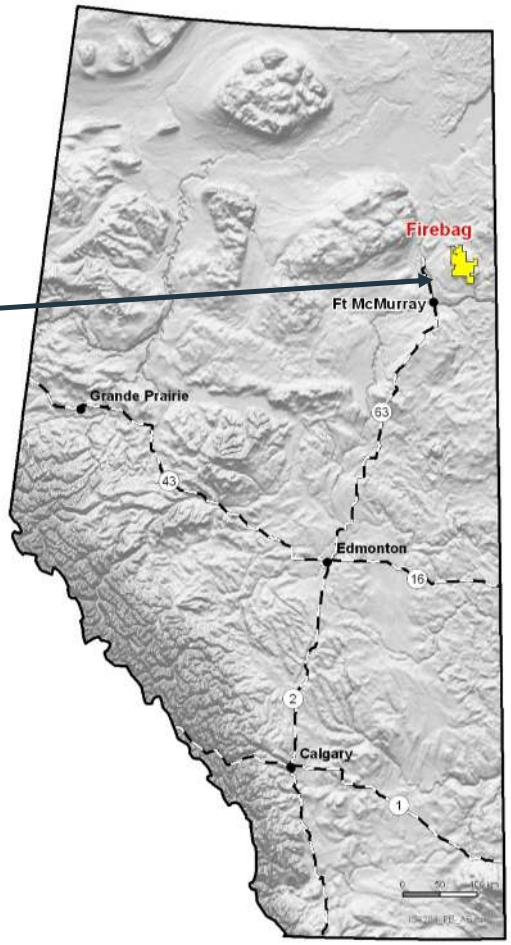
Suncor Firebag
2021 AER Scheme Performance Report
Commercial Scheme Approval No. 8870

Reporting Period:

January 1, 2021 to December 31, 2021

Introduction
4.1

Firebag Project Overview



- The Firebag Project is a commercial Steam Assisted Gravity Drainage (SAGD) scheme.
- Supplies bitumen to the Oil Sands Upgrader and sales to market.
- Average bitumen production for the reporting period has been 32,732 m^3/day (206,678 bbl/d) with a steam to oil ratio (iSOR) of 2.6

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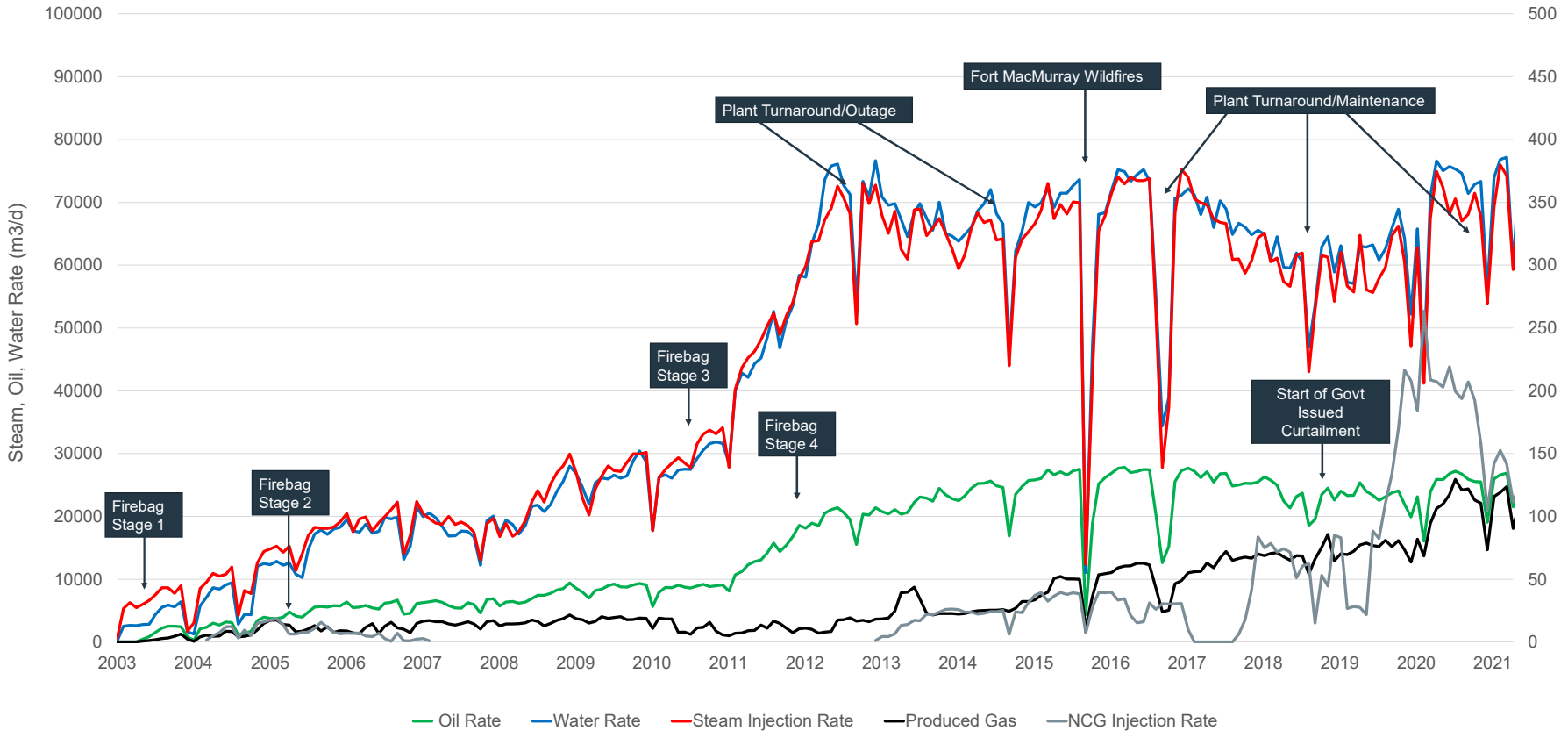
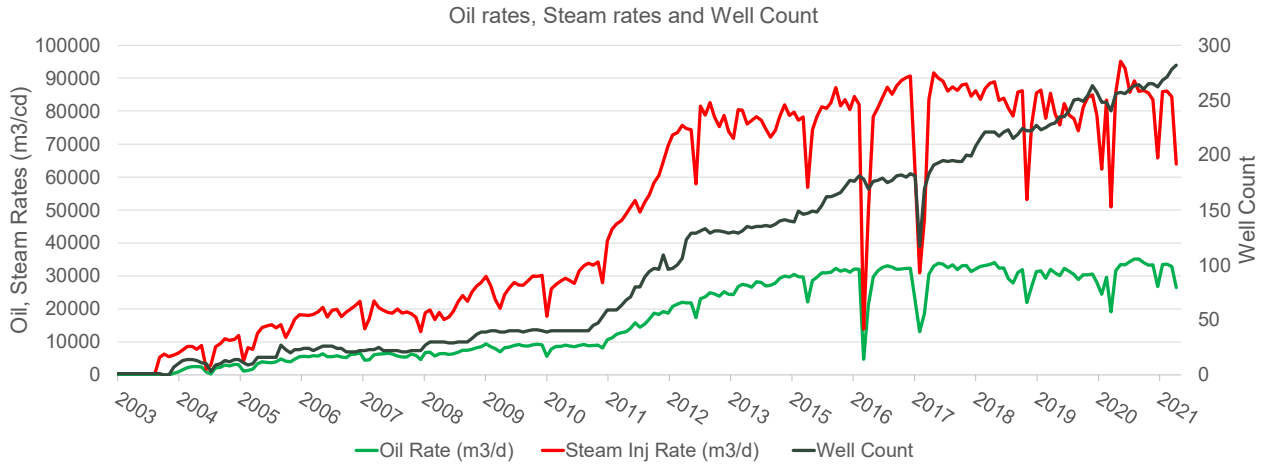
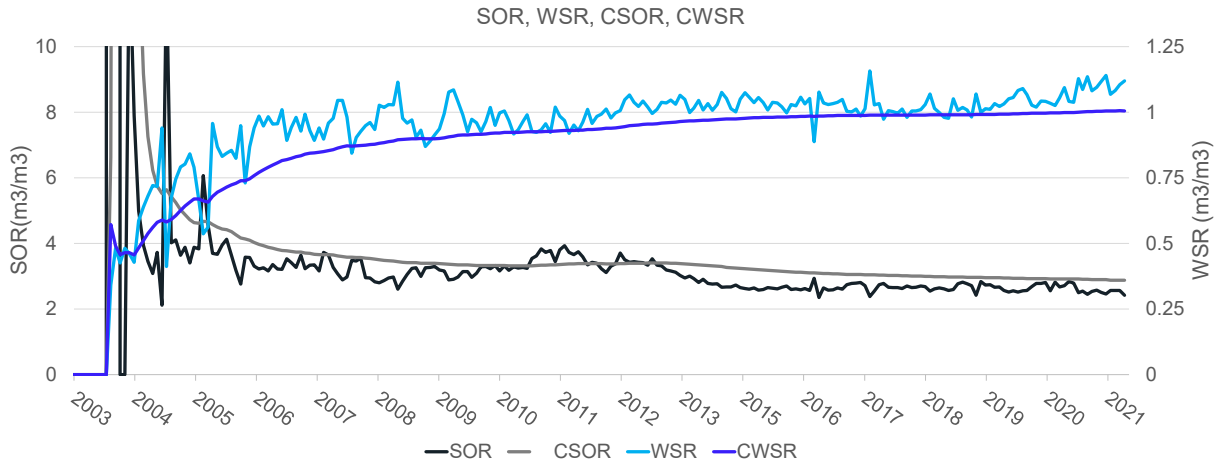
Subsurface
4.2

Scheme Performance – Well Production History

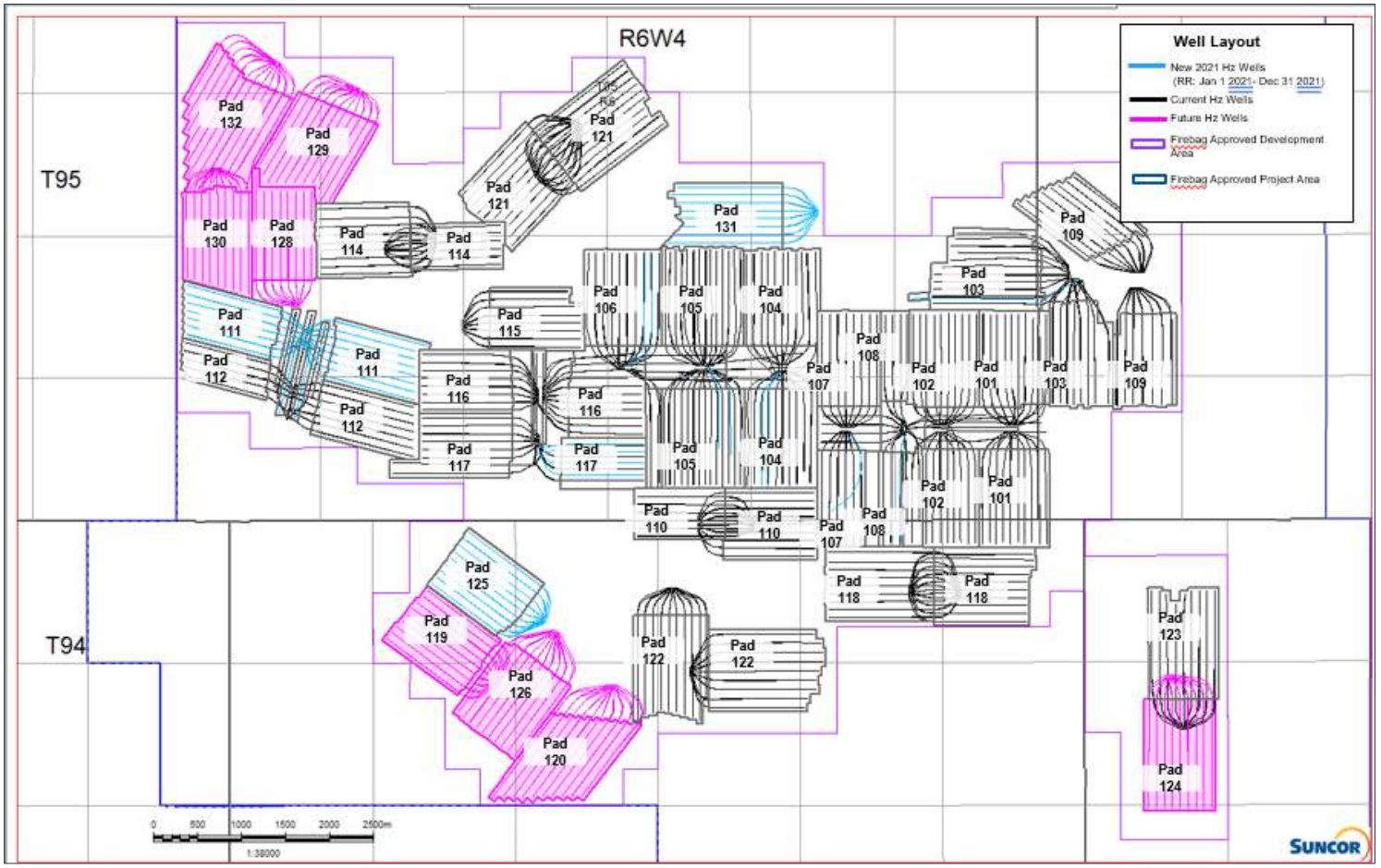


Scheme Performance – Well Production History



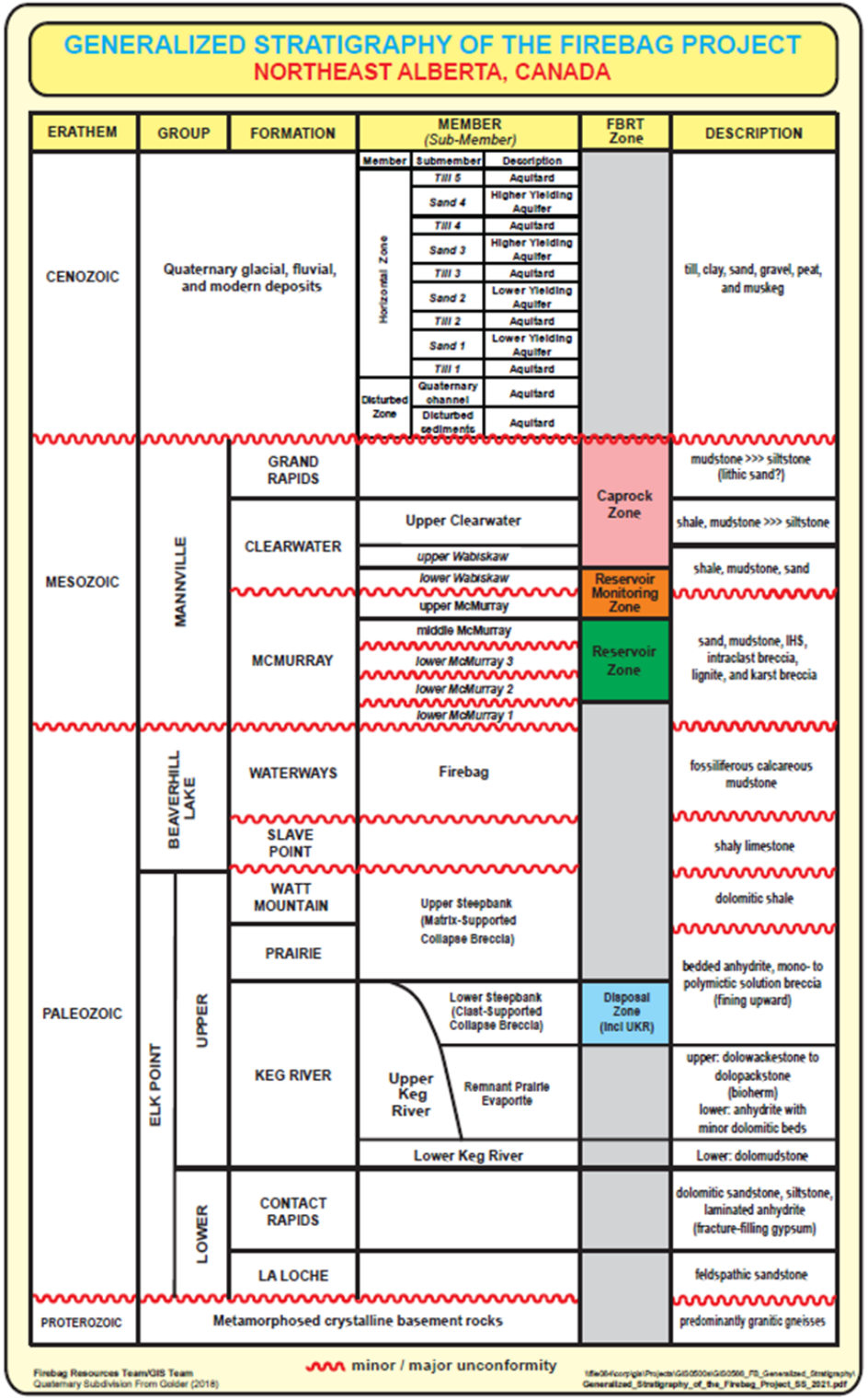


AER Project & Approved Development Areas

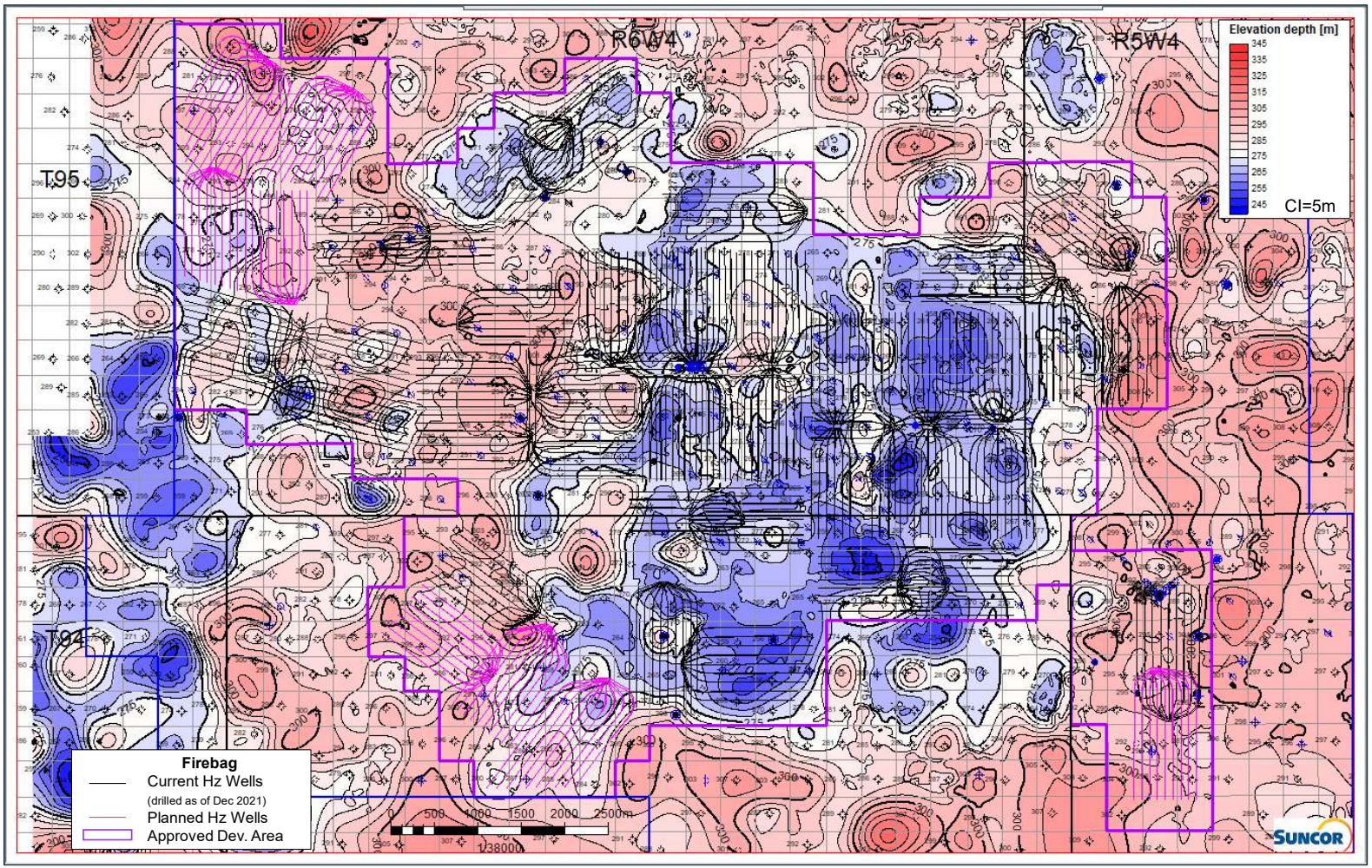


[7] Firebag Approval 8870 as of December 2021

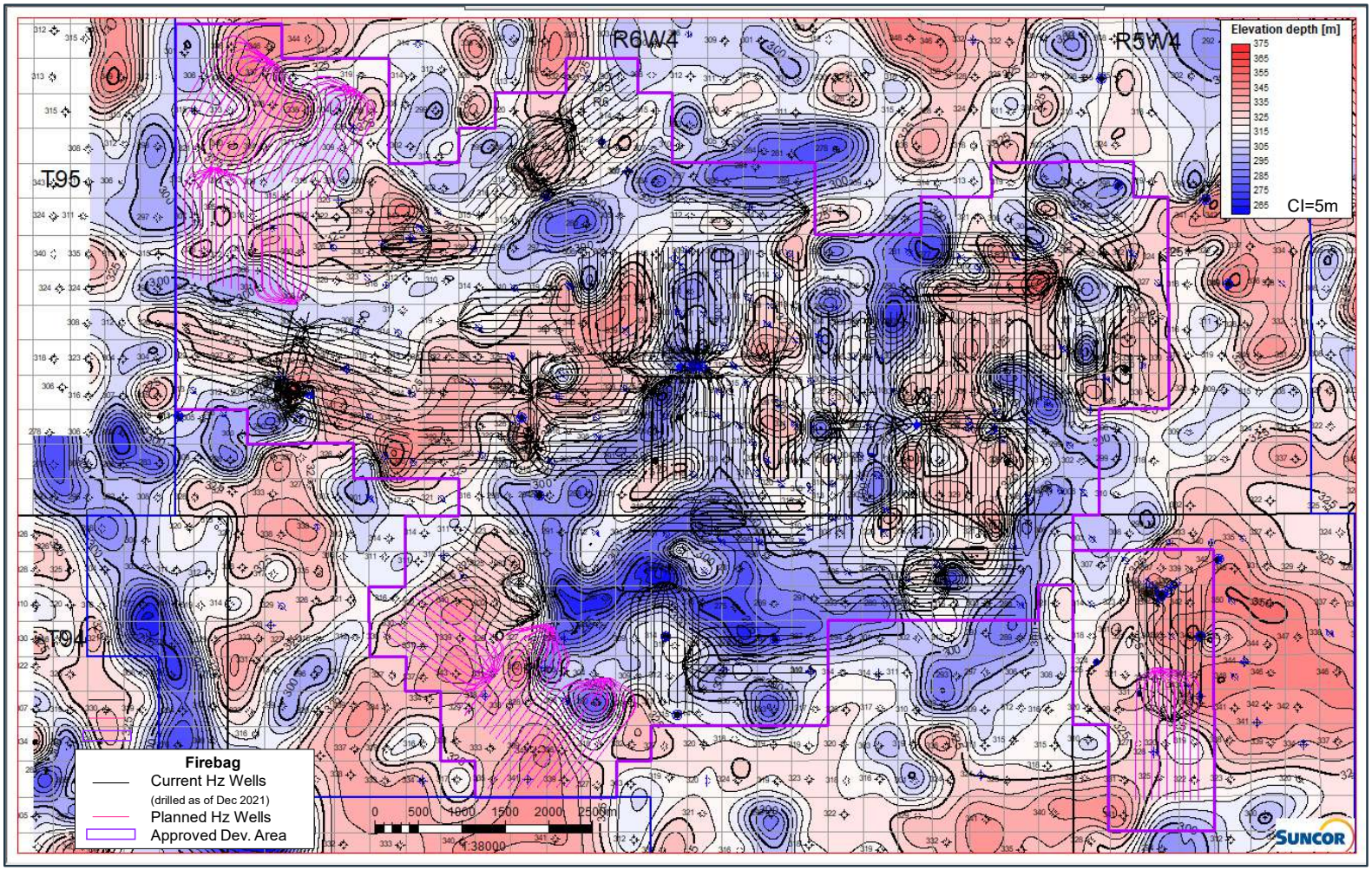
Firebag Stratigraphic Chart



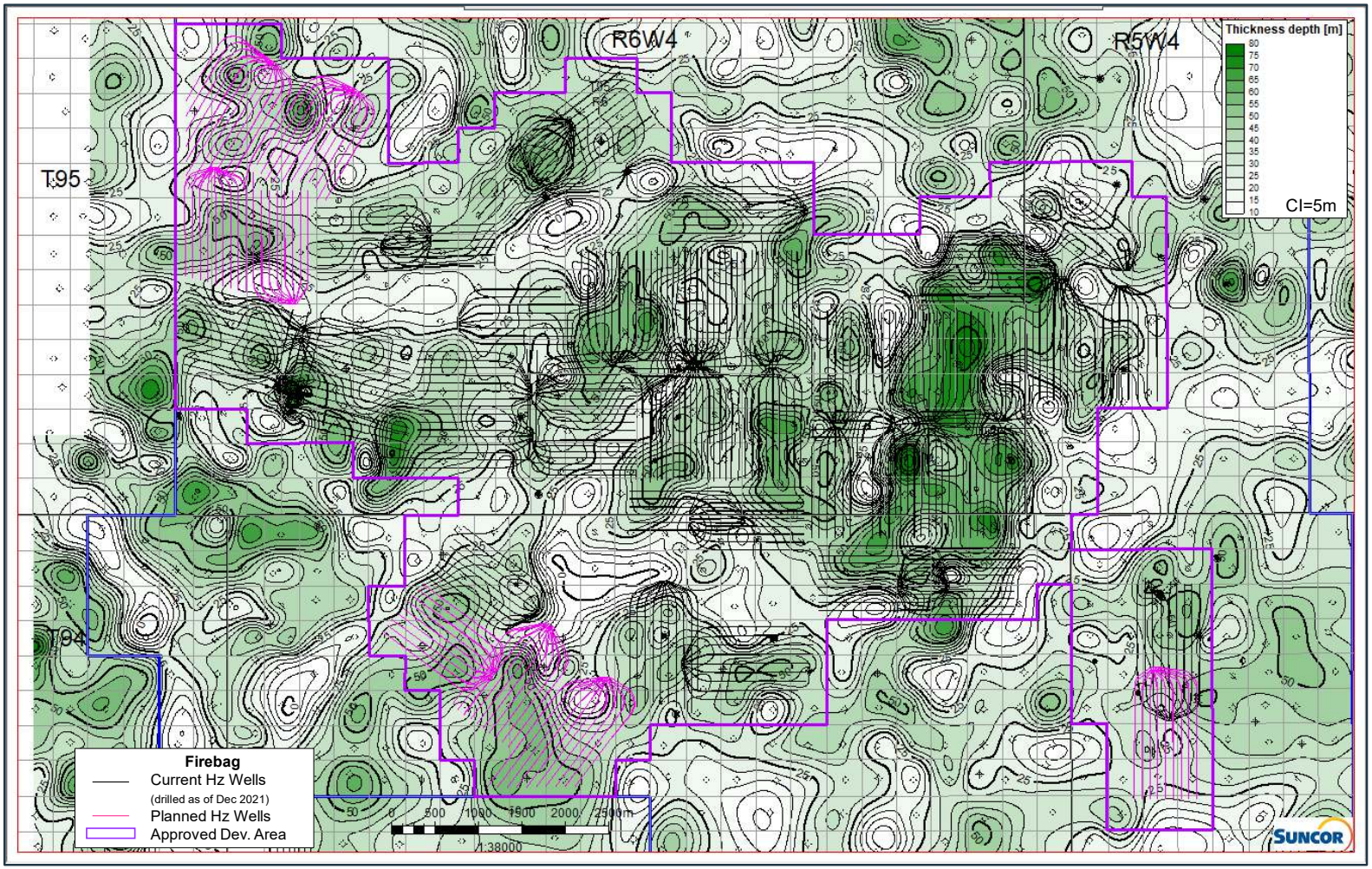
Structure Map of Base Continuous Reservoir



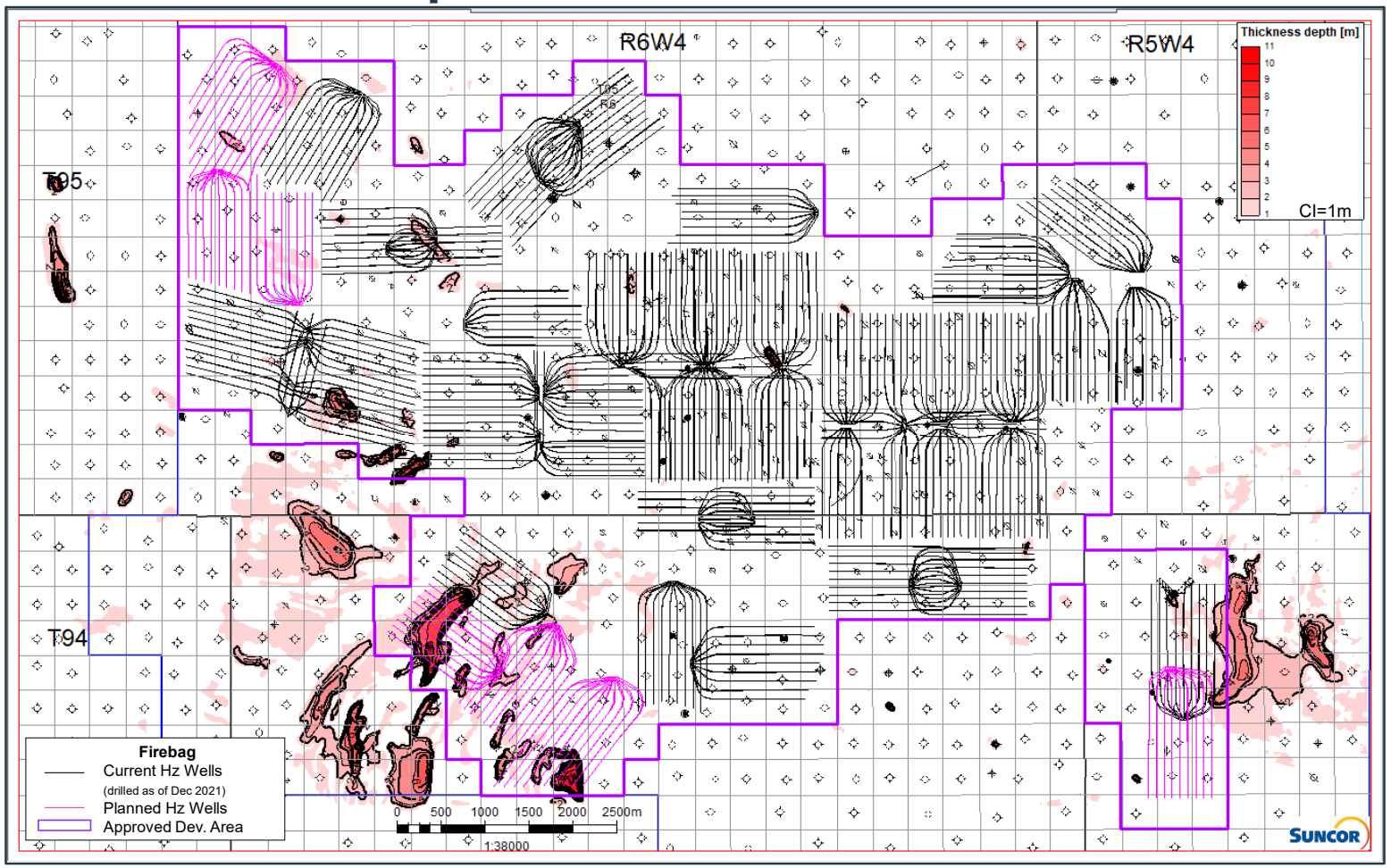
Structure Map of Top Continuous Reservoir



Isopach Map of Continuous Reservoir



Reservoir Zone Gas Isopach



Gas zones shown are inconsequential to SAGD operations at Firebag but are included for reference.

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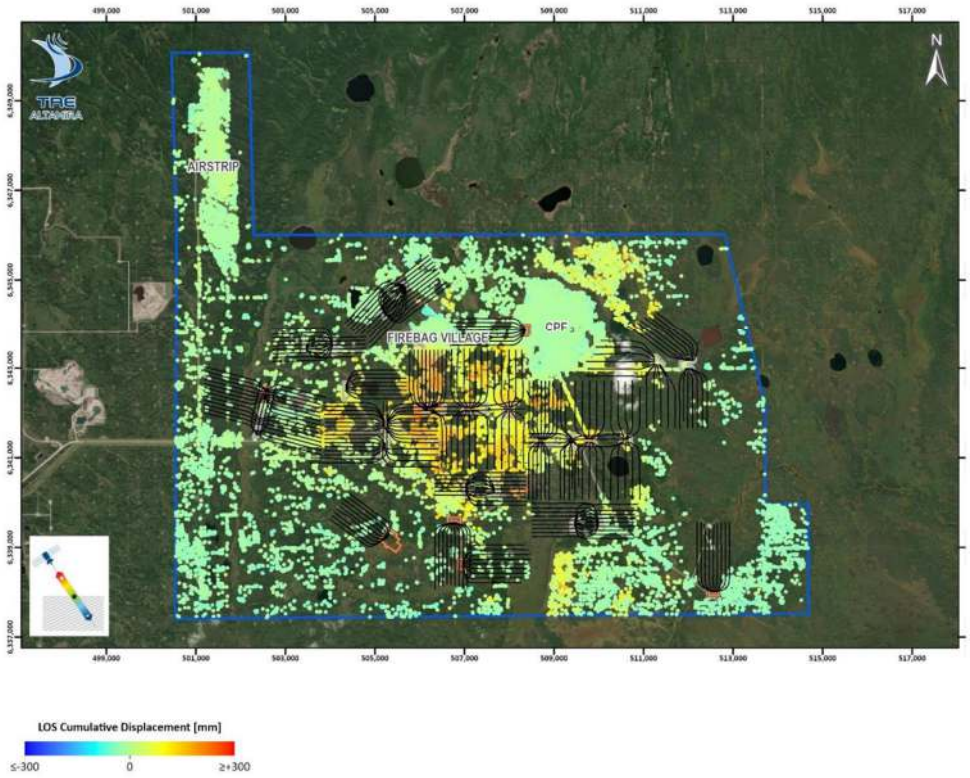
Water and Lean Zones

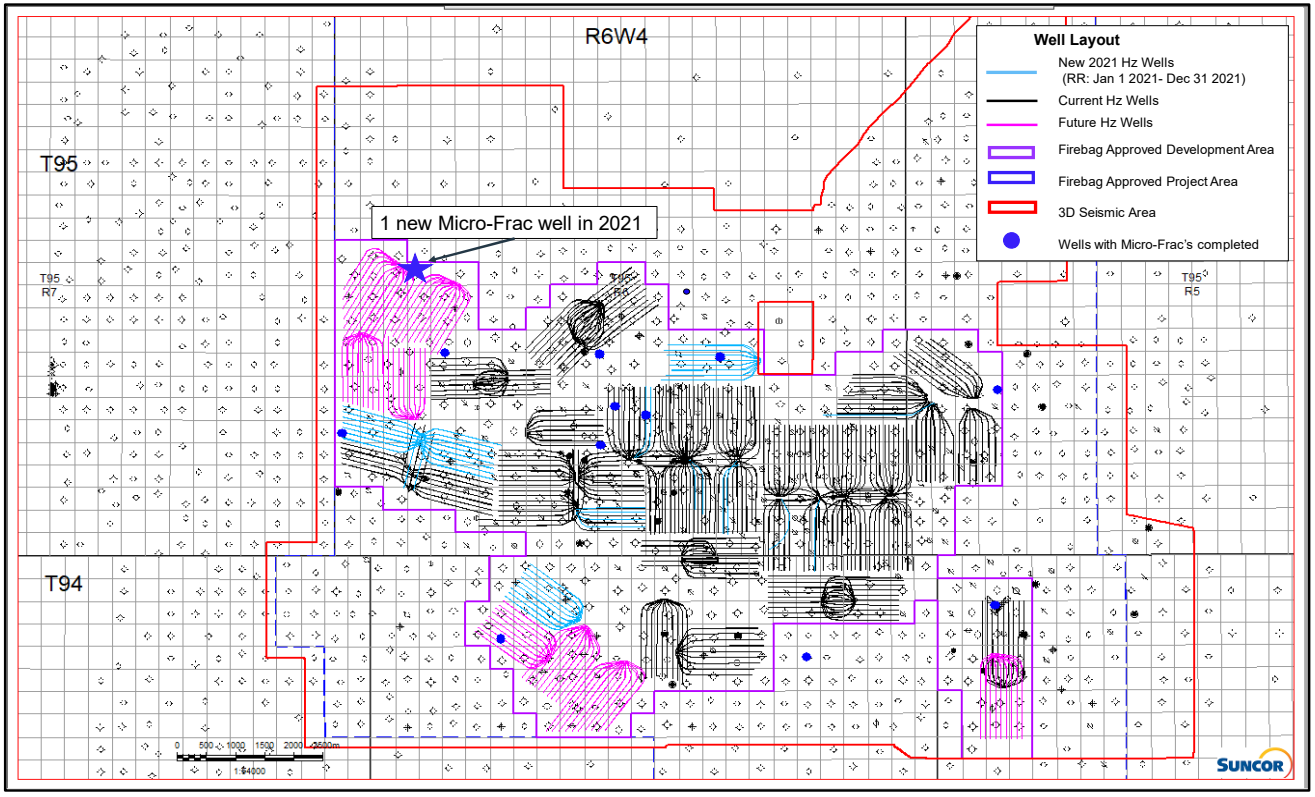
- No top or bottom water zones have been identified within the Firebag development area.
- Upper lean and middle lean are present in some parts of the Firebag development area. Thief zone potential is unknown at this time but is actively being investigated.
- For more information on lean zones, refer to applications 1875472 (Approval # 8870MMM) and 1925410 (Approval # 8870HHHH).

Firebag InSAR Cumulative Heave May 2013 - Nov 2021



- There are no geomechanical anomalies in the Firebag development area.
- Maximum heave of 336 mm observed at Pad 116
- Heave data is used to:
  - Calibrate geomechanical models
  - Monitor subsurface safety and flag areas that appear anomalous

Caprock Integrity Assurance



- **One new Micro-Frac well:**
  - SUNCOR FIREBAG 1-19-95-6 to assess the Clearwater
- **No new caprock core collected during the reporting period.**

- Geomechanical simulations are developed to assess all new pad startups.
- These activities confirm that operating at the approved maximum operating pressure (MOP) does not impact Firebag caprock integrity.

Reservoir Fracture Closure Gradients

Date	Well	Well Alias	TVD Perforated Interval (mKB)	Target	Minimum Stress (kPaa)	Fracture Closure Gradient (kPag/mGL)
15-Mar-12	01-16-095-06W4	OB134	297-298	lower McMurray 3 sand	5238.9	17.6
17-Mar-12	09-09-095-06W4	OB135	263-264	middle McMurray sand	5106.1	19.3
13-Mar-12	11-10-095-06W4	OB136	268-269	middle McMurray sand	4835.6	18.0
23-Feb-14	16-07-095-05W4	OB205	273-274	lower McMurray 3 sand	4319.7	15.7
11-Feb-15	05-07-095-06W4	OB147	255-258	middle McMurray sand	3868.3	15.1
10-Feb-16	15-26-094-06W4	OB140	296-299	middle McMurray sand	6171.9	20.6
08-Jan-19	03-32-094-06W4	OB145	272-275	middle McMurray sand	5330.4	19.5
16-Mar-12	01-16-095-06W4	OB134	277-278	middle McMurray mudstone	5398.7	19.4
18-Mar-12	09-09-095-06W4	OB135	247.5-248.5	middle McMurray mudstone	4020.2	16.1
13-Mar-12	11-10-095-06W4	OB136	257-258	middle McMurray mudstone	4910.0	19.0
24-Feb-14	16-07-095-05W4	OB205	247-248	middle McMurray IHS	4407.6	17.7
12-Feb-15	05-07-095-06W4	OB147	227-228	middle McMurray mudstone	4111.5	18.0
10-Feb-16	15-26-094-06W4	OB140	276-277	middle McMurray mudstone	4731.0	16.9
16-Mar-12	01-16-095-06W4	OB134	253.5-254.5	Wabiskaw/lower Clearwater	5482.5	21.6
18-Mar-12	09-09-095-06W4	OB135	231-232	Wabiskaw/lower Clearwater	5060.2	21.9
14-Mar-12	11-10-095-06W4	OB136	238-239	Wabiskaw/lower Clearwater	4532.7	19.0
05-Mar-13	01-09-095-06W4	OB182	232.5-233.5	Wabiskaw/lower Clearwater	5237.2	22.5
25-Feb-14	16-07-095-05W4	OB205	225.5-226.5	Wabiskaw/lower Clearwater	4952.2	22.0
12-Feb-15	05-07-095-06W4	OB147	209.5-210.5	Wabiskaw/lower Clearwater	4679.0	22.3
11-Feb-16	15-26-094-06W4	OB140	250.5-251.5	Wabiskaw/lower Clearwater	5434.6	22.3
16-Feb-17	07-31-094-05W4	OB184	225.5-226.5	Wabiskaw/lower Clearwater	4915.9	22.2
10-Jan-19	03-32-094-06W4	OB145	229.0-230.0	Wabiskaw/lower Clearwater	5464.9	23.8
03-Feb-19	04-17-095-06W4	OB148	219.5-220.5	Wabiskaw/lower Clearwater	4993.3	22.7
06-Feb-20	04-14-095-06W4	N/A	256.0-257.0	Wabiskaw/lower Clearwater	5335.2	20.8
15-Feb-21	01-19-095-06W4	N/A	214.4-215.4	Wabiskaw/lower Clearwater	4792.3	22.3

Note - Suncor limits Fracture Closure Gradient to Overburden Gradient (~21.5 kPag/mGL)

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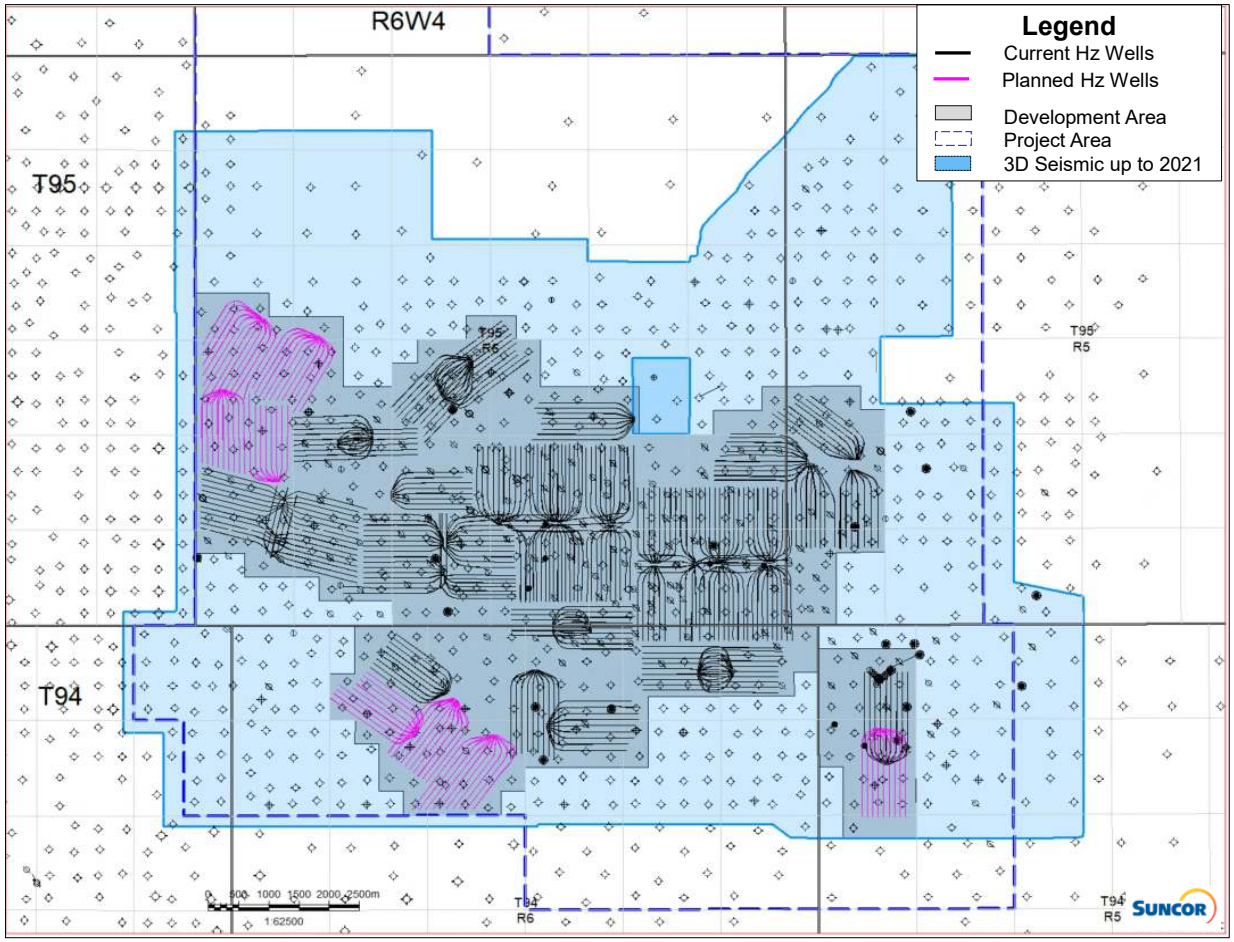
3D Seismic Survey Outlines

- No new 3D seismic acquired in 2021



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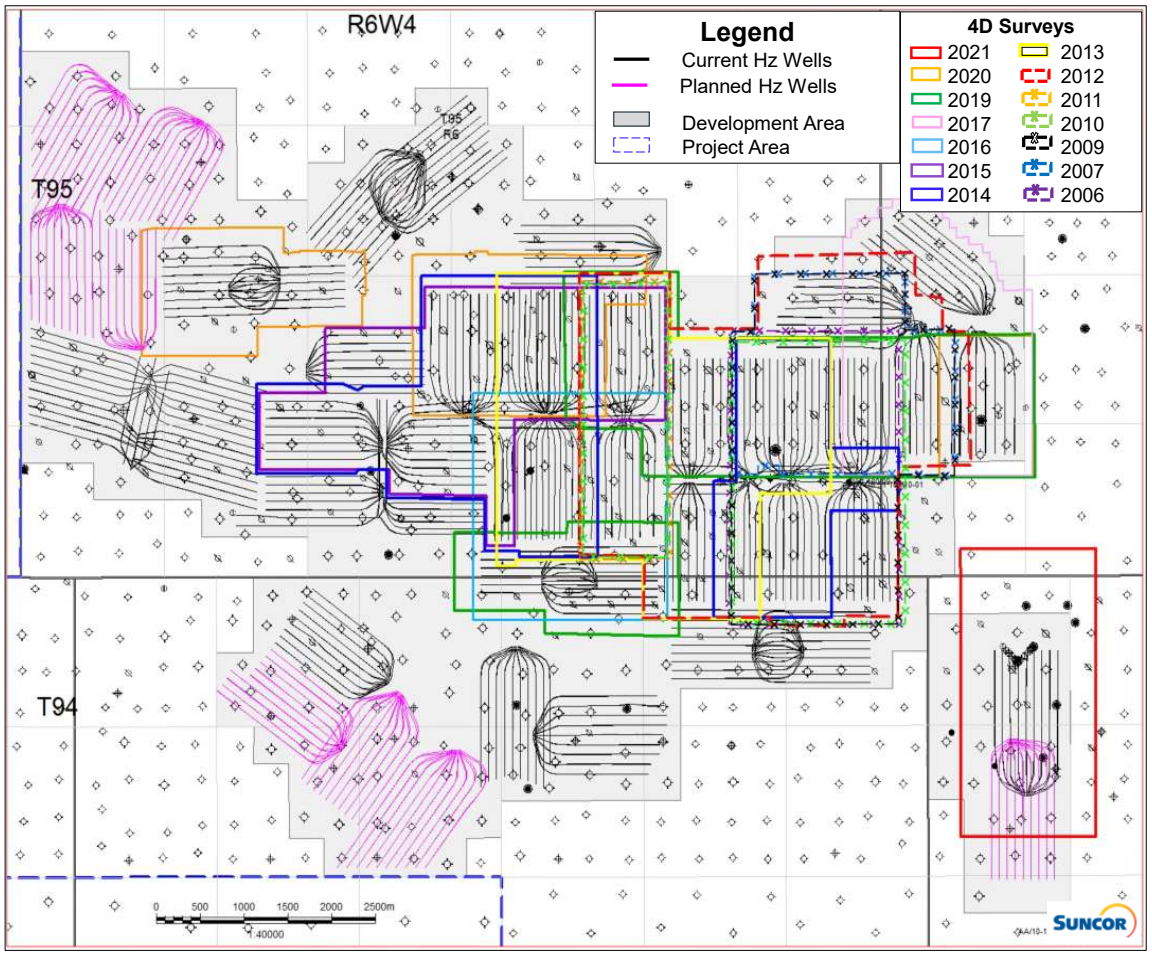
4D Seismic Survey Outlines



- 2021 4D seismic was collected to assess Pad 123 gas injection demonstration

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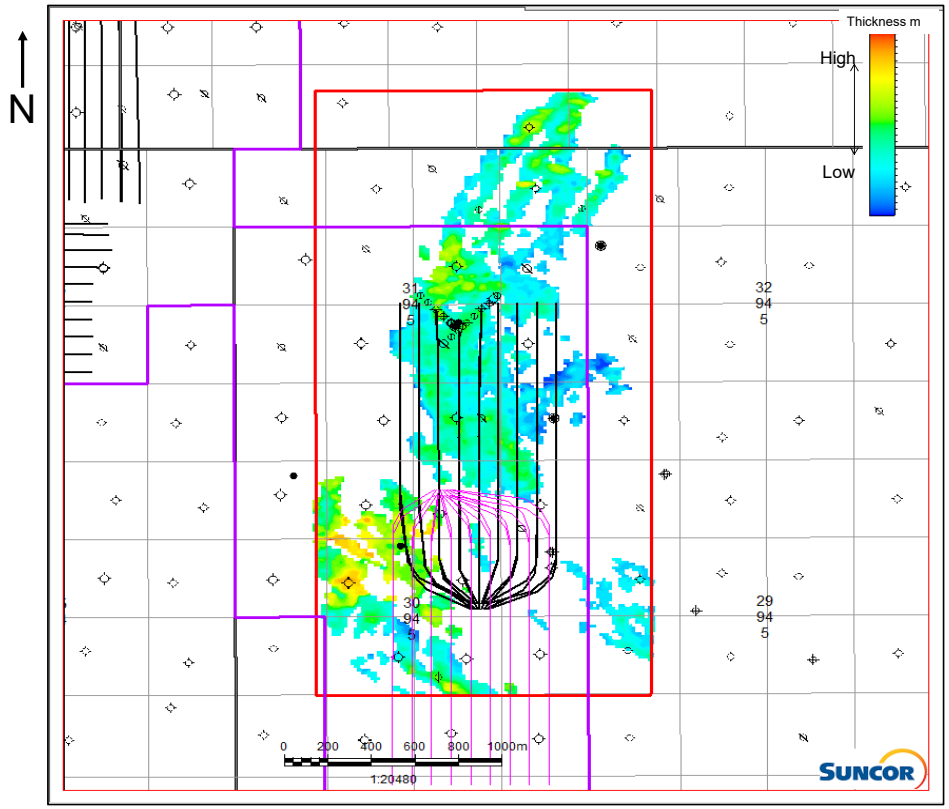
2021 4D Seismic – Injected Gas Thickness Map

- 2021 4D seismic was collected to assess Pad 123 gas injection demonstration



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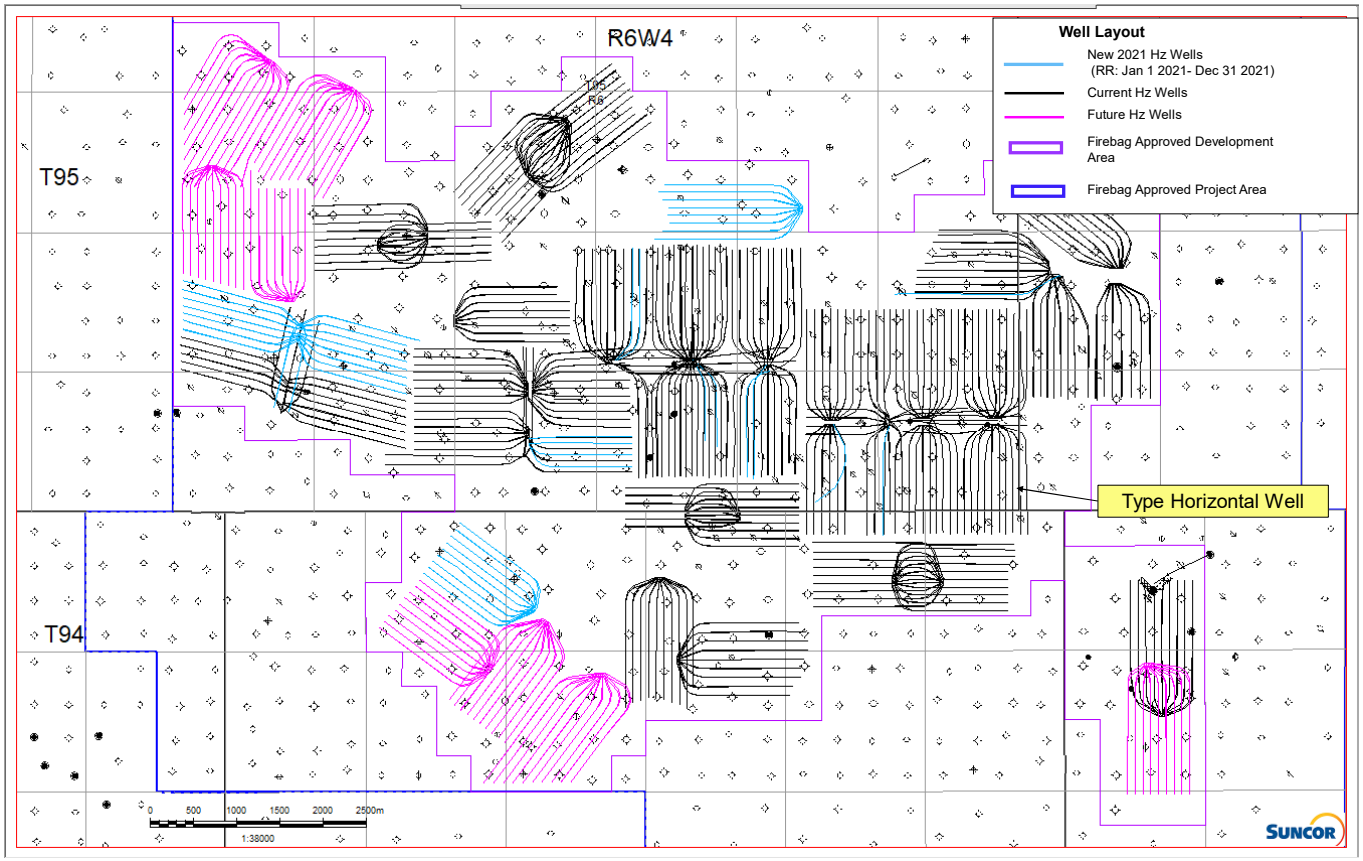
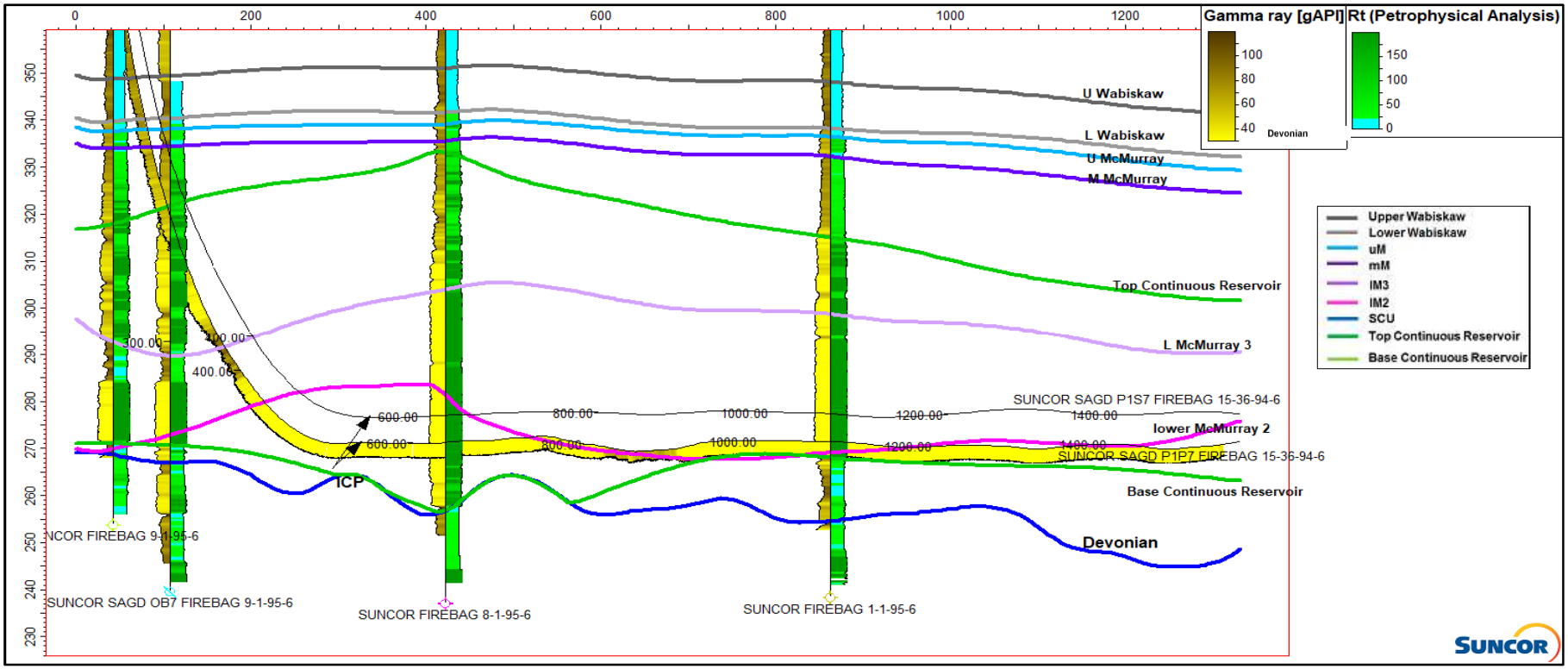
Type Well Location Map

Type Horizontal Well – Pad 101 Pair 7



Structural Cross Section Example

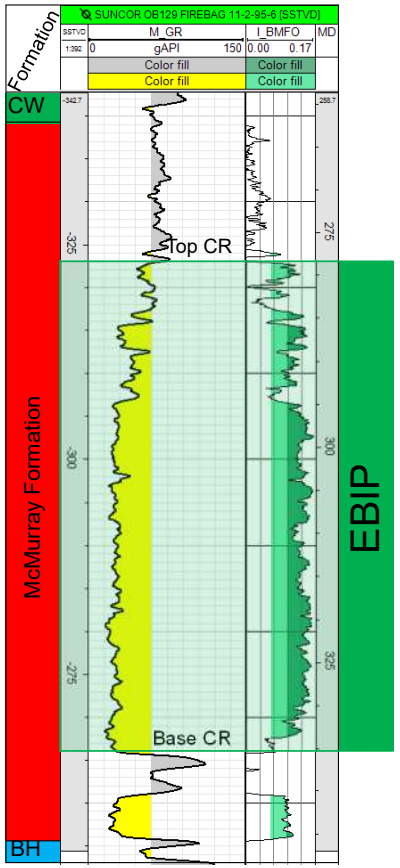


Pad 101 Well Pair 7

*Coreholes are projected onto cross section

Exploitable Bitumen in Place Methodology

- Exploitable Bitumen in Place (EBIP) is defined in each well by the top and base of Continuous Reservoir. It is selected at the base of a continuous sand unit either developed or most likely to be developed.
  - Continuous Reservoir base: lowest portion of the continuous reservoir sandstone with Bulk Mass Fraction of Oil (BMFO) cut off of 6%, <3m of >50% mud/breccia in the lower portion.
  - Continuous Reservoir top: 2m of mudstone, no BMFO or porosity cut offs.
- Upper Lean, Middle Lean, and Gas Zones that are in pressure communication with the continuous reservoir are included with no thickness cutoffs.
- Observation wells and 4D seismic will take precedence over pre-operations core and log based picks.



CW: Clearwater Formation
BH: Beaverhill Lake Group

Exploitable Bitumen in Place & Average Reservoir Properties

Pad	HC Area (e^3m^2)	Continuous Reservoir Thickness (m)	Porosity	Average Permeability (mD)	Oil Saturation	EBIP (e^6m^3)	EBIP (MMbbl)
SAGD Pad 101	1,756	52.7	0.320	5000 - 8000	0.78	23.2	145.6
SAGD Pad 102	1,608	58.3	0.316	5000 - 7000	0.72	21.3	133.9
SAGD Pad 103	1,907	44.9	0.316	5000 - 7000	0.73	20.5	129.0
SAGD Pad 104	1,910	45.3	0.321	5000 - 8000	0.77	21.3	134.0
SAGD Pad 105	1,573	41.6	0.326	5000 - 8000	0.78	16.3	102.6
SAGD Pad 106	1,602	37.6	0.325	5000 - 8000	0.79	16.8	105.4
SAGD Pad 107	1,381	46.3	0.319	5000 - 8000	0.74	13.8	86.9
SAGD Pad 108	1,726	46.3	0.321	5000 - 7000	0.76	19.7	124.2
SAGD Pad 109	734	26.0	0.333	5000 - 7000	0.79	5.0	31.5
SAGD Pad 110	1,449	33.4	0.320	4000 - 6000	0.69	10.9	68.4
SAGD Pad 112	1,458	39.6	0.332	5000 - 8000	0.78	16.2	102.1
SAGD Pad 114	1,473	35.4	0.322	5000 - 7000	0.76	12.9	80.9
SAGD Pad 115	749	30.4	0.325	4000 - 7000	0.72	5.3	33.5
SAGD Pad 116	1,661	40.2	0.326	5000 - 8000	0.78	17.0	107.2
SAGD Pad 117	1,573	33.9	0.321	5000 - 8000	0.72	12.9	81.4
SAGD Pad 118	2,028	40.1	0.313	5000 - 8000	0.75	19.1	120.3
SAGD Pad 121	2,094	41.9	0.324	5000 - 8000	0.72	20.4	128.3
SAGD Pad 122	2,165	37.3	0.314	5000 - 8000	0.70	17.8	111.8
SAGD Pad 123	998	43.7	0.318	6000 - 9000	0.75	10.5	65.8
SAGD Pad 131	929	38.8	0.324	5000 - 8000	0.79	9.2	57.9
Combined Operating Pads	**30,772**	**40.7**	**0.322**	**N/A**	**0.75**	**310.1**	**1950.6**
Firebag Approved Development Area	**68,422**	**35.0**	**0.321**	**N/A**	**0.74**	**568.1**	**3572.9**
Firebag Approved Project Area	**193617**	**30.9**	**0.319**	**N/A**	**0.71**	**1351.3**	**8,499.1**

EBIP: Exploitable Bitumen In Place. Without modification this generally stands for SAGD EBIP or producible bitumen in place.
HC: Hydrocarbon
EBIP = OBIP

Changes from last year reflect data from new coreholes, observation wells, time lapse seismic and some reinterpretation. EBIP procedure remains unchanged.

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Pad Recoveries

Pad	101	102	103	104	Stage 1 & 2 Totals
Recovery to Date, e3m3	17,193	14,520	12,052	12,415	56,180
Recovery Factor to Date, %	74%	68%	59%	58%	65%
Expected Ultimate Recovery, e3m3	20,990	17,322	14,897	16,757	69,966
Expected Ultimate Recovery Factor, %	91%	81%	73%	79%	81%
EBIP, e3m3	23,151	21,292	20,506	21,308	86,257

Pad	105	106	107	108	109
Recovery to Date, e3m3	13,128	8,003	7,154	6,244	2,856
Recovery Factor to Date, %	52%	45%	52%	34%	31%
Expected Ultimate Recovery, e3m3	17,665	11,337	9,770	9,336	5,407
Expected Ultimate Recovery Factor, %	70%	64%	71%	50%	59%
EBIP, e3m3	25,088	17,611	13,809	18,551	9,227

Pad	110	114	115	116	117	118	112	121	Stage 3 & 4 Totals
Recovery to Date, e3m3	3,419	2,113	2,478	8,624	2,937	1,793	1,165	948	23,477
Recovery Factor to Date, %	31%	16%	46%	51%	23%	9%	7%	5%	20%
Expected Ultimate Recovery, e3m3	6,011	6,537	3,539	11,605	7,519	9,820	8,753	10,668	64,452
Expected Ultimate Recovery Factor, %	55%	51%	66%	68%	58%	51%	54%	52%	56%
EBIP e3m3	10,868	12,856	5,332	17,047	12,934	19,134	16,225	20,402	114,798

EBIP = OBIP

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Average Reservoir Properties

Average reservoir properties for the operating portion of the scheme (Pads **101-110, 112** and Pads **114-118, 121-123,** and Pad **131**)

- Initial reservoir pressure: 800kPa
- Initial reservoir temperature: 8°C
- Average continuous reservoir: 40.7 m
- Average porosity: 0.322
- Average oil saturation: 0.75
- Effective horizontal permeability: 3 to 4 D
- Effective vertical permeability: 2 to 3 D
- Viscosity: ~ 11-13.5 cp @ 215°C

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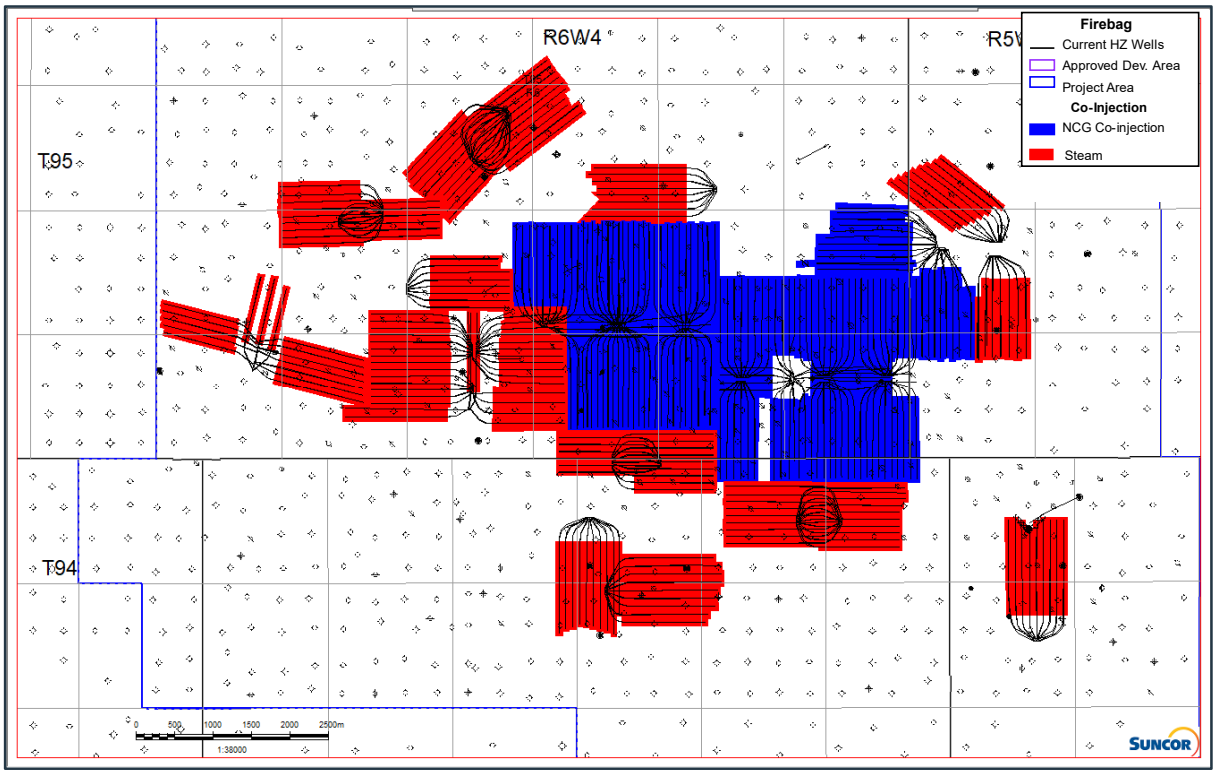
Co-Injection Overview



Non-condensable gas (NCG) co-injection has been implemented on the following well pads at Firebag:

Phase 1
- Pad 101
- Pad 102
- Pad 103
- Pad 104
- Pad 107

Phase 2
- Pad 105
- Pad 106
- Pad 108
- Pad 116

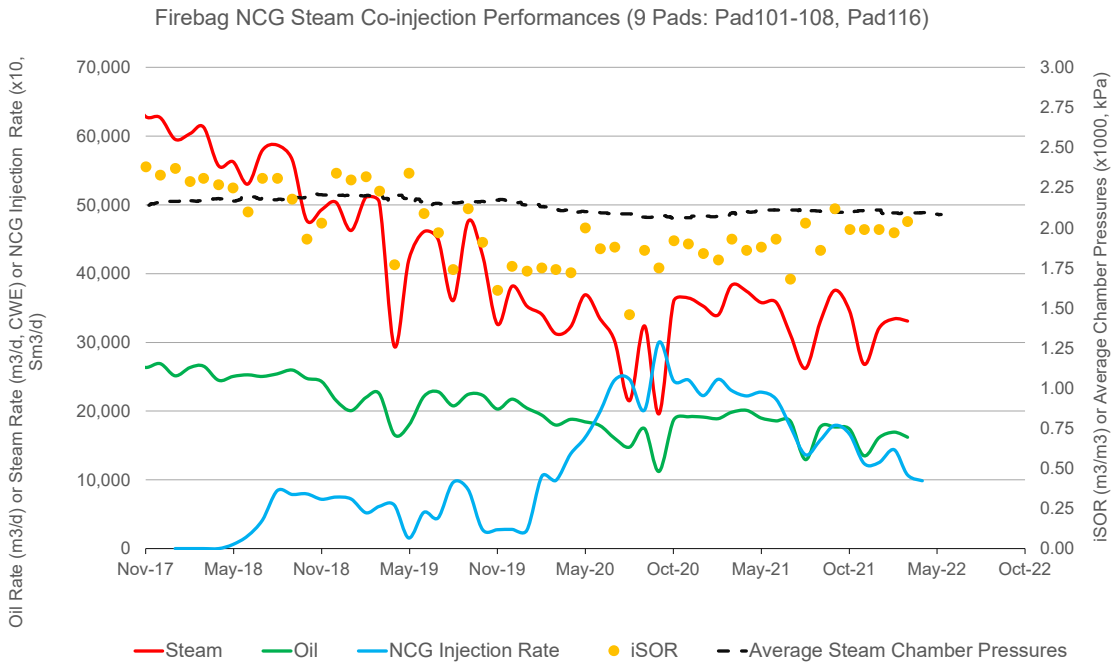
ES-SAGD Co-injection on Pad 109 completed May 1, 2020

Co-Injection Strategies

- Non-Condensable-Gas (i.e. methane fuel gas) co-injected with steam has been implemented on 9 mature pads (Pad101-108 and Pad116) since May of 2018.
- In Firebag, NCG and steam co-injection typically commence on a pad when estimated ultimate recovery (EUR) recovery has exceeded 65%, through normal SAGD operations.
- Geological characteristics, SAGD performances/optimization approaches and surface infrastructure are also considered when evaluating timelines for NCG co-injection.
- Main factors considered to determine, execute and monitor NCG steam co-injection rates:
  - Monitor reservoir responses and main KPIs (key production index) to make NCG injection rate justifications if necessary.
  - Field wide strategies for steam allocation from the matured NCG steam co-injection pads into the new pads.
  - Desired chamber pressures (e.g. maturity of the subject steam chamber(s)) to be maintained.
  - Predicted NCG retention within the reservoir, considering the balance of the injected NCG leak off and produced back.

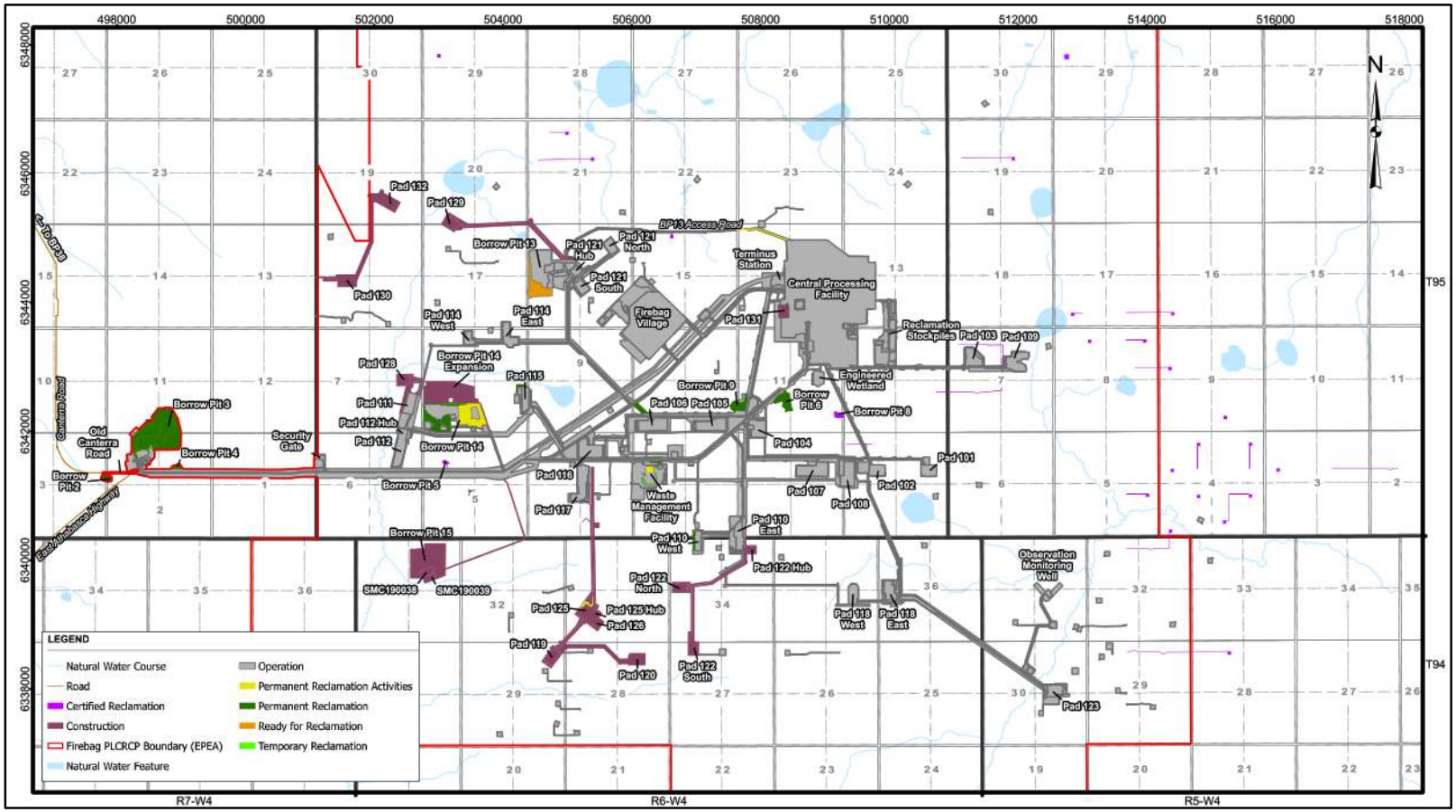
Co-Injection Observations

- No negative impacts on oil rate, after NCG steam co-injection
- SOR has been reduced.
  - Field wide steam injection has been optimized via reallocation to less mature SAGD pads.
- Reservoir pressure targets have been maintained with NCG co-injection. The concentrations for injected NCG gas (i.e. NCG to steam mole ratio) has been controlled in the range of 0.25~0.42% during January 1, 2021 to December 31, 2021
- Gradual increase in produced gas from reservoir (40% of injected NCG is produced back).
- No significant temperature reductions have been observed within existing steam chambers from observation well temperature/pressure data.



Surface
4.3

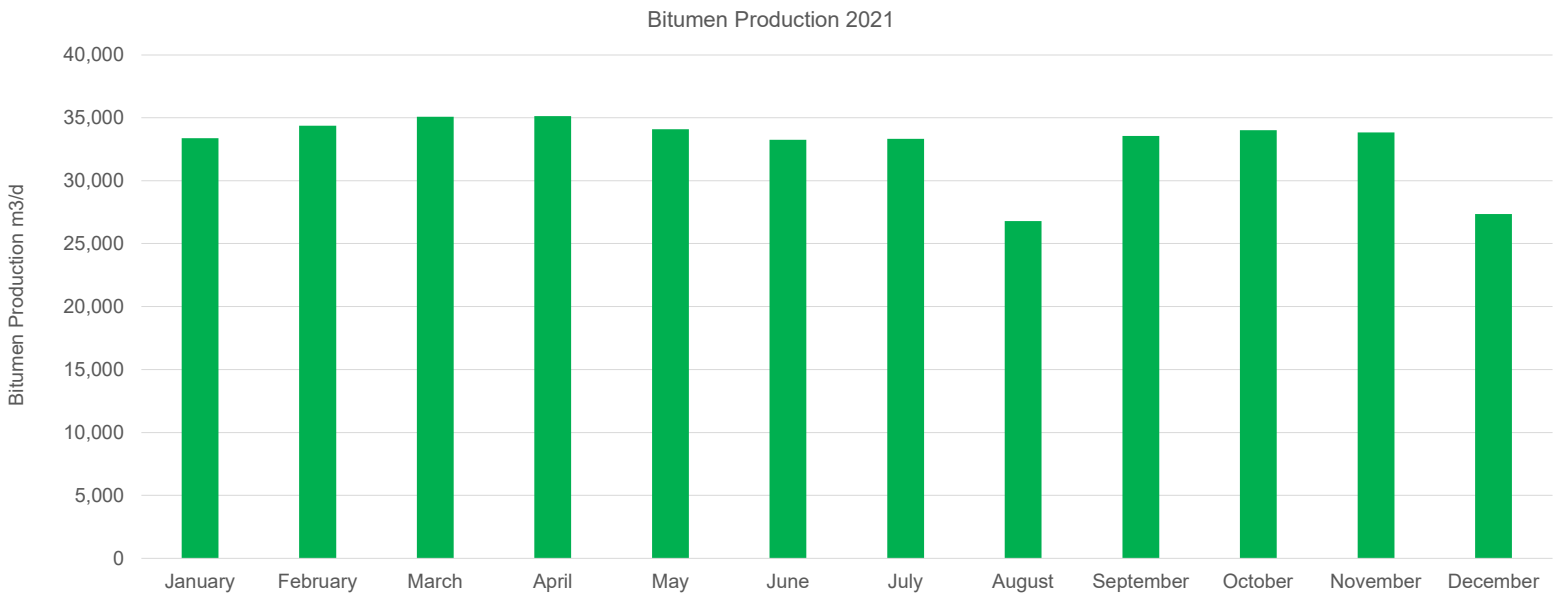
Overview of Built and Planned Surface Infrastructure



There have been no modifications to the Central Processing Plant (CPF) during the reporting period that have required an Alberta Energy Regulator (AER) application approval.

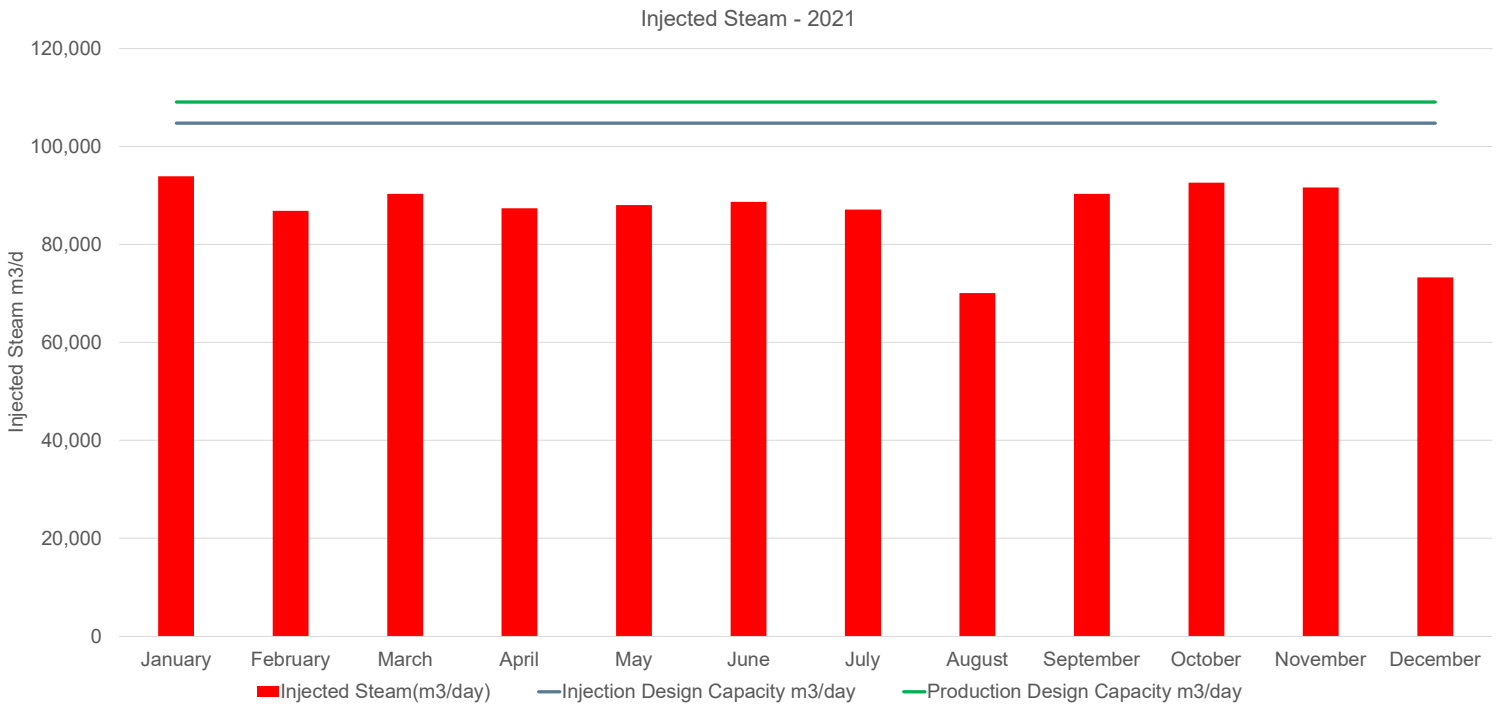
Annual Rates – Bitumen

- From January 2021 to December 2021 Firebag averaged 32,732 m3/day (206 kbbl/d) of bitumen production.
- The design rate for Firebag is 32,273 m3/d (203 kbbl/d) at 2.8 SOR.



Annual Rates – Steam

- From January 2021 to Dec 2021 Firebag injected on average 86,411 CWE m3/day (543 CWE kbbl/d) of steam into the wells.
- The average injection design capacity is 104,760 m3/d (659 kbbl/d)
- The average production design capacity is 109,100 m3/d (686 kbbl/d)



Historical and Upcoming Activity
4.4

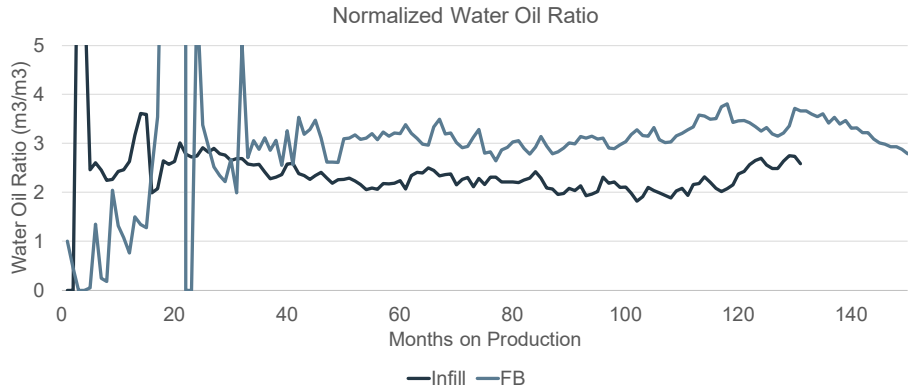
Summary of Key Learnings

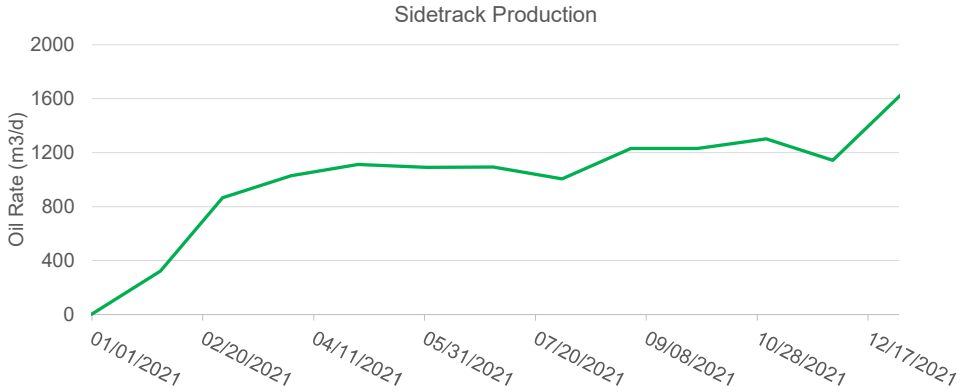
Infill Well Performance:

- 51 infill wells are currently in operation at Firebag with average oil production of 135 m3/d (849 bbl/d) per well.
- Infill well performance is optimized through effective management of infill and base well interactions at the steam chamber level.
- Infills are a reliable source of continued low water-oil ratio (WOR) production

Sidetrack Well Performance:

- 12 sidetrack wells were brought on production during the reporting period as a part of brownfield development program (including a sidetracked injector)
  - Enables access to new resource from existing underperforming wells
- These sidetrack wells are demonstrating beneficial WOR and SOR metrics as a result of their pre-heated steam chambers.





Summary of Key Learnings

Observation Well Monitoring

- Observation wells continue to be utilized for both caprock integrity monitoring and optimization in the current operating area at Firebag. They also continue to be incorporated into development planning and are drilled for new pads prior to first steam.
- Standard completion designs include a thermocouple string that spans the reservoir zone and into the caprock and/or individual pressure and temperature gauges in specific zones.
- Observation wells around Pad 123 continue to be useful in assessing reservoir connectivity and mobility using pressure monitoring gauges.

Pad Start Up

- Safe start-up of pads 122, 123, and 131 (36 well pairs)
- Combined circulation and bullheading (i.e. without circulating a portion of the steam back to surface) methods have been applied to new pad start ups from Firebag Stage 3 onwards.
- Bullheading requires less cumulative steam to achieve the same reservoir heating as circulation. This reduces cSOR and emissions produced.

Advanced Reservoir Management for Improved Energy Efficiency

- Firebag is actively exploring opportunities that incorporate data analytics to further optimize steam allocation and subsequently energy efficiency.
- Regional optimization has proven successful in leak-off management strategies, which mitigate the loss of injected energy.
- Steam chamber pressures are balanced between pads to optimize heat efficiency.

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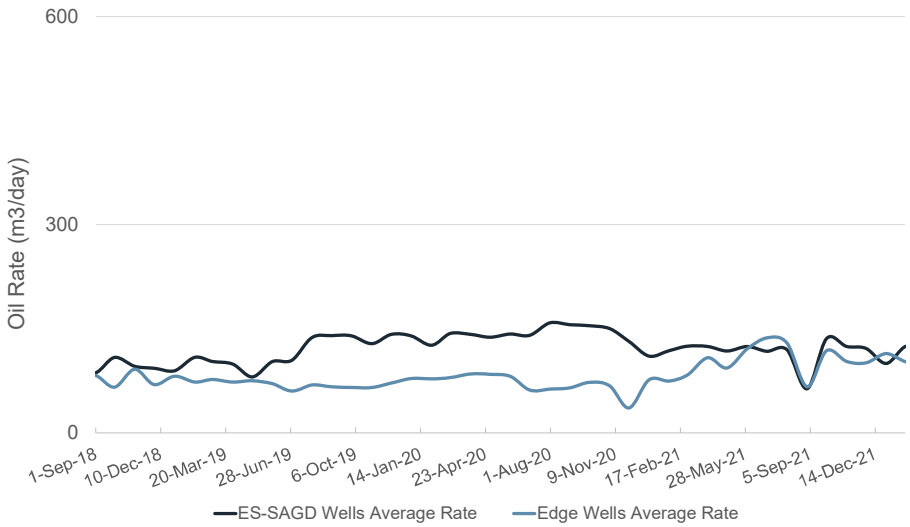
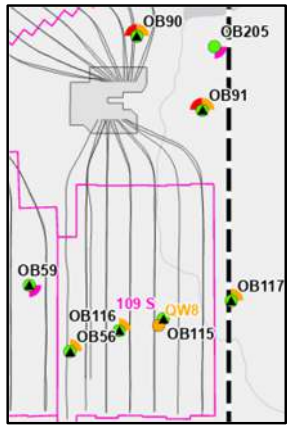
4.4.10 d), 4.4.12 a)

New Technology Update: Pad 109 South ES-SAGD (Hydrocarbon Co-Injection)

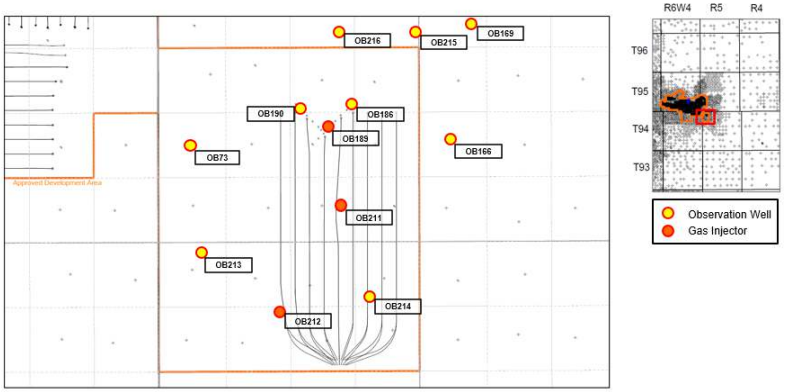
- Baseline data collection at Pad 109S started in July 2018, which included flow measurements and sample collection.
- A dedicated test separator operated since the beginning of the baseline at Pad 109S to enable enhanced surveillance of the demo.
- 4 out of 7 well pairs at Pad 109S were used for ES-SAGD, while edge wells were left in SAGD mode for control and pressure fencing. Continuous hydrocarbon co-injection started on April 3, 2019 and finished on May 1, 2020.
- Hydrocarbon co-injection concentration was achieved at 5-15%, within the approved limit.
- Injected hydrocarbon is a multicomponent diluent that is used at the Firebag Central Processing Facility (CPF) to dilute the bitumen for processing and transportation.
- Oil rate improvement was observed in the hydrocarbon co-injecting well pairs, while the edge SAGD well oil rates remained at the baseline level. A corresponding reduction in SOR has also been confirmed.
- Diluent return trends were established via physical separation and measurement in the test separator until Dec 2021. The technology demo officially ended and ES-SAGD surveillance stopped as of Jan 2022.

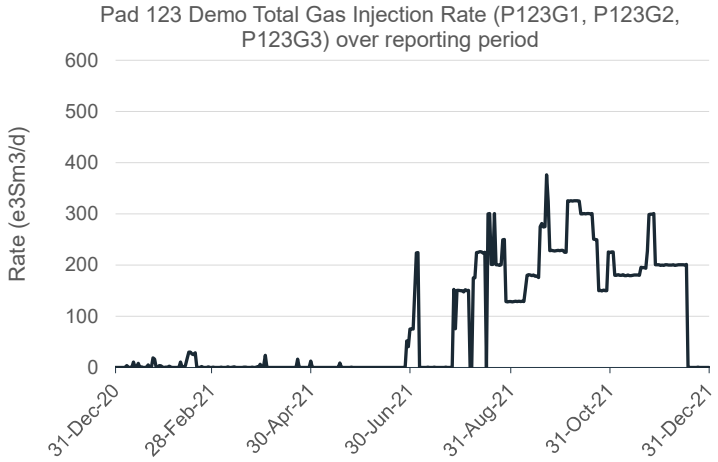




New Technology Update: Pad 123 Gas Injection Demonstration

- Suncor started gas injection in Pad 123 on August 5, 2017 as per AER approval.
- Suncor has safely ramped up to the total injection rate of 375 e3Sm3/d of gas while adhering to the terms of the AER approval with respect to containment of gas in the McMurray zone.
- Firebag fuel gas (primarily methane) is used for the current injection scheme.
- All 3 gas injectors (P123G1, P123G2, P123G3) are utilized. Injection pressure has been monitored and kept below approved MOP during operation.
- Suncor has optimized the gas injection rate/pressure in accordance with long term steam chamber operation associated with Pad 123 SAGD.
- Optimized gas injection schedule is being implemented in support of Pad 123 start-up (first steam was in November 2020).





Summary of Events

- The following horizontal wells were drilled during the reporting period:
  - Pad 111 (17 well pairs)
  - Pad 131 (8 well pairs)
  - Pad 125 (9 well pairs)
  - Pad 117 infills (3 infill wells)
  - Sidetrack program producers (3N7B,4N11B, 4P9B, 5P13B, 5P14B, 6P8B, 6P9B, 8P4B, 17P3B)
  - Sidetrack injector 7S9B

  - The following SAGD well pads were started up during the reporting period:
  - Pad 122
  - Pad 131

Suspension and Abandonment Activity

4.4.9 a) b)

License	Well Type	Well Name	UWI	Spud Date	Activity	ABN/SUSP Date	Justification	Remaining Reserves
261024	Producer	SUNCOR SAGD P1P1 FIREBAG 7-12-95-6	106/07-12-095-06W4/00	9/13/2002	Suspension	10/4/2021	Lack of productivity, no cellar oil/not a good sidetrack candidate	384,000m3
260967	Producer	SUNCOR SAGD P1P2 FIREBAG 7-12-95-6	100/07-12-095-06W4/00	9/15/2002	Suspension	10/6/2021	Lack of productivity, no cellar oil/not a good sidetrack candidate	44,000 m3
260968	Producer	SUNCOR SAGD P1P4 FIREBAG 8-12-95-6	102/08-12-095-06W4/00	9/17/2002	Abandonment	6/23/2021	Liner Failure	439,000 m3
260993	Producer	SUNCOR SAGD P2P4 FIREBAG 6-12-95-6	102/06-12-095-06W4/00	11/16/2001	Suspension	3/19/2021	Lack of productivity, no cellar oil/not a good sidetrack candidate	233,000 m3
445389	Producer	SUNCOR P10P10 FIREBAG 16-33-94-6	100/16-33-094-06W4/00	1/20/2013	Suspension	6/21/2021	Liner failure, lack of productivity, no cellar oil/not a good sidetrack candidate	308, 000 m3

- Suncor does not anticipate abandonment of any Firebag SAGD pads within the next 5 years.

Future Plans

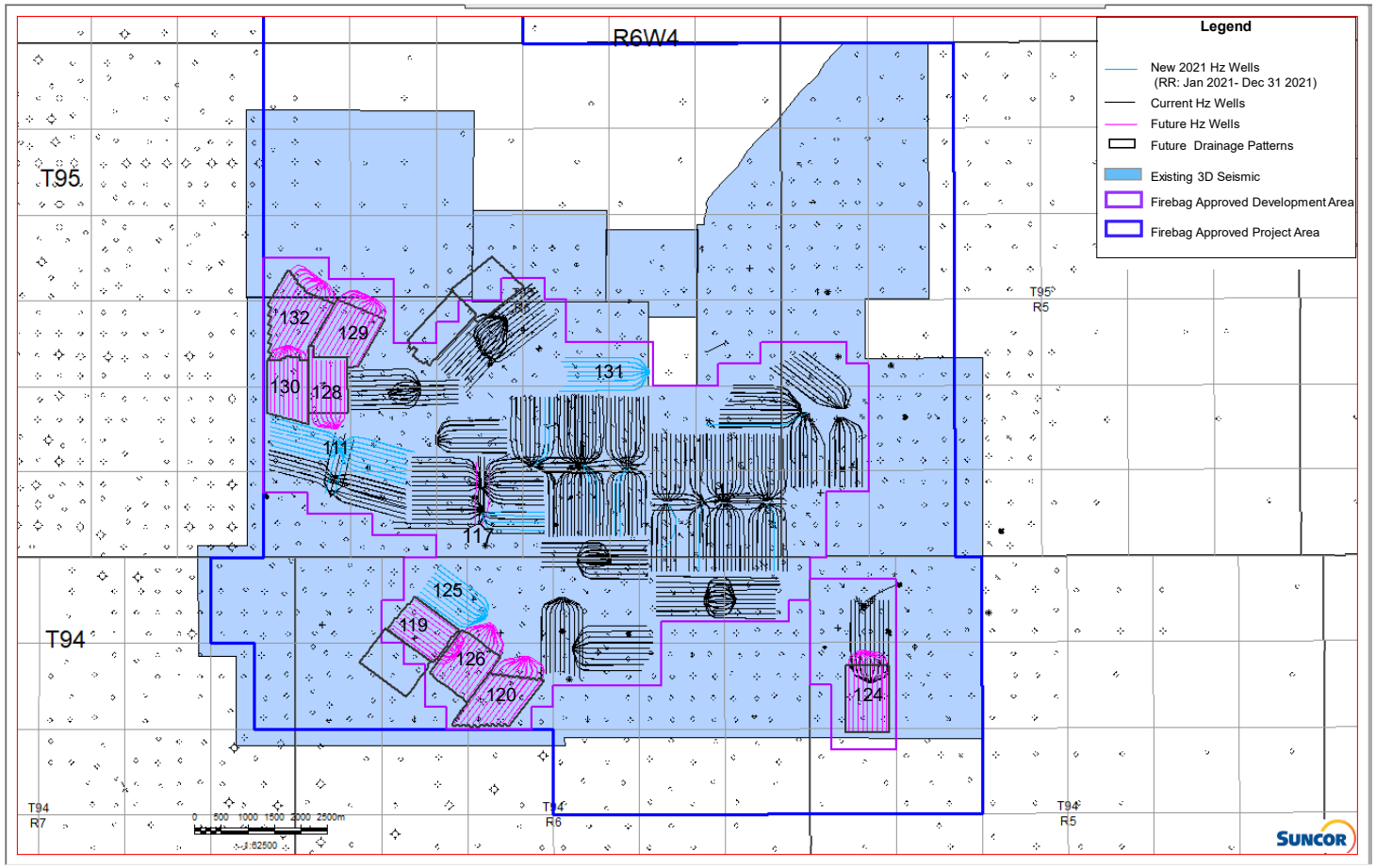
- The following horizontal drilling activities are expected to commence within the next year (2022):
  - Pad 117 Infills (2 well pairs)
  - Pad 126 (9 well pairs)
  - Pad 119 (9 well pairs)
  - Pad 128 (8 well pairs)

- The following first steam dates are planned to occur within the next year:
  - Pad 117 infills: Q3 2022
  - Pad 111: Q3 2022
  - Pad 125: Q4 2022
  - Pad 126: Q4 2022

- Coreholes, observation wells, and 4D monitor surveys will be planned as necessary to:
  - Monitor SAGD operations
  - Adequately delineate the resource
  - Further caprock integrity analysis
  - Conduct hydrogeology analysis
  - Conduct water disposal analysis

- Development plans are evaluated annually and are therefore subject to change.

Future Plans- 5 Year Outlook



The above map highlights development activities that are planned at Firebag for the next 5 years.

Development plans are evaluated annually and are therefore subject to change.

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4.4.10 a), 4.4.12 c)

Regulatory Applications

Approved Applications:

Application No.	Application Name	Date Filed	Date Approved	Application Type
1931858	Request to increase maximum pH limit from 11.0 to 12.0: Suncor Firebag Class 1B Disposal Wells Approval No. 9487K	2021/01/06	2021/02/02	Class I Diso: Amend
1932001	2021 Firebag Devonian Injectivity Tests AER Commercial Scheme Approval No. 8870KKKK, 9497K & AENV Environmental Protection…	2021/01/21	2021/02/17	Injectivity Test
1932039	Request for Temporary Variance Directive 23 Category 1 Application Alberta Energy Regulator (AER) Commercial Scheme Approval No. 8…	2021/01/26	2021/02/25	Comm Amend Category1
1932112	Request for Injector logging waiver (build section only) pad 131.	2021/02/02	2021/02/02	OS Drill/Log Waivers
1932665	Request to waive drilling to base of oil sand deposit for Firebag pad 125 horizontals	2021/03/26	2021/03/29	OS Drill/Log Waivers
1932797	Suncor Firebag Project AER Commercial Scheme Approval No. 8870 Application to implement dilation start-up at Pad 123 and Pad 122	2021/04/14	2021/06/08	Comm Amend Category2
1932853	AER Commercial Scheme Approval No. 8870KKKK, 9487K & AENV Environmental Protection and Enhancement Act Approval No. 80105	2021/04/21	2021/05/11	Injectivity Test
1932919	Suncor Energy Firebag Steam Assisted Gravity Drainage (SAGD) Project Pads 122 North and South Maximum Operating Pressure Increase	2021/04/30	2021/05/11	Comm Amend Category2
1932945	Suncor Energy Firebag Application to Amendment P93/94 Primary Reporting Method for Quantifying Produced Steam to Account for Lost	2021/05/04	2021/06/03	Comm Amend Category1
1933040	Application for Expanding Injected Hydrocarbon Steam Assisted Gravity Drainage AER Commercial Scheme Approval No. 8870 &AENV..	2021/05/17	2021/08/19	Comm Amend Category2
1933074	Request for waiver of logging for Pad 125, within Section 32 Township 94-06W4	2021/05/19	2021/05/21	OS Drill/Log Waivers
1933072	Request for Temporary Variance Directive 23 Category 1 Application AER Commercial Scheme Approval No. 8870 & Environmental Protection	2021/05/19	2021/06/16	Comm Amend Category1
1933528	Suncor Energy Firebag Application to Amendment P93/94 Primary Reporting Method for Quantifying Produced Steam to Account for	2021/06/30	2021/07/20	Comm Amend Category1
1933578	Suncor Energy Firebag SAG Project Pad 117 Amendment AER Commercial Scheme Approval No. 8870 & AENV Environmental Protection	2021/07/08	2021/08/04	Comm Amend Category2
1933896	Suncor Energy Firebag SAGD Project Amendment Application for the Suncor Firebag Pad 120 AER Commercial Scheme Approval No. 887	2021/08/05	2021/12/23	Comm Amend Category2
1933933	Application to Sidetrack Five Steam Assisted Gravity Drainage (SAGD) Production Wellbores at (AER) Commercial Scheme Approval No. 8	2021/08/10	2021/08/20	Comm Amend Category1
1934236	Request for Temporary Variance Directive 23 Category 1 Application AER Commercial Scheme Approval No. 8870 & Environmental Protect	2021/09/09	2021/10/05	Comm Amend Category1
1934425	Firebag, Injector build section logging waiver, Pad 117	2021/09/28	2021/10/04	OS Drill/Log Waivers
1934418	Firebag, Pad 117, infill base deposit waiver	2021/09/28	2021/10/04	OS Drill/Log Waivers
1934619	2021/22 Firebag Water Injectivity Test AER Commercial Scheme Approval No. 8870 & AENV Environmental Protection and Enhancement	2021/10/19	2021/11/03	Comm Amend Category1
1934692	Base Deposit Waiver Firebag Pad 126	2021/10/25	2021/10/29	OS Drill/Log Waivers
1934739	Suncor Firebag Field MOP Increase Application Commercial Scheme Approval No. 8870 & Environmental Protection and Enhancement	2021/10/28	2022/04/18	Comm Amend Category2

Future Applications: N/A

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Wellbore Integrity Failure

Well	Date of Failure	Cause
N/A	N/A	N/A

* No new failures in 2021

Intermediate Casing Corrosion Prevention:

- Proactive corrosion batch inhibition performed semi-annually on wells that show signs of corrosion during pump changes
- Corrosion analysis logs like caliper, darkvision etc. planned on wells that show signs of corrosion during pump changes

Surface Casing Vent Flow Prevention:

- Following general industry best practices such as good thermal cementing, premium connections on intermediate casing, monitoring CBL logs

Initiatives for Improving Well Integrity:

- Various initiatives are underway and consideration such as proactively changing the wellhead wing valves to improve design (ported AV types) to prevent any freezing occurrences

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Compliance History

2021 (Jan-Dec)	Number of Occurances	Reference Number	Date(s) of occurances	Details of Occurance	Suncor Actions
NOx CEMs Exceedance	9	375063, 375965, 375965, 375614, 375614, 378239, 380042, 380784, 385723	Various dates	NOx limit was exceeded on various units including our steam generatos and cogeneration units	Most incidents occurred because our cogeneration units went into extended lean-lean modes. This is a safe mode with a more stable combustion but results in higher NOx emitted from the unit to the atmosphere
CEMS Availability Violation	7	375614, 377121, 376260, 377121, 385106, 385406, 386709	Various dates	CEMS Code Section 5.4 Minimum System Availabilty requirements and Approval Number 80-105-01-00 Schedule 2 (i)(D)	Most incidents were a result of a faulty CEMS Stack top analyzers or their parts. The parts were replaced or repaired once problem was identified.
SO2 CEMS Exceedance	4	374960, 380147, 380622, 386303	Various dates	The Sulphur Recovery Units (SRU) had one-hour average stack top exceedances. Value of exeedances was higher than the limit (133kg SO2 per hour average)	Most incidents were a result of inadequate train performance. Contamination to the sweet gas analyzer cell caused it to go out of its operating range and the venturi on the acid gas flow rate analyzer partially plugged off causing inaccurate flow readings. In all cases the analyzers were thoroughly inspected.
SRU Incineration Stack Temp Violation	3	382132, 382217, 382422	Various dates	Due to Turnaround and maintenance activities there was a power interriuption causing the incinerator to trip. The loss of power impeded the fule gas deliver to the SRU. Without adequate fuel gas, the SRU was unable to generate the combustion and heat required to maintain the required incierator temperature of 538 degrees C.	Once the power supply was back onliune, the fule gas delivery system was restarted, supplying the required fuel gas back to SRU which increased the incinerator temperature back to operating levels above 538 degrees C.
Venting	14	374858, 375957, 377772, 380675, 382167, 382410, 382461, 382524, 383672, 385512, 386470, 386679, 386611, 386251	Various dates	there were 14 venting incidents reported to the AER in 2021.	Suncor continues to address the number and duration of venting incidents by identifying root causes and implementing corrective actions for wach venting event to prevent future occurances
Flaring	0				

Compliance with Daily Average Maximum Operating Pressure

The following occurrences have taken place from Jan 1, 2021 – Dec 31, 2021 and are reported as per the daily average Maximum Well Head Injection Pressure (MWHIP) Approval (No. 8870LLL):

Well	Date	Duration (hrs)	MOP (kPag)	Peak Pressure (kPag)	Daily Average Injection Pressure (kPag)
31P5 Bottomhole pressure	12/17/2021	2	4130	4656	3671
22P9 Bottomhole Pressure	10/16/2021	5.5	4360	4630	4154

- No occurrences resulted in a daily average injection pressure above the specified MOP.
- Learnings have been incorporated into future start ups to decrease the likelihood of reoccurrence.

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Update on Deferral Approval for 4P10 Repair of SCVF

- As per Nov 10, 2016 Approval, Suncor has drilled 3 Quaternary monitoring wells on Pad 104 to monitor for potential groundwater impacts around the SCVF at 4P10.
- Sampling results to date indicate no groundwater impacts from 4P10 SCVF. Based on groundwater sampling, geochemical and lab simulation conducted, increasing trends of a few parameters are attributed to due to heating as opposed to SCVF gases (2020 Groundwater Compliance Monitoring Report, Suncor Firebag Facility, Central Processing Facility and Well Pads, Approval No. 0080105-01-00, March 2021).
- As a result, in 2021, Suncor installed wells QW23 and QW25 upgradient of 4P10A, 4P10B and 4P10C as per the requirements of the Directive for the Assessment of Thermally-Mobilized Constituents for Thermal In Situ Operations.
- Suncor has received permission to remove sampling of 4P10A and 4P10B from the sampling program and continue with the sampling of the new upgradient wells.
- Results of groundwater sampling at 4P10C, QW23 and QW25 are to be reported in detail within the Firebag Annual Groundwater Compliance Monitoring Report as per Approval No. 0080105-01-00 going forward.

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Thank you