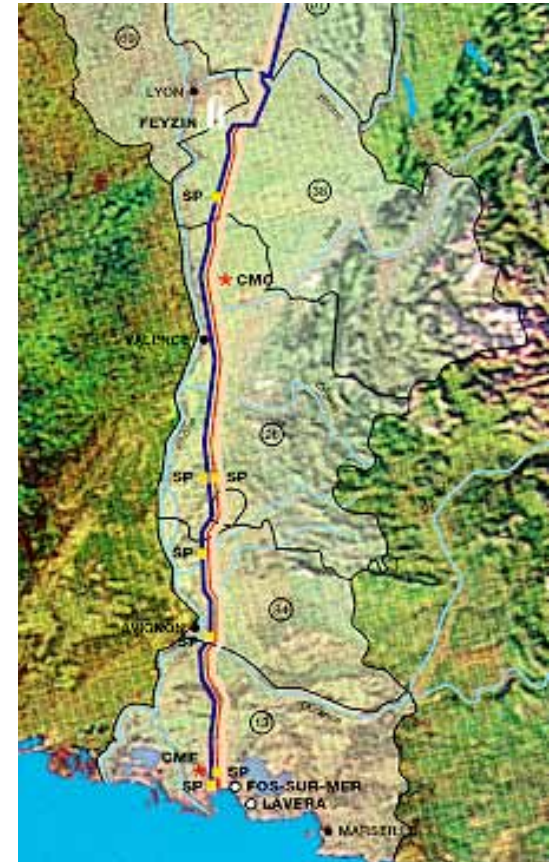
Drag Reducer Use For Pipeline Debottlenecking

The Challenge

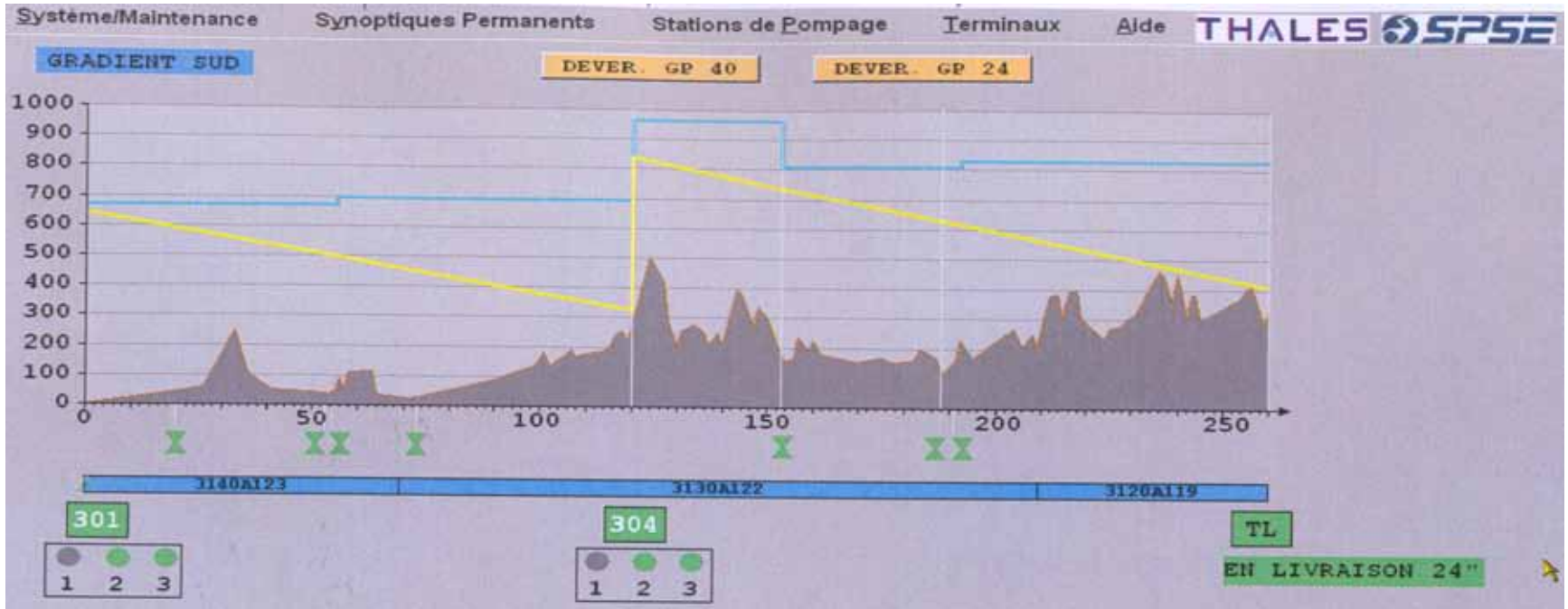
- Main 40” pipeline unavailable due to a major accident.
- Client’s supply needs still to be met.
- Parallel line by-passing the accident area available.
- Available line capacity : 12 MT/year
- Expected needs : 18 MT/year

24" Pipeline Capacity / Design

- Maximum Flowrate : 1200m³/h
- Maximum Pressure : 57 bar
- Length : 260 km
- Pumping Facilities : 2
- Pump design : 2000m³/h



24" hydraulics at 1200m³/h



- 2 pumps in Fos, 2 pumps at SSB
- Pressure at Fos : 54bar
- Pressure at SSB : 47 bar

Next step

- Hydraulic study at 1800m³/h
 - Required in order to establish that a higher flowrate wouldn't increase the risks on this pipeline and find solutions if yes
 - Assessment of the achievable flowrate using Drag Reducer
- Provider search, with ability to provide product and service in a short delay

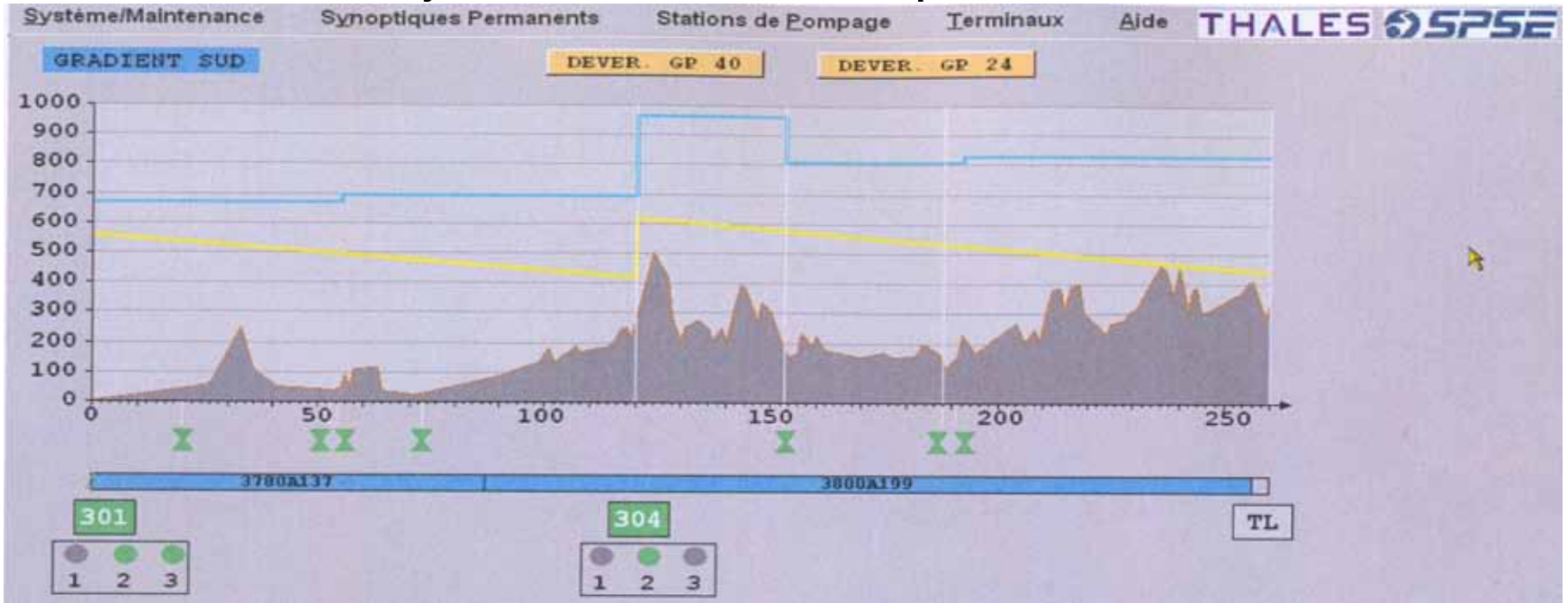
Provider/Equipment

- ConocoPhillips was able to provide service and equipment immediately
- Technical support and response
- 2 facilities equipped



24" hydraulics at 1600m³/h

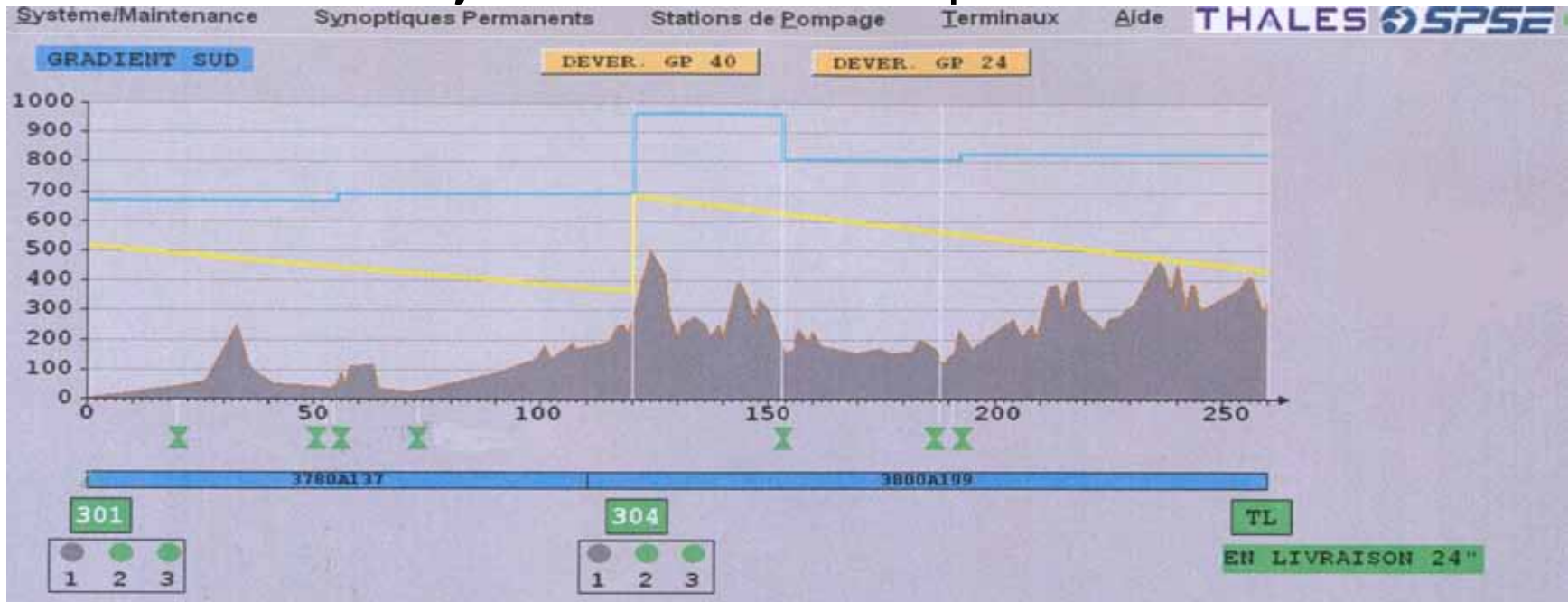
DR injection rate : 0.086 per thousand



- 2 pumps in Fos, 1 pump at SSB
- Pressure at Fos : 47 bar
- Pressure at SSB : 29 bar

24" hydraulics at 1950m³/h

DR injection rate : 0.082 per thousand



- 2 pumps in Fos, 2 pumps at SSB
- Pressure at Fos : 43 bar
- Pressure at SSB : 35 bar

Tuning

- The injection rate has to be tuned in order to achieve the best Flowrate/Injection rate ratio. For a given flowrate increasing the injection rate is pointless.
- The Product efficiency is closely related to the crude viscosity.
- For a steady 1600m³/h flowrate the injection ratio doubled from october to december due to lower temperatures and related increased viscosity

Injection ratio per month

Injection ratio at average 1630m³/h
(litres per thousand)



For the same average flowrate :

- Average injection rate of 65 l/h in October
- Average injection rate of 118 l/h in November
- Average injection rate of 140 l/h in December
- Average injection rate of 143 l/h in January

Achievement

- Significant 24” line capacity increase.
- 25% up to 50% flowrate improvement.
- Near 20% pressure reduction for a given flowrate.
- Increased energy efficiency (30% reduction)
- Achieved capacity : 17 MT/year (limited at 16.3 for unrelated administration authorization)

Cost

Not much time to discuss costs with the provider.

Even in that situation we were offered a good service level with decreasing supply costs.

In our case, these decreasing costs don't appear clearly as the injection ratio increased in time.

- Cost per ton in October : 0.39 €/ton
- Cost per ton in November : 0.59 €/ton
- Cost per ton in December : 0.75 €/ton
- Cost per ton in January : 0.84 €/ton