



# PERFORMANCE BULLETIN

## Placement of multiple PBL® Bypass Tools within a BHA delivers the required flow rates for efficient cleaning during a WBCO operation in Colombia

### Challenge

A deep well drilled at the Colombian foothills, with a combined casing and liner string, finished with a 4 1/2" liner set at approx. 19,800ft.

The task was to effectively clean out the 4 1/2" X 7" X 9 5/8" liner, ensuring proper flow rates in the adjacent liner and casing sections for efficient hole cleaning.

The operator required the ability to pump at different flow rates, in different sections of the well, so that optimal annulus flow rates could be achieved for effective hole cleaning.

The flow rates required were between 60gpm and 460gpm. Currently, there are no standalone tools that could effectively deliver flow rates in that range.



### Solution / Execution

Ecopetrol and DSI-BITO engineering teams designed a solution based on a combined BHA, including 1 x 2 7/8" OD and 1 x 4 3/4" OD PBL® Bypass Tools set at the appropriate positions.

Considering the well profile, which consisted of 11 3/4" OD and 4 1/2" OD liners, set apart by 9,842ft, DSI designed a solution that would deliver effective flow rates at the required depths. We placed a 4 3/4" PBL® tool at the transition point and a 2 7/8" PBL® tool at the lower section of the hole. The plan was to activate and pump through the 2 7/8" PBL® first to ensure hole cleaning inside the 4 1/2" liner, considering the tool OD and max flow rates allowed in that well section. While pulling out of hole and reaching 9,842ft we then activated the 4 3/4" PBL to pump at significantly higher flow rates enhancing the hole cleaning process at optimal annular velocity and ensuring a complete debris cleanout.

#### Proposed WBCO BHA:

QTY	BHA COMPONENTS
1	3.75" Concave Mill
1	2 7/8" Motor ECTD
1	Float sub
1	2 7/8" PBL® (TFA: 1.32 In <sup>2</sup> when tool open) 2 3/8" PAC Pin x Box
1	Crossover 2 3/8" Pac x 2 7/8" HTPac
1	3 1/8" Drill collar
1	Crossover 2 7/8" HTPAC pin x XT27 box
163	2 7/8" OD, 362" WT (10.40 lb/ft)
1	Crossover XT27 pin x NC38 box
1	4 3/4" PBL® (2.454 In <sup>2</sup> when tool open) API-NC38 Pin X Box
1	Crossover NC38 pin x NC50 box
99	5" DP NC50 (19.50 lb/ft)
1	Crossover NC50 pin x XT57 box
363	5 7/8" DP (30.3 lb/ft Adjusted)



### Operational Sequence:

- The 2 7/8" PBL® was tested at surface.
  - 2 7/8" PBL® was Activated with 42gpm – 129psi / Deactivated with 42gpm - 1,260psi, all the balls were kept at the PBL® cage.
- Continued RIH with Drill string/BHA
- The 4 3/4" PBL® was tested at surface when the BHA was at 5,330ft.
  - 4 3/4" PBL® was Activated with 45gpm – 250psi / Deactivated with 58gpm - 2,750psi.
  - All the surface test balls were retrieved from the cage (It was critical to recover the balls to ensure full drift thru 4 3/4" PBL®, for the later activation of the 2 7/8" PBL®)
- Continued to RIH to bottom.
- Once the drill out procedure was performed in 4 1/2" Liner, at 19,630ft, the 2 7/8" PBL® was activated using a dart: 105gpm – 2,400psi.
  - Subsequently, the flow rate was increased to 153gpm - 4,150psi, circulating through the PBL® for 3 hours, reciprocating for 30ft, reaching the total depth of 19,655ft, ensuring optimal flow rates to allow effective hole cleaning in that section, limited by Standpipe pressure < 4,200psi. Started POOH.
- At 14,540ft, at the top of the 9 5/8" liner, the flow rate was reduced to 205gpm, and pressure dropped to 205gpm - 2,580psi and circulated for 1 hour through the 2 7/8" PBL®.
- At this depth, the 4 3/4" PBL® was activated using a dart: 80gpm – 367psi, continued circulating through the 4 3/4" PBL® with 650gpm - 1,170psi, total strokes 10,171 ensuring hole cleaning inside the 11 3/4" Casing.
- POOH to Surface.

## Conclusion & Recommendation

This was a very successful well bore clean out operation which optimized and reduced the circulating time and excellent hole cleaning was observed in the subsequent BHAs Run in Hole. No restrictions or string plugging were experienced and clear access to work with wireline/braided line down to 19,500 ft was achieved without any issues.

Utilizing PBL® Bypass System, once again, has demonstrated extensive savings in costs and rig time to the operator. Having two PBL® tools of varied sizes placed within the same string at predetermined positions enabled the operator to pump at different flow rates, in different sections of the well, so that optimal annulus flowrates could be achieved for effective and efficient hole cleaning. This application eliminated the need for a dedicated cleanout run hence, saving the operator significant costs and valuable rig time.

**PBL® Bypass System demonstrated its value to the operator by facilitating an efficient wellbore clean out operation using a single drilling string assembly. As the result of this, the operator was able to perform the work in a single run, hence saving time and money.**