Extreme-Temperature Water-Based Drilling Fluid Performance

Wakefield-Harrison GU B #1 — Supporting a 21,006-ft re-entry in a well later logged and cored at temperatures up to 434°F

21,006 ft	20,949 ft	434°F	>4,000 ft
Measured depth	True vertical depth	Maximum reported logging/coring temperature	Open-hole interval evaluated

Executive Summary

Empire Petroleum Corporation re-entered the legacy Wakefield-Harrison GU B #1 and drilled, underreamed, and cleaned out the wellbore to 21,006 ft measured depth (MD) and 20,949 ft true vertical depth (TVD). Empire then acquired a modern open-hole logging suite and sidewall cores across more than 4,000 ft of open hole; logging and coring temperatures were reported at up to 434°F. [1,2]

For a drilling-fluid program, the significance is operational: the well had to remain drillable, cleanable, and conditionable through an ultra-deep re-entry before the operator could execute its planned open-hole evaluation. In HPHT water-based systems, thermal degradation, rheological instability, fluid-loss control, cuttings suspension, and filter-cake quality are recognized technical risks. [6,7]

This case study documents Saber Drilling Fluids' engineering approach to that environment: design the fluid around the anticipated thermal and solids-loading envelope, qualify the chemistry, monitor field trends, and adjust treatment as well conditions change. Saber's core services include fluids programming, hydraulic analysis, laboratory analysis, experienced mud engineering, and fluid-product development. [4,5]

The Operating Challenge

The Wakefield-Harrison re-entry combined depth, legacy-wellbore constraints, extended circulation, underreaming, cleanout, and a demanding post-drilling evaluation program. Public operator reporting establishes the following operating envelope: [1,2]

- 21,006 ft MD / 20,949 ft TVD.
- Legacy wellbore originally drilled in 1959 and subsequently deepened.
- More than 4,000 ft evaluated in open hole.
- Logging and sidewall-coring temperatures reported up to 434°F.
- Drilling, underreaming, cleanout, and subsequent open-hole logging and coring.

The 434°F figure should be described precisely: Empire reports it for logging and coring operations, not as a direct measurement of circulating drilling-fluid temperature. [2] Even with that distinction, the well represents an extreme thermal context in which water-based fluid performance must be managed against known HPHT failure modes. Recent technical literature identifies thermal degradation of additives, excessive fluid loss, rheological instability, poor cuttings suspension, and weak filter cakes among the recurring concerns in HPHT WBMs. [6]

The Saber Engineering Strategy

Saber's approach centers on an integrated engineering cycle that connects fluid design, laboratory qualification, field surveillance, and treatment decisions rather than relying on a single additive or laboratory temperature rating.

1. Thermal stability

Build the system around the expected temperature and exposure profile, recognizing that chemistry that performs at surface conditions may change materially after prolonged high-temperature aging.

2. Filtration control

Protect HTHP fluid-loss performance and filter-cake quality as temperature, contamination, and solids loading increase.

3. Rheology and hole cleaning

Maintain enough low-end rheology and carrying capacity to transport cuttings while avoiding excessive viscosity, progressive gelation, or an unfavorable hydraulic profile.

4. Solids management

Treat drilled solids as an engineering variable. Underreaming and cleanout can materially change rheology and treatment demand.

5. Chemical compatibility

Evaluate the formulation as a system rather than as isolated products; temperature, salinity, solids, and exposure time can change additive interactions.

6. Field adaptability

Use trend-based monitoring to adjust concentration, treatment timing, and operating targets as actual well conditions evolve. API RP 13B-1 provides standardized procedures for field testing key water-based drilling-fluid properties. [8]

Laboratory Qualification + Field Execution

Laboratory qualification establishes whether a proposed fluid chemistry is technically viable under the anticipated thermal and contamination envelope. Field engineering determines whether that system remains within operating targets after circulation, solids loading, dilution, contamination, and repeated treatment. Those two functions should be treated as one engineering loop, not as separate services.

For an ultra-deep re-entry, the surveillance program should focus on the variables that most directly affect wellbore condition and hydraulic performance:

- HTHP/static filtration trend
- Rheological trend and gel development
- Solids loading and low-gravity-solids control
- Chemical concentration and treatment response
- Hole-cleaning requirements and hydraulic margin
- Product inventory, treatment timing, and contingency planning

Saber’s public materials describe this same service architecture: comprehensive fluid programs, hydraulic analysis, laboratory support, experienced mud engineering, product development, and technical advisors. [4,5] The value of that model is clearest when those capabilities are connected to measurable field outcomes rather than presented as stand-alone service claims.

Field Result: The Well Stayed Ready for Evaluation

The strongest field-level indicator is what the operator was able to do after the drilling and cleanout work. Empire reported that the well reached 21,006 ft MD / 20,949 ft TVD, followed by a full modern open-hole logging suite and sidewall-core recovery at temperatures up to 434°F. More than 4,000 ft of the evaluated interval was open hole. [1,2]

DEPTH	**21,006 ft MD** 20,949 ft TVD
THERMAL CONTEXT	**Up to 434°F** during logging/coring
OPEN HOLE	**>4,000 ft** evaluated
EVALUATION	**Full open-hole logs** + sidewall cores

Drilling performance is multivariable, but the drilling-fluid program must maintain wellbore condition through the drilling and cleanout sequence so that subsequent operations can proceed. In this case, the well remained suitable for a sophisticated open-hole evaluation program after the ultra-deep drilling, underreaming, and cleanout work. [1,2]

Why It Matters to an Operator

For an operator, drilling-fluid performance matters insofar as it supports the well objective, maintains the wellbore, preserves operating flexibility, and enables the next planned operation. In this case, Empire obtained modern subsurface control across roughly 11,000 ft of deeper section and reported hydrocarbon shows across the logged interval, with evaluation spanning the Lower Travis Peak, Cotton Valley Sand, Bossier, and Haynesville intervals. [2]

Empire reported approximately $4.4 million for the re-entry and evaluation, compared with reported $30–45 million costs for newly drilled and completed ultra-deep wells elsewhere in the Western Haynesville. [1,2] That comparison is useful as context for capital efficiency, but it is not an apples-to-apples drilling-cost comparison; Empire itself cautions that the offset figures represent new drilled-and-completed wells and are not directly comparable to a re-entry. [2]

Saber Technical Capabilities

In an extreme-temperature application, Saber's technical value lies in treating the drilling fluid as an engineered operating system rather than a catalog of chemicals. Its published capabilities in fluids programming, laboratory analysis, hydraulics, field engineering, product development, and technical support align with that approach. [4,5]

FLUIDS PROGRAMMING Design the program around the anticipated operating envelope before the well creates the problem.

LABORATORY ANALYSIS Qualify chemistry and treatment options under representative conditions and use the lab to troubleshoot field trends.

HYDRAULIC ANALYSIS Connect rheology to hole cleaning, pressure management, and drilling efficiency.

EXPERIENCED MUD ENGINEERING Place decision-capable personnel at the wellsite to recognize trends early and adjust the system.

FLUID PRODUCT DEVELOPMENT Select chemistry around the actual performance requirement rather than a one-size-fits-all package.

TECHNICAL SUPPORT Keep field engineering, technical personnel, laboratory resources, and product supply aligned as conditions change.

The Wakefield-Harrison case is most compelling in its measurable operating outcomes: 21,006 ft MD, 20,949 ft TVD, more than 4,000 ft of open-hole evaluation, a full open-hole logging suite, sidewall cores, and temperatures reported up to 434°F during logging and coring. [1,2] Those results move the discussion beyond a laboratory temperature rating. The well was drilled, cleaned out, and left in condition to execute the operator's planned evaluation program.

Conclusion

The Wakefield-Harrison GU B #1 is a strong Western Haynesville case study because the result is measurable. Empire reached 21,006 ft MD / 20,949 ft TVD, evaluated more than 4,000 ft of open hole, and completed modern logging and sidewall coring in a well where temperatures were reported up to 434°F. [1,2]

For Saber, the case centers on engineering discipline: fluid-system design, laboratory qualification, hydraulic awareness, field surveillance, solids management, treatment strategy, and technical support working together as well conditions change. Saber’s published materials document that service model. [4,5]

Saber engineered and supported the HTHP water-based drilling-fluid program used during the Wakefield-Harrison re-entry. The documented field outcome provides a direct example of Saber’s engineering model applied in an ultra-deep, extreme-temperature operating environment. [1–5]

SABER DRILLING FLUIDS

References

[1] World Oil. “Empire Petroleum reaches 21,006 ft in Western Haynesville well in Texas.” 17 Aug. 2026. Link

[2] Empire Petroleum Corporation. “Empire Petroleum Marks Strategic Milestone With Successful 21,006-Foot Well in the Western Haynesville in Texas to Accelerate Revenue Development.” 17 Aug. 2026. Link

[3] Saber Drilling Fluids. Wakefield-Harrison GU B #1 project records, 2026.

[4] Saber Drilling Fluids. “Comprehensive Drilling Solutions.” Corporate website, accessed 21 Aug. 2026. Link

[5] Saber Drilling Fluids. Company capabilities infographic, n.d., accessed 21 Aug. 2026. Link

[6] Golab, E. G., and S. Hosseini. “NiO nanoparticles for enhanced thermal stability and filtration control in HPHT water-based drilling fluids.” Journal of Petroleum Exploration and Production Technology, 2026. doi:10.1007/s13202-026-02209-6. Link

[7] Aftab, A., A. R. Ismail, Z. H. Ibupoto, H. Akeiber, and M. G. K. Malghani. “Nanoparticles based drilling muds a solution to drill elevated temperature wells: A review.” Renewable and Sustainable Energy Reviews 76 (2017): 1301–1313. doi:10.1016/j.rser.2017.03.050. Link

[8] American Petroleum Institute. API Recommended Practice 13B-1, Testing Water-based Drilling Fluids, 6th ed., Jan. 2026.Link