Supplementary

Table S1. Summary of corefloods showing incremental oil recovery by EWF in carbonates.

Study	Incremental Oil by EWF (% OOIP)
Bagci, Kok [1]	18.4
Austad, RezaeiDoust [2]	28
Fathi, Austad [3]	18
Gupta, Smith [4]	9
Yousef, Al-Saleh [5]	18
Zahid, Shapiro [6]	20
Chandrasekhar and Mohanty [7]	32
Al-Attar, Mahmoud [8]	21.5
Awolayo, Sarma [9]	10
Alameri, Teklu [10]	7
Qiao, Li [11]	14
Mohsenzadeh, Pourafshary [12]	22.5
Nasralla, Mahani [13]	7
Fani, Al-Hadrami [14]	22.2
Sarvestani, Ayatollahi [15]	12
Masalmeh, Al-Hammadi [16]	6.5

Table S2. Experimental and numerical studies showing incremental oil recovery by EWPF in carbonates.

Study	Incremental Oil by EWPF (% OOIP)
Mohammadi and Jerauld [17]	10
Alzayer and Sohrabi [18]	4
Vermolen, Pingo-Almada [19]	8
Borazjani, Bedrikovetsky [20]	14
Santo and Muggeridge [21]	15
Alfazazi, AlAmeri [22]	10
Al-Murayri, Kamal [23]	12
AlSofi, Wang [24]	9.9
Lee, Lee [25]	12.3

Table S3. Coreflood studies used to develop comparison of PF and LSPF based on capillary desaturation.

Study	Flooding Scenario
Zhong, Zang [26]	PF
Qi, Ehrenfried [27]	PF
Clarke, Howe [28]	PF
Vermolen, Van Haasterecht [29]	PF
Vermolen, Van Haasterecht [29]	VEPF
Wenxiang, Demin [30]	PF
Al-Murayri, Kamal [23]	LSPF
AlSofi, Wang [24]	LSPF
Lee, Lee [25]	LSPF
Erincik, Qi [31]	LSPF
Tahir, Hincapie [32]	LSPF
Torrijos, Puntervold [33]	LSPF
Vermolen, Pingo-Almada [19]	LSPF

Shaker Shiran and Skauge [34]	LSPF

Table S4. Studies showing reduction in required polymer concentration by LSW.

Study	Polymer concentration (ppm)	
	HSW	LSW
Wang, Cheng [35]	2310	887
Zaitoun, Makakou [36]	1980	950
Vermolen, Pingo-Almada [19]	1800	800
Silveira, Lopes [37]	1250	100
Al-Murayri, Kamal [23]	4000	2500
AlSofi, Wang [24]	3000	2000
Moghadasi, Pisicchio [38]	1000	300

Table S5. Studies showing reduction in polymer retention by LSW

Study	Polymer Retention (μg/g of rock)	
	HSW	LSW
Aluhwal and Kalifa [39]	240	30
Vermolen, Pingo-Almada [19]	25	12.5
AlSofi, Wang [40]	230	84
AlSofi, Wang [40]	133	102
Unsal, Ten Berge [41]	271	53
Guetni, Marlière [42]	50	5
Moghadasi, Pisicchio [38]	36.91	16

References

1. Bagci, S.; Kok, M.V.; Turksoy, U. Effect of brine composition on oil recovery by waterflooding. *J. Pet. Sci. Technol*. **2001**, *19*, 359–372.
2. Tor, A.; Alireza, R.; Tina P. Chemical mechanism of low salinity water flooding in sandstone reservoirs. In Proceeding of SPE improved oil recovery symposium, Tulsa, Oklahoma, USA, 24–28 April 2010.
3. Fathi, S.J.; Austad, T.; Strand, S. Water-based enhanced oil recovery (EOR) by "smart water": Optimal ionic composition for EOR in carbonates. *Energy Fuels.* **2011**, *25*, 5173–5179.
4. Gupta, R.; Griffin, S.; Lu, H.; Thomas, W.; Mauro, L.C.; Chad, R.H. Enhanced waterflood for Middle East carbonate cores–Impact of injection water composition Paper SPE 142668. In Proceedings of SPE Middle East oil and gas show and conference, Manama, Bahrain, 25–28 September, 2011.
5. Yousef, A.A.; Salah, H.A.; Abdulaziz, A.; Mohammed, S.A. Laboratory investigation of the impact of injection-water salinity and ionic content on oil recovery from carbonate reservoirs. *SPE Reservoir Eval. Eng.* **2011**. *14*, 578–593.
6. Zahid, A.; Alexander S.; Arne S. Experimental Studies of Low Salinity Water Flooding in Carbonate Reservoirs: A Mew Promising Approach. In Proceedings of the SPE EOR Conference at Oil and Gas West Asia 2012, Muscat, Oman, 16–18 April 2012.
7. Chandrasekhar, S.; Mohanty, K. Wettability Alteration with Brine Composition in High Temperature Carbonate. Paper SPE 166280. In proceeding of SPE Annual Technical Conference and Exhibition, New Orleans, Louisiana, USA, 30 September–2 October 2013.
8. Al-Attar, H.; Mahmoud, M. Y.; Zekri, A.; Al-Mehaideb, R.; Mamdouh, T.G. Low-salinity flooding in a selected carbonate reservoir: experimental approach. *J. Pet. Explor. Prod. Technol*. 2013. **3**, 139–149.
9. Awolayo, A.; Hemanta, S.; Ali, A. A laboratory study of ionic effect of smart water for enhancing oil recovery in carbonate reservoirs. In proceeding of SPE EOR conference at oil and gas West Asia, Muscat, Oman, 31 March–2 April 2014.
10. Waleed, A.; Tadesse, W.T.; Hossein, K. Experimental and numerical modeling of low-salinity waterflood in a low permeability carbonate reservoir. In Proceeding of SPE Western Regional Meeting, Garden Grove, California, USA, 27–30, April 2015.
11. Changhe, Q.; Li, L.;Russell, T.J.; Jinchao, X. A mechanistic model for wettability alteration by chemically tuned waterflooding in carbonate reservoirs. *Soc. Pet. Eng*. **2015**. *20*, 767–783.

12. Adel, M.; Peyman, P.; Yahya, M.A. Oil recovery enhancement in carbonate reservoirs via low saline water flooding in presence of low concentration active ions; A case study. In Proceeding of SPE EOR Conference at Oil and Gas West Asia, Muscat, Oman, 21–23 March, 2016.
13. Nasralla, R.A.; Hassan, M.; Hilbert, A.L.; Fons, H.M.M.; Shehadeh, K.M.; Ekaterina, S.; Niels, J.B.; Sebastiaan, G.J.P.; Saptarshi, B. Low salinity waterflooding for a carbonate reservoir: Experimental evaluation and numerical interpretation. *J. Pet. Sci. Eng.* **2018**, *164*, 640–654.
14. Mahmood, F.; Hamoud A.; Peyman, P.; Gholamreza, V. Optimization of smart water flooding in carbonate reservoir. In Proceeding of Abu Dhabi International Petroleum Exhibition & Conference, Abu Dhabi, UAE, 12–15 November 2018.
15. Sarvestani, A.D.; Ayatollahi, S.; Moghaddam, M.B. Smart water flooding performance in carbonate reservoirs: an experimental approach for tertiary oil recovery. Pet. Explor. Prod. Technol. **2019**. *9*, 2643–2657.
16. Shehadeh, M.; Mohammad, A.; Seyed, A.F.;Mehran S. Low Salinity Water Flooding in Carbonate: Screening, Laboratory Quantification and Field Implementation. In Proceeding of Abu Dhabi International Petroleum Exhibition & Conference, Abu Dhabi, UAE, 11–14 November 2019.
17. Mohammadi, H.; Jerauld, G. Mechanistic modeling of the benefit of combining polymer with low salinity water for enhanced oil recovery. In Proceeding of SPE Improved Oil Recovery Symposium, Tulsa, Oklahoma, USA, 14–18 April 2012.
18. Alzayer, H.; Sohrabi, M. Numerical simulation of improved heavy oil recovery by low-salinity water injection and polymer flooding. In Proceeding of SPE Saudi Arabia section technical symposium and exhibition, Al-Khobar, Saudi Arabia, 19–22 May 2013.
19. Esther C.M.V.; Monica P.A.; Bart M.W.; Dick J.L. Low-salinity polymer flooding: improving polymer flooding technical feasibility and economics by using low-salinity make-up brine. In Proceeding of IPTC 2014: International Petroleum Technology Conference, Doha, Qatar, 19–22 January 2014.
20. Borazjani, S.; Bedrikovetsky, P.; Farajzadeh, R. Analytical solutions of oil displacement by a polymer slug with varying salinity. *J. Pet. Sci. Eng.* **2016**, *140*, 28–40.
21. Santo, A.; Muggeridge, A. An Investigation into the Benefits of Combined Polymer-Low Salinity Waterflooding. In Proceeding of SPE Asia Pacific Oil and Gas Conference and Exhibition, Brisbane, Australia, 23–25 October 2018
22. Alfazazi, U.; AlAmeri, W.; Hashmet, M.R. Experimental investigation of polymer flooding with low-salinity preconditioning of high temperature–high-salinity carbonate reservoir. *Pet. Explor. Prod. Technol.* **2019**, *9*, 1517–1530.
23. Al-Murayri, M.T.; Dawood, S.K.; Hessa, M. A.; Tareq A. Low-Salinity Polymer Flooding in a High-Temperature Low-Permeability Carbonate Reservoir in West Kuwait. In Proceeding of SPE Kuwait Oil & Gas Show and Conference, Mishref, Kuwait, 13–16 October 2019
24. AlSofi, A.M.; Jinxun, W.; Abdullah, A.; Bandar, A.; Subhash, C.A.; Ali, A.A. Smartwater Synergy with Chemical Enhanced Oil Recovery: Polymer Effects on Smartwater. *SPE Reservoir Eval. Eng.* **2019**, *22*, 61–77.
25. Yeonkyeong, L.;Wonsuk, L.;Youngho, J.;Wonmo, S. Oil recovery by low-salinity polymer flooding in carbonate oil reservoirs. *J. Pet. Sci. Eng.* **2019**, *181*, 106211.
26. Huiying, Z.;Qiuyuan, Z.;Hongjun, Y.; Huifen, X. Experimental study on medium viscosity oil displacement using viscoelastic polymer. *Geofluids*. **2018**, *2018*, 4321380.
27. Pengpeng, Q.; Daniel, H.E.; Heesong, K.; Matthew T.B. Reduction of residual oil saturation in sandstone cores by use of viscoelastic polymers. *J. SPE*. **2017**, *22*, 447–458.
28. Andrew, C.; Andrew, H.; Jonathan M.; John S.; Laurence A.H. How viscoelastic-polymer flooding enhances displacement efficiency. *J. SPE*. **2016**, *21*, 675–687.
29. Vermolen, E.; Haasterecht, M.V.; Masalmeh S. A systematic study of the polymer visco-elastic effect on residual oil saturation by core flooding. In Proceeding of SPE EOR Conference at Oil and Gas West Asia, Muscat, Oman, 31 March–2 April 2014.
30. Wenxiang, W.; Demin, W.; Haifeng, J. Effect of the visco-elasticity of displacing fluids on the relationship of capillary number and displacement efficiency in weak oil-wet cores. In Proceeding of Asia Pacific Oil and Gas Conference and Exhibition, Jakarta, Indonesia, 30 October–1 November 2007.
31. Mehmet, Z.E.; Pengpeng, Q.; Matthew, Q.B.; Gary, A.P. New method to reduce residual oil saturation by polymer flooding. SPE. **2018**, *23*, 1944–1956.
32. Muhammad, T.; Rafael, E.H.; Hendrik, F.; Hiwa, A.; Leonhard, G. Impact of Sulphates Presence During Application of Smart Water Flooding Combined with Polymer Flooding. In Proceeding of SPE Europec featured at 80th EAGE Conference and Exhibition, Copenhagen, Denmark, 11–14 June 2018.

33. Iván, D.P,T.; Tina, P.; Skule, S.; Tor, A.;Tord, H.B.; Hakar I.A. An experimental study of the low salinity Smart Water-Polymer hybrid EOR effect in sandstone material. *J. Pet. Sci. Eng*. **2018**, *164*, 219–229.
34. Shaker, S.B.; Skauge, A. Enhanced oil recovery (EOR) by combined low salinity water/polymer flooding. *Energy Fuels*, **2013**, *27*, 1223–1235.
35. Demin, W.; Jiecheng, C.; Qingyan, Y.; Wenchao, G. Viscous-elastic polymer can increase microscale displacement efficiency in cores. In Proceeding of SPE annual technical conference and exhibition. Dallas, Texas, 1–4 October, 2020.
36. Alain, Z.; Patrick, M.; Nicolas, B.; Rashid, S.A. Shear stability of EOR polymers. *J. Pet. Chem. Eng*. **2012**, *17*, 335–339.
37. Silveira, B.; Lopes, L.; Moreno, R. Rheological approach of HPAM solutions under harsh conditions for EOR applications. *Int. J. Eng. Technol. IJET-IJENS*, 2016, **16**, 1–8.
38. Moghadasi, L.; Pisicchio, P.; Bartosek, M.; Braccalenti, E.; Albonico, P.; Moroni, I.; Veschi, R.; Masseran, F.; Scagliotti, S.; Gaudio, L.D.; Simoni, M.D. Laboratory Investigation on Synergy Effect of Low Salinity-Polymer Water Injection on Sandstone Porous Media. In Proceeding of Offshore Mediterranean Conference and Exhibition, Ravenna, Italy, 27–29 March 2019.
39. Aluhwal, H.; Kalifa, O. Simulation study of improving oil recovery by polymer flooding in a Malaysian reservoir. Master's thesis, Department of Petroleum Engineering, Universiti Teknologi Malaysia, Johor, Malaysia, 2008.
40. AlSofi, A.M.; Wang, J.; Kaidar, Z.F. SmartWater synergy with chemical EOR: Effects on polymer injectivity, retention and acceleration. *J. Pet. Sci. Eng*. **2018**. *166*, 274–282.
41. Unsal, E.; Berge, A.T.; Wever, D. Low salinity polymer flooding: Lower polymer retention and improved injectivity. *J. Pet. Sci. Eng.* **2018**, *163*, 671–682.
42. Imane, G.; Claire, M.; David, R.; Isabelle, B.; Manuel P.; Frédéric, V. Transport of HPAM Solutions in low Permeability Porous Media: Impacts of Salinity and Clay Content. In Proceeding of SPE Europec featured at 81st EAGE Conference and Exhibition, London, UK, 3–6 June 2019.