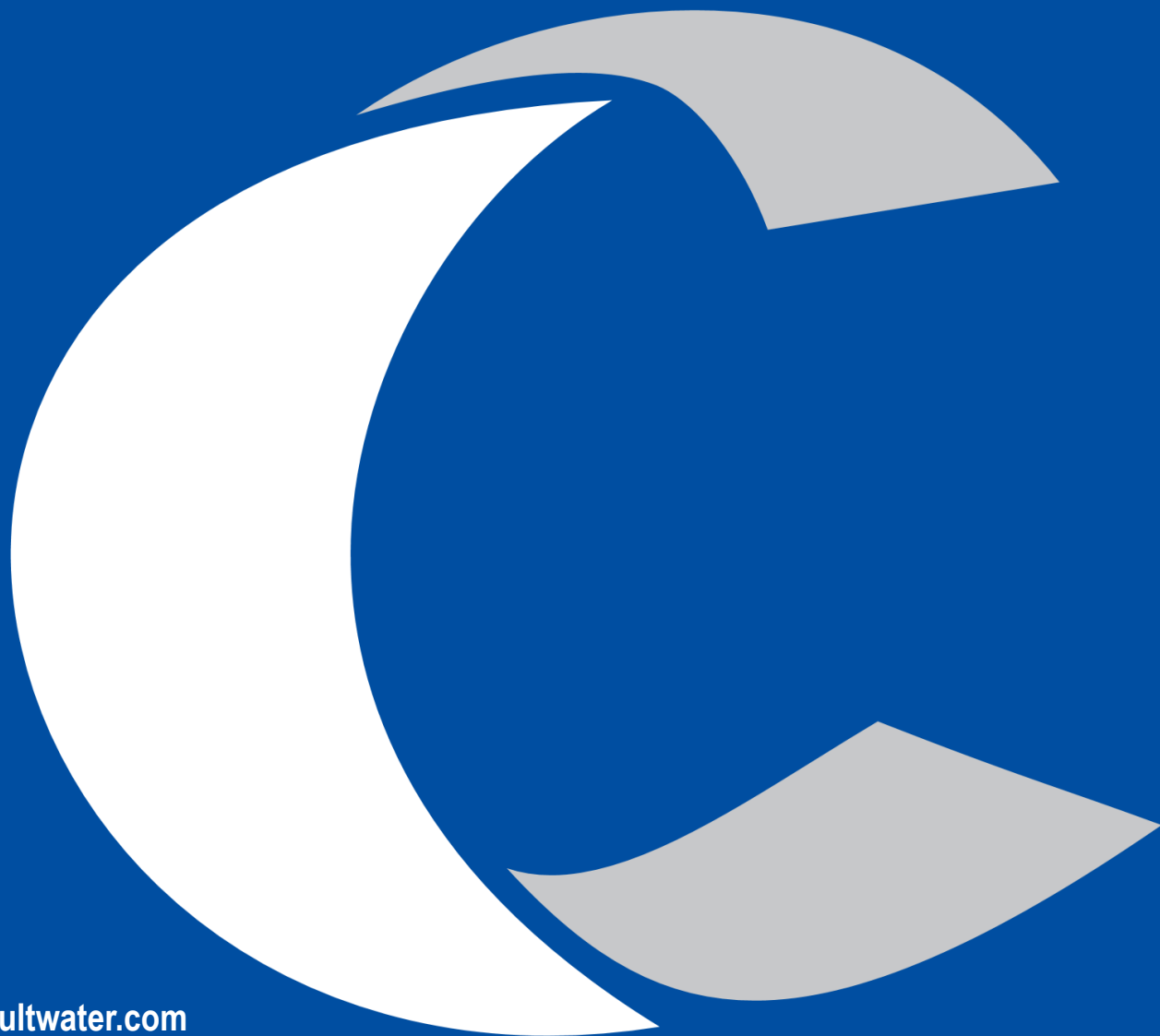


Catapult Water Intelligence

Disposal Across the Montney Duvernay

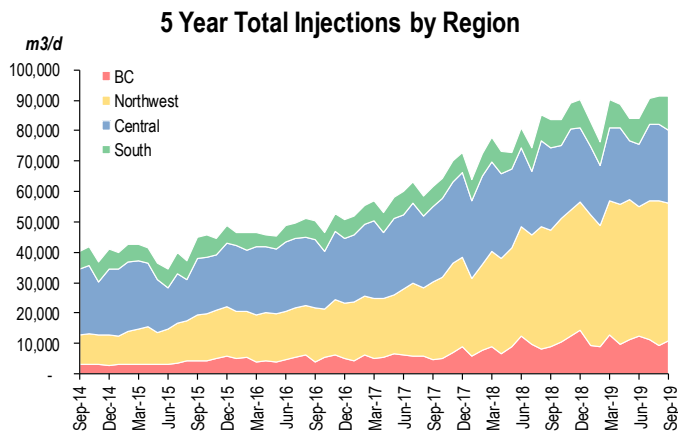




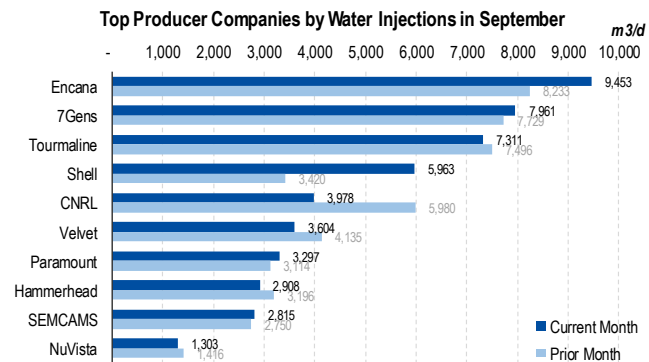
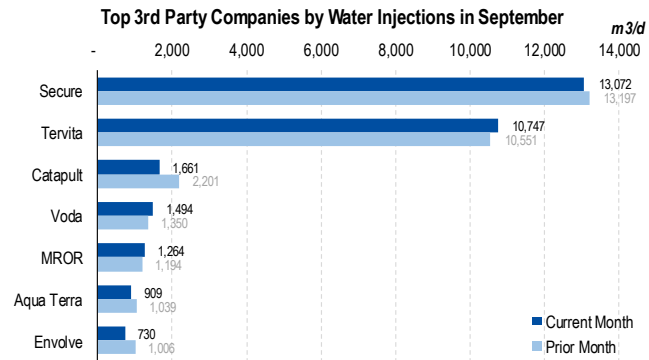
Disposal Across the Montney Duvernavy

Injection Report October 2019

Updated with data from September



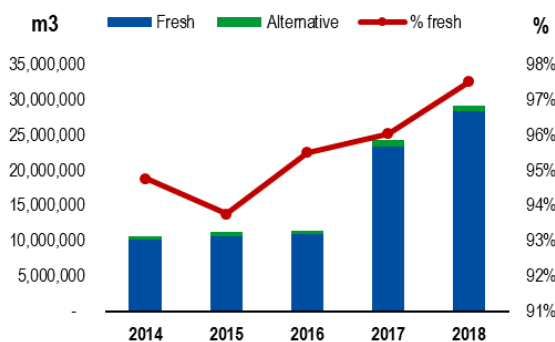
September injections remained steady posting only a slight decline of 0.1% relative to prior month, with 89,344 m³/d disposed across all four regions. Northwest and Central regions saw declines of 2,214 m³/d and 1,328 m³/d, respectively. Gold Creek led the group down with a drop of 2,565 m³/d but remained the strongest area for disposal across the Montney-Duvernavy with a total of 25,065 m³/d of fluid disposed. Fox Creek maintained its level of roughly 14,600 m³/d of fluid disposed across both months with only CNRL Sturgeon at Valleyview driving the decline in the Central region. The surprise this month came from the South region with an increase of almost 2,000 m³/d over prior month. While we reported a dramatic increase in injections into Shell Caroline's 6-29 Leduc well last month the number has doubled again since then to 4,084 m³/d for September. Not only is this unusual given the facility's average injection rate hovers around ~400 m³/d, the timing of this spike in disposal is curious as the facility is transferring ownership to Pieridae Energy. We have also made a revision to South AB to account for changes by Alphabow in injected water reported, contributing to an overall increase to the South region's total to 11,383 m³/d.



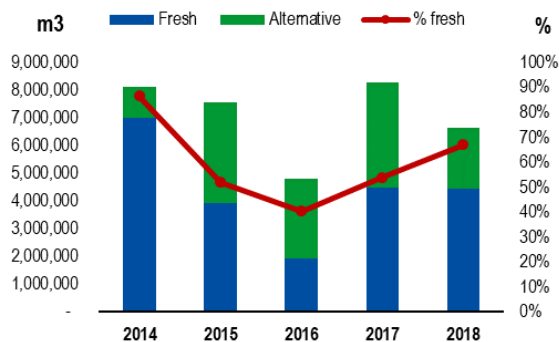
While most of the ordering remained the same relative to prior month there were a couple of notable exceptions. Shell made the largest jump from 8th to 4th on the Top Producer Companies list, mostly attributed to its injections at Caroline. In Fox Creek, Shell activated its new 2-19 battery and associated disposal well adding almost 1,200 m3/d to the company's total. CNRL Sturgeon dropped once again and as utilization has been jumping month to month the overall trend continues to be down. This play could be viewed as an EOR play, however, does take third party fluid at times. Encana posted another big month at its facilities in Dawson with close to 6,000 m3/d, while its injections at Fox Creek declined roughly 700 m3/d to a total in September of 2,957 m3/d. While there has been a small pull back in both Velvet and Hammerhead injections, they remain two of the top producers with operations in a single market (Gold Creek/Elmworth). NuVista continues to make the list despite only operating a single well captured within the regional study.

IN FOCUS: WATER ACROSS PROVINCES

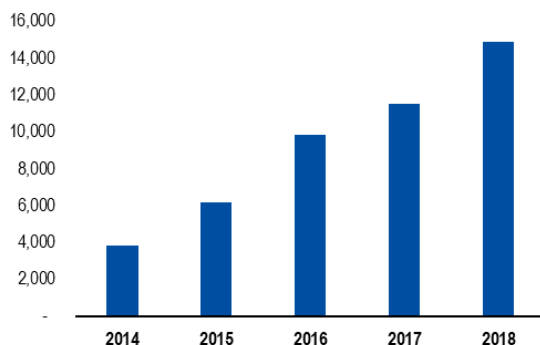
Water Used in Hydraulic Fracturing in Alberta



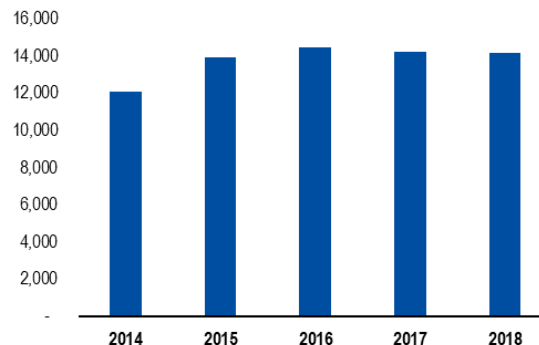
Water Used in Hydraulic Fracturing in British Columbia



Water Used per Well for HF in Alberta (m3)



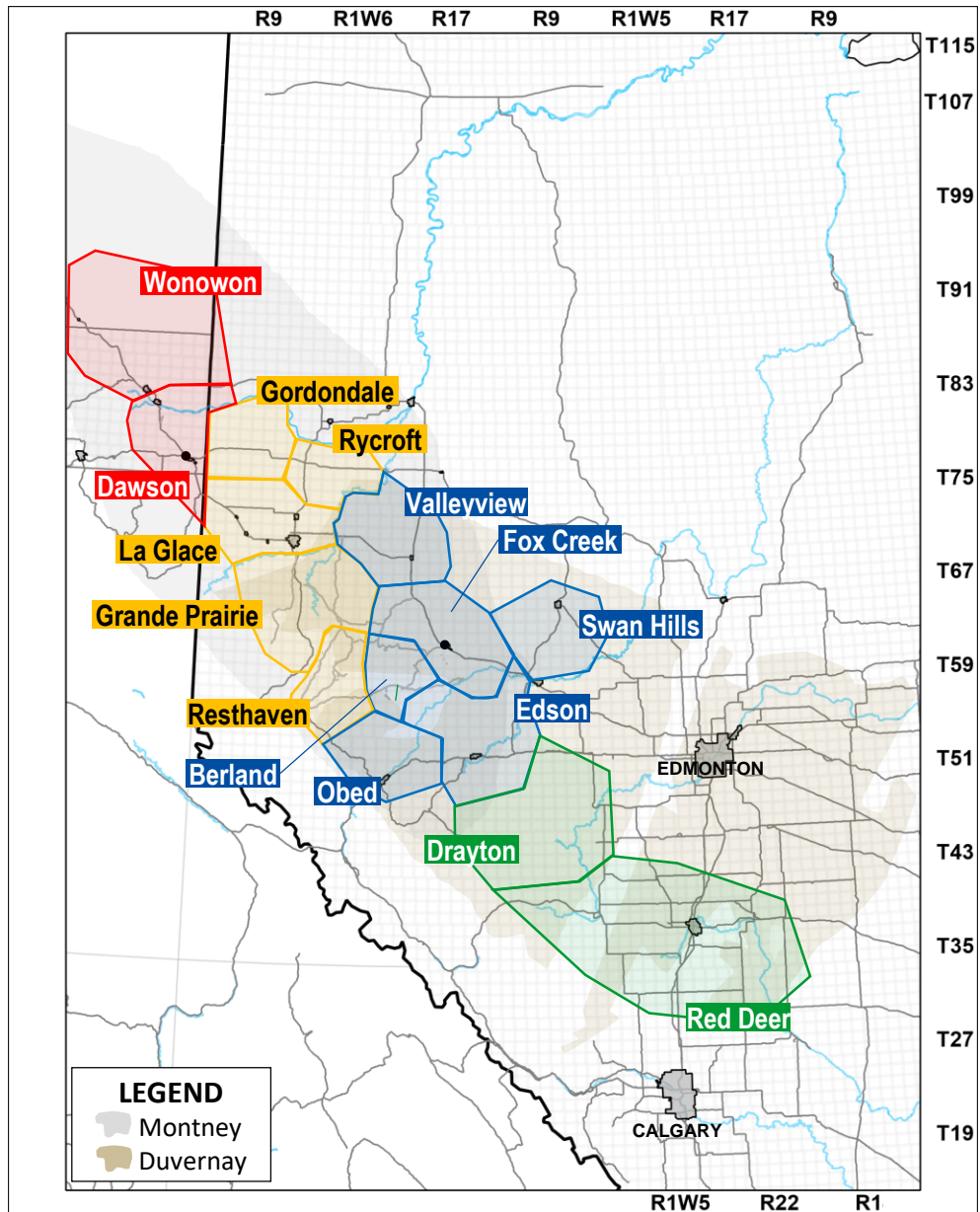
Water Used per Well for HF in British Columbia (m3)



The amount of water used in fracs throughout Alberta and British Columbia over the 2014-2018 period has increased dramatically. The combined total water consumed since 2014 in HF operations across both provinces has risen from 10.7M m3 to 29.2M m3 per year, a factor increase of 172%.

Comparing the two provinces, it is clear that BC has been better able to recycle fluid (BCOGC lists them as saline sources) than producers in Alberta. 2016 was a dismal year insofar as well count in both provinces, but while Alberta has jumped in total water use year-over-year BC has remained relatively stable, resulting in an inflection from the downward trend in % fresh water since 2014. The amount of water used per well in BC remains fairly flat, largely due to the wells targeted being primarily Montney, while in Alberta the numbers include Cardium, Spirit River, Viking, and Duvernay wells in the total, skewing the average down. We would like to remind the reader that average water required per Cardium and Viking wells are typically between 2,000-10,000 m3. This is far less compared to Montney wells which typically require between 12,000-40,000 m3 per well, or Duvernay wells which can be in the range of 40,000-100,000 m3.

As a note to the reader: Alberta numbers were taken from the AER's Water Performance report which distinguishes between "non-saline" and "recycled" water. BC numbers were taken from BCOGC data and include only totals from "fresh water" and "saline water" categories.

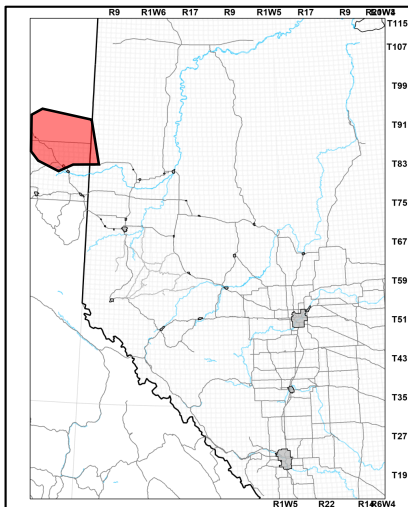
**METHODOLOGY:**

Areas were divided into four main regions: BC (RED), West (GOLD), Central (BLUE), and South (GREEN). Each region was further subdivided into areas taking into account market, facility location, and road access. The disposal wells included in this analysis were primarily selected based on the producing formation being the Montney/Duvernay but do include other sources (Spirit River, Charlie Lake, etc) that have a material effect on market dynamics for water handling. For the most part, wells that are considered part of an Enhanced Oil Recovery scheme are excluded from this analysis, with the exception of those that are disposing fluid produced from a separate formation.

DEFINITIONS:

'1st Party' volume refers to injections by facilities owned and operated by the producers themselves, whereas '3rd Party' refers to volume from facilities owned and operated by independent disposal/waste companies. 'Facilities' listed in the following charts are either batteries or waste plants that may be tied to more than one disposal well.

WONOWON



Top 5 Wonowon Facilities by Monthly Volume

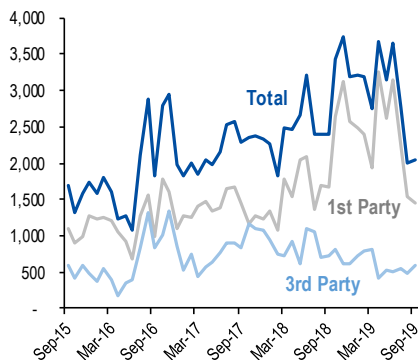
Name	Company	Volume (m3)
Tervita Mile 103	Tervita	17,398
CNRL Birch C-018-I/094-A-13 Disp	CNRL	11,938
Progress A-032-K/094-G-02	Progress	10,861
Kelt LNG C-093-I/094-A-12	Kelt	10,434
COP Blueberry D-050-C/094-A-13 Disp	Conoco	2,787

Top 5 Wonowon Wells by Monthly Volume

LSD	Formation	Company	Volume (m3)
202/D-096-K/094-A-12/0	Upper Debolt	Tervita	17,398
200/A-085-H/094-A-13/0	Bluesky	CNRL	11,806
200/C-032-K/094-G-02	Debolt	Progress	10,861
200/C-093-I/094-A-12/4	Debolt	Kelt	10,434
200/A-050-C/094-A-13/2	Upper Debolt	Conoco	2,787

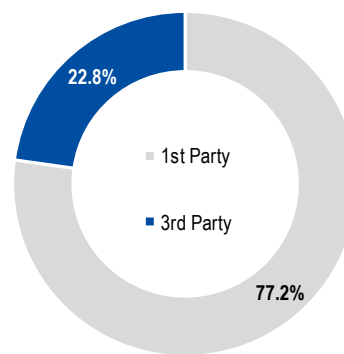
1st Party/3rd Party Injections over last Four Years

Monthly Injections in m3/d



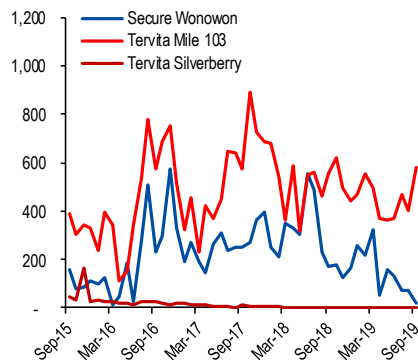
First Party vs Third Party

Rolling Three Month Average



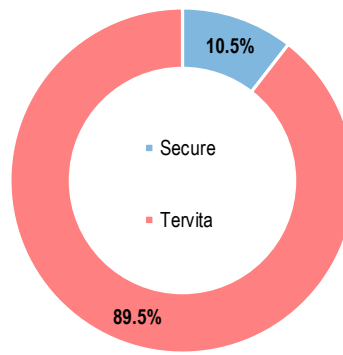
3rd Party Facility Injections over last Four Years

Monthly injections in m3/d

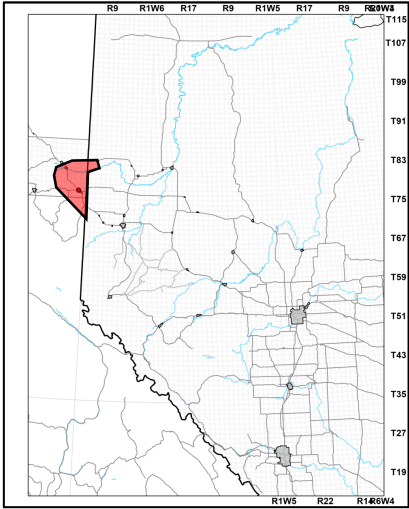


Market Share by Company

Rolling Three Month Average



DAWSON



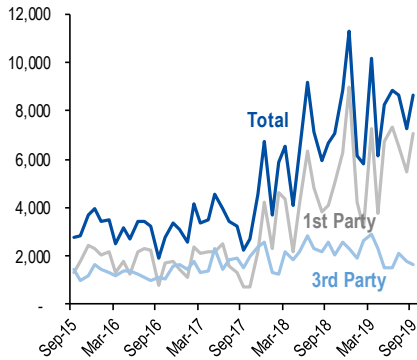
Top 5 Dawson Facilities by Monthly Volume

Name	Company	Volume (m3)
ECA Sunrise (01-27) Disp	Encana	49,952
ECA Sunrise (14-35) Disp	Encana	42,692
ECA Tower (16-06) Disp	Encana	27,419
ECA Heritage C-046-H/093-P-09 Disp	Encana	22,521
ECA Sunrise (13-33) Disp	Encana	18,510

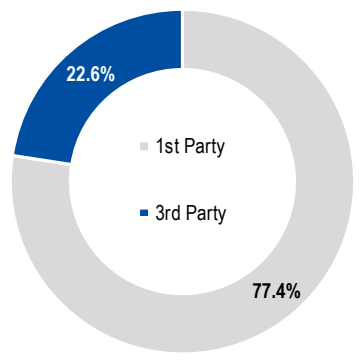
Top 5 Dawson Wells by Monthly Volume

LSD	Formation	Company	Volume (m3)
100/14-28-078-17W6/0		Encana	49,952
100/14-35-078-17W6/4		Encana	42,692
102/06-05-081-17W6		Encana	27,419
200/A-056-H/093-P-09/2		Encana	22,521
100/15-32-078-17W6		Encana	18,510

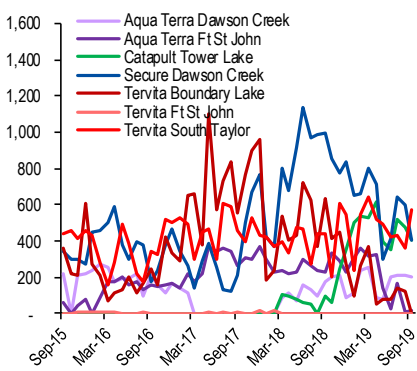
1st Party/3rd Party Injections over last Four Years Monthly Injections in m3/d



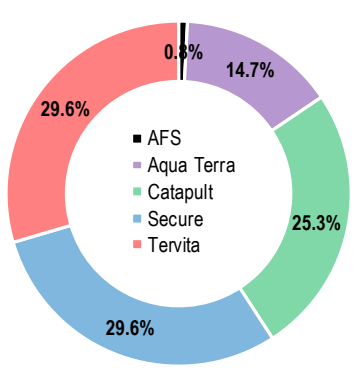
First Party vs Third Party Rolling Three Month Average



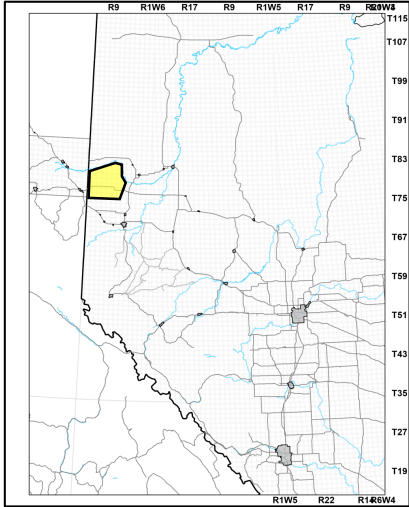
3rd Party Facility Injections over last Four Years Monthly injections in m3/d



Market Share by Company Rolling Three Month Average



GORDONDALE



Top 5 Gordondale Facilities by Monthly Volume

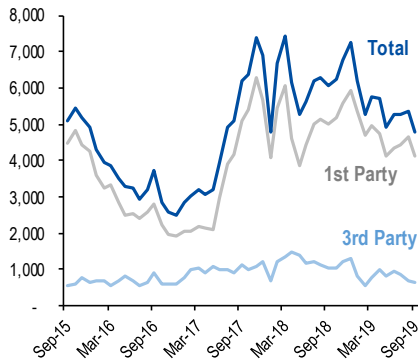
Name	Company	Volume (m3)
Tourmaline 15-13 Disp	Tourmaline	39,679
Tourmaline 12-6 Disp	Tourmaline	35,338
Birchcliff 3-22 Disp	Birchcliff	16,293
Birchcliff 5-27 Disp	Birchcliff	14,304
Kelt 6-19 Disp	Kelt	8,068

Top 5 Gordondale Wells by Monthly Volume

LSD	Formation	Company	Volume (m3)
100/13-15-081-08W6/2	Belloy	Tourmaline	27,115
102-12-13-082-09W6/0	Belloy	Tourmaline	22,173
102/07-13-082-09W6/4	Belloy	Tourmaline	17,506
103/07-06-079-11W6/0	Paddy-Cadotte	Birchcliff	14,304
100/11-22-078-12W6/3	Paddy-Cadotte	Birchcliff	8,289

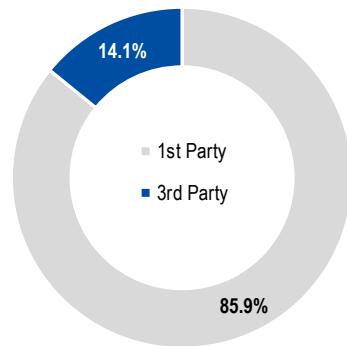
1st Party/3rd Party Injections over last Four Years

Monthly Injections in m3/d



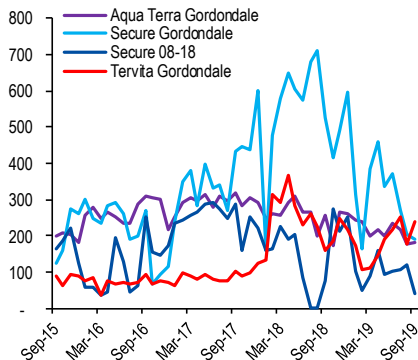
First Party vs Third Party

Rolling Three Month Average



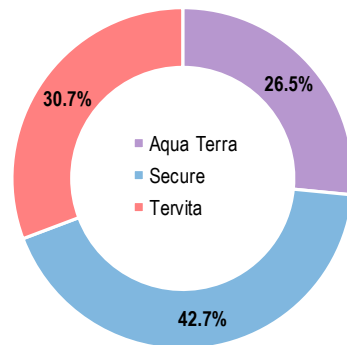
3rd Party Facility Injections over last Four Years

Monthly injections in m3/d



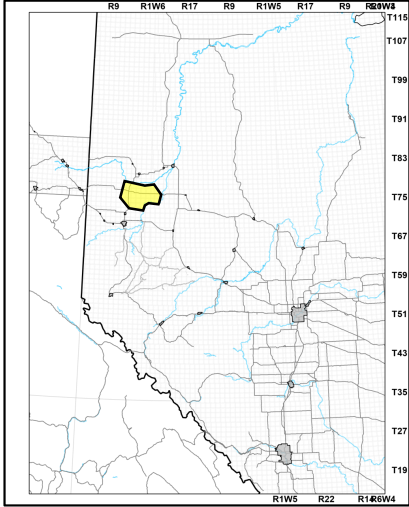
Market Share by Company

Rolling Three Month Average





RYCROFT



Top 4 Rycroft Facilities by Monthly Volume

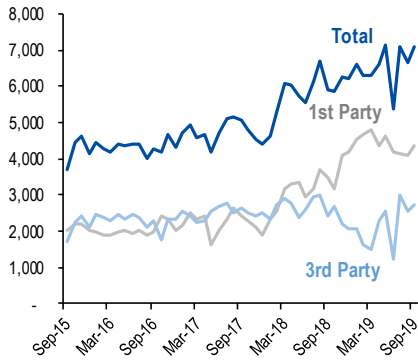
Name	Company	Volume (m3)
Tourmaline Spirit River Inj	Tourmaline	130,217
Secure Rycroft	Secure	45,502
Tervita Spirit River	Tervita	34,572
Voda Rycroft	Voda	31,840

Top 5 Rycroft Wells by Monthly Volume

LSD	Formation	Company	Volume (m3)
100/09-01-078-07W6/0	Belloy	Tourmaline	37,636
100/03-07-078-04W6/2	Gething	Secure	27,244
100/14-22-077-07W6/4	Belloy	Tourmaline	24,620
100/01-31-077-05W6/2	Cadomin	Tervita	20,961
100/15-11-078-05W6/2	Gething	Secure	18,258

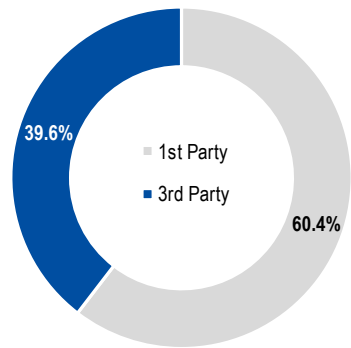
1st Party/3rd Party Injections over last Four Years

Monthly Injections in m3/d



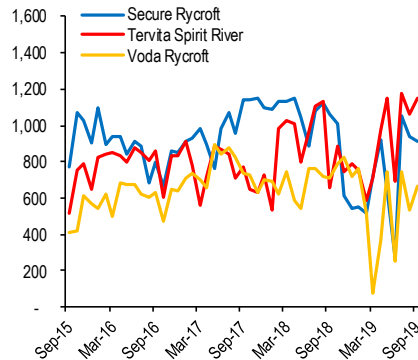
First Party vs Third Party

Rolling Three Month Average



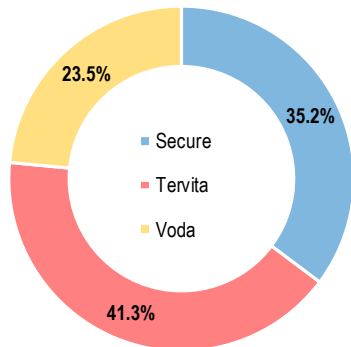
3rd Party Facility Injections over last Four Years

Monthly injections in m3/d

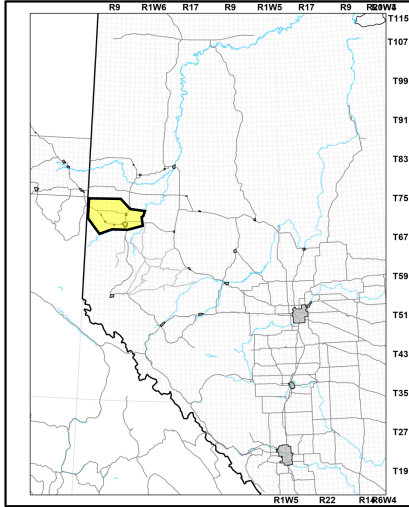


Market Share by Company

Rolling Three Month Average



LA GLACE



Top 5 La Glace Facilities by Monthly Volume

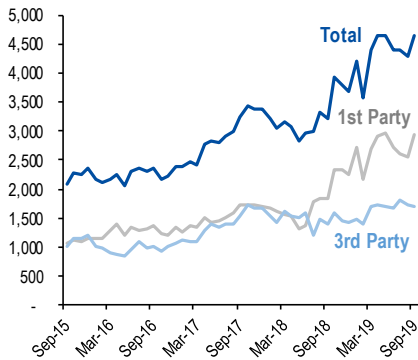
Name	Company	Volume (m3)
Encana Wembley 16-27 Disp	Encana	37,498
Tervita La Glace	Tervita	37,015
Encana Saddle Hills GP	Encana	16,979
Secure Emerson	Secure	7,944
CNRL 14-34 Disp	CNRL	7,861

Top 5 La Glace Wells by Monthly Volume

LSD	Formation	Company	Volume (m3)
100/16-27-072-09W6/0	Cadotte	Encana	37,498
100/06-17-075-07W6/2	Belloy	Encana	16,979
100/13-36-072-09W6/0	Paddy	Tervita	26,217
100/08-09-072-08W6/0	Paddy	Tervita	10,798
100/04-34-075-12W6/0	Baldonnel	Advantage	10,693

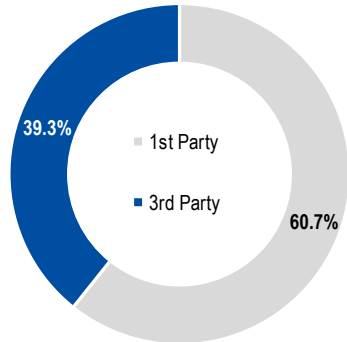
1st Party/3rd Party Injections over last Four Years

Monthly Injections in m3/d



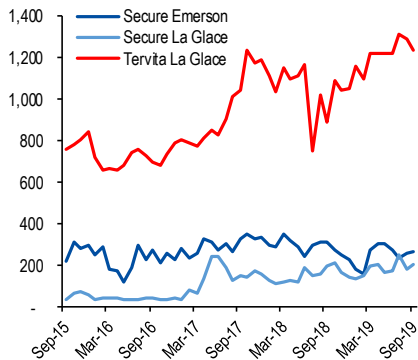
First Party vs Third Party

Rolling Three Month Average



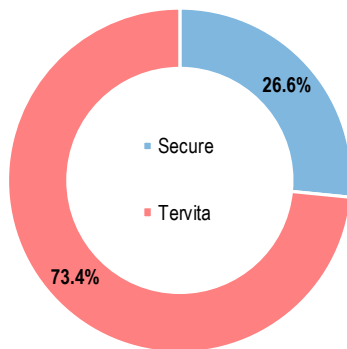
3rd Party Facility Injections over last Four Years

Monthly injections in m3/d

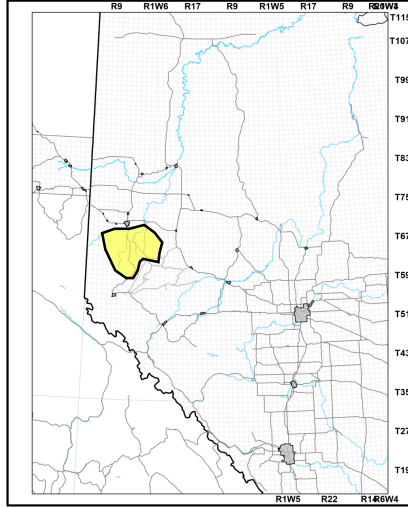


Market Share by Company

Rolling Three Month Average



GOLD CREEK



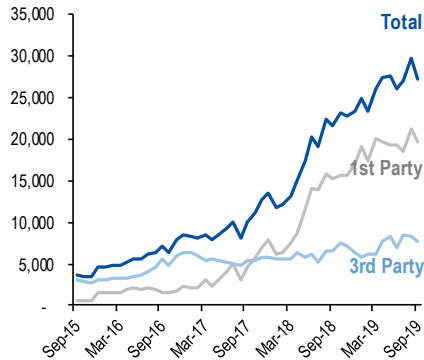
Top 5 Gold Creek Facilities by Monthly Volume

Name	Company	Volume (m3)
7Gens 16-17 Disp (Karr)	7Gens	139,694
7Gens 9-10 Disp (Karr)	7Gens	99,141
Secure Big Mountain Creek	Secure	78,487
Hammerhead GGS (9-3)	Hammerhead	65,089
Keyera Wapiti GP	Keyera	64,808

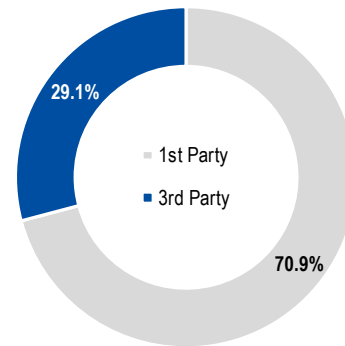
Top 5 Gold Creek Wells by Monthly Volume

LSD	Formation	Company	Volume (m3)
100/05-21-064-04W6/0	Winterburn	7Gens	105,293
100/12-11-064-04W6/0	Winterburn	7Gens	99,141
100/12-22-066-06W6/3	Leduc	NuVista	39,092
103/14-17-064-04W6/2	Winterburn	7Gens	34,401
100/03-06-066-06W6/0	Leduc	Keyera	34,214

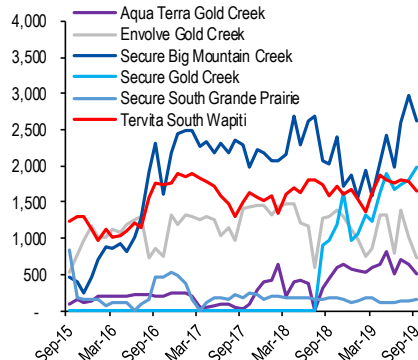
1st Party/3rd Party Injections over last Four Years Monthly Injections in m3/d



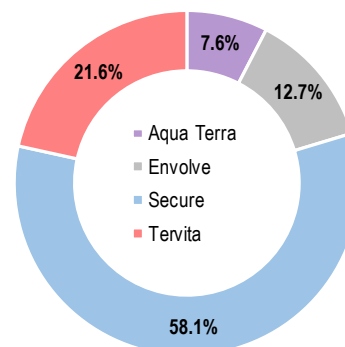
First Party vs Third Party Rolling Three Month Average



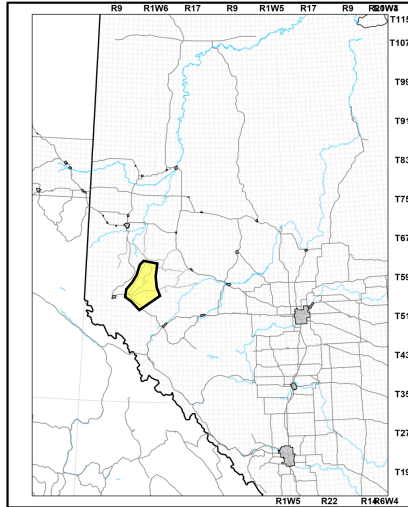
3rd Party Facility Injections over last Four Years Monthly injections in m3/d



Market Share by Company Rolling Three Month Average



RESTHAVEN



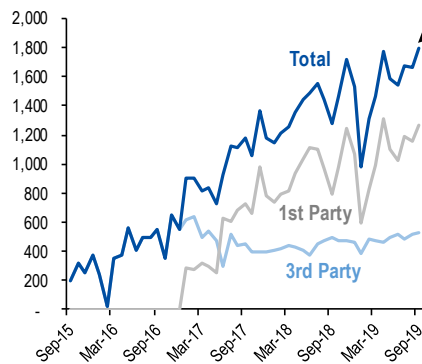
Top 5 Resthaven Facilities by Monthly Volume

Name	Company	Volume (m3)
Strath Jayar 06-08-062-03W6	Strath	27,681
Voda Grande Cache	Voda	15,679
XTO Resthaven 2-10-060-01W6	XTO	6,168
Cequence 2-21 Disp	Cequence	4,228
Cequence 4-23 Disp	Cequence	769

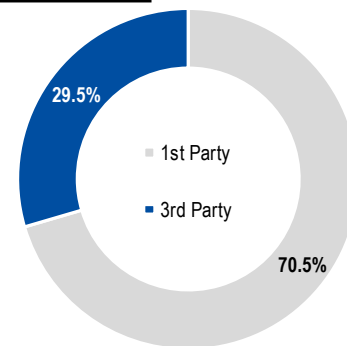
Top 5 Resthaven Wells by Monthly Volume

LSD	Formation	Company	Volume (m3)
100/10-07-062-03W6/0	Leduc	Strath	16,350
100/11-26-057-06W6/2	Doig/Montney	Voda	14,810
100/15-20-062-03W6/0	Leduc	Strath	11,331
100/11-03-060-01W6/0	Belloy	XTO	6,168
100/04-23-061-27W5/2	Paddy Cadotte	Cequence	3,459

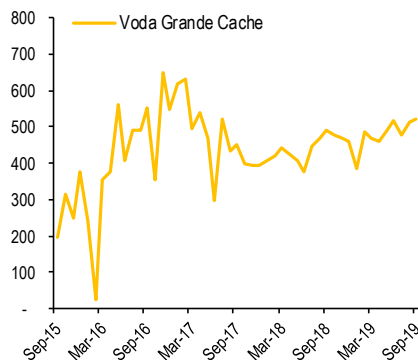
1st Party/3rd Party Injections over last Four Years Monthly Injections in m3/d



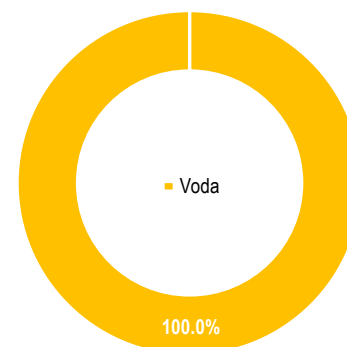
First Party vs Third Party Rolling Three Month Average



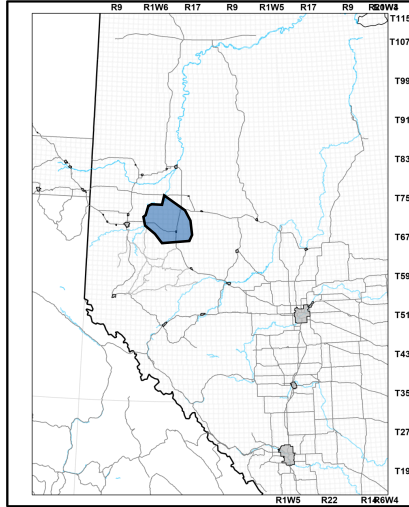
3rd Party Facility Injections over last Four Years Monthly injections in m3/d



Market Share by Company Rolling Three Month Average



VALLEYVIEW



Top 5 Valleyview Facilities by Monthly Volume

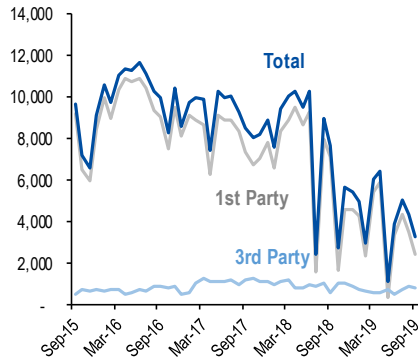
Name	Company	Volume (m3)
CNRL Sturgeon 11-2 Disp	CNRL	25,347
CNRL Sturgeon 7-31 Disp	CNRL	22,228
Tervita Valleyview	Tervita	16,255
CNRL Sturgeon 12-5 Disp	CNRL	13,470
CNRL Sturgeon 9-26 Disp	CNRL	11,327

Top 5 Valleyview Wells by Monthly Volume

LSD	Formation	Company	Volume (m3)
100/05-32-068-21W5/0	Leduc	CNRL	14,375
100/04-05-069-21W5/0	Leduc	CNRL	10,157
100/09-16-069-22W5/0	Leduc	Tervita	9,921
100/15-02-069-22W5/2	Leduc	CNRL	9,680
100/07-10-069-22W5/0	Leduc	CNRL	9,314

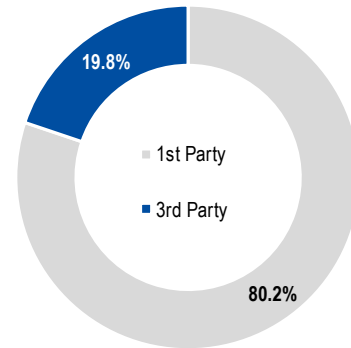
1st Party/3rd Party Injections over last Four Years

Monthly Injections in m3/d



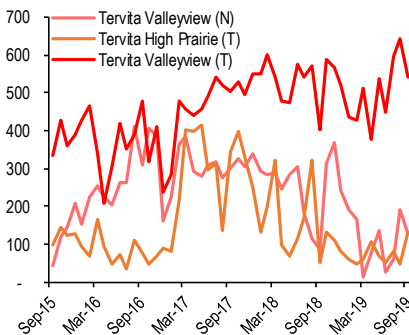
First Party vs Third Party

Rolling Three Month Average



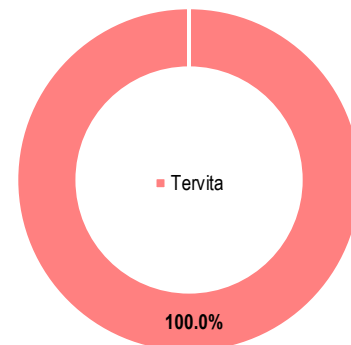
3rd Party Facility Injections over last Four Years

Monthly injections in m3/d

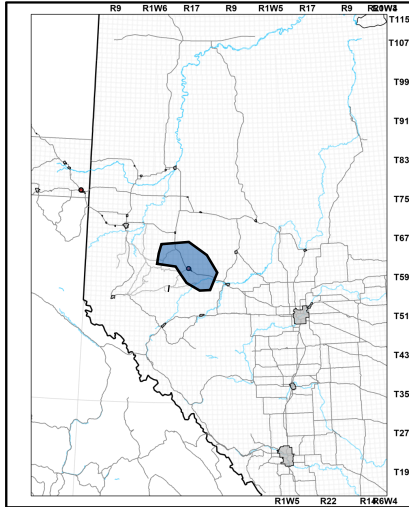


Market Share by Company

Rolling Three Month Average



FOX CREEK



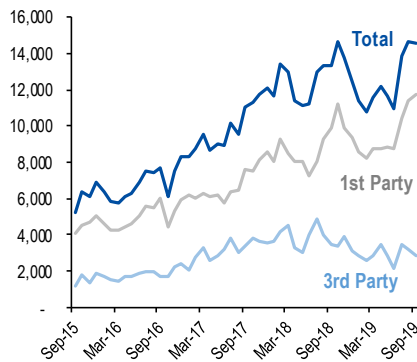
Top 5 Fox Creek Facilities by Monthly Volume

Name	Company	Volume (m3)
Encana 15-31 Gas Plant	Encana	54,758
SEMCAMS KA	Semcams	52,974
Paramount 16-7 Injection	Paramount	49,362
Paramount 8-9 Gas Plant	Paramount	38,340
XTO 14-7 Dip	XTO	28,205

Top 5 Fox Creek Wells by Monthly Volume

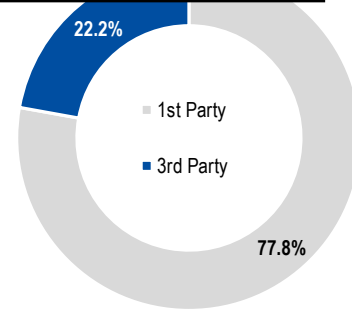
LSD	Formation	Company	Volume (m3)
100/08-05-063-21W5/0	Debolt	Encana	54,758
100/14-06-062-19W5/0	Swan Hills	Semcams	52,974
100/04-20-064-18W5/0	Debolt	Paramount	49,362
100/12-14-064-19W5/2	Swan Hills	Paramount	38,340
100/14-07-060-18W5/0	Swan Hills	XTO	28,205

1st Party/3rd Party Injections over last Four Years
Monthly Injections in m3/d

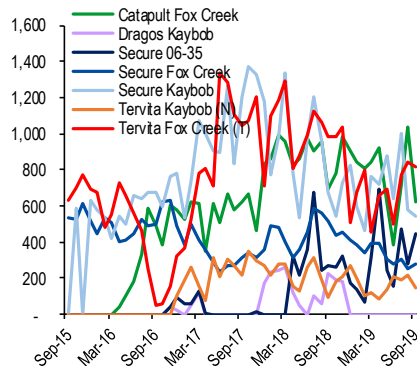


First Party vs Third Party
Rolling Three Month Average

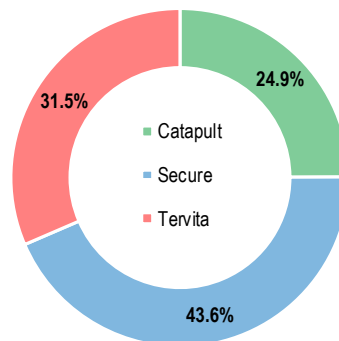
*Shell and XTO injecting ~2,000 m3/d into new disposal assets



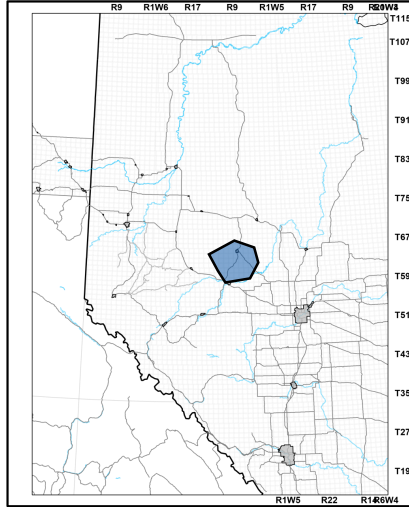
3rd Party Facility Injections over last Four Years
Monthly injections in m3/d



Market Share by Company
Rolling Three Month Average



SWAN HILLS



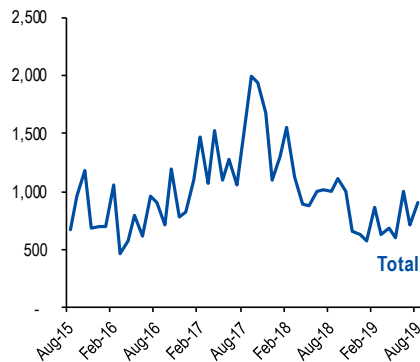
Top 5 Swan Hills Facilities by Monthly Volume

Name	Company	Volume (m3)
Tervita Greencourt (N)	Tervita	10,897
Tervita Judy Creek	Tervita	5,583
Secure Judy Creek	Secure	4,976
Voda Mayerthorpe	Voda	2,931
Tervita Swan Hills	Tervita	2,598

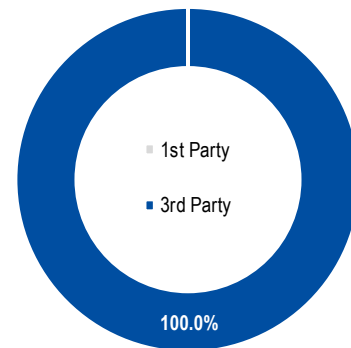
Top 5 Swan Hills Wells

LSD	Formation	Company	Volume (m3)
102/06-31-058-09W5/0	Pekisko	Tervita	10,897
100/02-06-063-11W5/2	Nisku	Tervita	3,589
100/16-31-056-08W5/0	Pekisko	Voda	2,931
100/06-29-063-09W5/2	Wabamun	Secure	2,717
102/06-30-063-10W5/0	Wabamun	Tervita	2,526

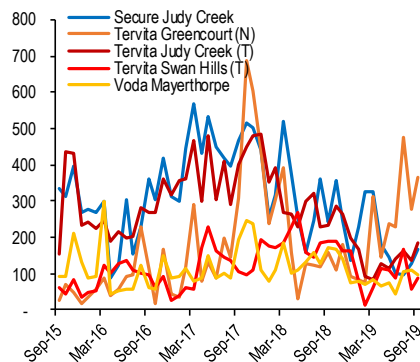
1st Party/3rd Party Injections over last Four Years
Monthly Injections in m3/d



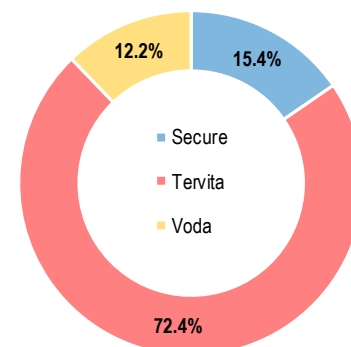
First Party vs Third Party
Rolling Three Month Average



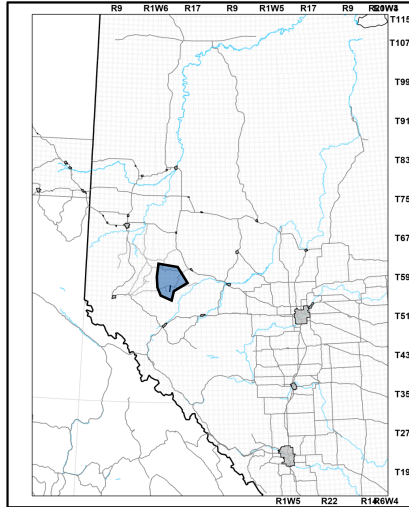
3rd Party Facility Injections over last Four Years
Monthly injections in m3/d



Market Share by Company
Rolling Three Month Average



BERLAND



Top 5 Berland Facilities by Monthly Volume

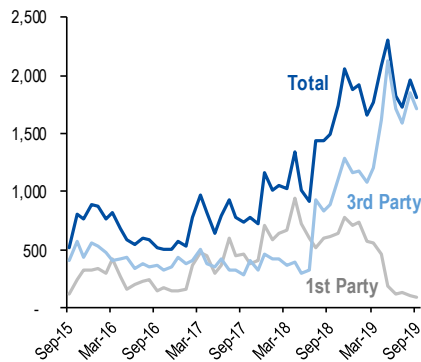
Name	Company	Volume (m3)
Secure Tony Creek	Secure	22,595
Catapult Berland	Catapult	18,929
Secure Wild River	Secure	9,956
CNRL Wild River (4-3 Plant)	CNRL	1,733
SEMCAMS 16-32 GGS	Semcams	644

Top 5 Berland Wells by Monthly Volume

LSD	Formation	Company	Volume (m3)
100/06-21-062-22W5/0	Blueridge	Secure	22,595
100/01-19-059-23W5/0	Leduc	Catapult	18,929
100/06-09-057-22W5/0	Nisku	Secure	9,956
100/12-29-056-22W5/0	Montney	CNRL	1,733
100/10-02-059-22W5/0	Pekisko	Semcams	644

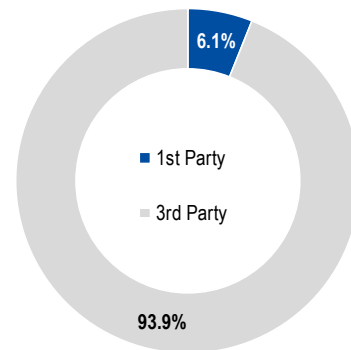
1st Party/3rd Party Injections over last Four Years

Monthly Injections in m3/d



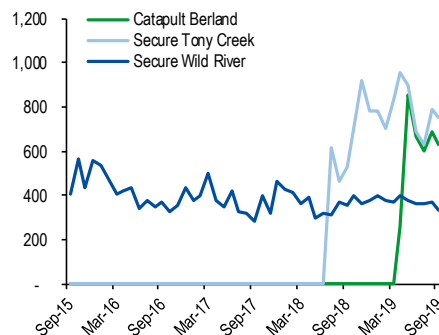
First Party vs Third Party

Rolling Three Month Average



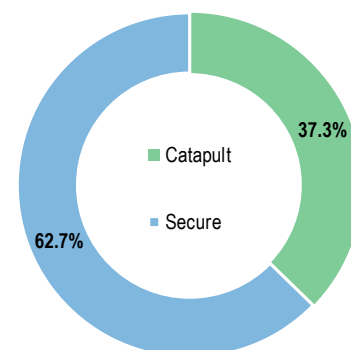
3rd Party Facility Injections over last Four Years

Monthly injections in m3/d

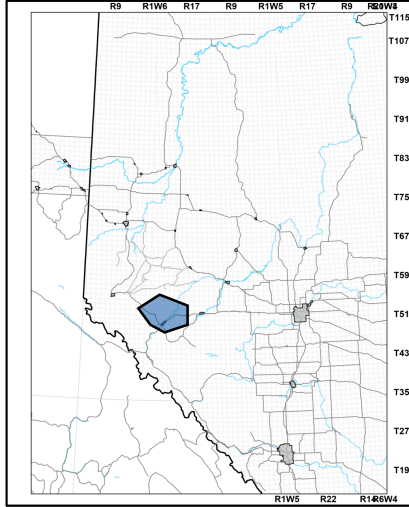


Market Share by Company

Rolling Three Month Average



OBED



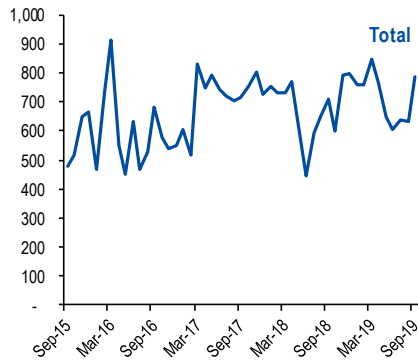
Top 3 Obed Facilities by Monthly Volume

Name	Company	Volume (m3)
Secure Obed (Lambert)	Secure	10,690
Secure Obed (Dalehurst)	Secure	9,907
Secure Eccles (Sundance)	Secure	2,996

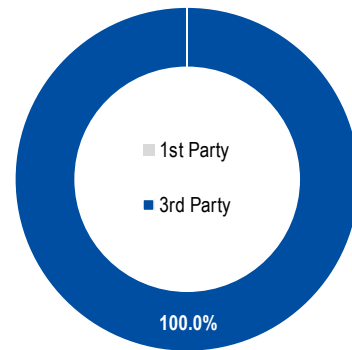
Top 5 Obed Wells by Monthly Volume

LSD	Formation	Company	Volume (m3)
100/09-30-052-22W5/2	Leduc	Secure	9,768
100/04-26-052-23W5/3	Leduc	Secure	9,056
100/06-24-054-23W5/0	Leduc	Secure	2,996
100/09-30-052-22W5/2	Leduc	Secure	922
100/04-26-052-23W5/3	Leduc	Secure	851

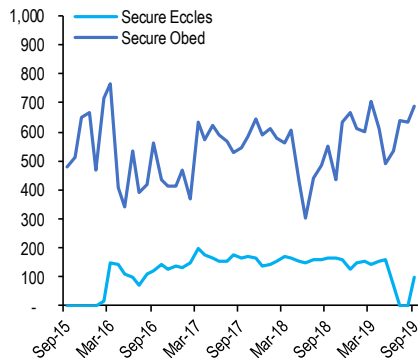
1st Party/3rd Party Injections over last Four Years
Monthly Injections in m3/d



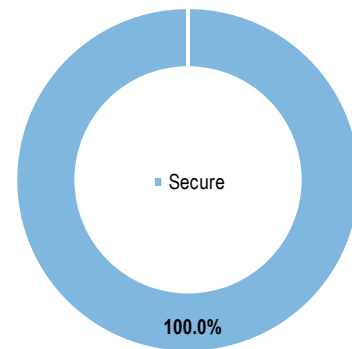
First Party vs Third Party
Rolling Three Month Average



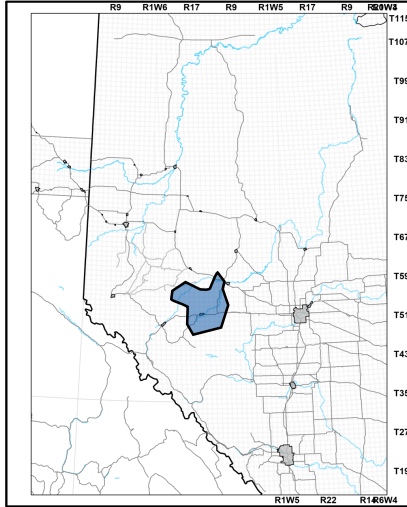
3rd Party Facility Injections over last Four Years
Monthly injections in m3/d



Market Share by Company
Rolling Three Month Average



EDSON



Top 5 Edson Facilities by Monthly Volume

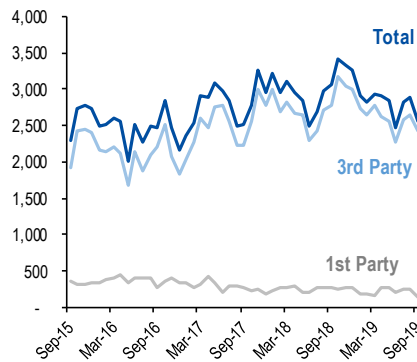
Name	Company	Volume (m3)
Secure Pine Creek	Secure	23,763
Tervita West Edson	Tervita	14,177
Secure Nosehill	Secure	12,136
Tervita Moose Creek	Tervita	11,495
Tervita Niton Junction (N)	Tervita	11,398

Top 5 Edson Wells by Monthly Volume

LSD	Formation	Company	Volume (m3)
100/08-01-055-18W5/0	Leduc	Secure	23,763
100/09-31-055-20W5/2	Leduc	Secure	12,136
100/15-16-053-19W5/0	Elkton	Tervita	11,675
100/06-13-052-16W5/2	Swan Hills	Tervita	9,826
100/12-23-054-12W5/0	Shunda/Pekisko	Tervita	6,057

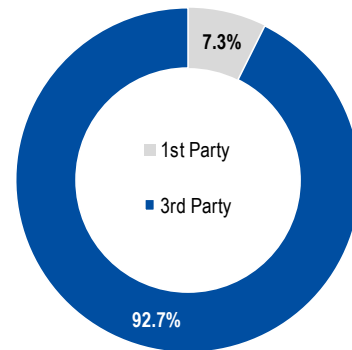
1st Party/3rd Party Injections over last Four Years

Monthly Injections in m3/d



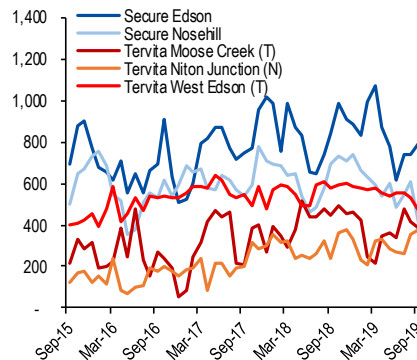
First Party vs Third Party

Rolling Three Month Average



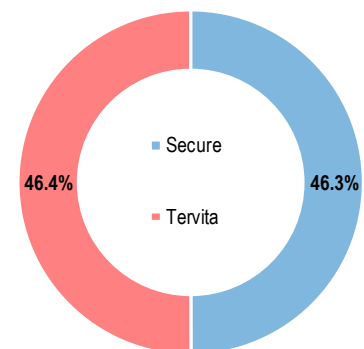
3rd Party Facility Injections over last Four Years

Monthly injections in m3/d

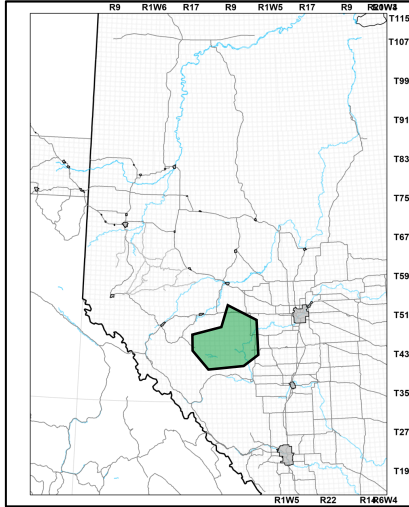


Market Share by Company

Rolling Three Month Average



DRAYTON



Top 5 Drayton Facilities by Monthly Volume

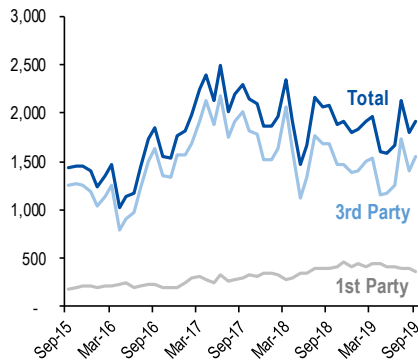
Name	Company	Volume (m3)
Secure Brazeau	Secure	20,511
Tervita Brazeau	Tervita	14,926
Secure Drayton	Secure	8,247
Voda Cynthia	Voda	6,110
Tervita Drayton (N)	Tervita	5,062

Top 5 Drayton Wells by Monthly Volume

LSD	Formation	Company	Volume (m3)
100/09-26-047-11W5/2	Nisku	Secure	15,211
100/10-13-047-11W5/2	Nisku	Tervita	12,379
104/12-32-048-06W5/0	Nordegg	Secure	7,425
104/06-02-049-10W5/0	Nisku	Voda	6,110
1W0/13-08-047-10W5/4	Nisku	Secure	5,148

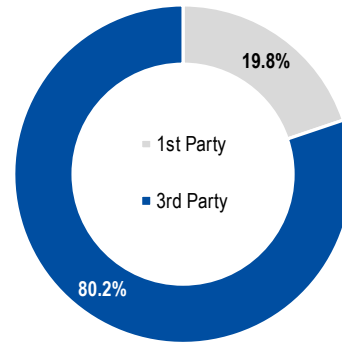
1st Party/3rd Party Injections over last Four Years

Monthly Injections in m3/d



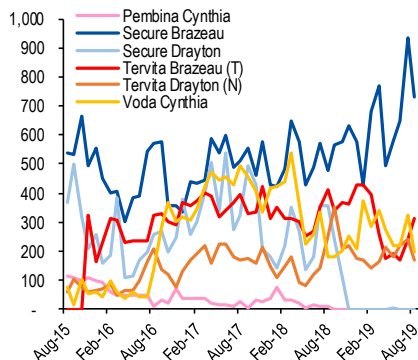
First Party vs Third Party

Rolling Three Month Average



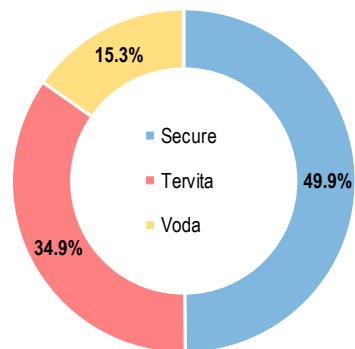
3rd Party Facility Injections over last Four Years

Monthly injections in m3/d

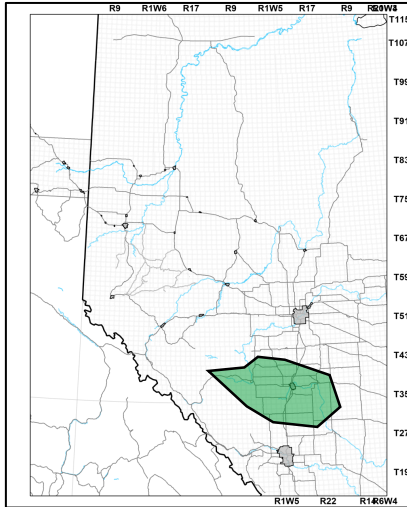


Market Share by Company

Rolling Three Month Average



RED DEER



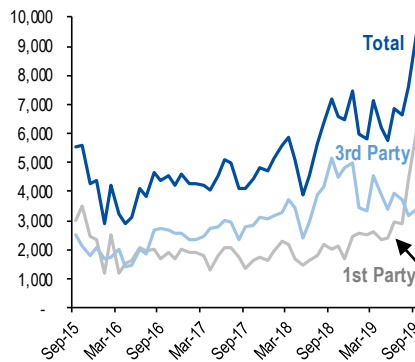
Top 5 Red Deer Facilities by Monthly Volume

Name	Company	Volume (m3)
Shell Caroline GP (3-30)	Shell	123,161
MROR Eckville	MROR	37,925
Secure Rocky Mountain House	Secure	32,965
Alphabow Joffre (5-30) Disp	Alphabow	30,390
Tervita Eckville (N)	Tervita	12,838

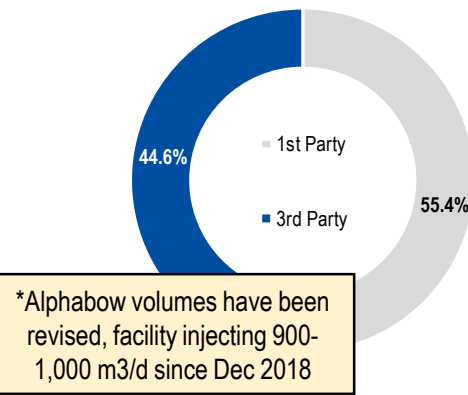
Top 5 Red Deer Wells by Monthly Volume

LSD	Formation	Company	Volume (m3)
102/06-29-034-05W5/2	Leduc	Shell	122,524
100/16-24-039-26W4/2	Leduc	Alphabow	30,390
102/10-07-040-08W5/2	Nisku	Secure	17,714
100/08-34-039-03W5/2	Leduc	MROR	17,017
103/04-04-040-08W5/0	Nisku	Secure	15,169

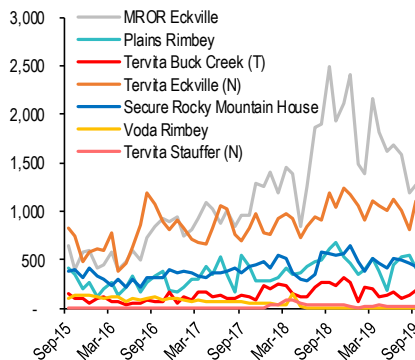
1st Party/3rd Party Injections over last Four Years Monthly Injections in m3/d



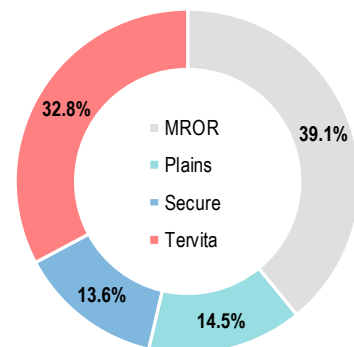
First Party vs Third Party Rolling Three Month Average



3rd Party Facility Injections over last Four Years Monthly injections in m3/d



Market Share by Company Rolling Three Month Average



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