Suncor Dover Underground Test Facility
Final Technical Presentation
Commercial Scheme Approval No. 9044

February 2015

SUNCOR

Dover Underground Test Facility (UTF) Project Overview

- Project located ~65 km northwest of Fort McMurray
- Adjacent to Suncor MacKay River Project
- Dover Commercial Project consists of underground SAGD (UTF) and Surface SAGD portions
- UTF permanently abandoned by Suncor in 2013
- UTF consists of Phase A, Phase B, and Chevron Heated Annulus Steam Drive (HASDrive) tests
- Surface SAGD project consists of Phase D, Phase E, Phase F, Phase G, and DOVAP (Dover VAPEX) experimental scheme
- Information presented herein will focus on the UTF portion of the Dover Commercial Project only

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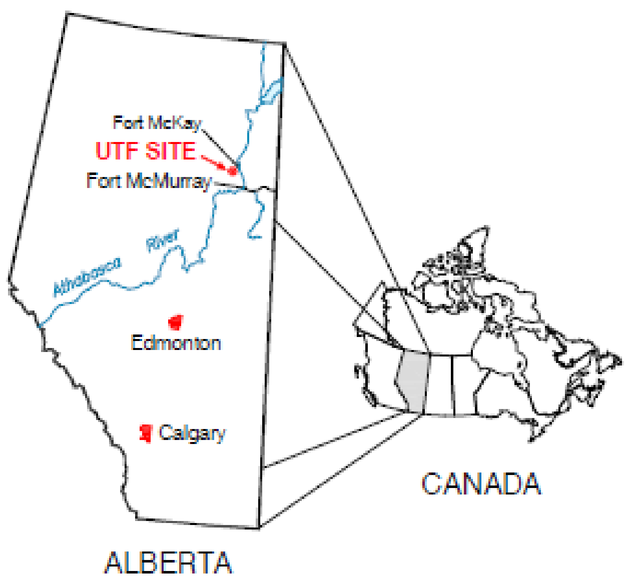
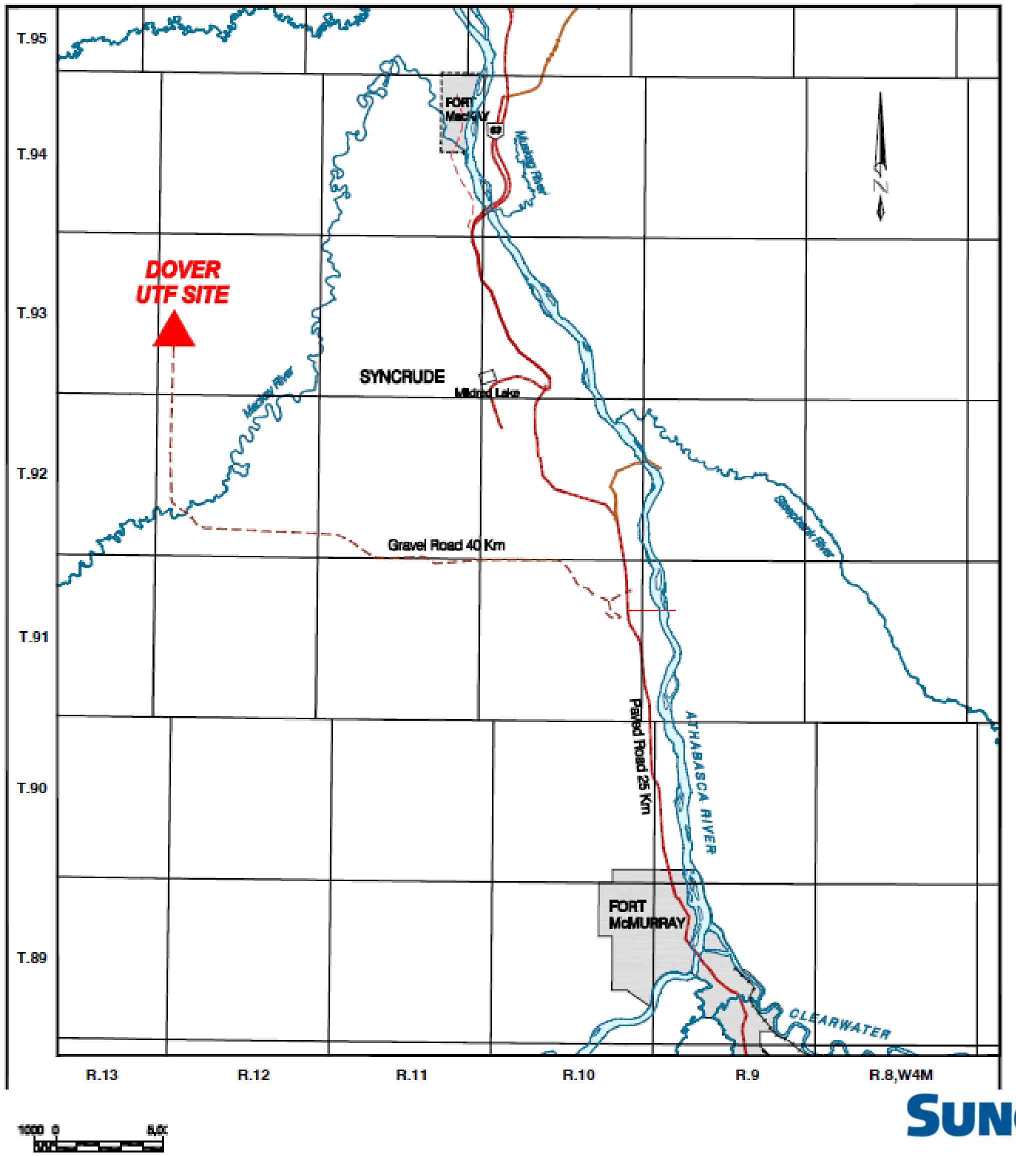
UTF Overview

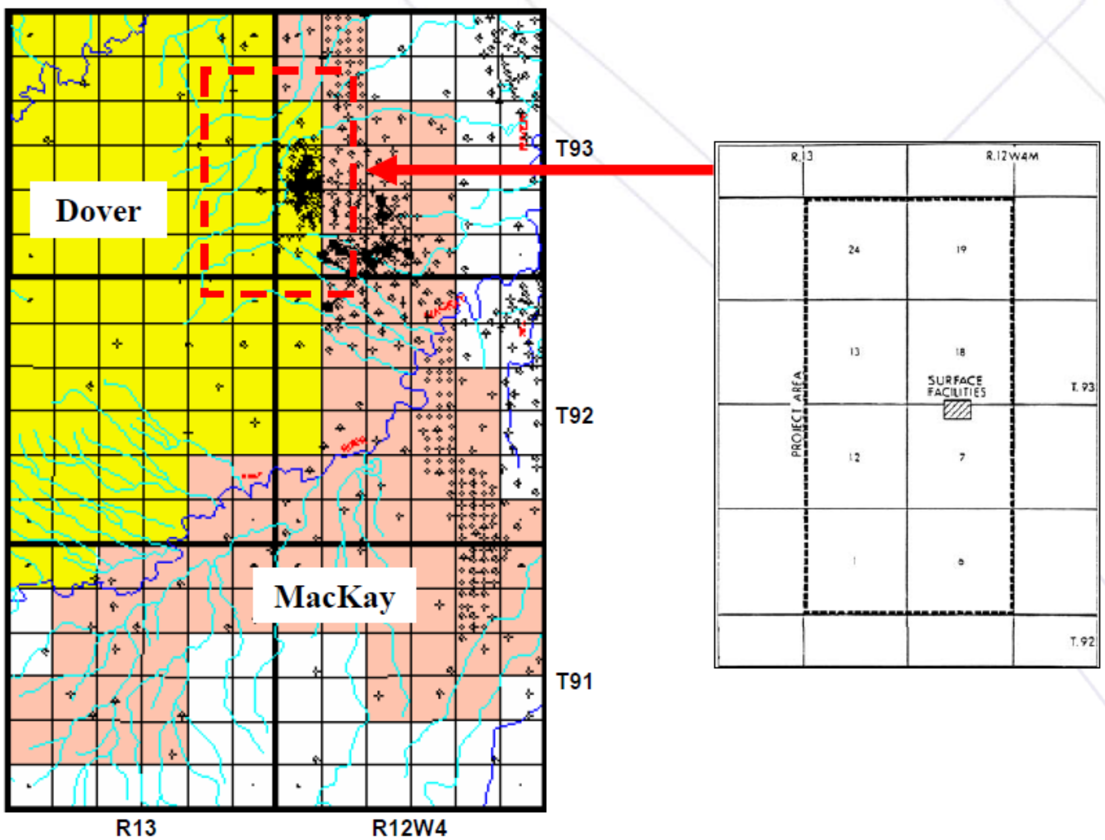
- UTF was constructed between 1985 and 1987
- Facility consists of two vertical shafts and a 1.5 km underground tunnel system
- Tunnels were driven into Devonian limestone below the McMurray Formation
- Wells drilled upwards from the tunnels starting at angles of 15 to 20 degrees above the horizontal and then dropped to horizontal in the oil sand
- Consisted of 3 tests to investigate different variations of the SAGD process:
  - Phase A
  - Chevron HASDrive
  - Phase B
- Wellhead abandonment occurred in 2008
- Underground Mine abandonment and associated surface facilities decommissioning was completed in 2013

Project Area and Project Site





Project Area and Project Site



- UTF located in Sections 7 and 18, Township 93, Range 12, west of the 4th Meridian
- Mineral Surface Lease (MSL) 830941

Project Area and Project Site

Project History

- Dover Project was originally known as the Alberta Oil Sands Technology and Research Authority (AOSTRA) UTF
- Facility was built in 1984 and operated by AOSTRA, now the Alberta Energy Research Institute (AERI)
- Gibson Petrolem Co. Ltd. Operated the UTF from 1995 to 1997
- Northstar Energy Corporation (Northstar) acquired the majority of working interest and assumed operatorship of the UTF in January 1998 – project renamed Dover
- Northstar became Devon Canada Corporation (Devon) in 2001
- Petro-Canada acquired the Dover Project from Devon in February 2005 – acquisition included the bitumen resources
- Suncor acquired the UTF through a merger with Petro-Canada in August 2009
- Resources immediately adjacent to the UTF area are depleted; consequently Suncor has no further use for the underground facility
- Complete abandonment of the UTF and associated infrastructure occurred in 2013

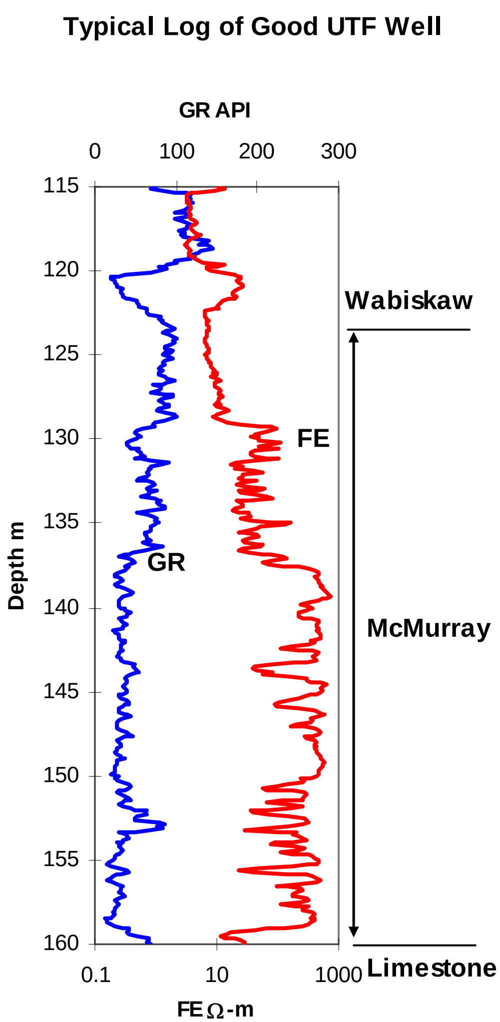
Historical Project Approvals – ERCB/EUB

- AOSTRA UTF originally approved under Energy Resources Conservation Board (ERCB) Approval No. 4198 in 1984
- Approval No. 4198 amended in 1986 to include Phase A test (Approval No. 4198A)
- Approval No. 4198A amended in 1987 to include Chevron HASDrive test (Approval No. 4198B)
- Approval No. 4198B was rescinded in 1990 and new Approval No. 6809 was issued to include the Phase B test
- Approval No. 6809 became commercial scheme Approval No. 9044 in 2002 when Devon applied to extend the operating term to June 2007
- Experimental Scheme Approval No. 9046 was issued in 2002 for the DOVAP experimental scheme
- In 2009 Approval No. 9046 and Approval No. 6809 were combined into the existing Approval No. 9044
- In December 2010 Approval No. 9044H was issued to Suncor for the abandonment of the UTF

Historical Project Approvals – Alberta Environment

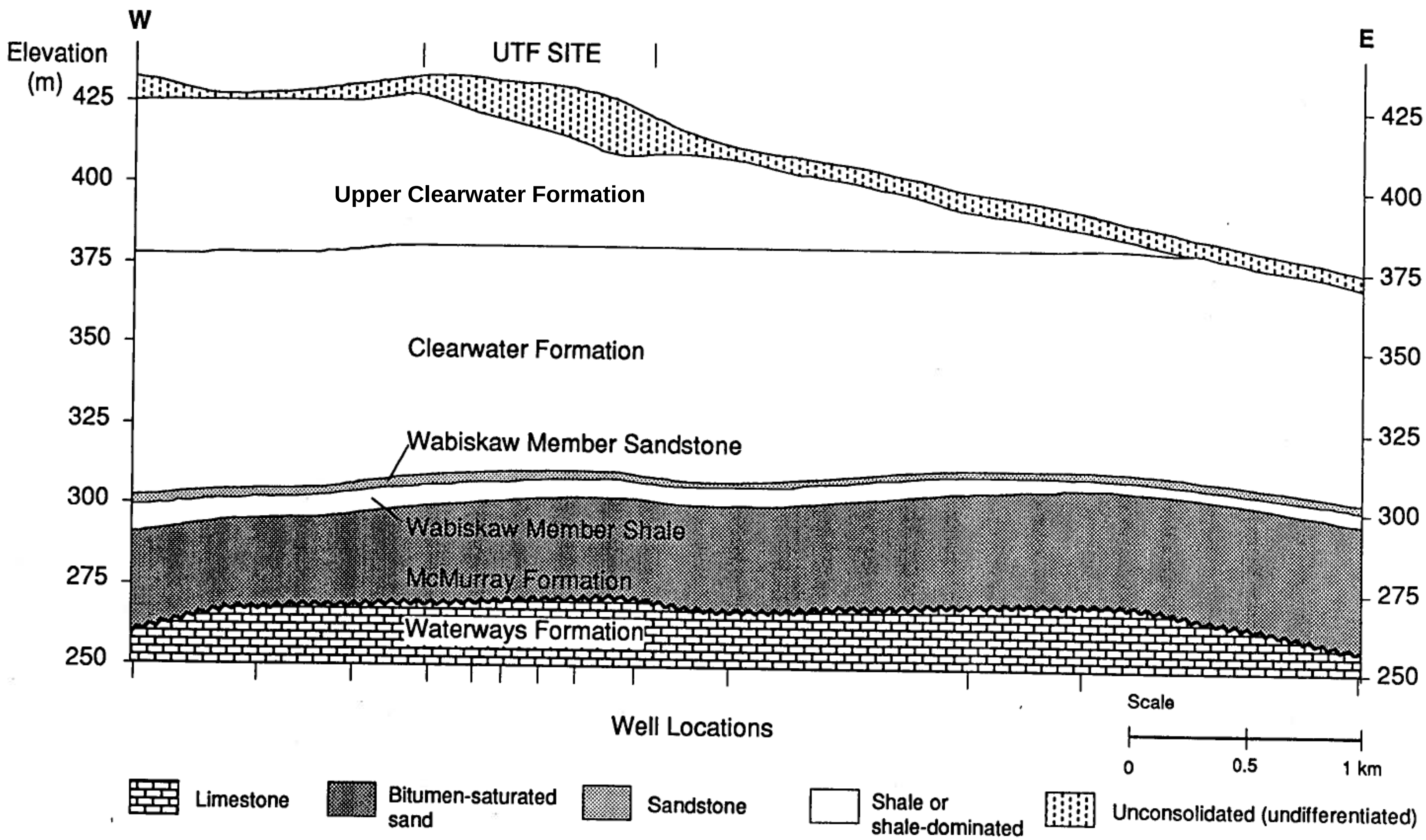
- Alberta Environment originally issued *Environmental Protection and Enhancement Act (EPEA)* Approval No. 705-00-00 in 1992 for the AOSTRA Oil Production Site
- In August 1999, the EPEA approval was renewed and issued as Approval No. 705-01-00 to Northstar Energy Corporation for the Construction, Operation and Reclamation of the Dover Enhanced Recovery In-Situ Heavy Oil Processing Plant
- In June 2010, EPEA Approval No. 705-01-00 was again renewed, and issued as Approval No. 705-02-00 to Suncor Energy Inc.
- The Suncor Dover Commercial Project (UTF and Surface SAGD/Pilot Projects) currently operates under EPEA Approval No. 705-02-00 (as amended)
  - ESEIEH and BEST Pilot Projects included in current EPEA Approval

Geology and Geoscience



- North-South estuarine channel sand deposit
- Channel width is about 500 to 800m
- Main target reservoir is the McMurray Formation
- Best quality at the base of reservoir
  – (high porosity and So)
- Lower quality near the top of reservoir
  – (bioturbated interbedded shales)
- No extensive bottom water and top gas/water

Geology and Geoscience



West-east cross section through the post-Devonian strata in the UTF Area

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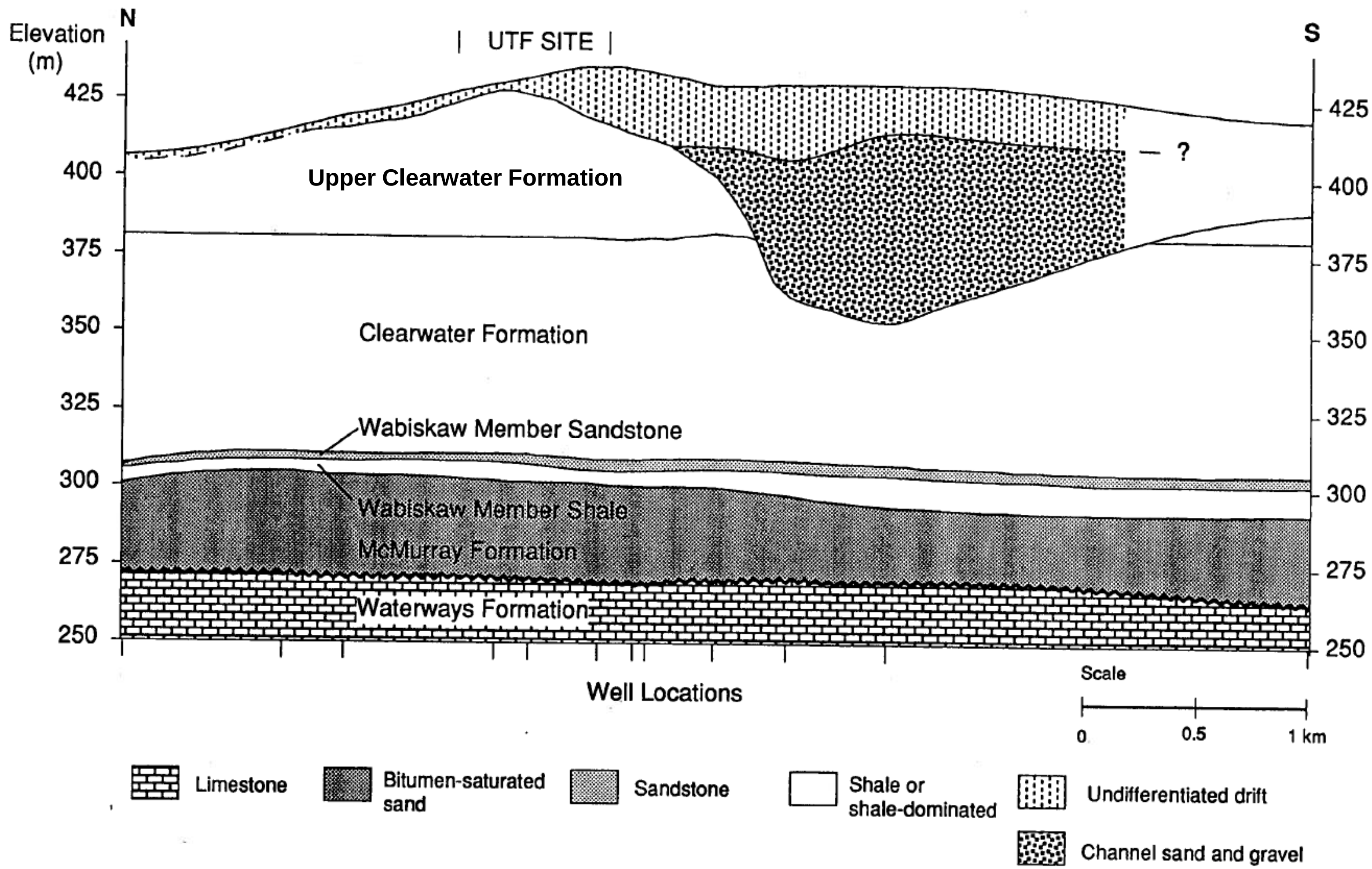
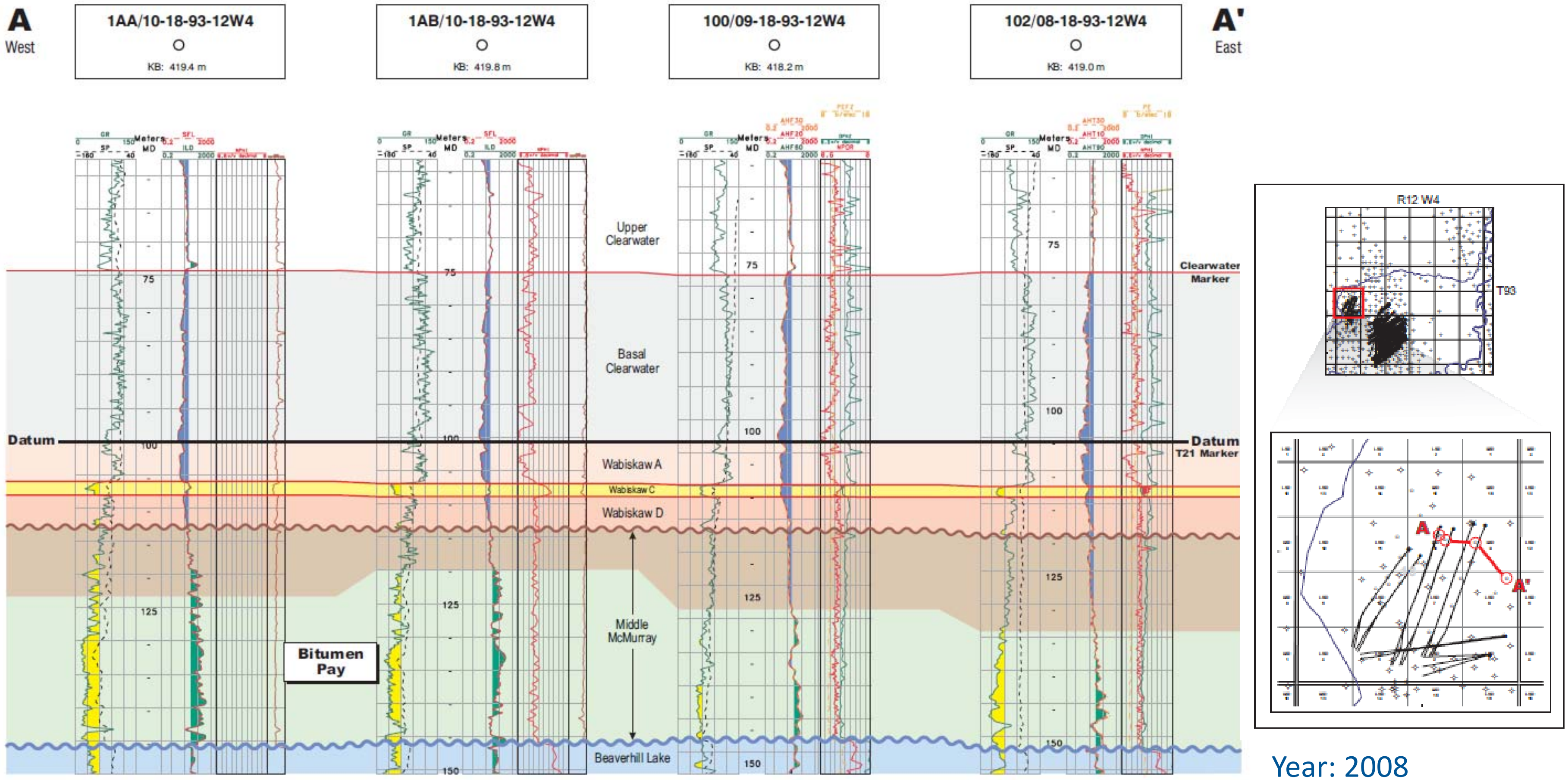
Geology and Geoscience



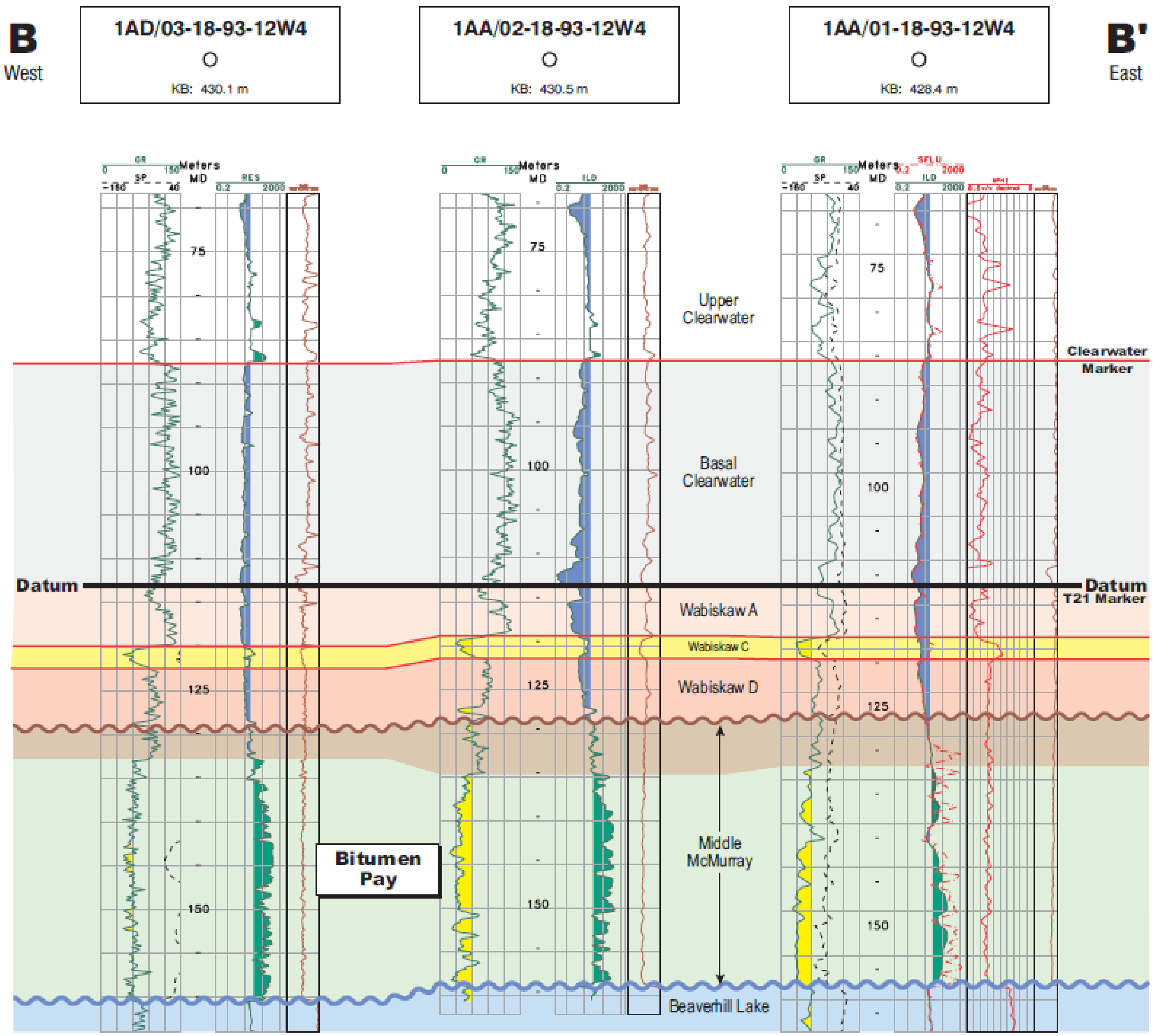
North-south cross section through the post-Devonian strata in the UTF Area

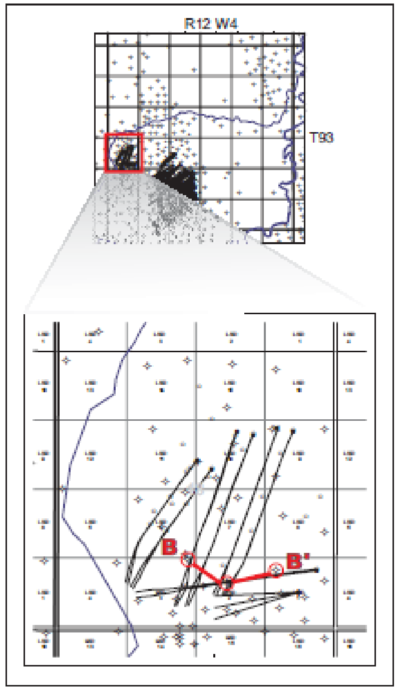
Geology and Geoscience



Year: 2008

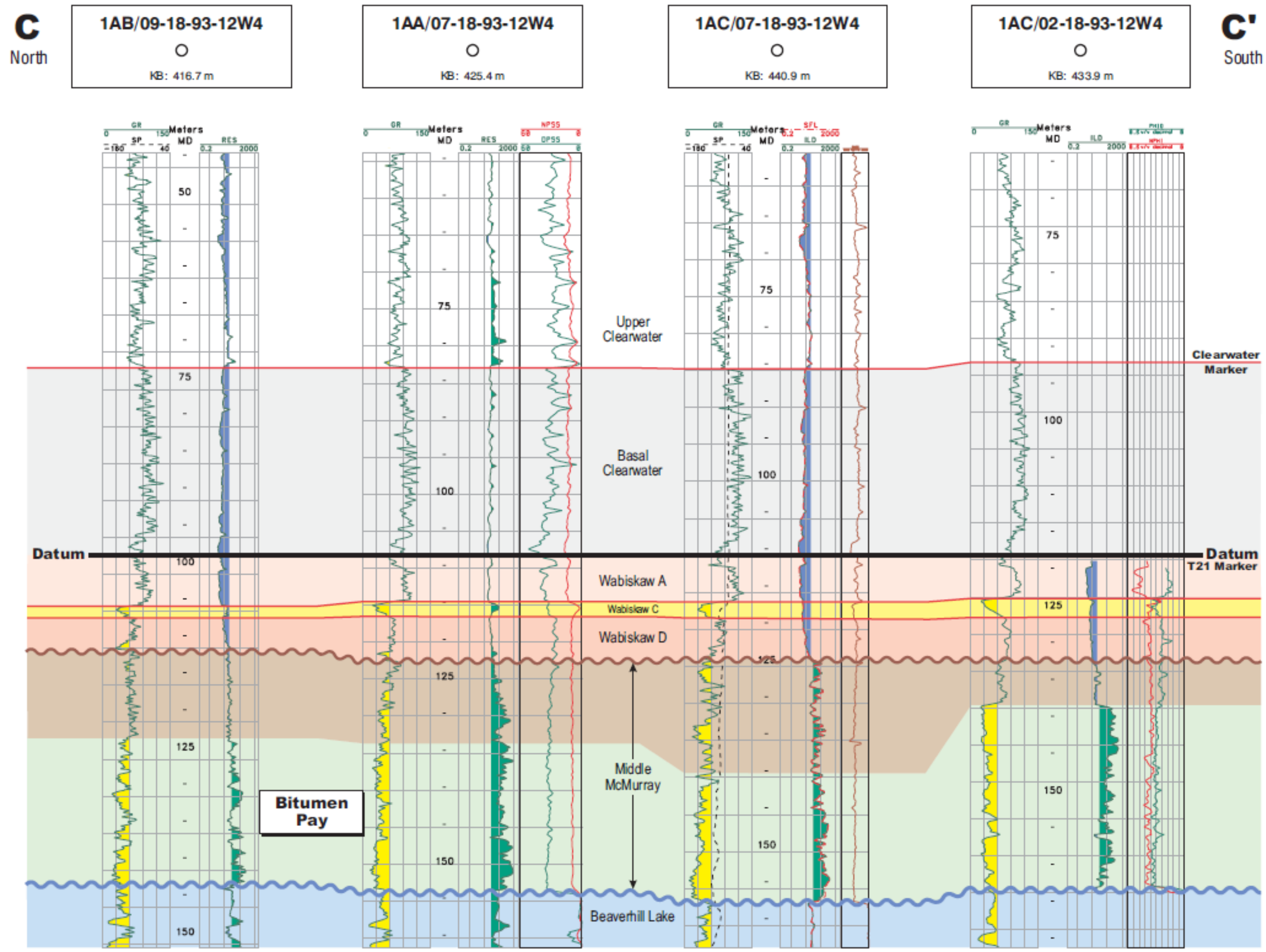
Geology and Geoscience

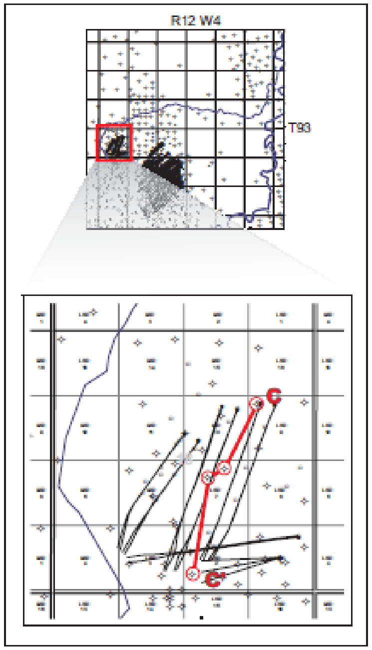




Year: 2008

Geology and Geoscience





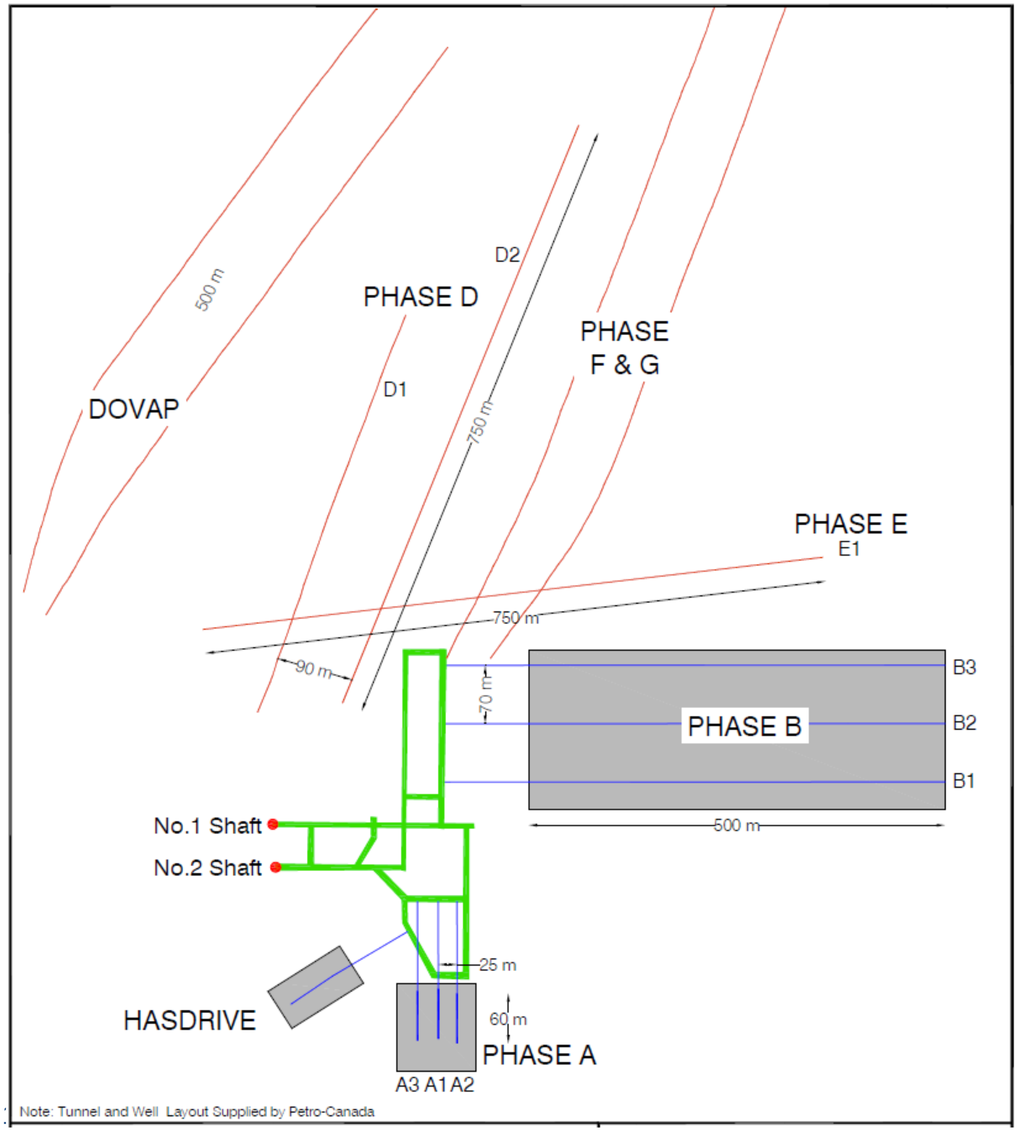
Year: 2008

Hydrostratigraphy of UTF Site

Stratigraphy		Composition	↓	Hydrostratigraphy	Water Quality
Glacial		Till, clay, sand, silt	3 to 25	Variable K	Variable/Fresh Water
Upper Clearwater		Lithic sand and sandstone Shale and siltstone	30 to 52	K~ $1x10^{-7}$ m/s	Fresh Water
Clearwater		Thick claystones interbedded with siltstone, sands and sanstone	65 to 75	Aquitard K= $5x10^{-9}$ m/s	Fresh Water: TDS 1500 to 5,500 mg/l
Clearwater	Wabiskaw	sandstone	~3	K~ $4x10^{-5}$ m/s	Saline: TDS 11,000 to 24,200 mg/l
Clearwater	Wabiskaw	shale	~10	K~$x10^{-10}$ m/s	
McMurray		Quartzose sand with heavy oil	30 to 35	Aquitard K~$1x10^{-10}$ m/s	Saline: TDS 32,000 to 36,500 mg/l
Waterways		Devonian Limestone	> 115	Aquitard K~$1x10^{-10}$ m/s	Saline TDS ~ 22,000 mg/l

Source: 2010 Approved Dover UTF Mine Abandonment Plan

Dover Shafts, Tunnels, and Well Layout

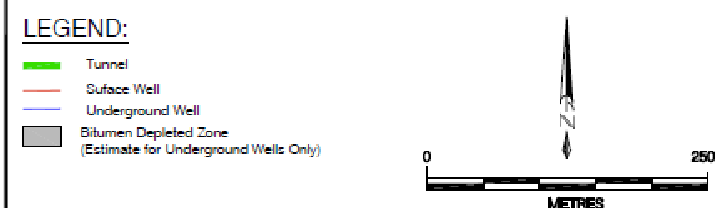


UTF Wells:

- Phase A – 3 well pairs (A1, A2, and A3)
- HASDrive – 1 well pair (CH and CP)
- Phase B – 3 well pairs (B1, B2, and B3)

Surface Wells:

- Phase D, E, F, G and DOVAP



Source: 2010 Approved Dover UTF Mine Abandonment Plan

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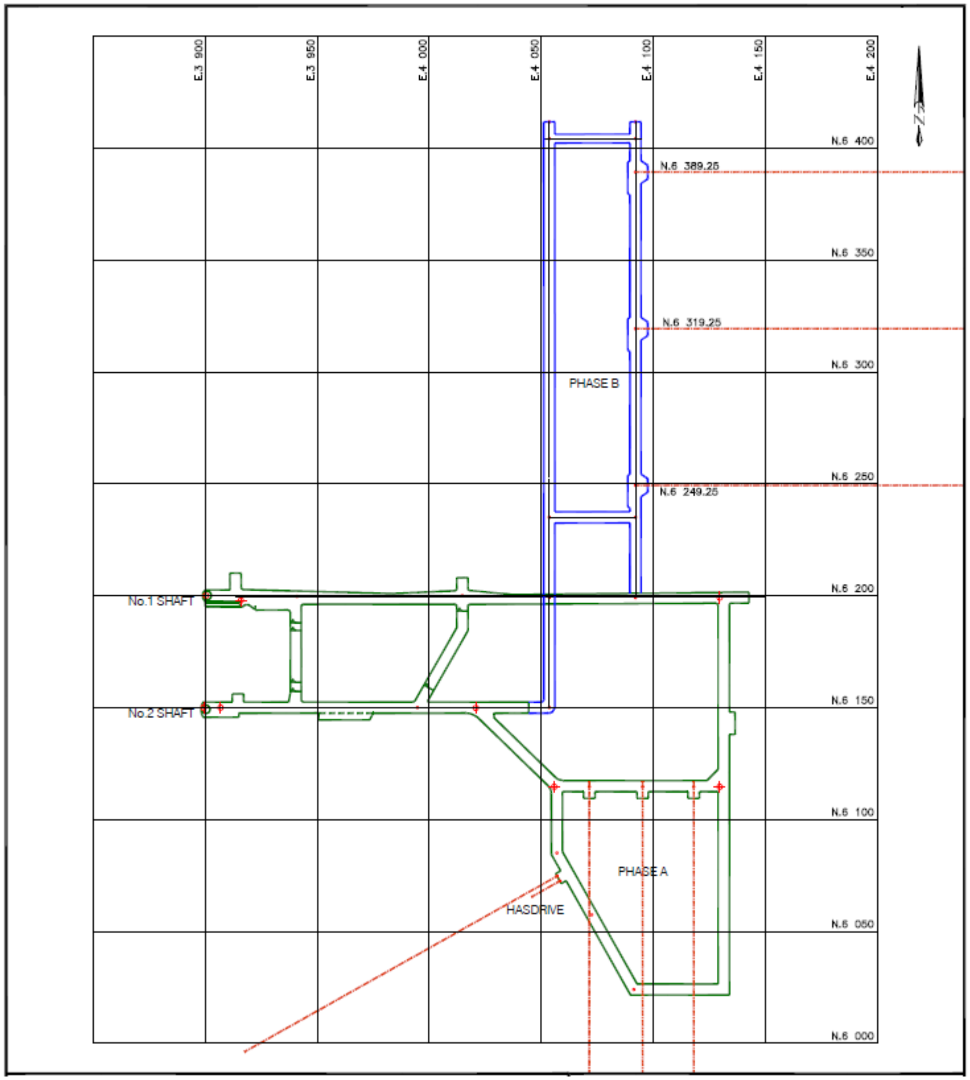
UTF Construction

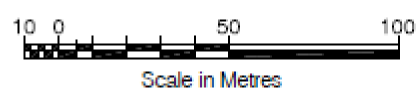


Underground Facility:

- Two vertical shafts provided access to tunnels in the limestone that host the well chambers
- Well-pairs were drilled horizontally upwards into the reservoir
- Surface facilities and infrastructure were required to support UTF
  - Access, ventilation, and production services

LEGEND:

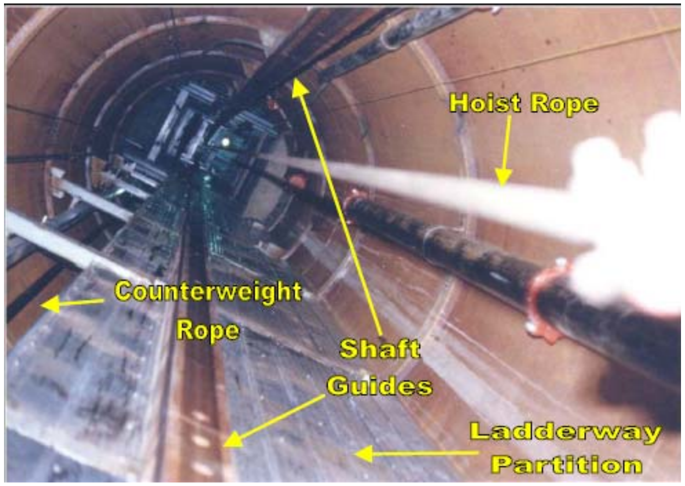
- Phase A and HAS Drive
- Phase B
- Underground Well



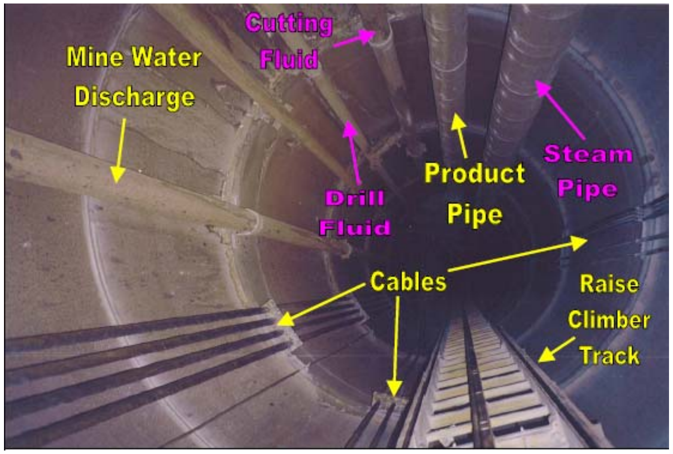
UTF Shafts

- Two 4 m diameter shafts drilled in 1985 to a depth of 223 m and finished with 3 m diameter steel hydrostatic lining installed to depth of 213 m
- No. 1 Shaft provided the main access
  - equipped with a single rope hoist with cage and counterweight
  - emergency ladder-way
  - services for power and communications
- No. 2 Shaft was the main bitumen production shaft
  - equipped with rise chamber
  - various pipelines, electrical power and communication cables
  - return air shaft with exhausting ventilation by two axial-flow fans

No. 1 Shaft

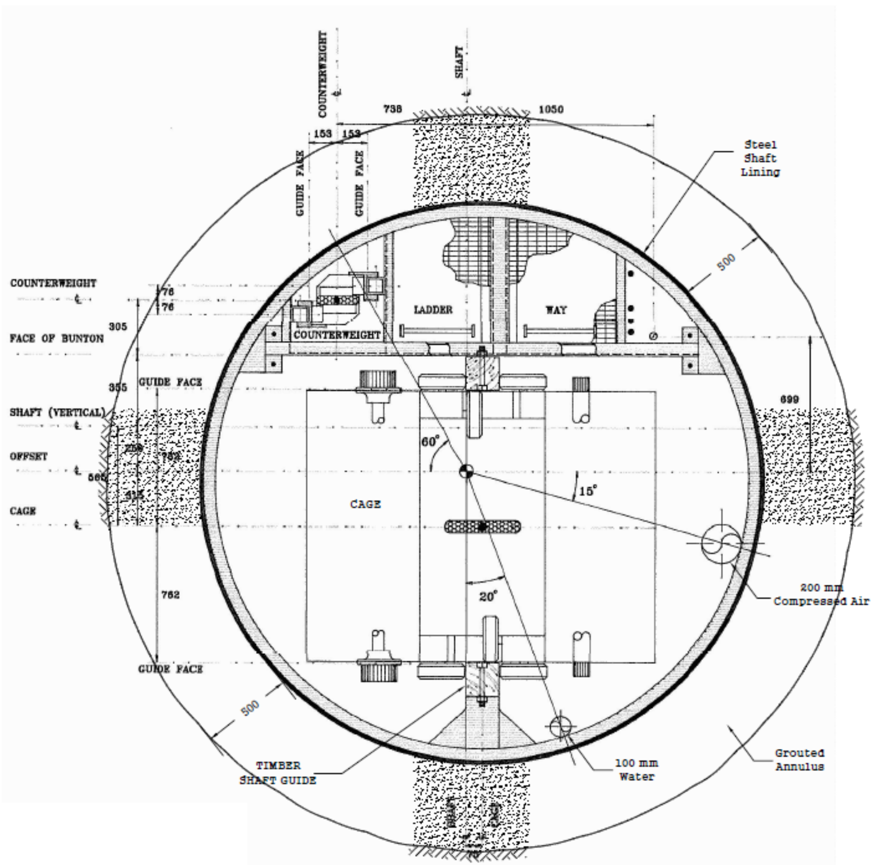


No. 2 Shaft

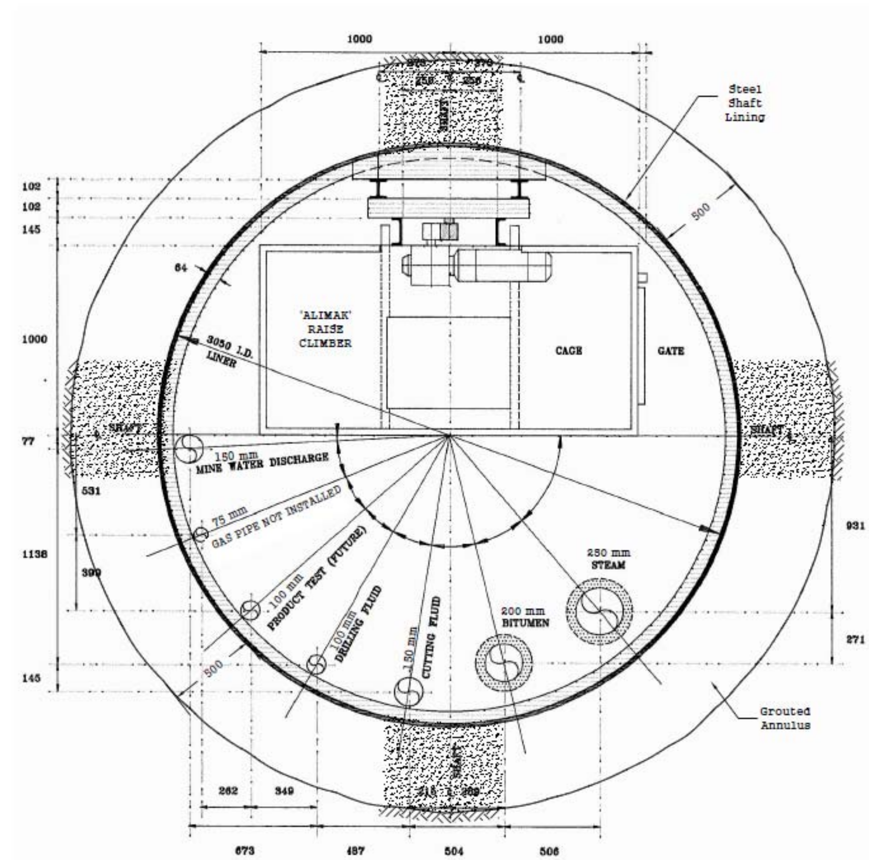


UTF Shafts Continued

No. 1 Shaft General Arrangement Cross Section



No. 2 Shaft General Arrangement Cross Section



Source: 2010 Approved Dover UTF Mine Abandonment Plan

UTF Tunnels

- Total of ~ 1.5 km of rectangular tunnels (5 m wide by 4 m high) developed using the drill and blast method of mining
- Tunnels were constructed in competent limestone about 15 m below the McMurray Formation
  - Limestone roof with rock bolts were installed for stability
- Layer of shotcrete was applied to the sides in sections of the tunnels for durability
  - Painted white to improve reflectivity
- Tunnels remained stable for over 24 years without additional support required

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UTF SAGD Wells

Phase A:

- Consisted of 3 well-pairs (A1, A2, and A3) - operated from 1987 to 1990
- Pilot test of the SAGD Process
- Produced 20,600 m^3 (~130,000 barrels) of bitumen

HASDrive:

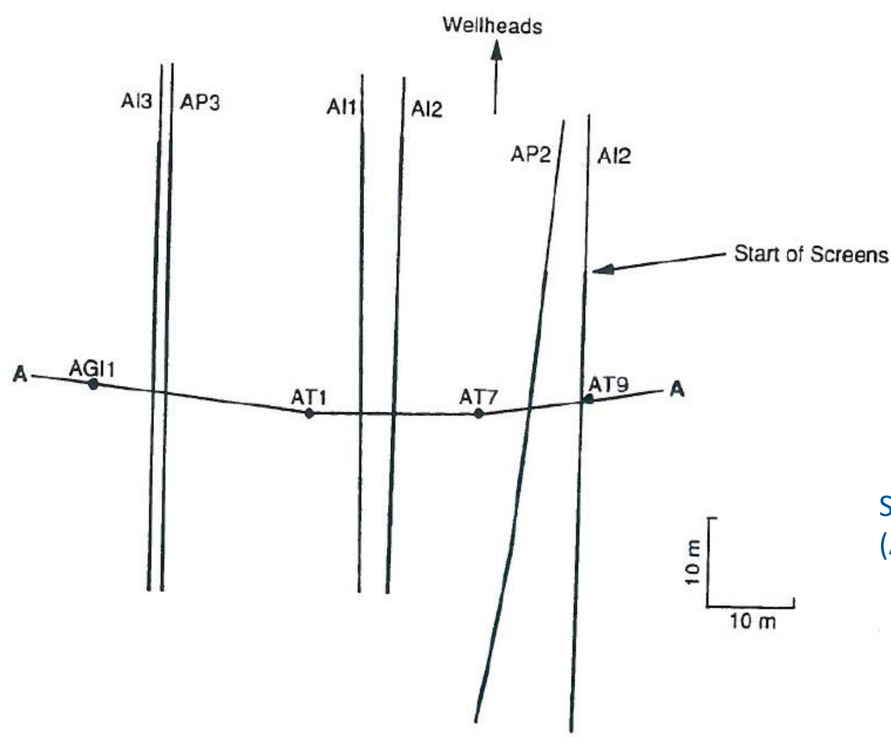
- Chevron patented HASDrive (Heated Annulus Steam Drive) process tested at UTF from 1987 to 1989
- Two underground horizontal wells (CH and CP) and one surface injection well (CI)
- Production unpublished

Phase B:

- Consisted of 3 well-pairs (B1, B2, and B3) – operated from 1990 to 2004
- Test to prove SADG process on commercial scale
- Produced 696,000 m^3 (~4.4 Mbbl) of bitumen

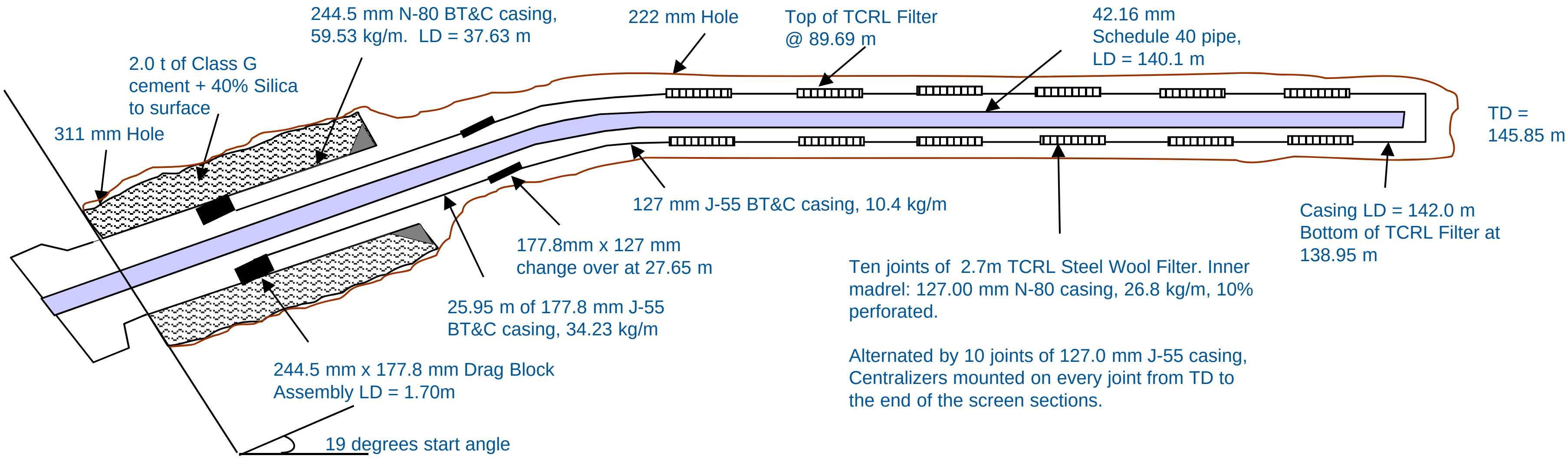
Phase A – Drilling and Completions

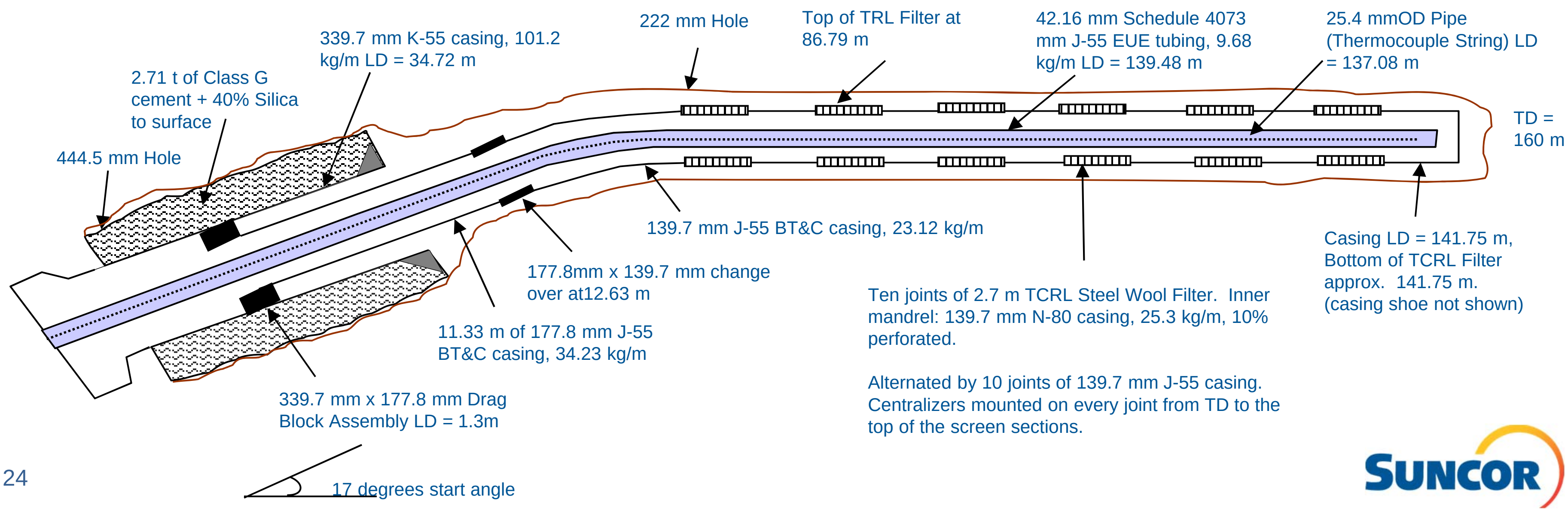
- Three horizontal well-pairs (A1, A2, and A3) were drilled in 1987 and shut-in in 1990
- The six wells were 160 m long with a 60 m horizontal section completed in the oil sands
- Wells were drilled in pairs with steam injection well 5 m above the production well
- Three pairs spaced 25 m apart
- Achieved recovery of ~ 53% of original bitumen in place (OBIP)



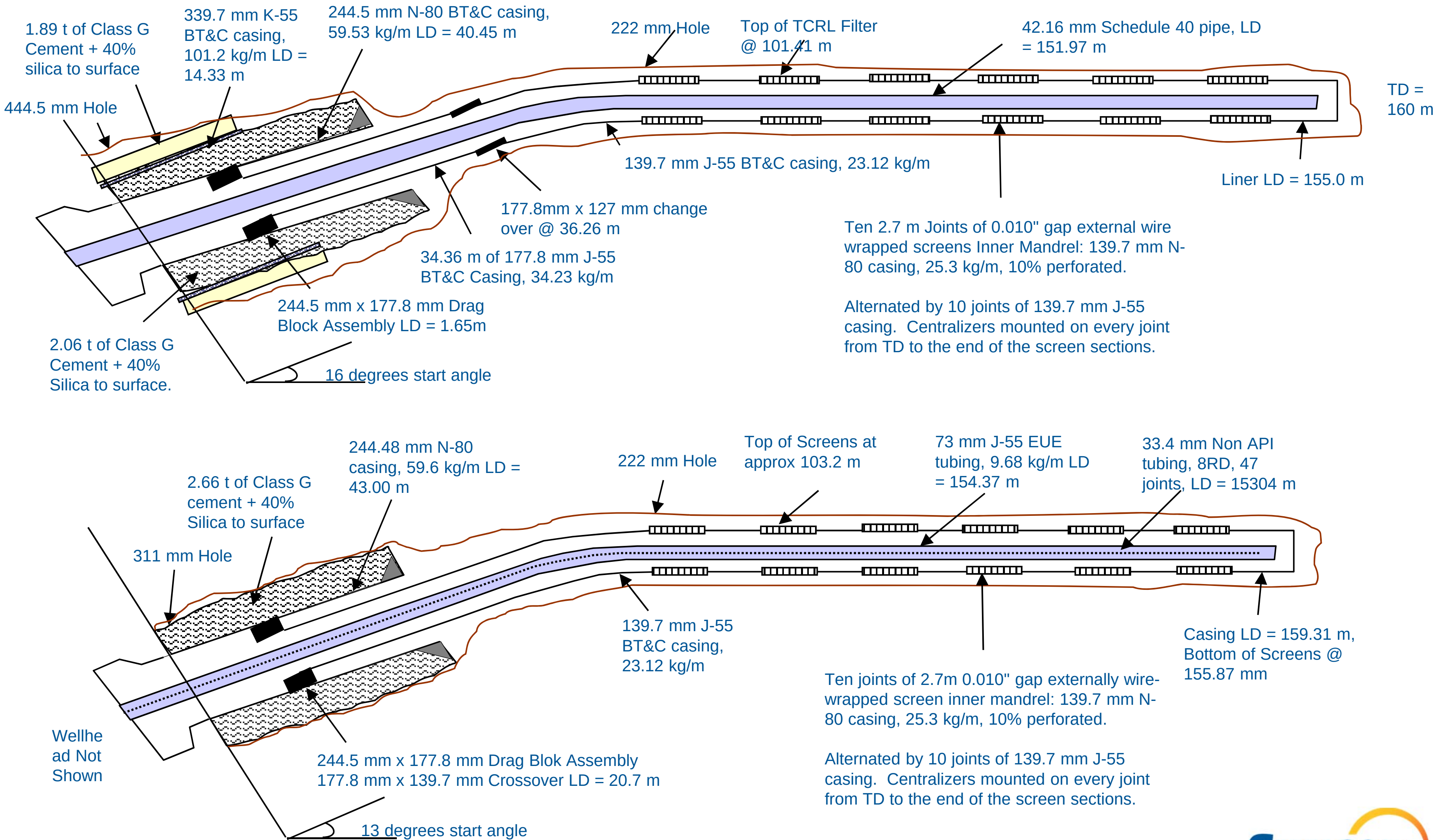
Source: UTF Phase A Summary Report (AOSTRA, 1991)

A1 Well Pair


244.5 mm N-80 BT&C casing, 59.53 kg/m. LD = 37.63 m
222 mm Hole
Top of TCRL Filter @ 89.69 m
42.16 mm Schedule 40 pipe, LD = 140.1 m
2.0 t of Class G cement + 40% Silica to surface
311 mm Hole
TD = 145.85 m
127 mm J-55 BT&C casing, 10.4 kg/m
Casing LD = 142.0 m Bottom of TCRL Filter at 138.95 m
177.8mm x 127 mm change over at 27.65 m
Ten joints of 2.7m TCRL Steel Wool Filter. Inner madrel: 127.00 mm N-80 casing, 26.8 kg/m, 10% perforated.
25.95 m of 177.8 mm J-55 BT&C casing, 34.23 kg/m
Alternated by 10 joints of 127.0 mm J-55 casing, Centralizers mounted on every joint from TD to the end of the screen sections.
244.5 mm x 177.8 mm Drag Block Assembly LD = 1.70m
19 degrees start angle

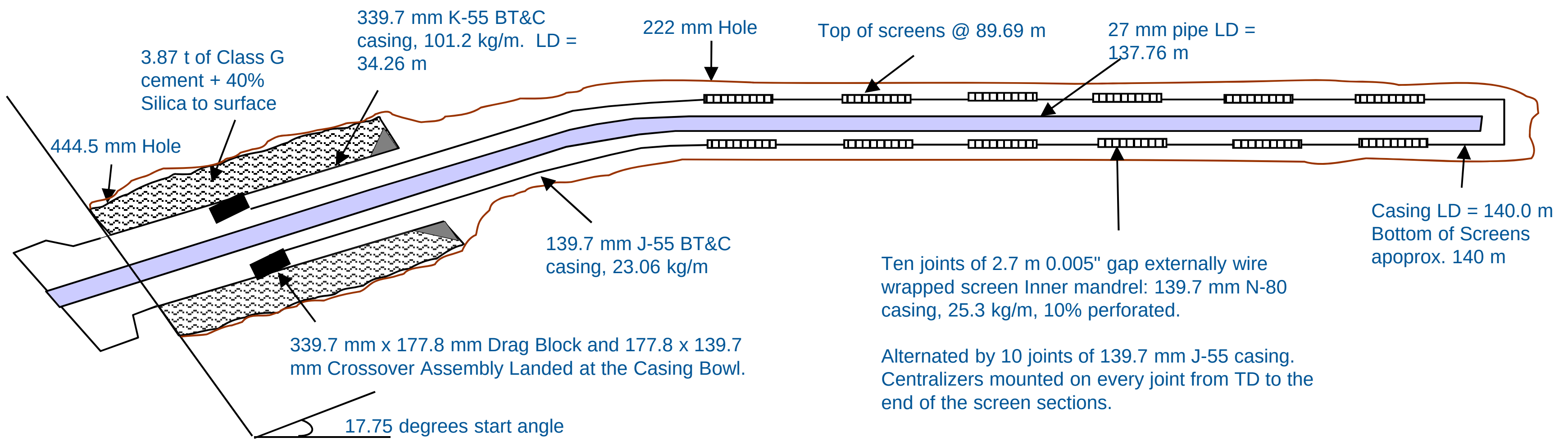

222 mm Hole
Top of TRL Filter at 86.79 m
42.16 mm Schedule 4073 mm J-55 EUE tubing, 9.68 kg/m LD = 139.48 m
25.4 mmOD Pipe (Thermocouple String) LD = 137.08 m
339.7 mm K-55 casing, 101.2 kg/m LD = 34.72 m
2.71 t of Class G cement + 40% Silica to surface
444.5 mm Hole
TD = 160 m
139.7 mm J-55 BT&C casing, 23.12 kg/m
Casing LD = 141.75 m, Bottom of TCRL Filter approx. 141.75 m. (casing shoe not shown)
177.8mm x 139.7 mm change over at12.63 m
Ten joints of 2.7 m TCRL Steel Wool Filter. Inner mandrel: 139.7 mm N-80 casing, 25.3 kg/m, 10% perforated.
11.33 m of 177.8 mm J-55 BT&C casing, 34.23 kg/m
Alternated by 10 joints of 139.7 mm J-55 casing. Centralizers mounted on every joint from TD to the top of the screen sections.
339.7 mm x 177.8 mm Drag Block Assembly LD = 1.3m
17 degrees start angle

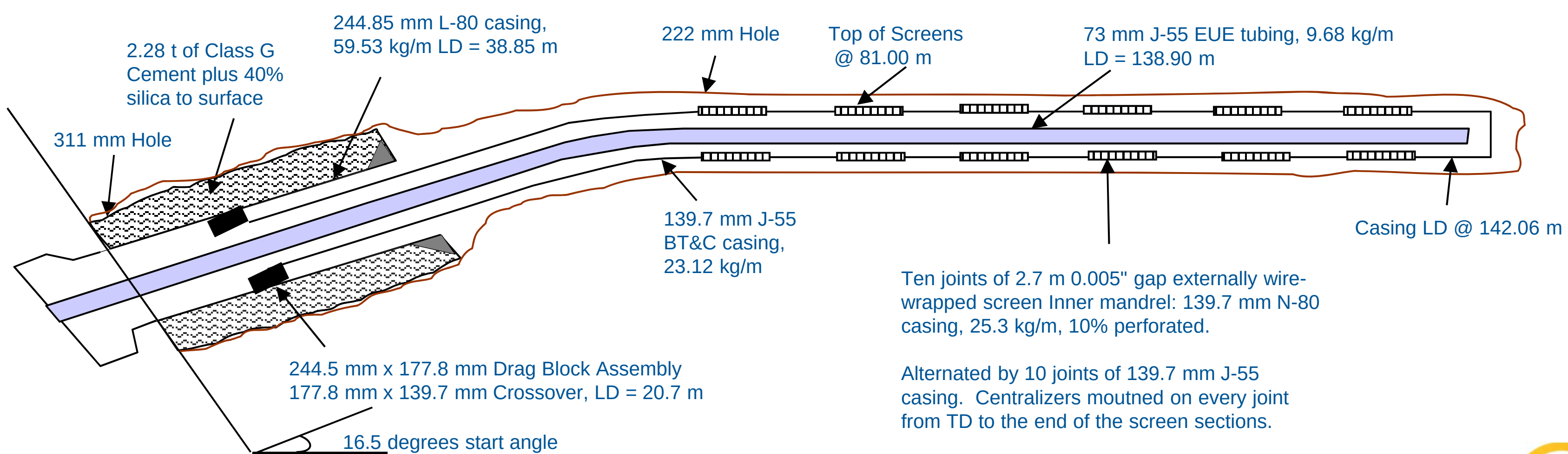
A2 Well Pair



1.89 t of Class G Cement + 40% silica to surface
339.7 mm K-55 BT&C casing, 101.2 kg/m LD = 14.33 m
244.5 mm N-80 BT&C casing, 59.53 kg/m LD = 40.45 m
222 mm Hole
Top of TCRL Filter @ 101.41 m
42.16 mm Schedule 40 pipe, LD = 151.97 m
TD = 160 m
444.5 mm Hole
139.7 mm J-55 BT&C casing, 23.12 kg/m
Liner LD = 155.0 m
177.8mm x 127 mm change over @ 36.26 m
Ten 2.7 m Joints of 0.010" gap external wire wrapped screens Inner Mandrel: 139.7 mm N-80 casing, 25.3 kg/m, 10% perforated.
34.36 m of 177.8 mm J-55 BT&C Casing, 34.23 kg/m
Alternated by 10 joints of 139.7 mm J-55 casing. Centralizers mounted on every joint from TD to the end of the screen sections.
244.5 mm x 177.8 mm Drag Block Assembly LD = 1.65m
2.06 t of Class G Cement + 40% Silica to surface.
16 degrees start angle
244.48 mm N-80 casing, 59.6 kg/m LD = 43.00 m
222 mm Hole
Top of Screens at approx 103.2 m
73 mm J-55 EUE tubing, 9.68 kg/m LD = 154.37 m
33.4 mm Non API tubing, 8RD, 47 joints, LD = 15304 m
2.66 t of Class G cement + 40% Silica to surface
311 mm Hole
139.7 mm J-55 BT&C casing, 23.12 kg/m
Casing LD = 159.31 m, Bottom of Screens @ 155.87 mm
Ten joints of 2.7m 0.010" gap externally wire-wrapped screen inner mandrel: 139.7 mm N-80 casing, 25.3 kg/m, 10% perforated.
Wellhead Not Shown
244.5 mm x 177.8 mm Drag Blok Assembly 177.8 mm x 139.7 mm Crossover LD = 20.7 m
Alternated by 10 joints of 139.7 mm J-55 casing. Centralizers mounted on every joint from TD to the end of the screen sections.
13 degrees start angle

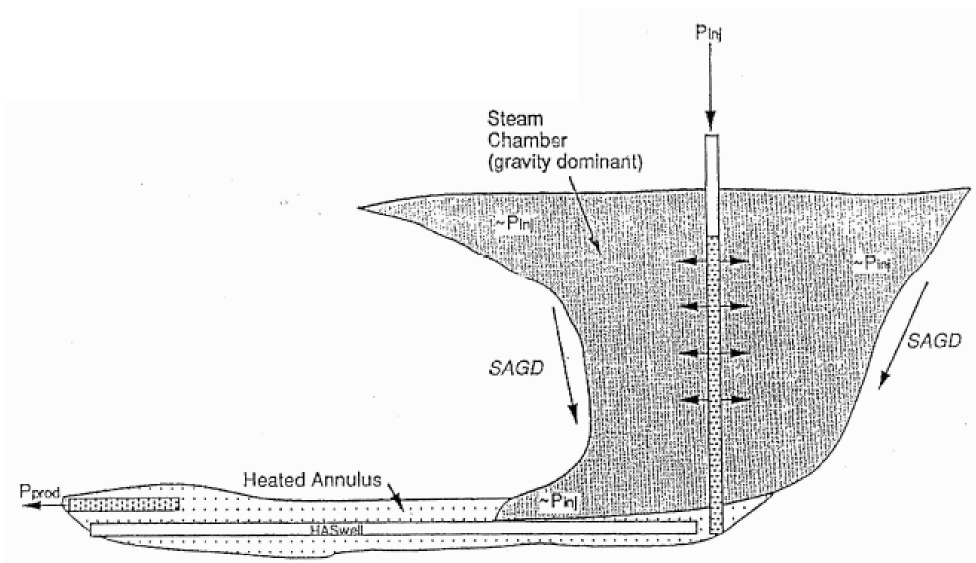
A3 Well Pair


339.7 mm K-55 BT&C casing, 101.2 kg/m. LD = 34.26 m
222 mm Hole
Top of screens @ 89.69 m
27 mm pipe LD = 137.76 m
3.87 t of Class G cement + 40% Silica to surface
444.5 mm Hole
139.7 mm J-55 BT&C casing, 23.06 kg/m
Casing LD = 140.0 m Bottom of Screens apoprox. 140 m
Ten joints of 2.7 m 0.005" gap externally wire wrapped screen Inner mandrel: 139.7 mm N-80 casing, 25.3 kg/m, 10% perforated.
Alternated by 10 joints of 139.7 mm J-55 casing. Centralizers mounted on every joint from TD to the end of the screen sections.
339.7 mm x 177.8 mm Drag Block and 177.8 x 139.7 mm Crossover Assembly Landed at the Casing Bowl.
17.75 degrees start angle

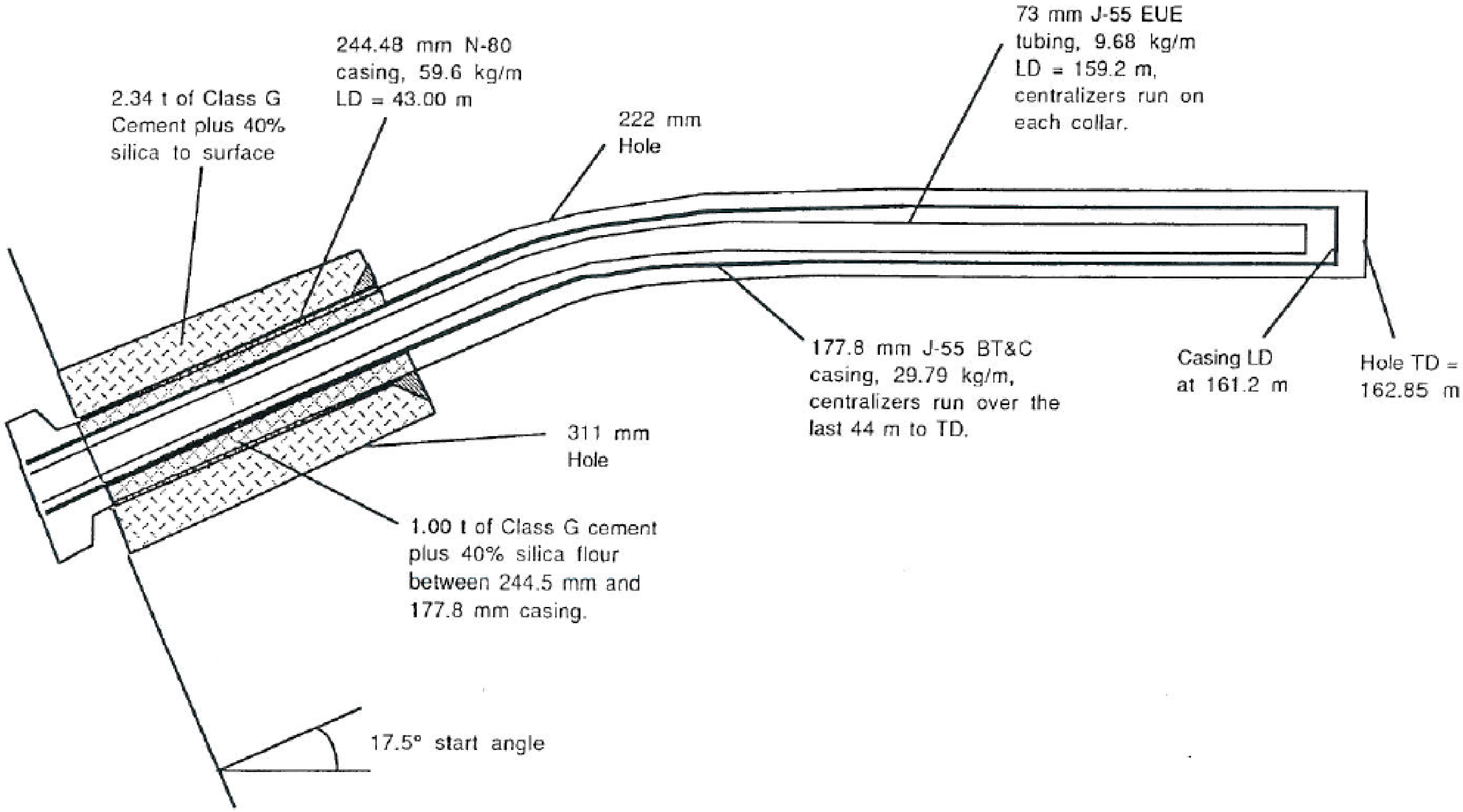

244.85 mm L-80 casing, 59.53 kg/m LD = 38.85 m
222 mm Hole
Top of Screens @ 81.00 m
73 mm J-55 EUE tubing, 9.68 kg/m LD = 138.90 m
2.28 t of Class G Cement plus 40% silica to surface
311 mm Hole
139.7 mm J-55 BT&C casing, 23.12 kg/m
Casing LD @ 142.06 m
Ten joints of 2.7 m 0.005" gap externally wire-wrapped screen Inner mandrel: 139.7 mm N-80 casing, 25.3 kg/m, 10% perforated.
Alternated by 10 joints of 139.7 mm J-55 casing. Centralizers moutned on every joint from TD to the end of the screen sections.
244.5 mm x 177.8 mm Drag Block Assembly 177.8 mm x 139.7 mm Crossover, LD = 20.7 m
16.5 degrees start angle

Chevron HASDrive – Drilling and Completions

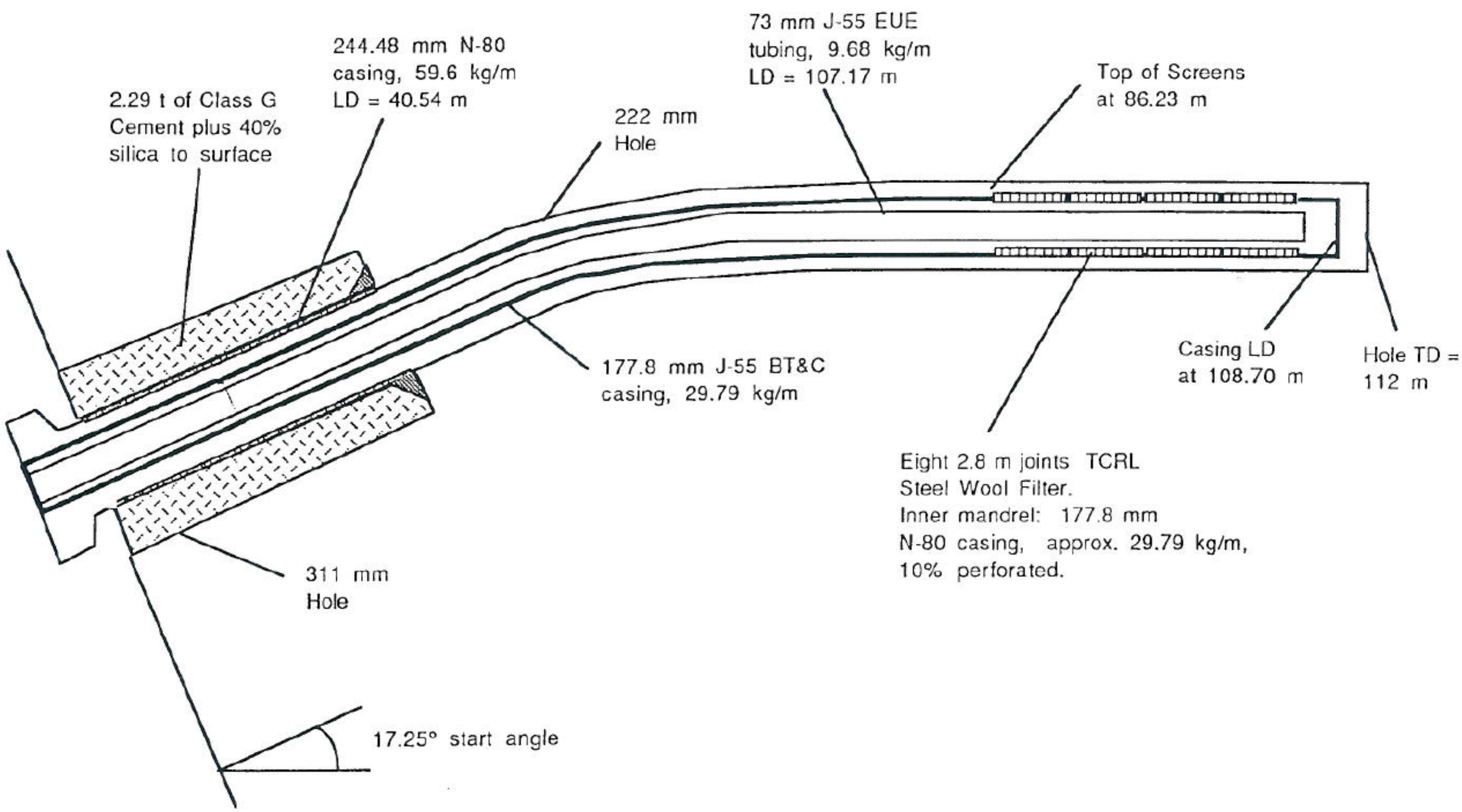
- Consisted of two horizontal underground wells (CH and CP) and one surface-drilled vertical injection well (CI)
- HASDrive process used an unperforated horizontal "pipe" (CH) placed in the reservoir to circulate steam to create a heated path between the vertical steam injection well (CI) and the horizontal production well (CP)
- There was no steam injected into the reservoir from horizontal well – only used to conduct heat into the reservoir and maintain heated flow path



HASDrive Well Pair – CH Well

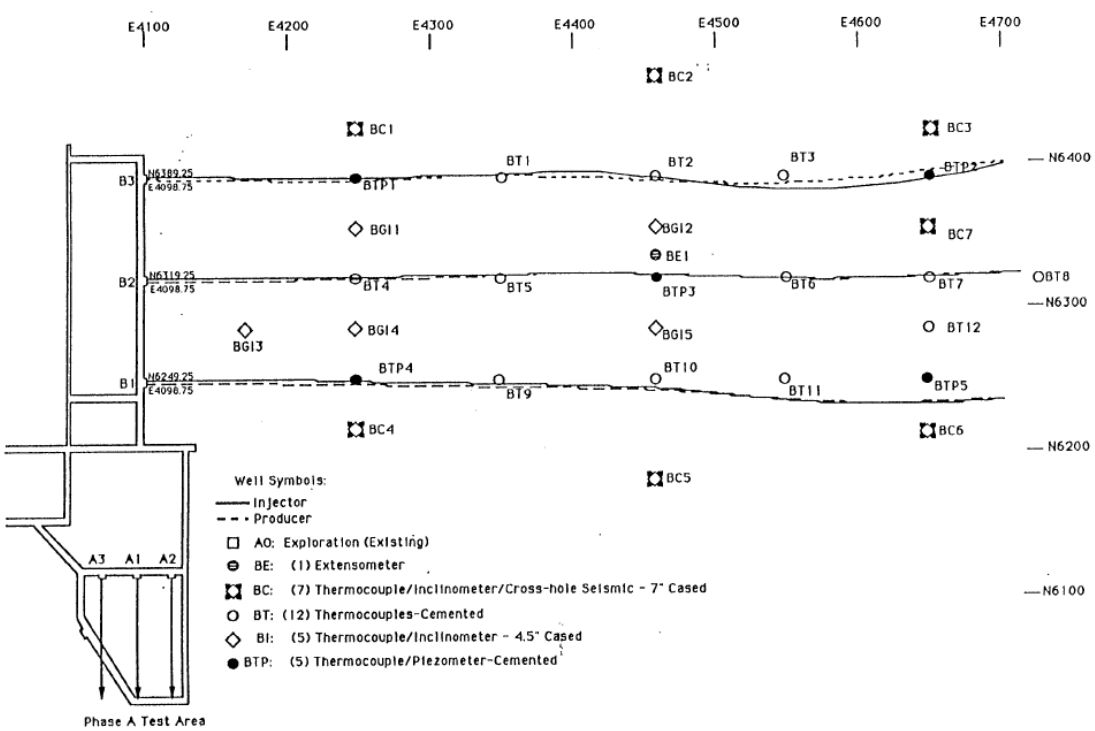


HASDrive Well Pair – CP Well

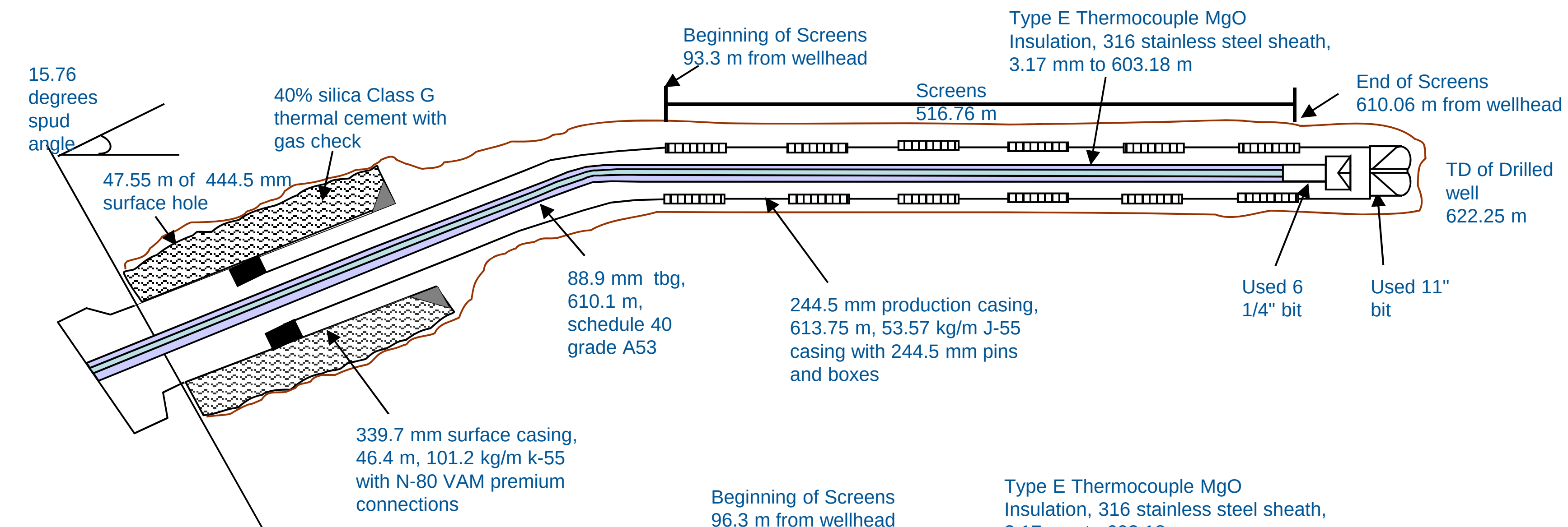


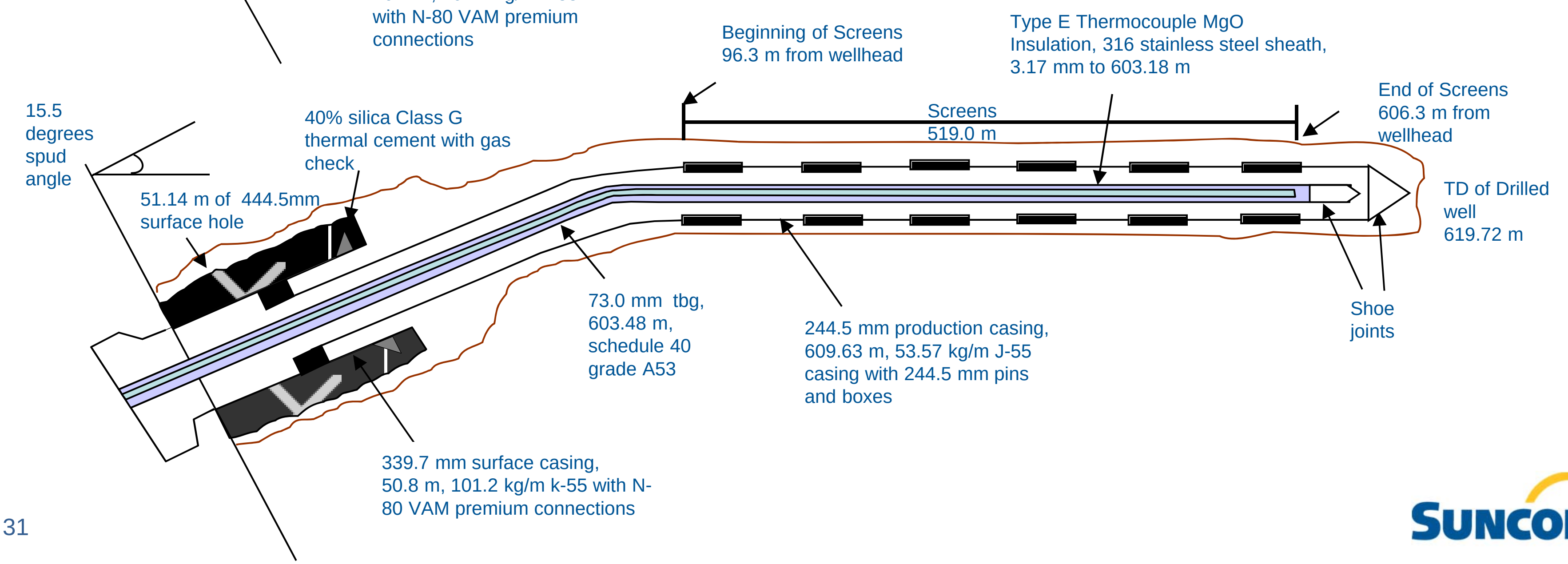
Phase B – Drilling and Completions

- Three horizontal well-pairs (B1, B2, and B3) drilled in 1990 and shut-in in 2004
- Six wells were 600 m long with a 500 m horizontal section completed in the oil sands
- Wells were drilled in pairs with steam injection well 5 m above the production well
- Three pairs spaced 70 m apart
- B1 well-pair achieved recovery of ~ 55% OBIP
- B2 well-pair achieved recovery of ~ 90% OBIP
- B3 well-pair achieved recovery of ~ 51% OBIP

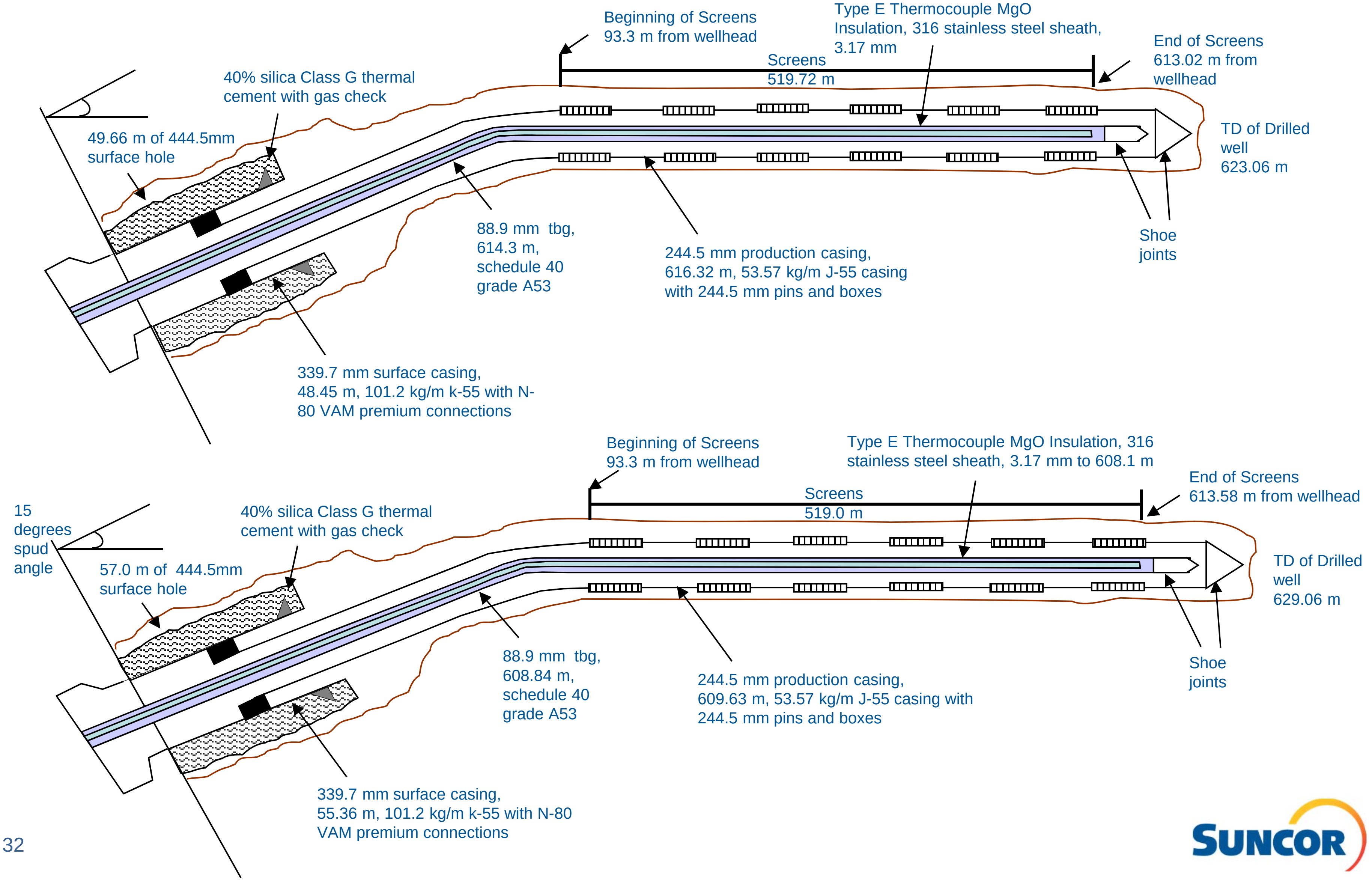


B1 Well Pair


15.76 degrees spud angle
40% silica Class G thermal cement with gas check
47.55 m of 444.5 mm surface hole
Beginning of Screens 93.3 m from wellhead
Type E Thermocouple MgO Insulation, 316 stainless steel sheath, 3.17 mm to 603.18 m
Screens 516.76 m
End of Screens 610.06 m from wellhead
TD of Drilled well 622.25 m
88.9 mm tbg, 610.1 m, schedule 40 grade A53
244.5 mm production casing, 613.75 m, 53.57 kg/m J-55 casing with 244.5 mm pins and boxes
Used 6 1/4" bit
Used 11" bit
339.7 mm surface casing, 46.4 m, 101.2 kg/m k-55 with N-80 VAM premium connections

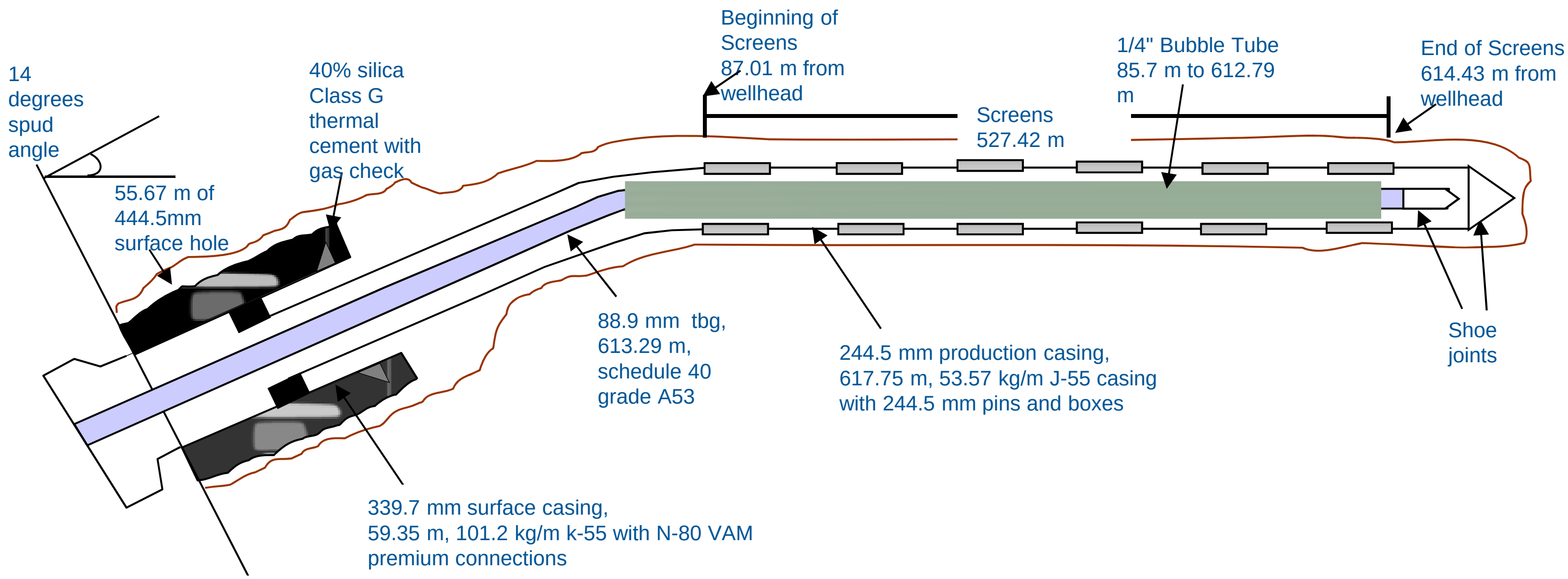

15.5 degrees spud angle
40% silica Class G thermal cement with gas check
51.14 m of 444.5mm surface hole
Beginning of Screens 96.3 m from wellhead
Type E Thermocouple MgO Insulation, 316 stainless steel sheath, 3.17 mm to 603.18 m
Screens 519.0 m
End of Screens 606.3 m from wellhead
TD of Drilled well 619.72 m
73.0 mm tbg, 603.48 m, schedule 40 grade A53
244.5 mm production casing, 609.63 m, 53.57 kg/m J-55 casing with 244.5 mm pins and boxes
Shoe joints
339.7 mm surface casing, 50.8 m, 101.2 kg/m k-55 with N-80 VAM premium connections

B2 Well Pair



Beginning of Screens
93.3 m from wellhead
Type E Thermocouple MgO Insulation, 316 stainless steel sheath, 3.17 mm
Screens
519.72 m
End of Screens
613.02 m from wellhead
40% silica Class G thermal cement with gas check
49.66 m of 444.5mm surface hole
TD of Drilled well
623.06 m
88.9 mm tbg, 614.3 m, schedule 40 grade A53
244.5 mm production casing, 616.32 m, 53.57 kg/m J-55 casing with 244.5 mm pins and boxes
Shoe joints
339.7 mm surface casing, 48.45 m, 101.2 kg/m k-55 with N-80 VAM premium connections
Beginning of Screens
93.3 m from wellhead
Type E Thermocouple MgO Insulation, 316 stainless steel sheath, 3.17 mm to 608.1 m
Screens
519.0 m
End of Screens
613.58 m from wellhead
15 degrees spud angle
40% silica Class G thermal cement with gas check
57.0 m of 444.5mm surface hole
TD of Drilled well
629.06 m
88.9 mm tbg, 608.84 m, schedule 40 grade A53
244.5 mm production casing, 609.63 m, 53.57 kg/m J-55 casing with 244.5 mm pins and boxes
Shoe joints
339.7 mm surface casing, 55.36 m, 101.2 kg/m k-55 with N-80 VAM premium connections

B3 Well Pair



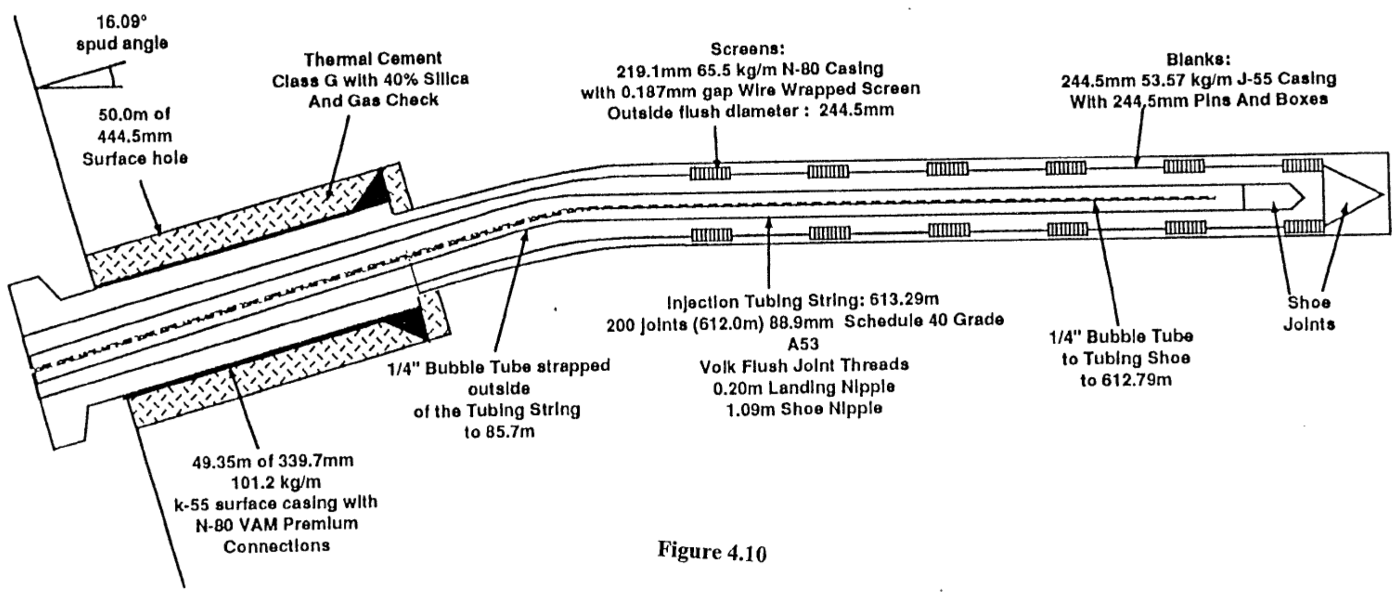
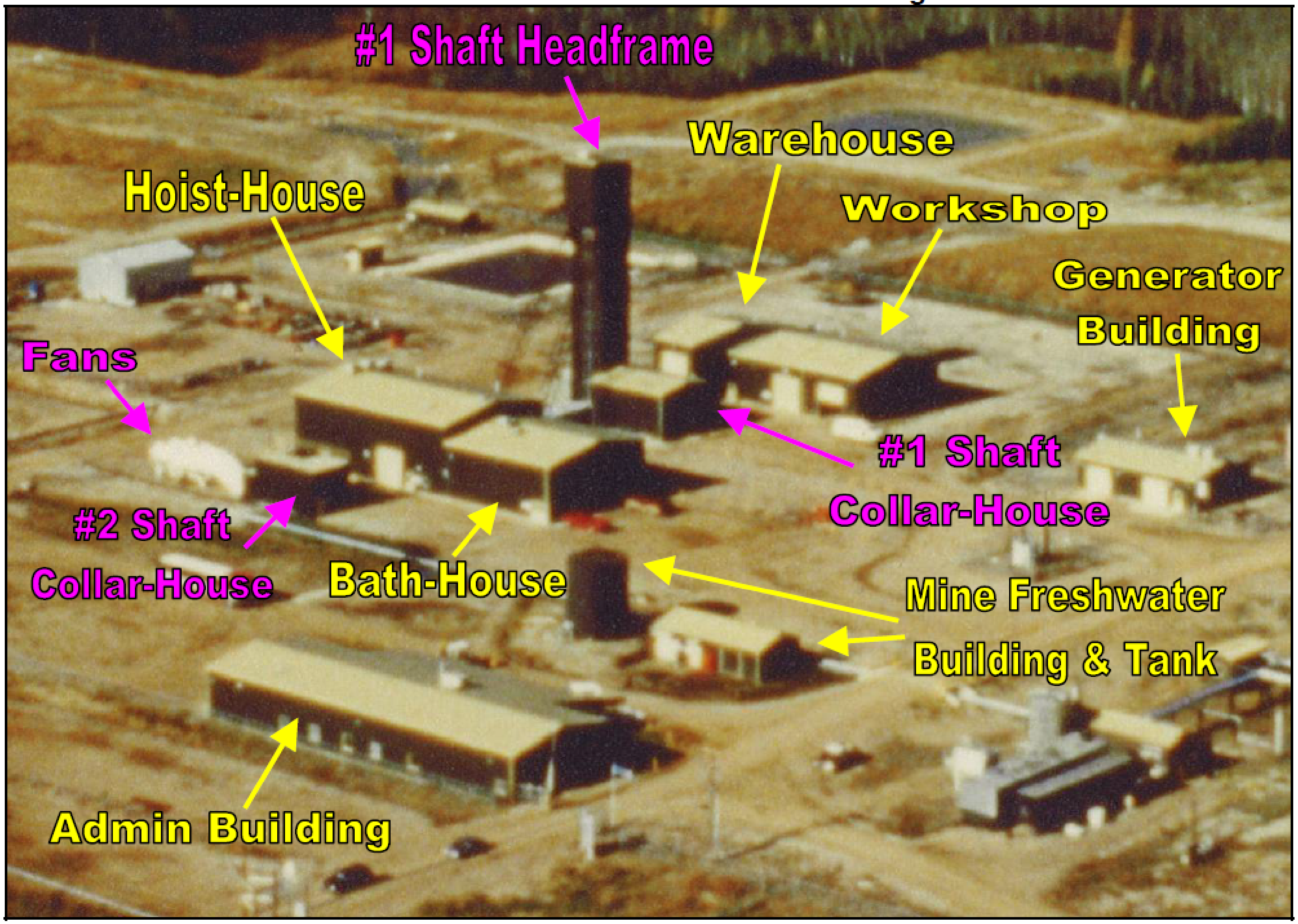


Figure 4.10

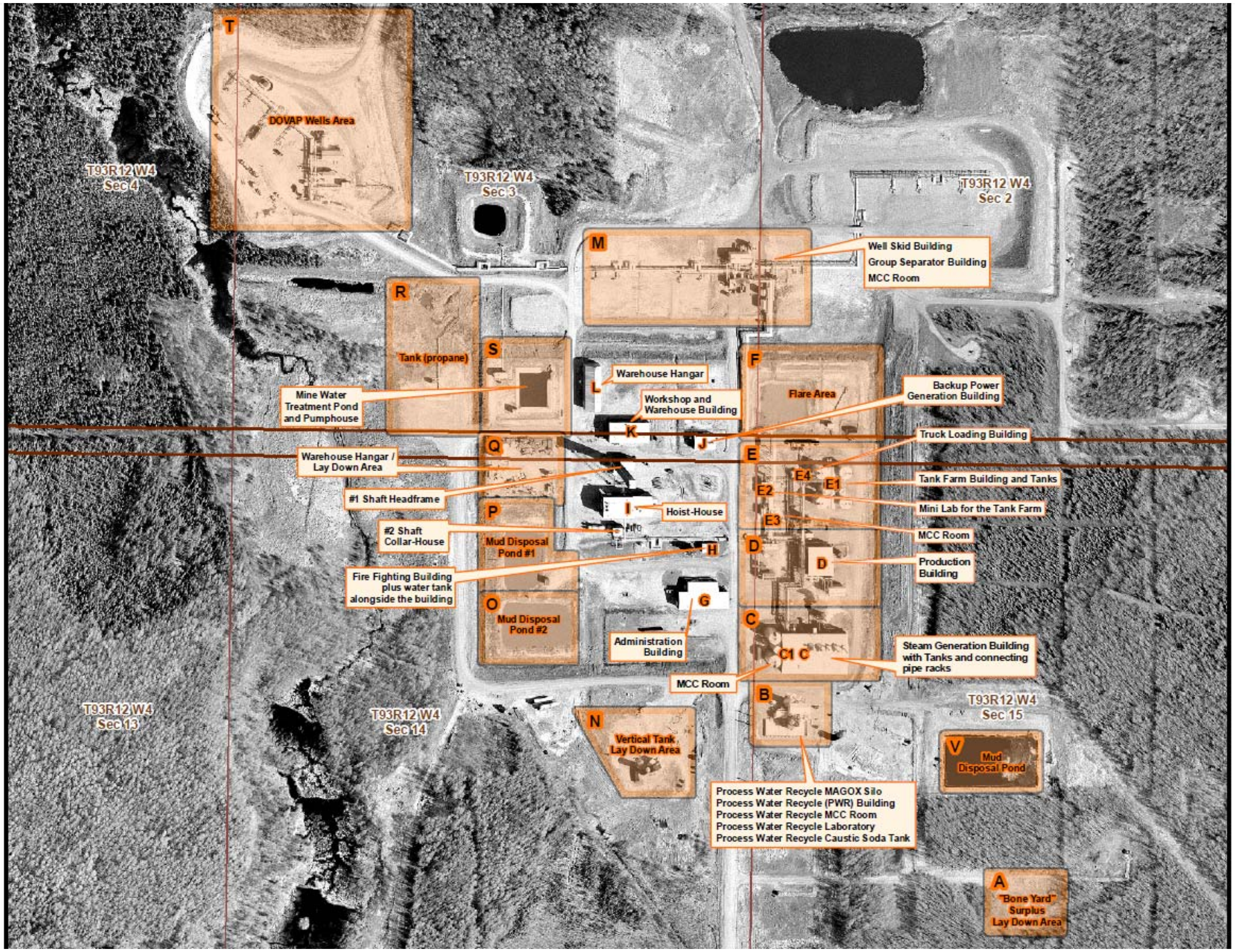
UTF Surface Facilities

Aerial View of Dover UTF Shaft Buildings



Source: 2010 Approved Dover UTF Mine Abandonment Plan

UTF Surface Facilities



UTF Wellhead and Shaft Locations

				Mine Grid		3TM		mASL
UWI	**Well Name**	**Dover Name**	**Licence**	**Easting**	**Northing**	**Easting**	**Northing**	**Elevation**
180/15-07-09-12W4/00		A1I	NOT LIC.	4093.4	6109.4	-55906.6	6326109.4	254.8
181/15-07-09-12W4/00		A1P	NOT LIC.	4095.2	6109.4	-55904.8	6326109.4	254.7
182/15-07-09-12W4/00		A2I	NOT LIC.	4119.1	6108.5	-55880.9	6326108.5	255.0
183/15-07-09-12W4/00		A2P	NOT LIC.	4117.2	6108.5	-55882.8	6326108.5	254.6
184/15-07-09-12W4/00		A3I	NOT LIC.	4069.1	6109.1	-55930.9	6326109.1	254.6
185/15-07-09-12W4/00		A3P	NOT LIC.	4071.7	6109.1	-55928.3	6326109.1	254.6
1AG/01-18-093-12W4/00	DEVON ET AL UTF B1I DOVER 1-18-93-12	B1I	0275248	4099	6249	-55901	6326249	256
1AK/01-18-093-12W4/00	DEVON ET AL UTF B1P DOVER 1-18-93-12	B1P	0275251	4099	6249	-55901	6326249	256
1AH/01-18-093-12W4/00	DEVON ET AL UTF B2I DOVER 1-18-93-12	B2I	0275249	4099	6319	-55901	6326319	255
1AL/01-18-093-12W4/00	DEVON ET AL UTF B2P DOVER 1-18-93-12	B2P	0275252	4099	6319	-55901	6326319	255
1AJ/01-18-093-12W4/00	DEVON ET AL UTF B3I DOVER 1-18-93-12	B3I	0275250	4099	6389	-55901	6326389	255
1AM/01-18-093-12W4/00	DEVON ET AL UTF B3P DOVER 1-18-93-12	B3P	0275253	4099	6389	-55901	6326389	255
1CH/14-07-093-12W4/00		CH	NOT LIC.	4056.7	6073.9	-55943.3	6326073.9	254.4
1CP/14-07-093-12W4/00		CP	NOT LIC.	4057.6	6072.4	-55942.4	6326072.4	254.4
No.1 Shaft (centre at bank level)				3900.1	6199.9	-56099.9	6326199.9	433
No.2 Shaft (centre at surface)				3899.3	6150.1	-56100.7	6326150.1	433

Notes:
1. 3TM coordinates are referred to Longitude 111° West of Greenwich.
2. Mine coordinates are obtained by subtracting 6,3200,000 m from the 3TM Northing and adding 60,000 m to the 3TM Easting.
3. Wellhead coordinates for Phase A and HASDrive Wellheads are to an accuracy of about ±1 m.
4. Wellhead coordinates for Phase B are estimated from geotechnical monitoring stations and are to an accuracy of about ±3 m.
5. Phase B Wells are licensed and more accurate wellhead locations are likely to be available.

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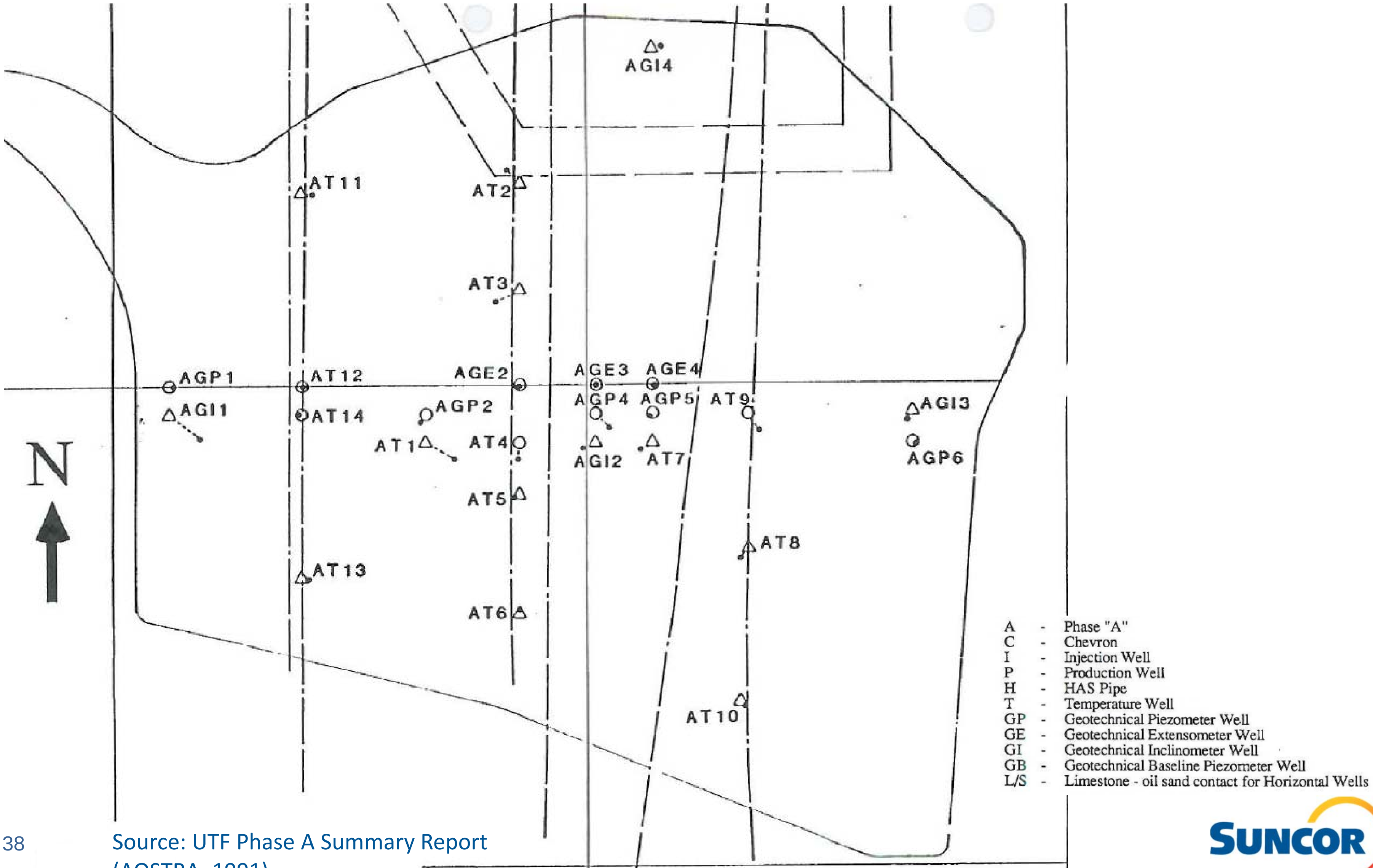
Observation Wells

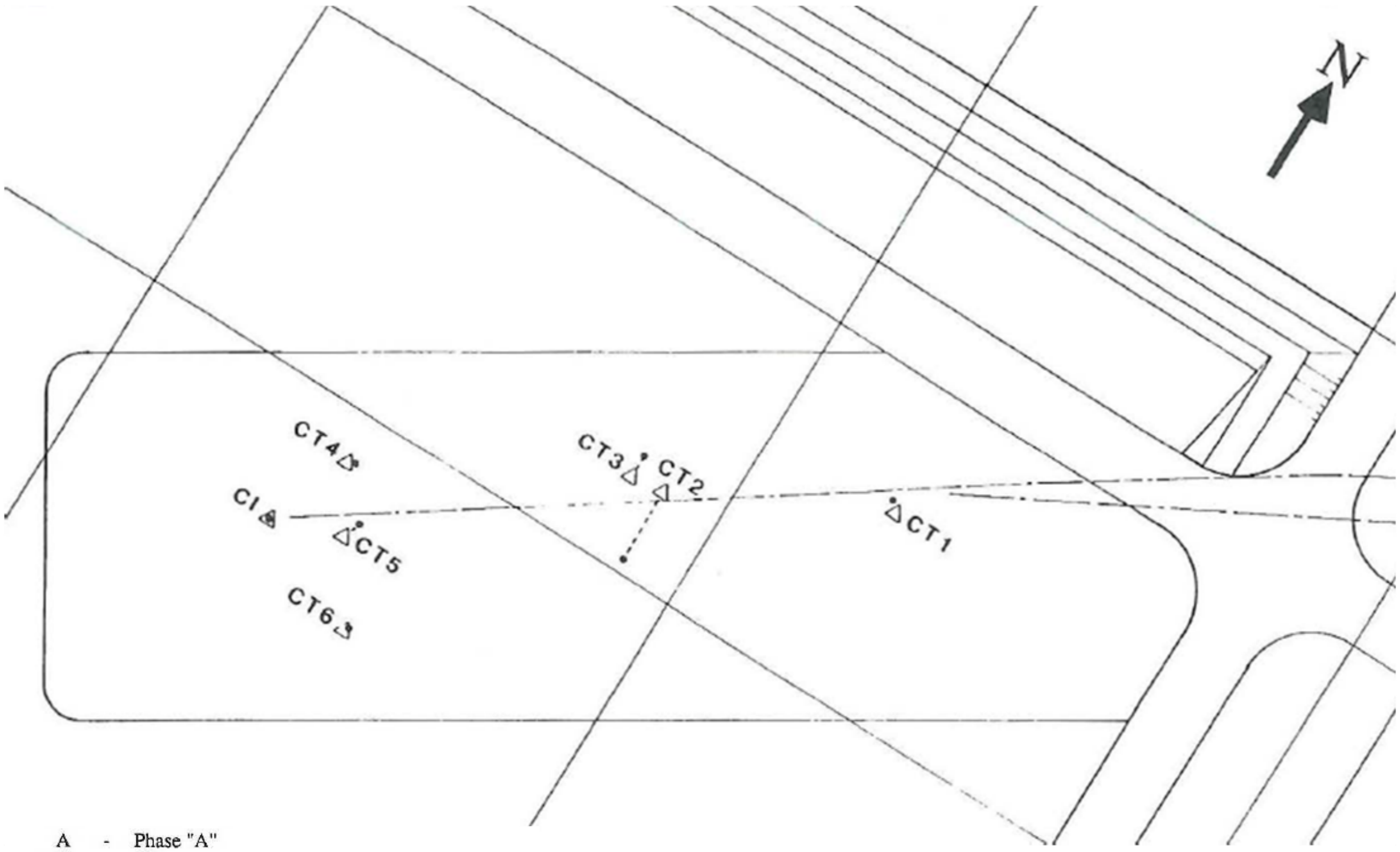
- Phase A:
  - 28 observation wells were drilled in 1987
  - 8 temperature, 4 pressure, 5 temperature/pressure, 2 baseline pressure, 3 extensometer (vertical strata movement), and 6 temperature/inclinometer (horizontal strata movement)
- HASDrive:
  - 6 observation wells were drilled in 1987
  - All 6 wells used to measure reservoir temperatures along the underground CH well
- Phase B:
  - 30 observation wells were drilled in 1991
  - 1 extensometer, 7 thermocouple/inclinometer – 7” cased, 12 thermocouple, 5 thermocouple/inclinometer – 4.5” cased, and 5 thermocouple/piezometer

Observation Well Layout – Phase A



Source: UTF Phase A Summary Report (AOSTRA, 1991)

Observation Well Layout – HASDrive



A	-	Phase "A"
C	-	Chevron
I	-	Injection Well
P	-	Production Well
H	-	HAS Pipe
T	-	Temperature Well
GP	-	Geotechnical Piezometer Well
GE	-	Geotechnical Extensometer Well
GI	-	Geotechnical Inclinometer Well
GB	-	Geotechnical Baseline Piezometer Well
L/S	-	Limestone - oil sand contact for Horizontal Wells

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Observation Well Layout – Phase B

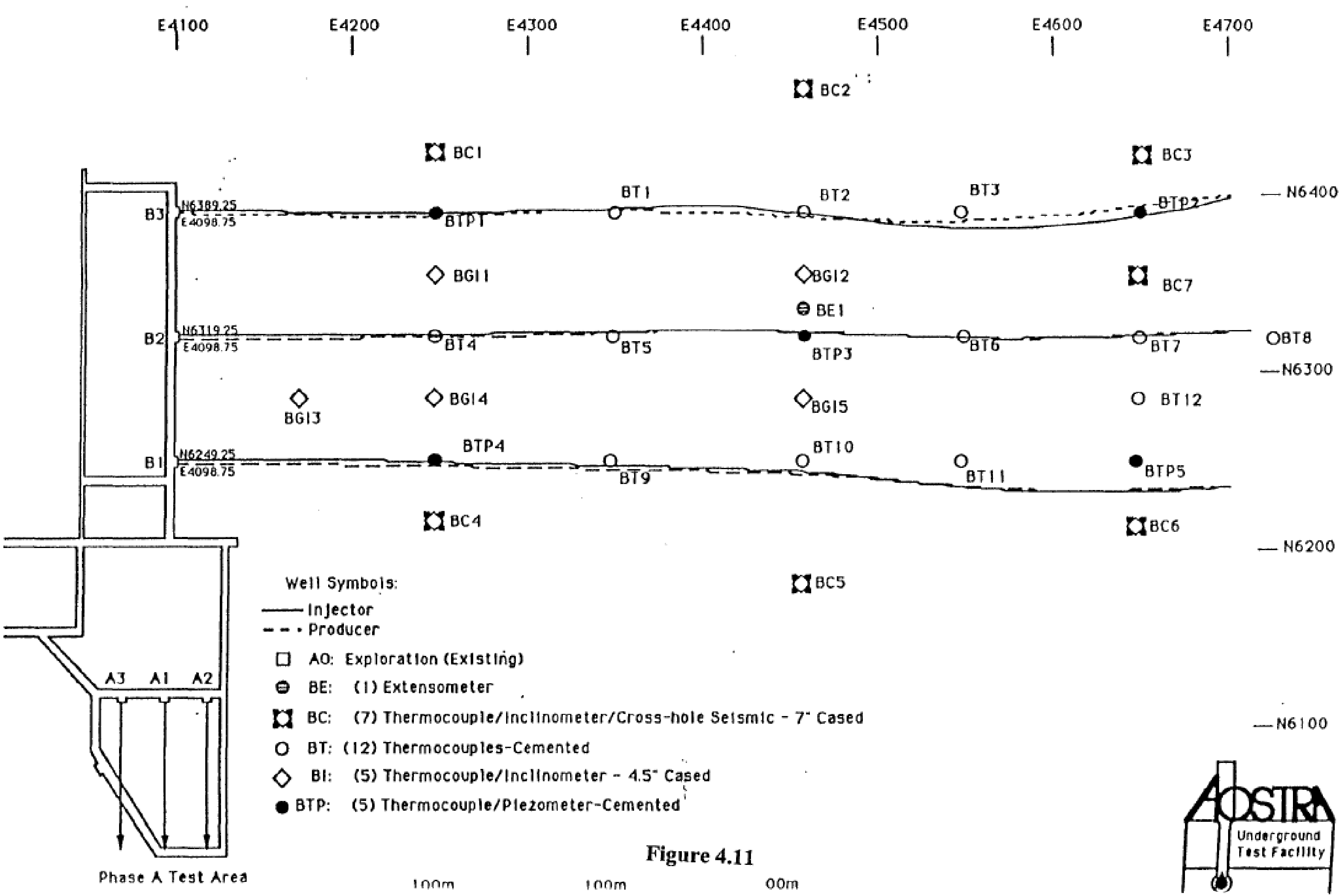
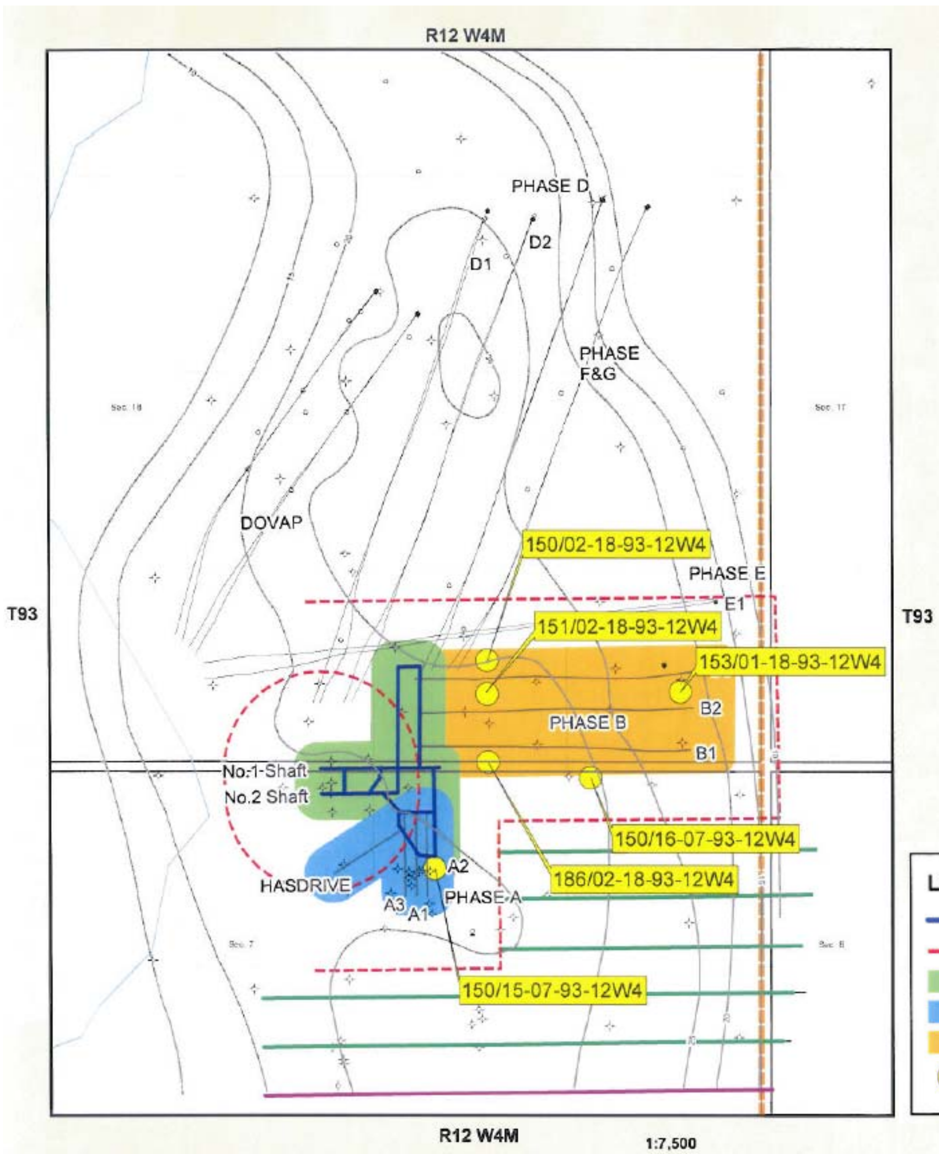


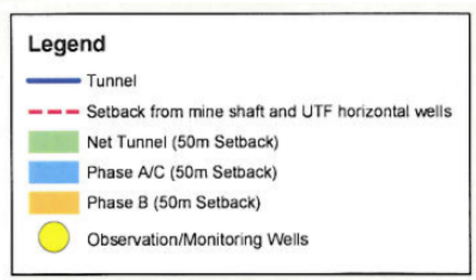
Figure 4.11

Dover UTF Observation/Monitoring Wells



- 6 observation wells in the direct area of the UTF will be used to monitor the pressure and temperature behavior in the McMurray reservoir

- At this time Suncor is finalizing the details around post-closure pressure and temperature monitoring in these observation/monitoring wells



UTF Technical Challenges

- Unique Recovery Process:
  - Prior to the UTF SAGD process, recovery relied on vertical wells for injection and production
  - Previous concept was to develop heated path with steam or combustion between vertical injector and vertical producer
  - Steam or air injection at the injector would drive the heated bitumen to the producer
  - Process was found to be ineffective
- Horizontal Wells:
  - At the time of UTF development, horizontal wells in oil reservoirs were not able to be drilled with assurance
  - SAGD process at the UTF was considered well beyond the accuracy or control of horizontal well technology at the time
- Sand Production:
  - All vertical well projects prior to the UTF were plagued with excessive sand production
  - Three single horizontal wells were drilled prior to the UTF by Texaco, and all three failed do to sand influx and poor production rates

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UTF Technical Challenges Continued

- Steam Channeling:
  - Experience with vertical well steam injection prior to the UTF was cause for concern that steam would channel to the producer without spreading into the reservoir to heat oil for production
- No Downhole Pumps:
  - Design of UTF wells with no downhole oil pumps was contrary to all oil sands industry experience up to that point in time
- Steam/Oil Ratio:
  - Steam/oil ratio predicted for the UTF was more favorable (less steam required to produce a barrel of bitumen) than was ever achieved in oil sands operations in Alberta

UTF Technical Challenges Continued

- Production Rates:
  - Technology at the time called for high reservoir and pressure to drive heated bitumen to vertical production wells to achieve production rates
  - Disbelief of the SAGD concept of having heated bitumen flow down to the horizontal producer could provide adequate production rates
- Wells Drilled from Underground Shafts:
  - Used to achieve required accuracy of horizontal well drilling and critical steam trap control on production well
  - This was beyond any experience in the Western Canadian Oil industry at the time

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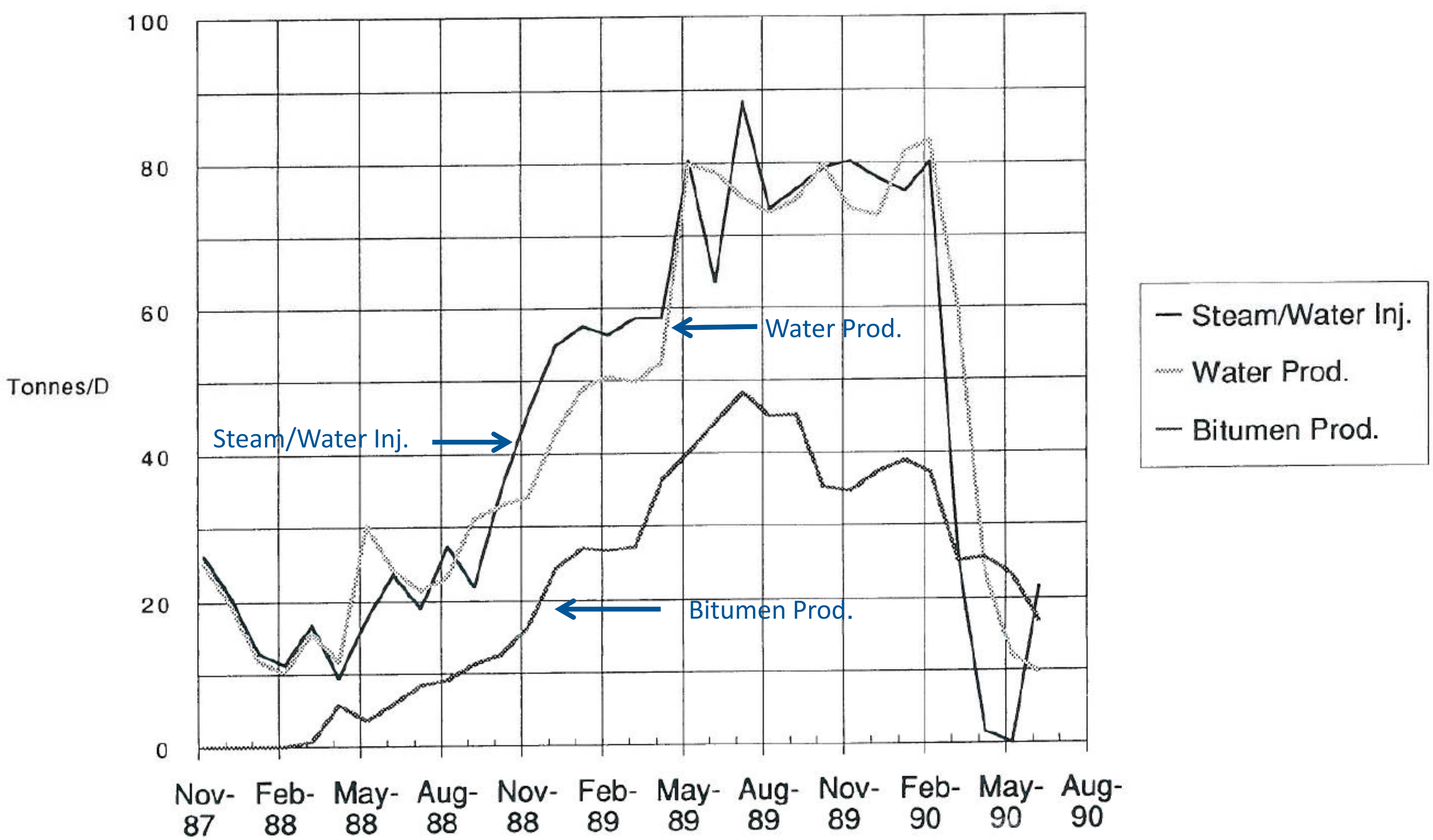
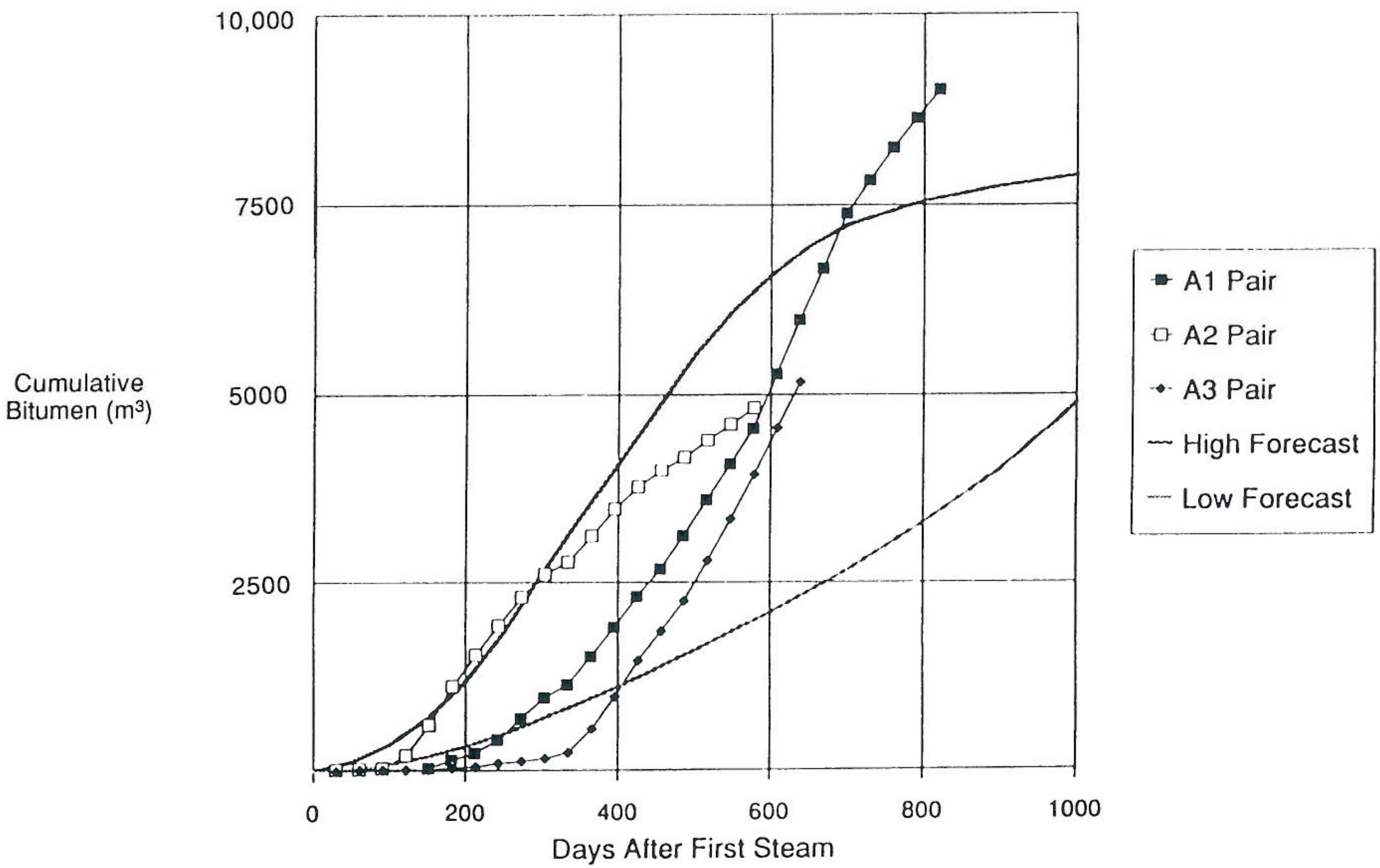
Historical Scheme Performance – Phase A



Source: UTF Phase A Summary Report (AOSTRA, 1991)

Historical Scheme Performance – Phase A



Source: UTF Phase A Summary Report (AOSTRA, 1991)

Historical Scheme Performance – A1 Well Pair

DATE	STEAM INJ. CDA RATE (M3/D)	STEAM INJ. CUM (M3)	WATER PROD. CDA RATE (M3/D)	WATER PROD. CUM (M3)	BITUMEN CDA RATE (M3/D)	BITUMEN CUM (M3)	HEAT INJECTION CDA (J/D)	HEAT INJECTION CUM (J)	EQUIV.* MONTHLY IOSR	EQUIV.* CUM COSR
8712	20.9	647	19.9	616	0.0	1	5.71E+10	1.77E+12	0.00	0.00
8801	20.7	1289	19.7	1227	0.0	1	5.68E+10	3.53E+12	0.00	0.00
8802	12.8	1662	11.8	1570	0.0	2	3.52E+10	4.55E+12	0.00	0.00
8803	11.2	2010	10.2	1887	0.0	2	3.08E+10	5.50E+12	0.00	0.00
8804	16.9	2515	15.7	2358	0.8	26	3.39E+10	6.52E+12	0.05	0.01
8805	9.5	2808	6.4	2555	3.2	124	1.88E+10	7.10E+12	0.39	0.04
8806	10.6	3126	11.0	2886	2.6	201	2.24E+10	7.78E+12	0.27	0.06
8807	16.5	3638	15.8	3375	5.0	357	4.53E+10	9.18E+12	0.26	0.09
8808	18.4	4207	15.9	3867	8.1	606	5.03E+10	1.07E+13	0.37	0.13
8809	14.0	4627	12.6	4243	8.1	851	3.83E+10	1.19E+13	0.49	0.17
8810	16.9	5151	11.1	4588	4.9	1001	4.63E+10	1.33E+13	0.24	0.17
8811	22.7	5833	18.8	5150	10.9	1327	6.23E+10	1.52E+13	0.40	0.20
8812	23.8	6570	19.1	5742	11.1	1670	6.52E+10	1.72E+13	0.39	0.23
8901	25.8	7370	19.6	6351	11.7	2032	7.08E+10	1.94E+13	0.38	0.24
8902	26.5	8114	19.4	6894	11.7	2359	7.28E+10	2.14E+13	0.37	0.26
8903	24.4	8871	20.9	7542	12.8	2754	6.70E+10	2.35E+13	0.44	0.27
8904	26.7	9673	20.4	8153	13.8	3169	7.33E+10	2.57E+13	0.44	0.29
8905	30.4	10614	16.3	8659	13.4	3584	8.32E+10	2.83E+13	0.37	0.29
8906	54.7	12254	29.9	9556	14.1	4005	1.50E+11	3.28E+13	0.22	0.28
8907	40.3	13504	29.4	10466	20.4	4637	1.11E+11	3.62E+13	0.43	0.30
8908	51.5	15101	27.5	11318	20.7	5278	1.41E+11	4.06E+13	0.34	0.30
8909	46.7	16503	27.1	12130	19.9	5873	1.28E+11	4.44E+13	0.36	0.31
8910	49.6	18041	29.6	13048	20.3	6504	1.36E+11	4.87E+13	0.35	0.31
8911	48.0	19481	25.3	13807	12.6	6882	1.32E+11	5.26E+13	0.22	0.30
8912	51.8	21088	19.8	14421	12.3	7262	1.42E+11	5.70E+13	0.20	0.30
9001	55.7	22813	16.4	14930	10.8	7596	1.53E+11	6.17E+13	0.16	0.29
9002	55.4	24365	22.5	15559	11.8	7925	1.52E+11	6.60E+13	0.18	0.28
9003	60.0	26226	21.8	16233	10.9	8261	1.65E+11	7.11E+13	0.15	0.27
9004	4.4	26357	14.2	16660	6.5	8456	1.20E+10	7.15E+13	1.25	0.27
9005	0.0	26357	5.3	16824	9.2	8741	0.00E+00	7.15E+13		0.28
9006	0.0	26357	3.9	16942	8.9	9009	0.00E+00	7.15E+13		0.29
9007	21.5	27023	2.6	17022	6.5	9210	1.52E+10	7.19E+13	0.99	0.30
9008	23.5	27753	11.1	17366	3.8	9328	1.84E+10	7.25E+13	0.48	0.30
9009	26.5	28548	5.8	17540	2.4	9401	2.94E+10	7.34E+13	0.19	0.30
9010	54.7	30244	3.8	17659	2.4	9474	0.00E+00	7.34E+13		0.30
9011	27.8	31078	6.5	17853	2.6	9553	4.48E+10	7.47E+13	0.14	0.30
9012	12.5	31466	4.1	17978	1.0	9584	2.04E+10	7.54E+13	0.11	0.30

- Cumulative Steam Injection: 31,466 m^3
- Cumulative Water Production: 17,978 m^3
- Cumulative Bitumen Production: 9,548 m^3

Source: UTF Phase A Summary Report (AOSTRA, 1991)

Historical Scheme Performance – A2 Well Pair

DATE	STEAM INJ.		WATER PROD.		BITUMEN		HEAT INJECTION		EQUIV.*	
	CDA. RATE (M3/D)	CUM (M3)	CDA. RATE (M3/D)	CUM (M3)	CDA. RATE (M3/D)	CUM (M3)	CDA. (J/D)	CUM (J)	MONTHLY IOSR	CUM COSR
8712	0.0	0	0.0	0	0.0	0	0.00E+00	0.00E+00		
8802	0.0	0	0.0	0	0.0	0	0.00E+00	0.00E+00		
8804	0.0	0	0.0	0	0.0	0	0.00E+00	0.00E+00		
8805	0.0	0	0.0	0	0.0	0	0.00E+00	0.00E+00		
8806	0.0	0	0.3	9	0.0	0	0.00E+00	0.00E+00		
8807	0.0	0	0.0	9	0.0	0	0.00E+00	0.00E+00		
8808	13.4	415	9.0	289	0.4	14	3.67E+10	1.14E+12	0.03	0.03
8809	1.6	461	0.4	301	0.1	15	4.29E+09	1.27E+12	0.03	0.03
8810	9.0	740	6.1	489	0.5	31	2.46E+10	2.03E+12	0.05	0.04
8811	16.6	1238	10.6	807	5.1	182	4.55E+10	3.39E+12	0.26	0.12
8812	23.4	1963	18.2	1372	11.3	533	6.42E+10	5.38E+12	0.41	0.23
8901	25.1	2740	24.0	2118	14.6	986	6.87E+10	7.51E+12	0.49	0.30
8902	25.5	3454	24.3	2797	13.1	1352	6.99E+10	9.47E+12	0.43	0.33
8903	26.6	4277	23.4	3524	11.0	1692	7.28E+10	1.17E+13	0.35	0.33
8904	26.4	5068	23.1	4217	11.2	2027	7.23E+10	1.39E+13	0.36	0.34
8905	23.9	5808	20.8	4860	9.0	2305	6.54E+10	1.59E+13	0.32	0.34
8906	18.0	6348	14.5	5296	4.6	2442	4.93E+10	1.74E+13	0.22	0.33
8907	32.6	7358	24.2	6045	10.1	2754	8.93E+10	2.02E+13	0.26	0.32
8908	21.2	8015	24.6	6807	10.1	3066	5.82E+10	2.20E+13	0.40	0.32
8909	24.7	8756	22.0	7468	8.6	3323	6.77E+10	2.40E+13	0.29	0.32
8910	27.0	9591	25.0	8242	6.1	3511	7.39E+10	2.63E+13	0.19	0.31
8911	25.9	10368	21.7	8894	5.2	3666	7.10E+10	2.84E+13	0.17	0.30
8912	21.5	11034	23.1	9609	6.4	3865	5.88E+10	3.02E+13	0.25	0.30
9001	20.6	11671	21.4	10272	6.1	4055	5.64E+10	3.20E+13	0.25	0.29
9002	20.1	12234	22.1	10890	6.8	4245	5.51E+10	3.35E+13	0.29	0.29
9003	21.3	12893	21.9	11570	5.4	4411	5.83E+10	3.53E+13	0.21	0.29
9004	1.5	12939	8.3	11819	2.4	4482	4.23E+09	3.55E+13	1.30	0.29
9005	0.0	12939	3.3	11922	3.7	4598	0.00E+00	3.55E+13		0.30
9006	0.0	12939	2.7	12002	1.5	4644	0.00E+00	3.55E+13		0.30
9007	0.0	12939	3.8	12119	2.8	4732	0.00E+00	3.55E+13		0.31
9008	0.0	12939	6.9	12333	2.2	4799	0.00E+00	3.55E+13		0.31
9009	0.0	12939	2.3	12401	2.5	4873	0.00E+00	3.55E+13		0.32
9010	0.0	12939	0.0	12401	0.0	4873	0.00E+00	3.55E+13		0.32
9011	0.0	12939	0.0	12401	0.0	4873	0.00E+00	3.55E+13		0.32

- Cumulative Steam Injection: 12,939 m^3
- Cumulative Water Production: 12,401 m^3
- Cumulative Bitumen Production: 4,873 m^3

Source: UTF Phase A Summary Report (AOSTRA, 1991)

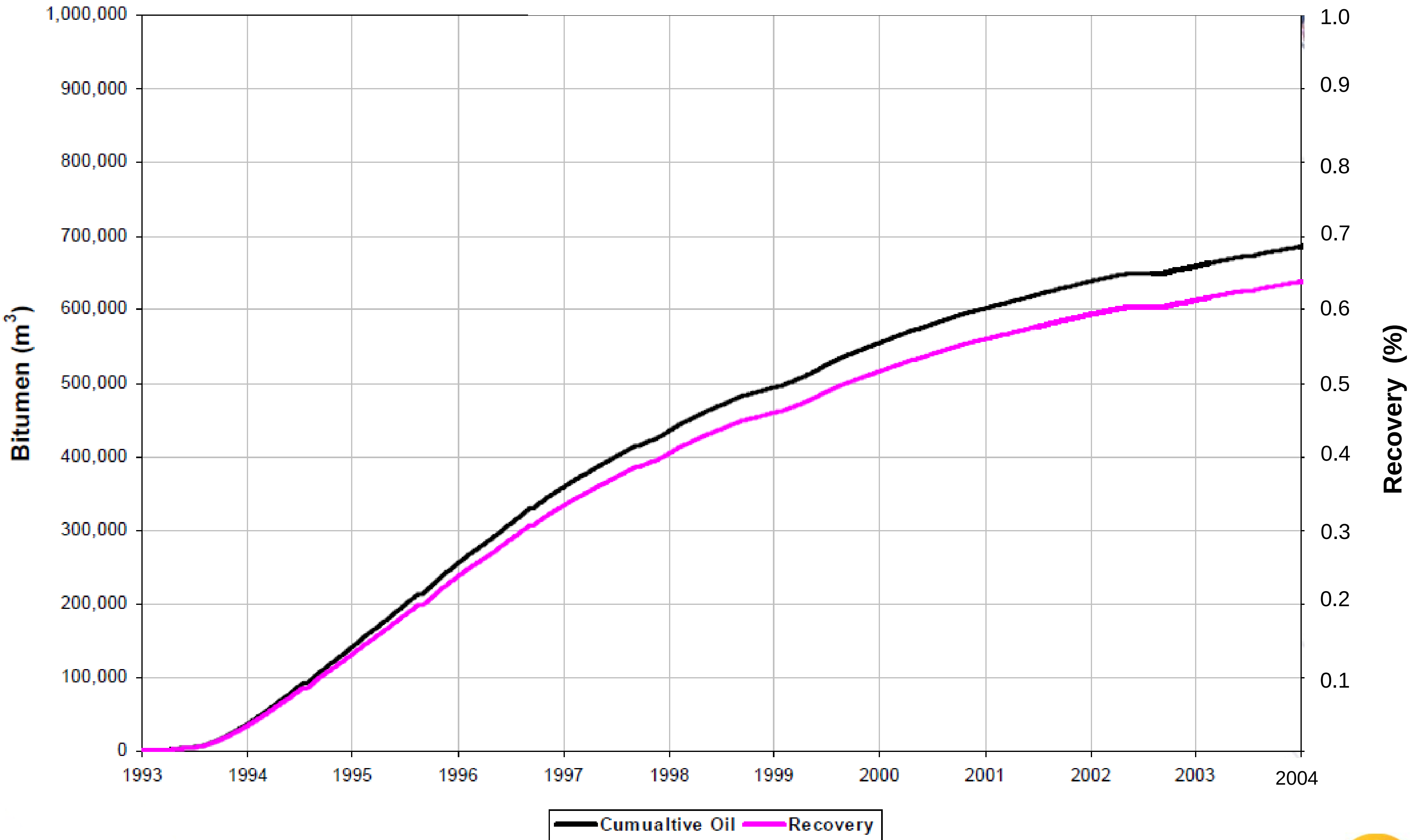
Historical Scheme Performance – A3 Well Pair

	STEAM INJ.		WATER PROD.		BITUMEN		HEAT INJECTION		EQUIV.*	
DATE	CDA RATE (M3/D)	CUM (M3)	CDA RATE (M3/D)	CUM (M3)	CDA RATE (M3/D)	CUM (M3)	CDA (J/D)	CUM (J)	MONTHLY IOSR	CUM COSR
8712	0.0	0	0.0	0	0.0	0	0.00E+00	0.00E+00		
8802	0.0	0	0.0	0	0.0	0	0.00E+00	0.00E+00		
8804	0.0	0	0.0	0	0.0	0	0.00E+00	0.00E+00		
8805	0.0	0	0.0	0	0.0	0	0.00E+00	0.00E+00		
8806	7.1	212	5.6	168	0.0	0	1.71E+10	5.14E+11	0.00	0.00
8807	7.1	432	5.3	332	0.4	11	1.95E+10	1.12E+12	0.04	0.02
8808	0.7	454	0.5	348	0.1	13	1.94E+09	1.18E+12	0.06	0.02
8809	0.0	454	0.0	348	0.0	13	0.00E+00	1.18E+12		0.02
8810	3.5	562	1.0	380	0.1	17	9.50E+09	1.47E+12	0.03	0.03
8811	3.6	670	1.9	436	0.5	32	9.92E+09	1.77E+12	0.12	0.04
8812	5.3	835	4.2	566	0.5	47	1.46E+10	2.22E+12	0.08	0.05
8901	5.6	1010	4.7	711	1.2	85	1.54E+10	2.70E+12	0.18	0.07
8902	6.1	1180	5.4	862	0.9	110	1.67E+10	3.17E+12	0.12	0.08
8903	6.4	1380	5.4	1031	0.9	138	1.76E+10	3.72E+12	0.12	0.09
8904	5.4	1542	6.2	1217	2.4	210	1.49E+10	4.16E+12	0.37	0.12
8905	1.9	1602	9.9	1524	9.0	490	5.31E+09	4.33E+12	3.95	0.26
8906	1.9	1658	18.7	2084	12.5	864	5.07E+09	4.48E+12	5.71	0.45
8907	5.3	1820	19.1	2678	13.6	1285	1.44E+10	4.92E+12	2.19	0.61
8908	4.4	1955	14.2	3118	11.0	1625	1.19E+10	5.29E+12	2.13	0.71
8909	5.8	2131	18.0	3657	12.0	1986	1.60E+10	5.77E+12	1.74	0.80
8910	2.1	2195	20.6	4295	15.3	2462	5.66E+09	5.95E+12	6.29	0.96
8911	4.3	2325	28.7	5156	16.1	2945	1.19E+10	6.31E+12	3.15	1.08
8912	2.5	2402	30.3	6094	16.7	3462	6.85E+09	6.52E+12	5.65	1.23
9001	0.8	2426	29.6	7013	17.9	4016	2.09E+09	6.58E+12	19.85	1.42
9002	0.0	2426	33.8	7959	19.1	4551	0.00E+00	6.58E+12		1.60
9003	0.0	2426	34.6	9031	17.7	5098	0.00E+00	6.58E+12		1.80
9004	0.0	2426	22.1	9694	12.2	5463	0.00E+00	6.58E+12		1.93
9005	0.0	2426	9.2	9978	13.0	5866	0.00E+00	6.58E+12		2.07
9006	0.0	2426	4.9	10124	10.5	6180	0.00E+00	6.58E+12		2.18
9007	0.0	2426	3.9	10245	8.8	6453	0.00E+00	6.58E+12		2.27
9008	0.0	2426	11.2	10591	7.0	6669	0.00E+00	6.58E+12		2.35
9009	0.0	2426	4.8	10734	4.0	6788	0.00E+00	6.58E+12		2.39
9010	0.0	2426	0.0	10734	0.0	6788	0.00E+00	6.58E+12		2.39
9011	0.0	2426	1.3	10774	0.5	6802	0.00E+00	6.58E+12		2.40
9012	1.6	2476	1.8	10830	0.9	6830	0.00E+00	6.58E+12		2.41

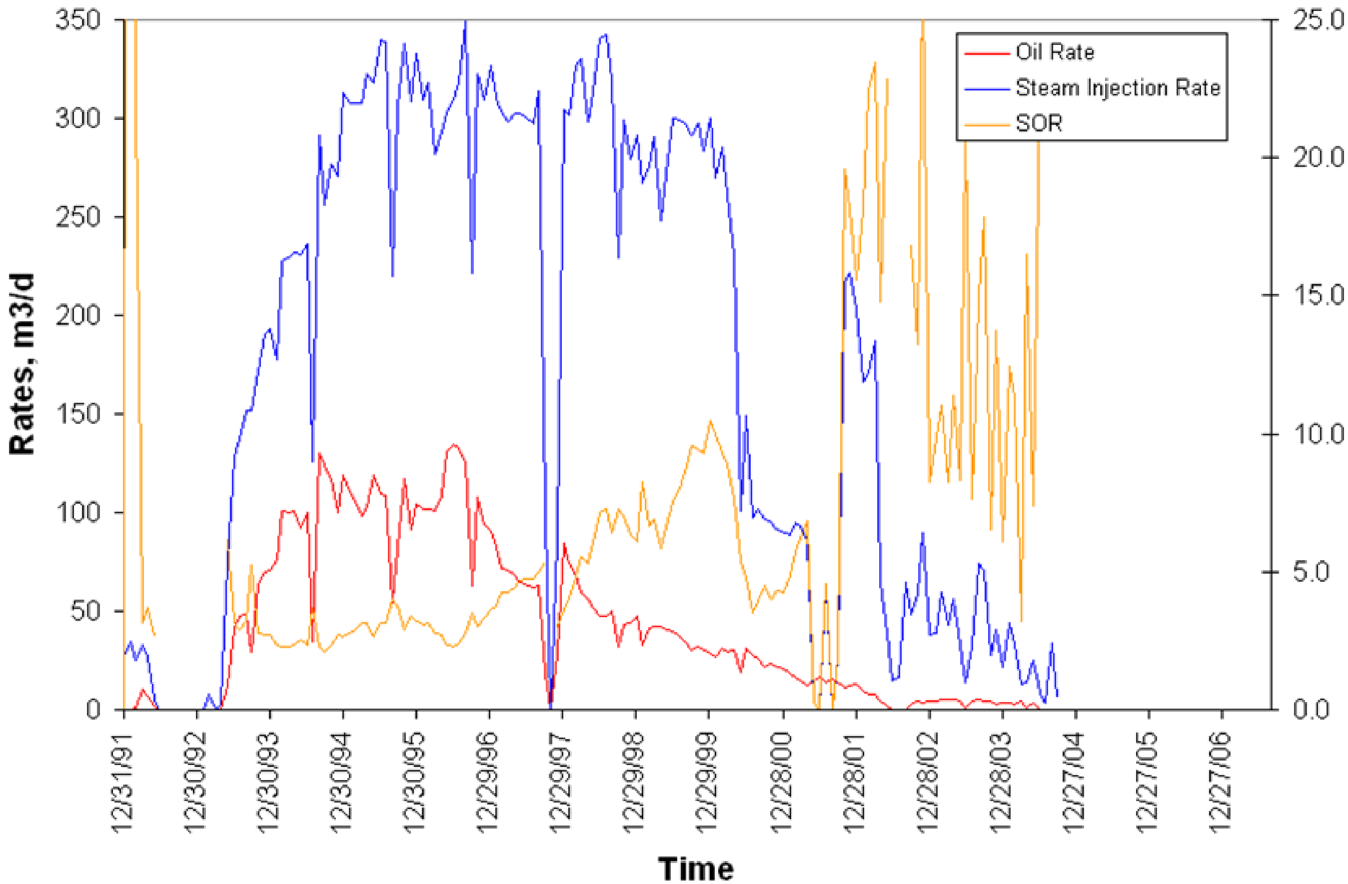
- Cumulative Steam Injection: 2,476 m^3
- Cumulative Water Production: 10,830 m^3
- Cumulative Bitumen Production: 6,830 m^3

Source: UTF Phase A Summary Report (AOSTRA, 1991)

Historical Scheme Performance – Phase B

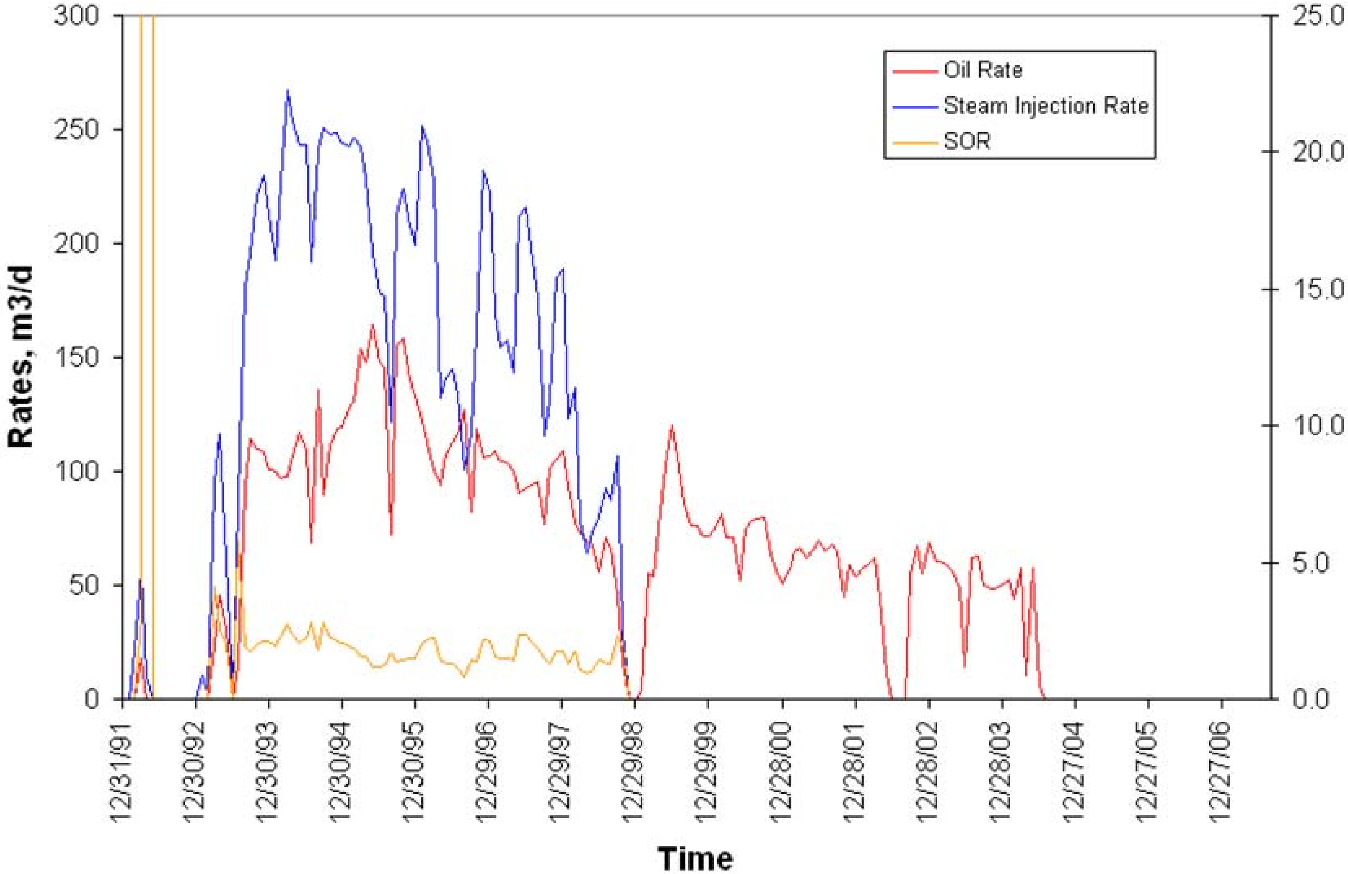


Historical Scheme Performance – B1 Well Pair



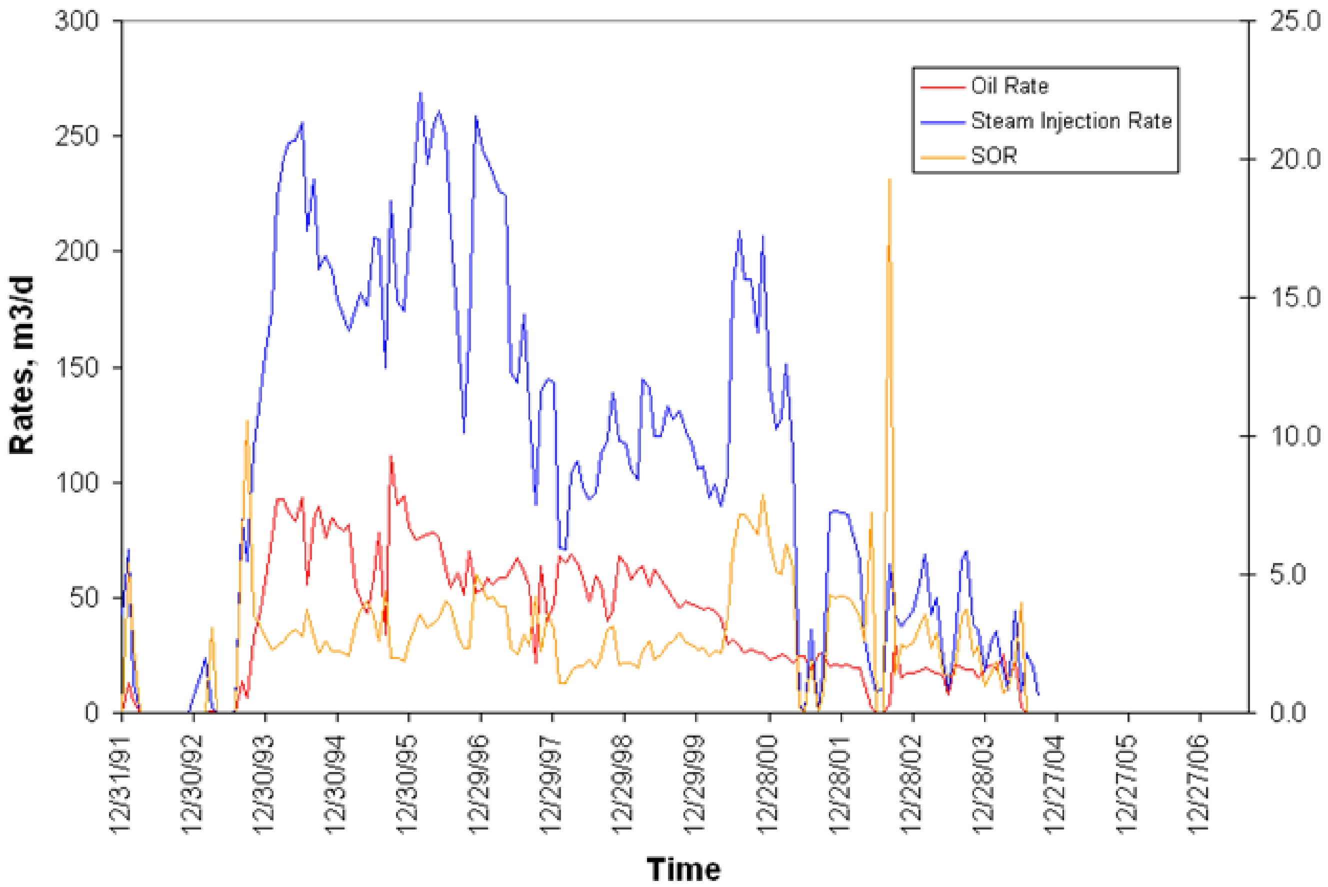
- Cumulative Steam Injection: 796,000 m^3
- Cumulative Water Production: 447,900 m^3
- Cumulative Bitumen Production: 194,300 m^3

Historical Scheme Performance – B2 Well Pair



- Cumulative Steam Injection: 360,300 m^3
- Cumulative Water Production: 797,400 m^3
- Cumulative Bitumen Production: 321,300 m^3

Historical Scheme Performance – B3 Well Pair



- Cumulative Steam Injection: 511,800 m^3
- Cumulative Water Production: 416,300 m^3
- Cumulative Bitumen Production: 181,000 m^3

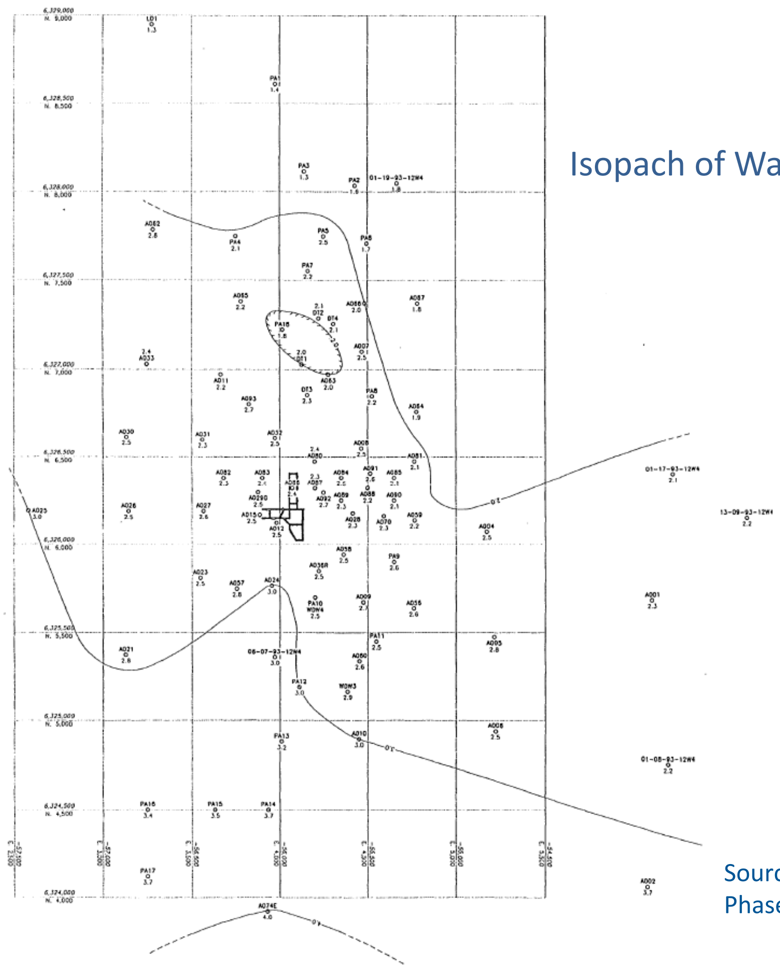
Historical Scheme Performance Summary

Phase	Bitumen Produced (10^3 m^3)	Water Produced (10^3 m^3)	Steam Injected (10^3 m^3)	NCG Injected (10^3 m^3)	Oil Cut (%)	SOR (m^3/m^3)	OBIP (10^3 m^3)	Recovery (%)
A	21.25	41.21	46.88	-	-	-	39.68	53.55
B1	194.3	447.9	796	5419.67	30	4.1	354.93	54.74
B2	321.3	797.4	360.3	5419.67	29	1.1	354.93	90.52
B3	181	416.3	511.8	5419.67	30	2.8	354.93	51.0
HASDrive	Unpublished	-	-	-	-	-	-	-

- Bitumen production from the underground wells at the UTF Mine was discontinued in June 2004

Water Disposal Geology

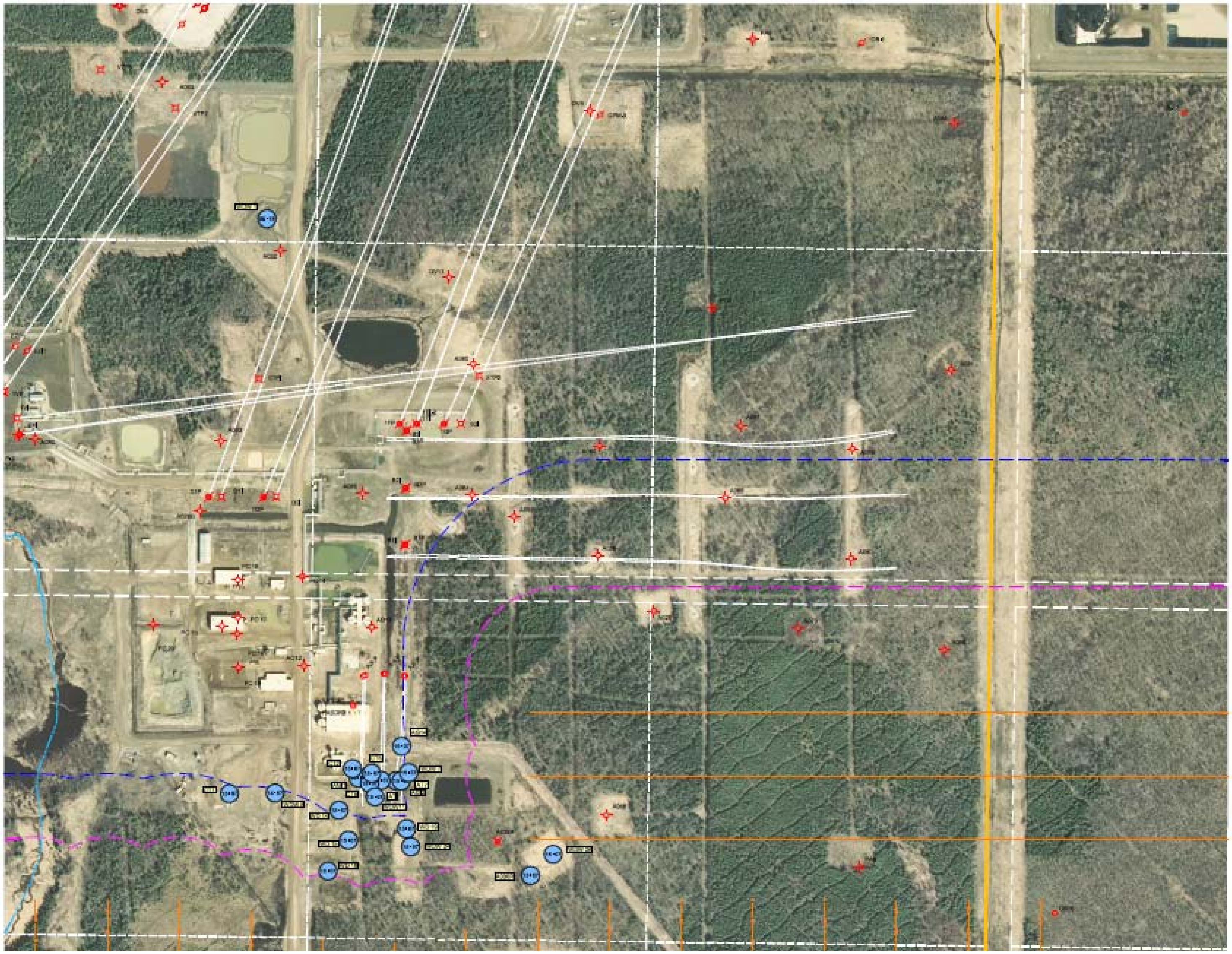
- The Wabiskaw Sand at the base of the Clearwater Formation was used for water disposal at the UTF
- Core and geophysical logs showed the Wabiskaw sand is thicker and less cemented to the south of the UTF



Isopach of Wabiskaw Member

Source: AOSTRA UTF Project SAGD – Phase B Final Report (AOSTRA, 1999)

Water Disposal Wells



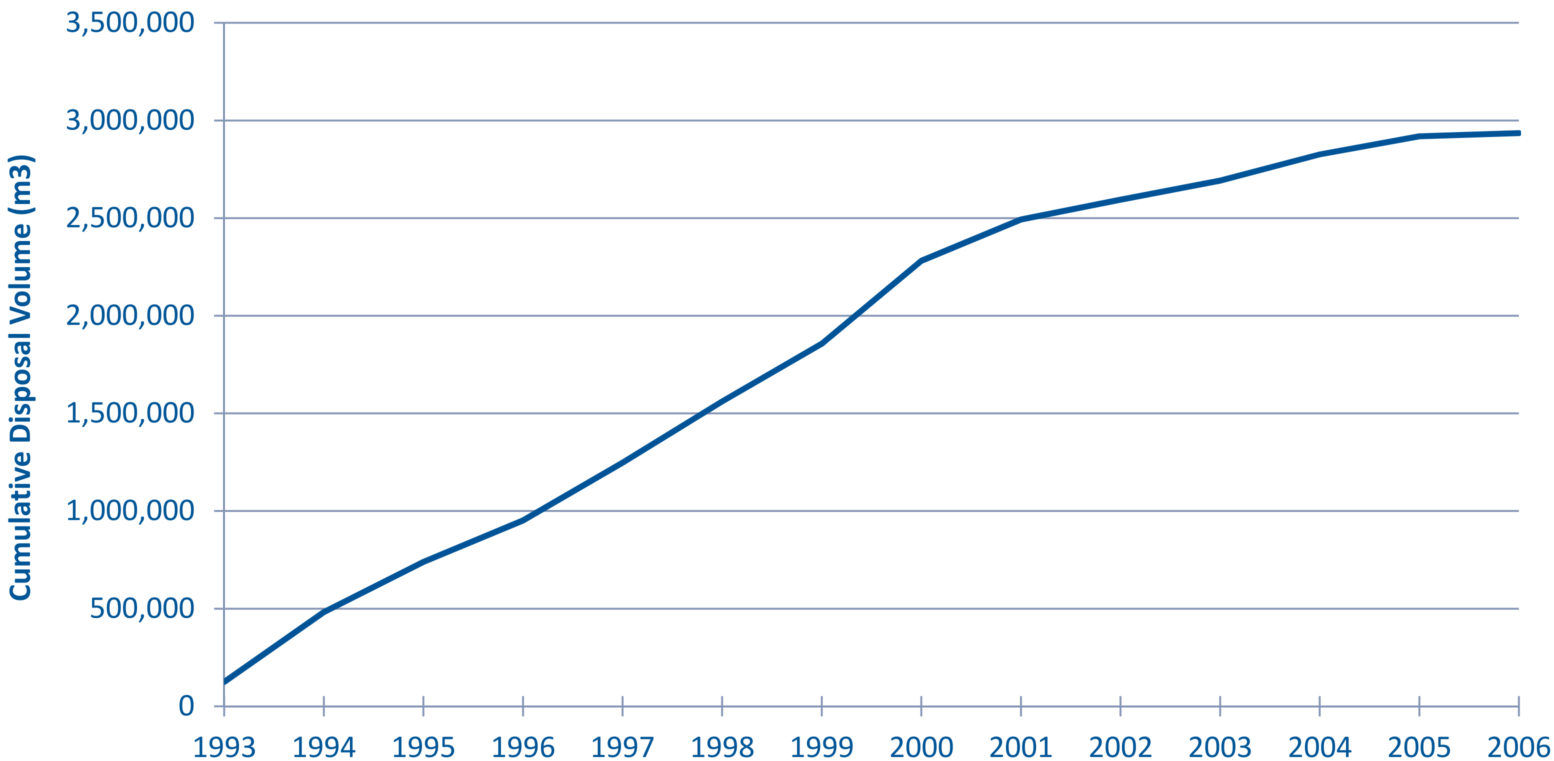
Water Disposal Well

Water Disposal Wells

Water Disposal Well

Water Disposal into Wabiskaw

- EUB Class II Disposal Approval No. 10991
  - 31 water disposal wells (WDWs) associated with the disposal scheme approval
  - No disposal occurred into these wells after 2006
  - All WDWs have been abandoned as of March 2013



Note: The water disposal volume is associated with operations resulting from UTF and Surface SAGD portions of the Dover Facility

UTF Water Source Wells

- 4 Water Source Wells (WSWs) were associated with the Dover UTF:
  - WSW No.1 – drilled in 1984 originally under AENV Approval No. 30414-00-00
    - Suspended in 1996
  - WSW No.2 – drilled in 1984 originally under AENV Approval No. 30414-00-00
  - WSW No.3 – drilled in 1992 originally under AENV Approval No. 30415-00-00
  - WSW No.4 – drilled in 1996 to replace WSW No.1
- In 1984, the Dover UTF was permitted to divert up to 239,120 m^3/year of groundwater utilizing WSW No. 1 and No. 2
  - Groundwater withdrawal from the Birch Channel Aquifer
- In 1992, a new permit was issued for WSW No. 3 to divert 438,234 m^3/year of groundwater
- WSWs currently under Diversion License No. 251163 for a total diversion of 677,345 m^3/year
- License No. 251163 is in the process of being renewed to support Dover and MacKay River future development

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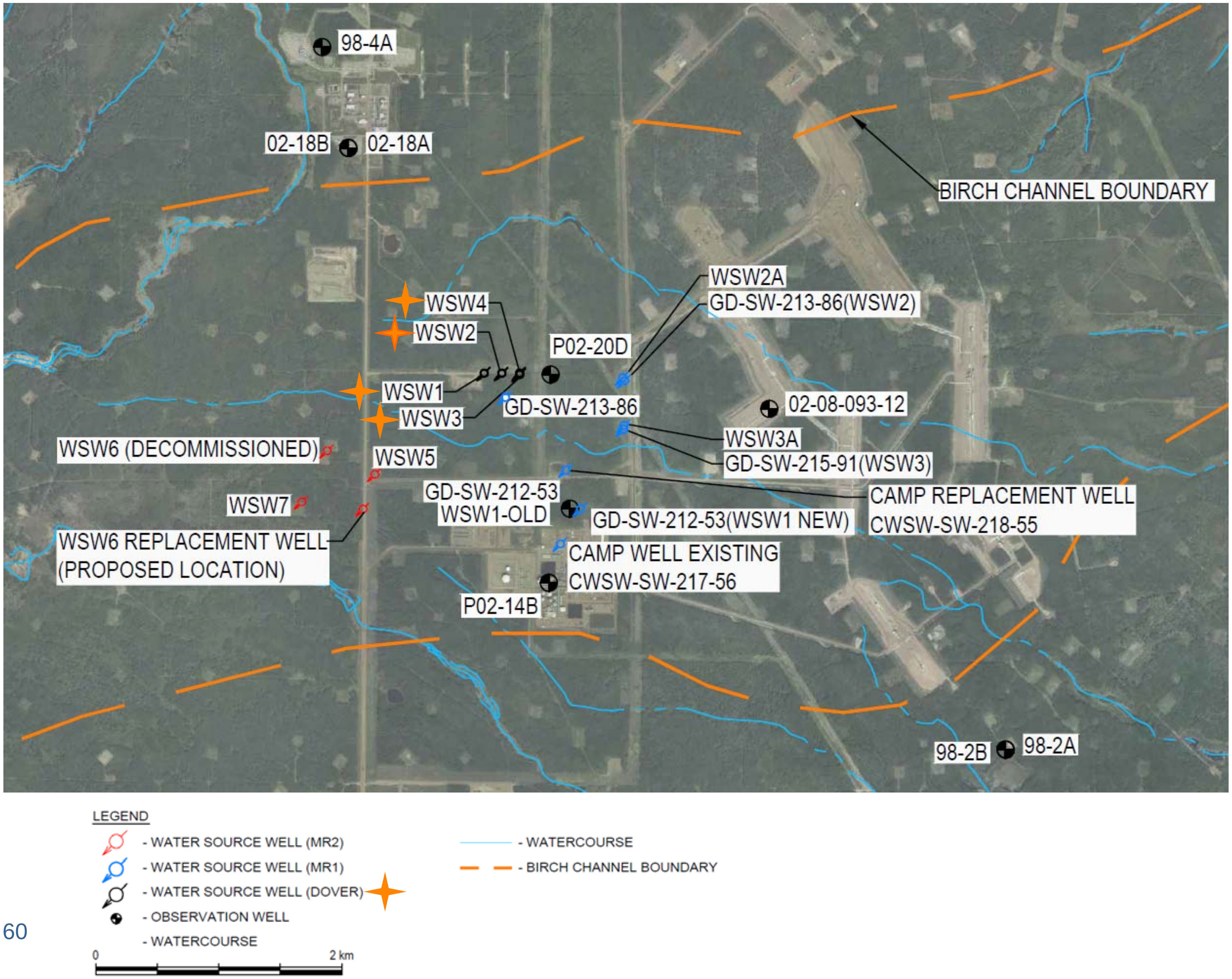
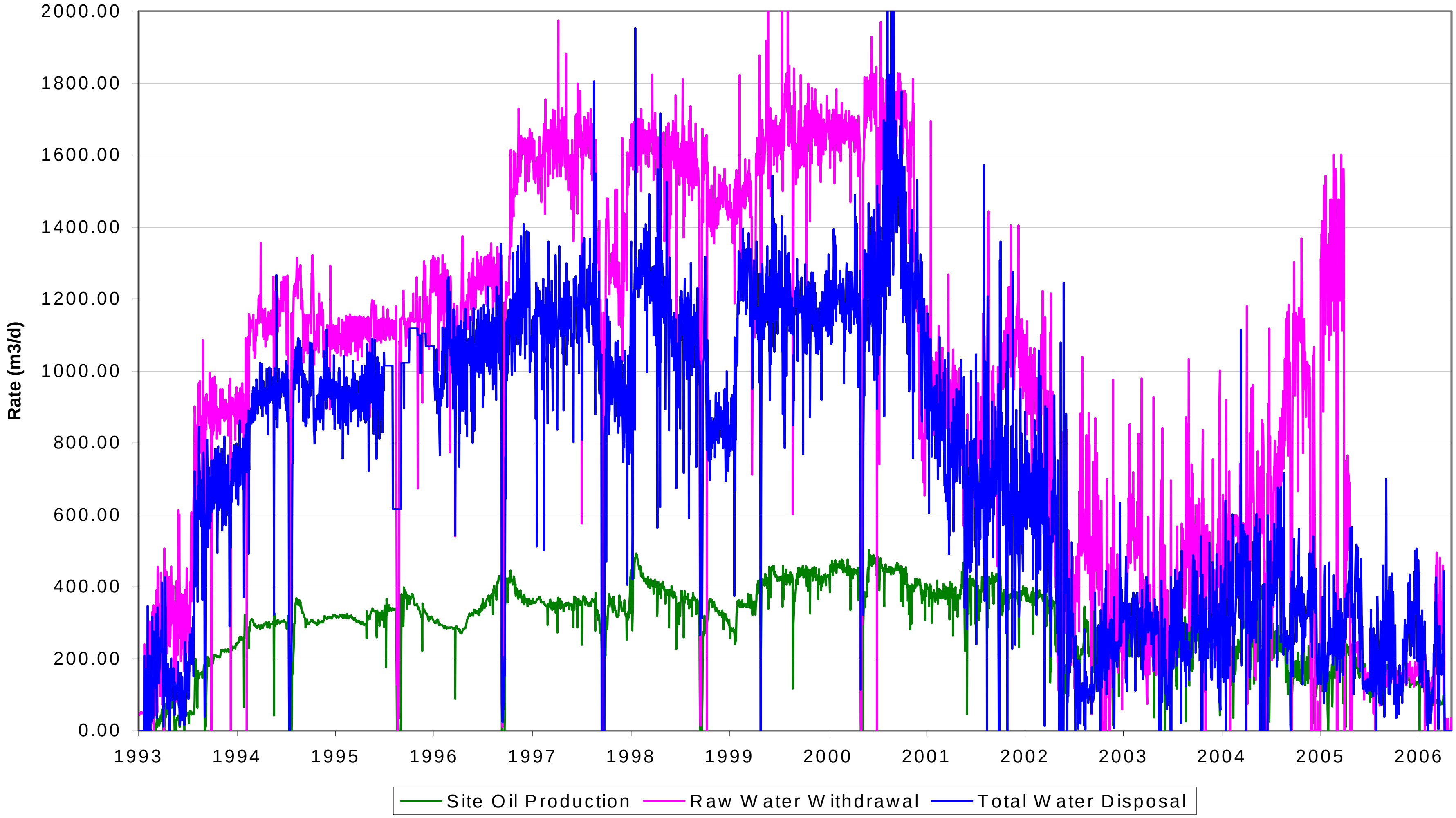
UTF Water Source Wells

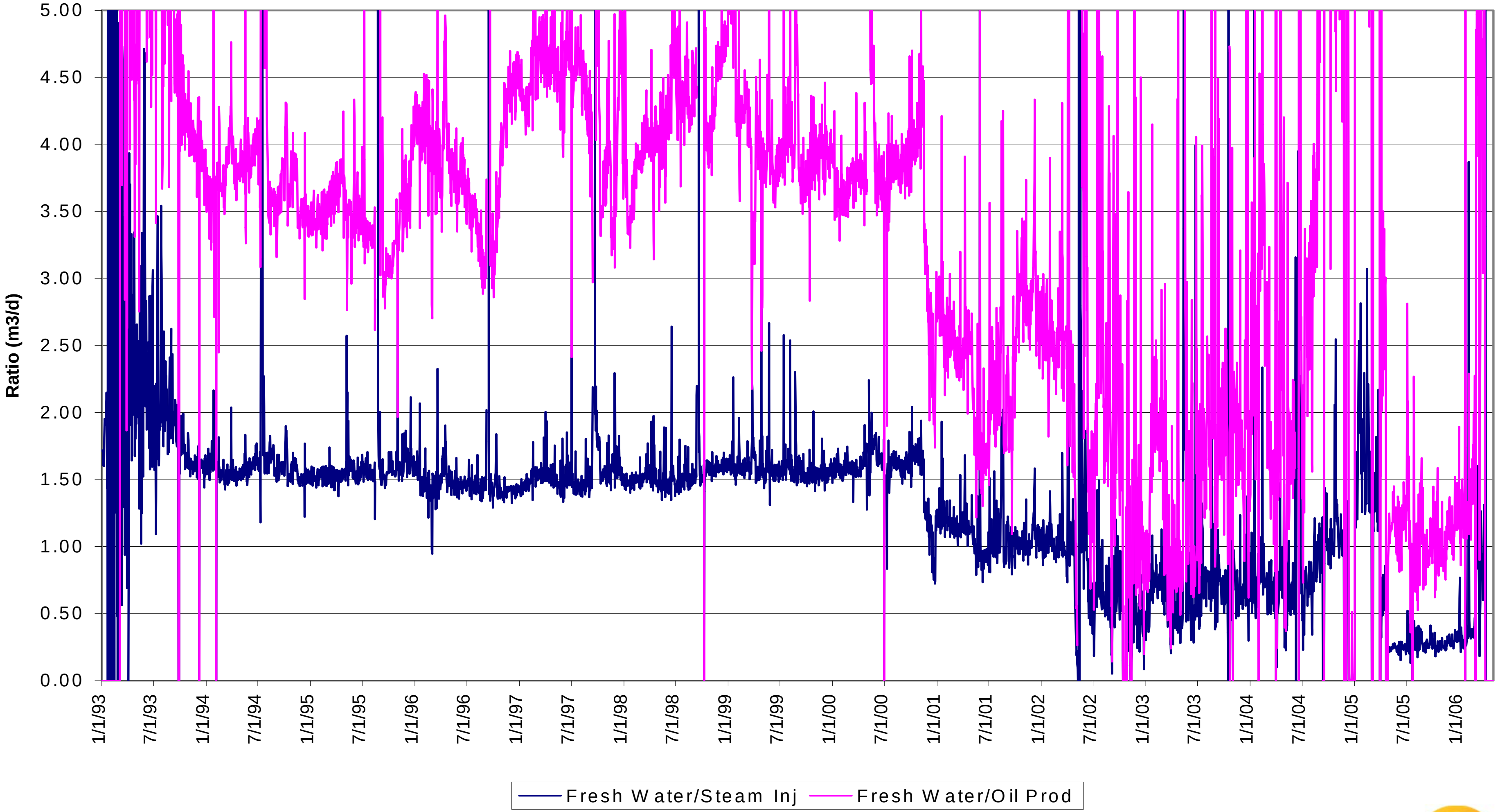


Fresh Water Withdrawal



Note: The fresh water withdrawal rate is associated with operations resulting from UTF and Surface SAGD portions of the Dover Facility

Fresh Water Usage Ratios



Note: The fresh water usage rations are associated with operations resulting from UTF and Surface SAGD portions of the Dover Facility

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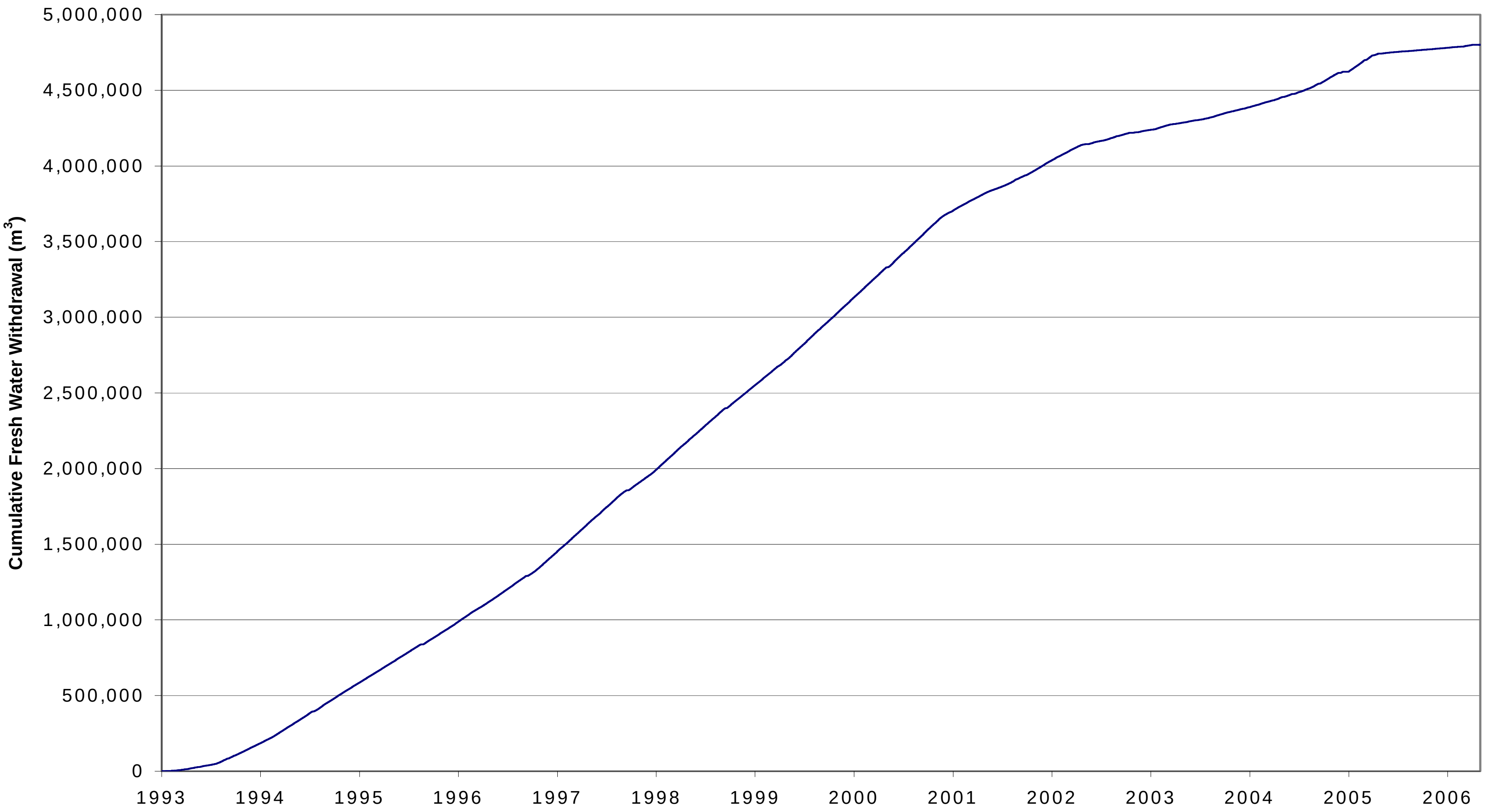
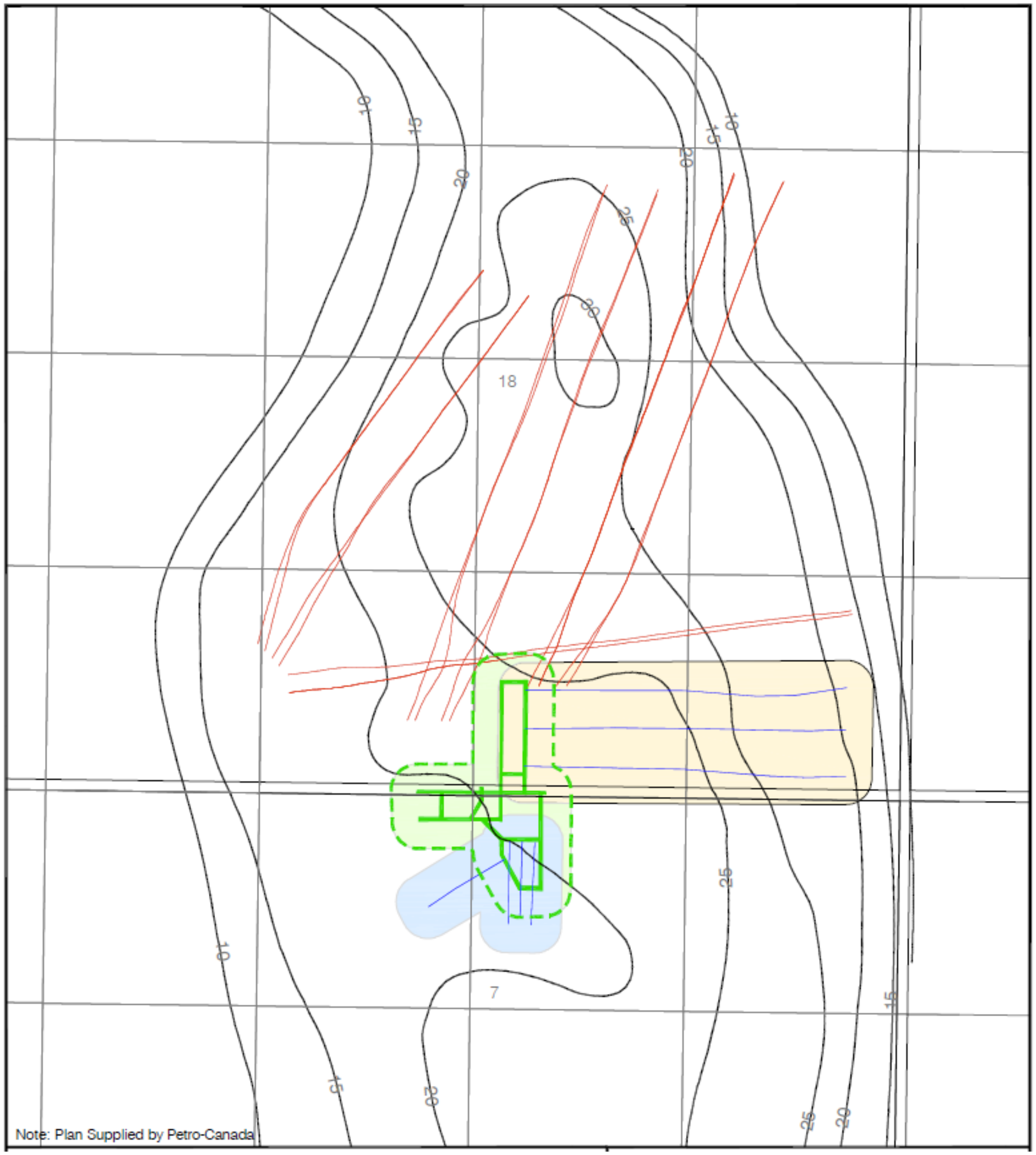
UTF Cumulative Fresh Water Withdrawal



Note: The fresh water withdrawal volume is associated with operations resulting from UTF and Surface SAGD portions of the Dover Facility

Dover Net Pay and Resource Areas Impacted by UTF



- Resource net pay thickness isopach at 6% Bulk Mass Fraction of Oil (BMFO) in relation to the facility and wells
- 50 m setbacks from the estimated underground production areas and the tunnels

LEGEND:

Net Pay - 6% BMFO

Net Pay Areas

- PhaseA/C (50m Setback)
- PhaseB (50m Setback)
- Net Tunnel (50m Setback)

Tunnels

- Tunnel
- Tunnel Outline (50m Setback)

UTF Oil-In-Place Volumetric Calculations

- Oil-In-Place (OIP) was based on 6% cut-off from the BMFO measurements from core analysis and wireline logs
- 50 m setback was generated around Phase A, B, and HASDrive (C) wells
- Phase A and HASDrive setbacks combined into one zone (Phase A/C)
- Setback generated around the tunnels, but Phase B and Phase A/C zones subtracted from this area to create a net-tunnel setback
- Volume of sand for the three setback areas was calculated
- Average oil saturation and porosity (SoPHI) from well data was used to calculate oil in place

Oil-In-Place (6% BMFO cutoff)

50 m Setback Area	Sand Volume (M m^3)	SoPHI	OIP (M m^3)	OBIP (M bbl)
Phase A/C	1.109	0.252	0.279	1.756
Phase B	4.393	0.252	1.106	6.957
net Tunnels	0.975	0.252	0.246	1.544
Cumulative Total:			**1.631**	**10.257**

Phase A Operating Experience

- Sand control was a major success – only one well produced more sand than would fill the wellbore
- Any sand produced appeared to readily flow out of the wells when production rates increased
- Sand control and the absence of moving parts in the wellbores obviated the need for underground workovers
- Erosion and jamming of control valves (steam trap valves) was the only common type of equipment failure – caused by flashing of hot produced water across the valve
- Gas breakout in the hot production caused problems with the mass flow meters – a separator was eventually installed upstream of the underground test skid

Phase B Key Learnings

- Long horizontal wells of 500 m horizontal sections could be drilled and completed in unconsolidated oil sands formation
- Results from the Phase A pilot could be scaled up to longer wells
- Production through the tubing was favored early in the well life to keep the entire wellbore hot and accelerate the full wellbore utilization
- When production rates climbed, production from tubing and annulus was favored so that overall pressure drop in the production well was reduced and production maximized

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UTF Wellhead Abandonment

- Wellhead abandonment of all 14 wellheads (6 Phase A, 6 Phase B, and 2 HASDrive) was completed in August 2008
- HSE Integrated Ltd. on behalf of Suncor completed all abandonment work
- The scope of work for each of the wellhead abandonments included the following:
  - Closure of all valves found to be in ‘open’ position
  - Hot tapped steam injection and bitumen production lines piped into wellheads. Checked for pressure and bled off as required.
  - Removed insulation piping and cold cut piping to be blind flanged where appropriate.
  - Installed blind flanges onto all flanged wellhead outlets and installed threaded bull plugs into all threaded wellhead outlets.

UTF Mine Abandonment

- Bitumen production from the underground wells was discontinued in June 2004
- In October 2006, the underground facility was placed on a ‘Care and Maintenance’ program undertaken by Petro-Canada
- The ERCB approved the Mine Abandonment Plan in December 2010 and issued Approval No. 9044H
- Alberta Environment approved the decommissioning of surface facilities associated with the UTF in May 2010
- The Dover UTF Mine Abandonment Project was completed December 31, 2013
- Mining Concrete Ltd. completed the UTF Mine Abandonment on behalf of Suncor
- The overall mine abandonment consisted of the following activities:
  - Removal of some limited infrastructure and equipment from underground
  - Closure of shafts with engineered fill, isolation plug and concrete cap
  - Demolition and disposal of some surface buildings
  - Surface grading for drainage control

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UTF Surface Facilities Decommissioning

- Mine abandonment was limited to the UTF, including the shafts, tunnels and associated surface buildings and infrastructure directly associated with the shafts
- The surface buildings included the No. 1 Shaft collar house and headframe, and the No. 2 Shaft collar house, fan drift and mine fans
- Surface buildings and infrastructure were removed to a depth of 2 m below ground surface
- Equipment and materials were salvaged for recycling or disposed of in the upper shaft fill or at an approved facility
- Abandonment did not include other surface wells and surface facilities required for steaming and bitumen processing

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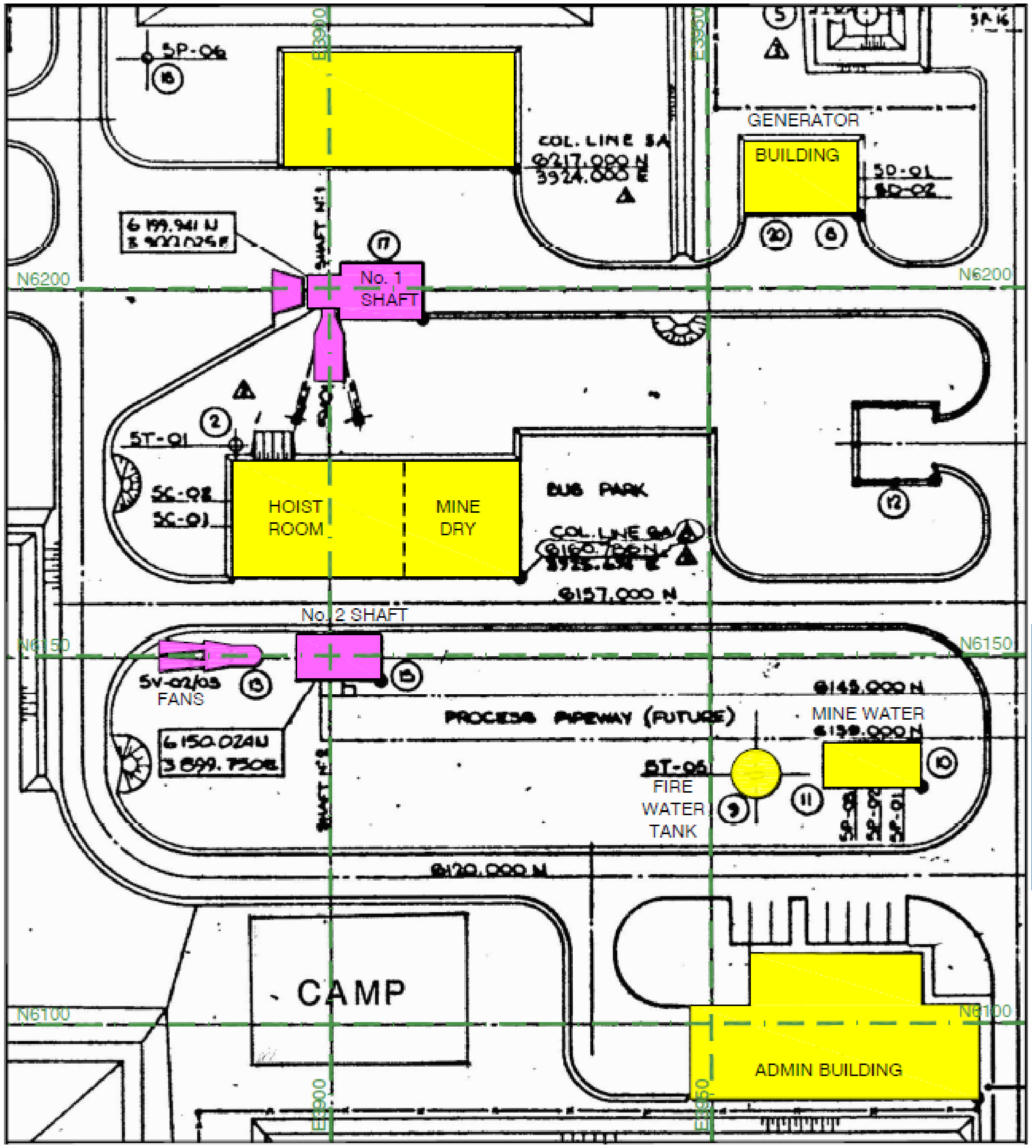
UTF Surface Facilities Decommissioning

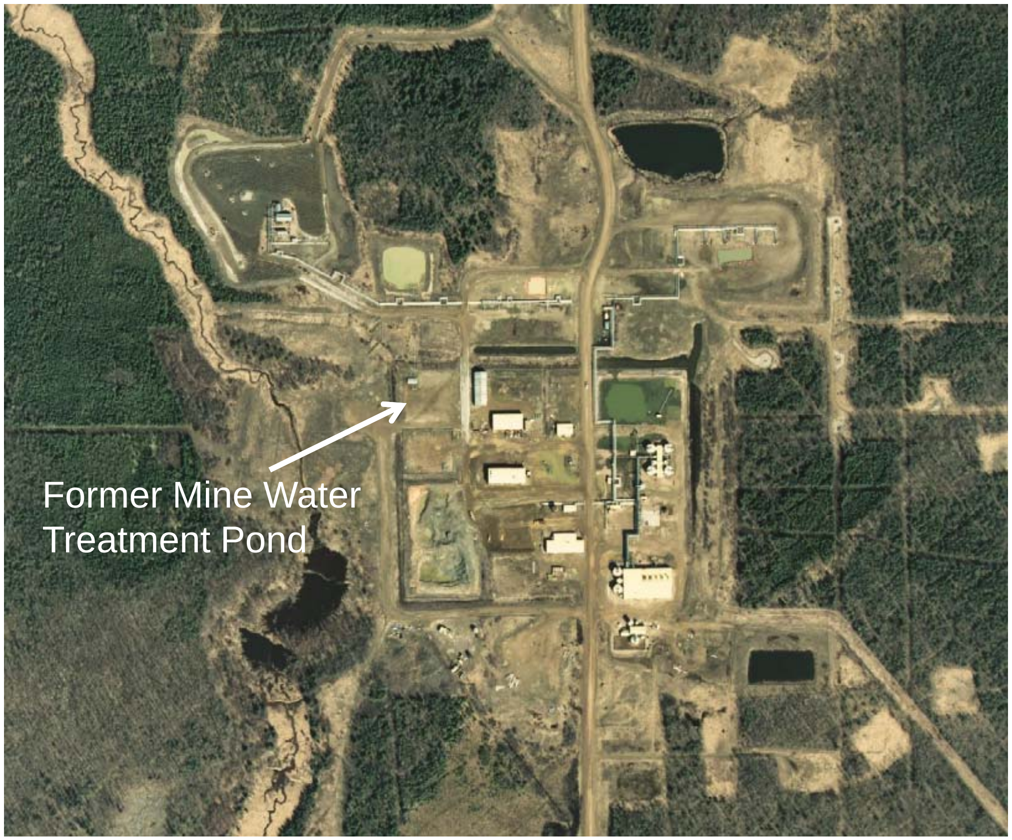


LEGEND:

- Buildings demolished
- Support Buildings left intact

Source: 2010 Approved Dover UTF Mine Abandonment Plan

UTF Mine Water Treatment Pond



- Mine water treatment pond originally built to capture produced water and water seepage from the UTF shafts and tunnels
- Suncor received approval from Alberta Environment in July 2010 to decommission the concrete pond and the associated pump house
- Soil samples were obtained from the pond area, and as of January 2013 Suncor is waiting on the analytical results before proceeding with backfilling and re-contouring

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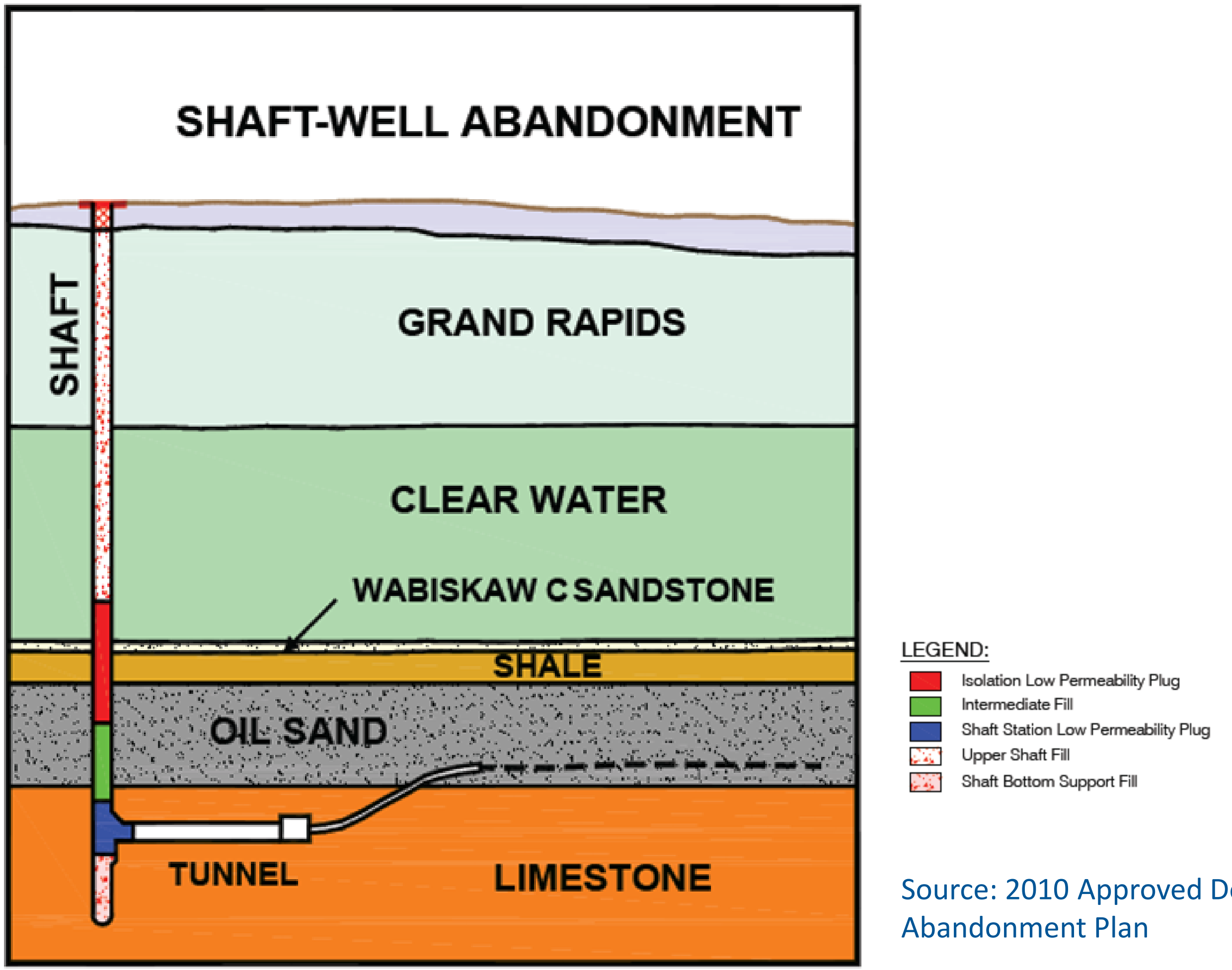
UTF Mine Abandonment

- Hybrid shaft-well abandonment method used to provide required groundwater protection over the long term

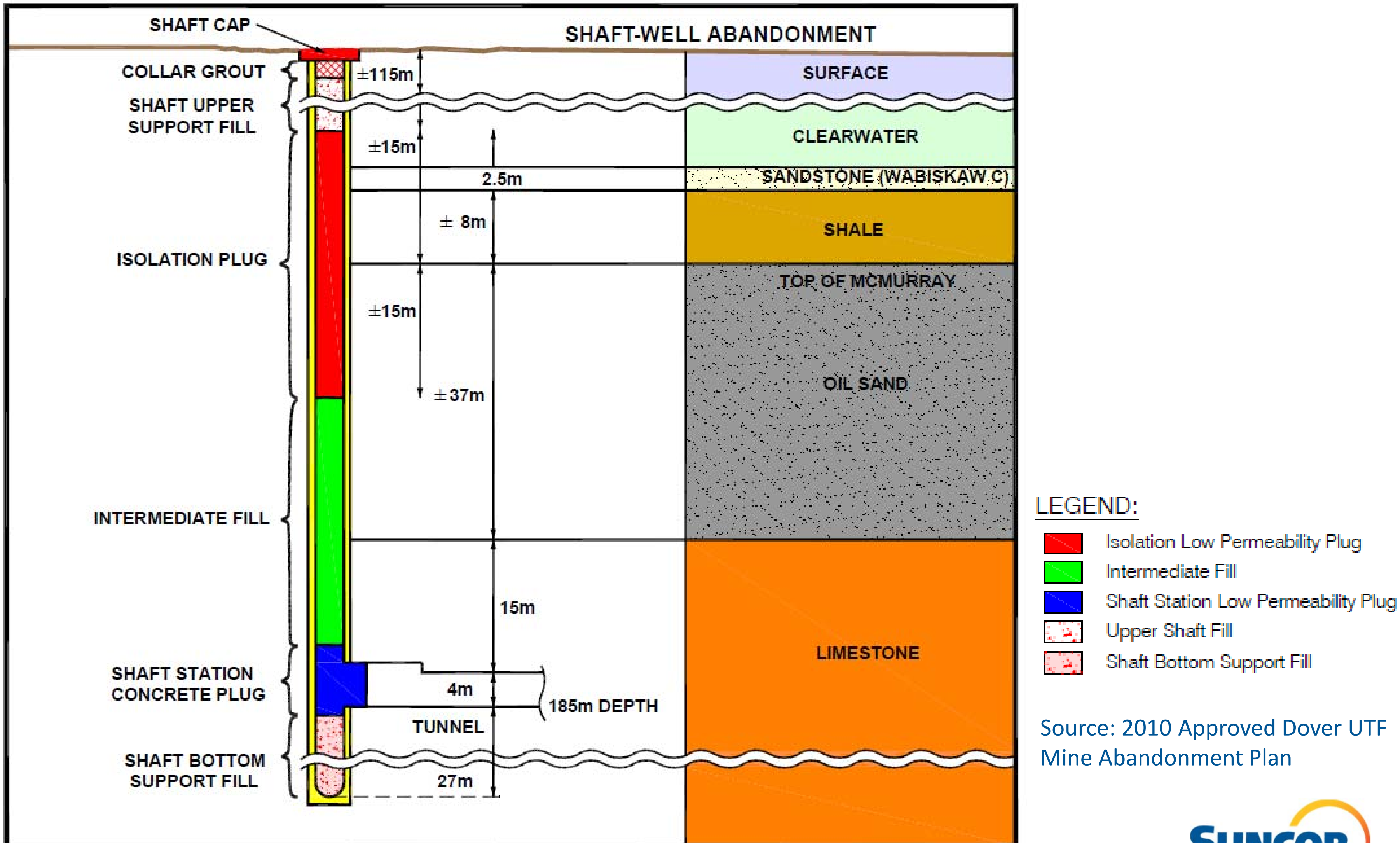


Source: 2010 Approved Dover UTF Mine Abandonment Plan

Hybrid Shaft-Well Abandonment

- Hybrid shaft-well abandonment method used to isolate the lower saline formation water from the upper freshwater zones
  - Engineered fill used to isolate the McMurray and Clearwater
  - Isolation plugs designed to ensure saline formation water was restricted from connecting with upper freshwater zones
  - Engineered solution with low permeability concrete used in shaft isolation and shaft station plugs

Hybrid Shaft-Well Abandonment



Note: Isolation Membrane at Shaft Isolation Plug and Tunnel Isolation Bulkhead not Shown.

Source: 2010 Approved Dover UTF Mine Abandonment Plan

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UTF Shaft Closure

- Shaft Bottom Fill:
  - A Very High Volume Supplementary Cementing Material (VHVSCM) with low-permeability, low-shrinking flowable concrete was used
  - Extended from the shaft bottom to 1 m below the shaft station (~27 m in length) for both the No. 1 and No. 2 shafts
- Shaft Station Concrete Plug:
  - Provides low-permeability between the tunnels and the shafts
  - A High Volume Supplementary Cementing Material (HVSCM) with low-permeability, low-shrinking flowable concrete was used
  - Installed from 1 m below the tunnel floor to 1 m above the tunnel roof at the shaft station location
- Shaft Intermediate Fill:
  - Required for a distance of about 36 m above the shaft station plug
  - A VHVSCM with low-permeability, low-shrinking flowable concrete, similar to the shaft bottom fill was used

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UTF Shaft Closure

- Shaft Isolation Plug:
  - A HVSCM with low-permeability, low-shrinking flowable concrete was used in this 30 m zone
  - Any infrastructure (e.g. pipes and timber shaft guides) in this zone was removed
- Shaft Upper Fill:
  - A matrix of VHVSCM low-permeability, low-shrink concrete at a ratio of 50% was used in this zone
  - Required for about 110 m above the shaft isolation plug
- Shaft Collar and Cap:
  - A reinforced concert cap 0.5 m thick and 6 m wide was installed on top of the shafts with the top of the cap 2 m below final surface
  - Top 3 m of the shafts below the cap were filled with lean concrete mix

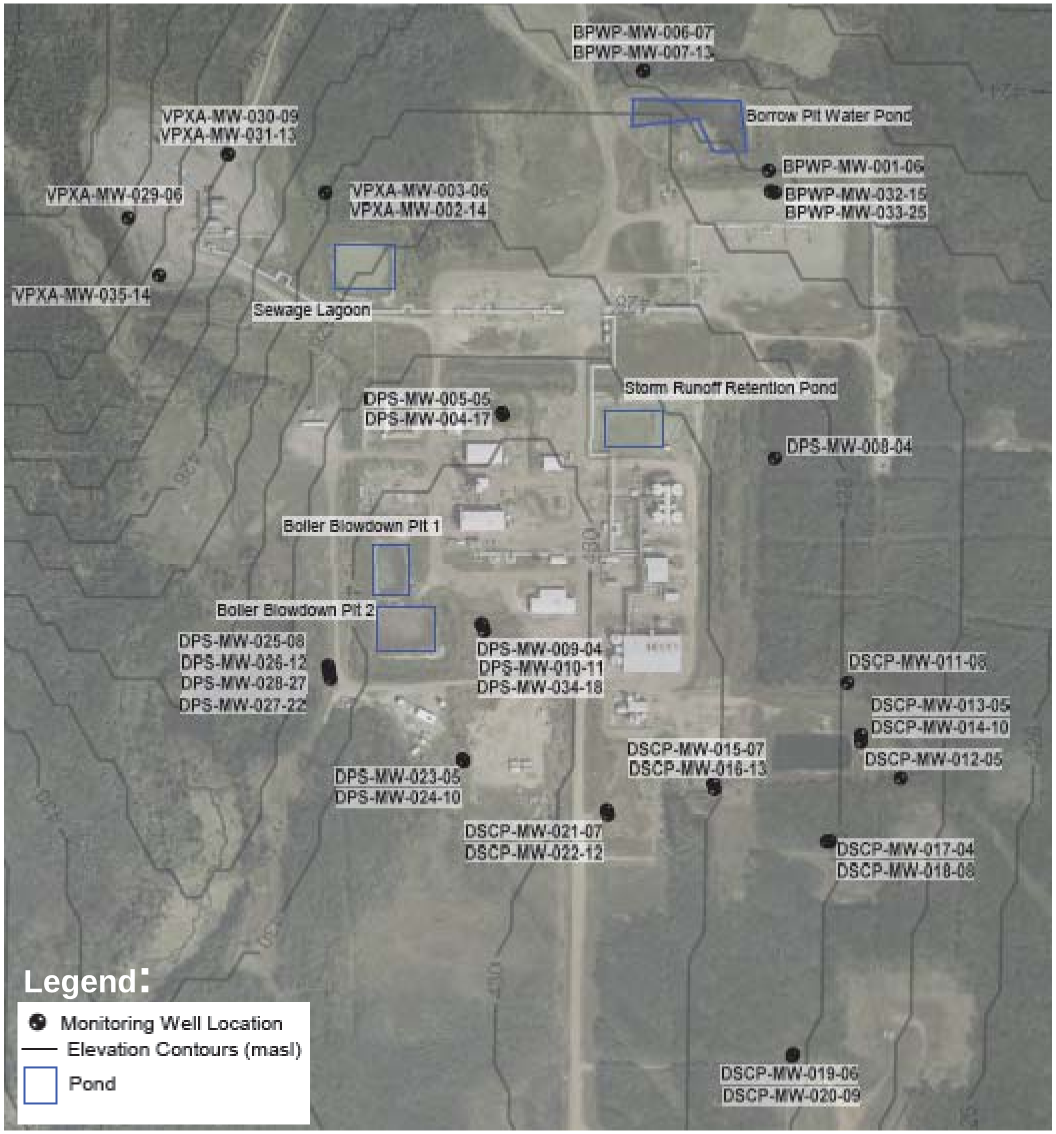
UTF Environmental Summary – Soil and Groundwater

- An ongoing Groundwater Monitoring Program (GMP) and Soil Management Program (SMP) are currently in place at the Suncor Dover Facility, as required under EPEA Approval No. 705-02-00 (as amended)

- The findings from the 2013 GMP include the following:
  - Total dissolved solids concentrations exceeded Tier 1 guidelines in 16 wells, and sodium concentrations exceeded Tier 1 guidelines in 14 wells
  - Concentrations of BTEX and PHC fractions F1 and F2 were less than analytical detection limits at all wells sampled in 2013

- The findings from the 2013 SMP include the following:
  - Hydrocarbon impacted material may remain close to the Hoist/Mine Building
  - Minor hydrocarbon and salinity impacts have not yet been fully delineated in the area of the warehouse and shop building

GMP Monitoring Well Locations



- 35 GW monitoring wells in the current
- Based on the 2013 groundwater quality data, the current groundwater monitoring and sampling program is considered adequate to monitor changes in groundwater

Source: 2013 Groundwater Monitoring Report – Dover Plant (Tetra Tech EBA, 2014)

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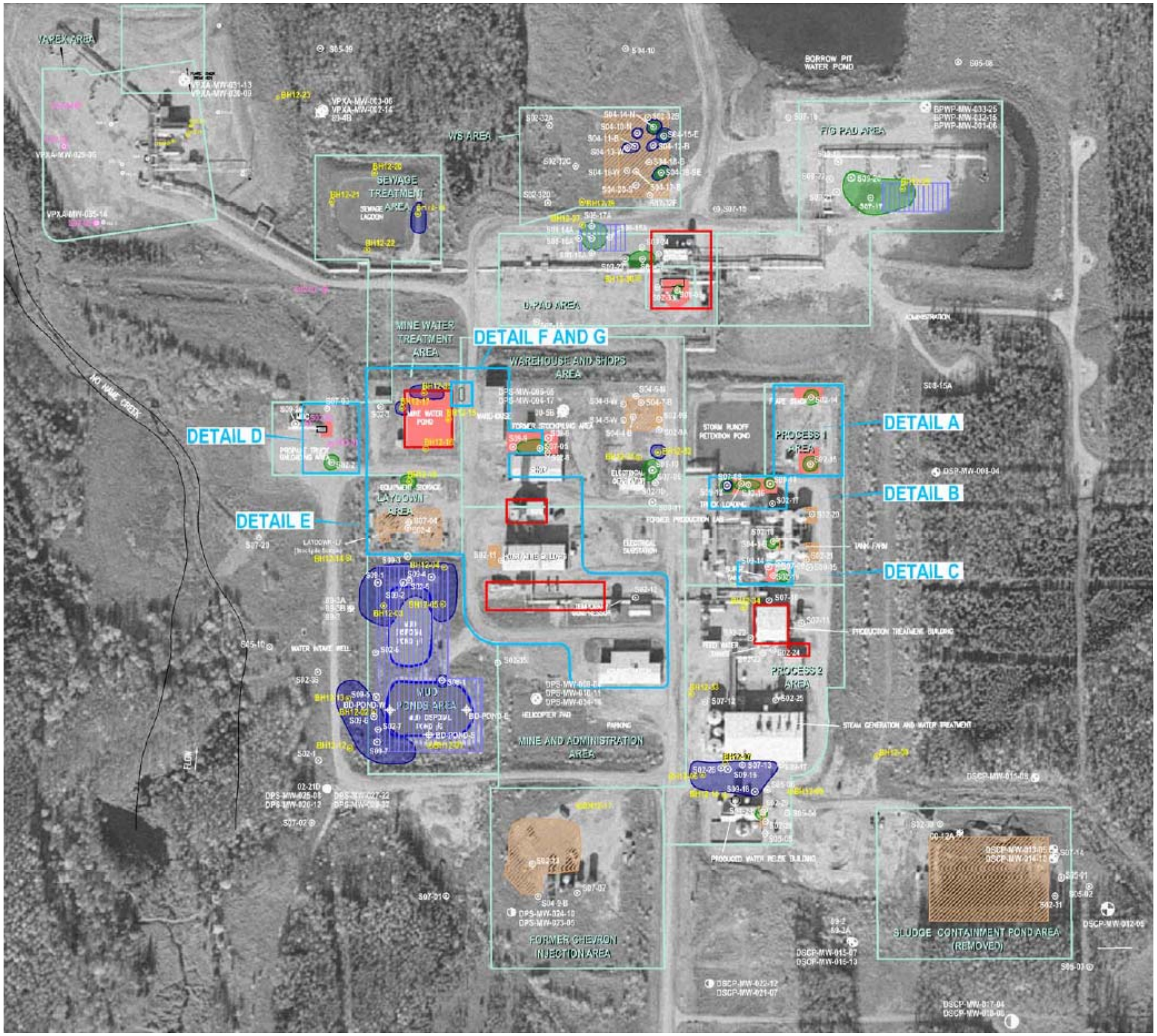
SMP Summary



LEGEND

- SINGLE PIEZOMETER INSTALLATION
- DOUBLE PIEZOMETER LOCATION
- TRIPLE PIEZOMETER LOCATION
- QUADRUPLE PIEZOMETER LOCATION
- ABANDONED PIEZOMETER LOCATION
- SOIL SAMPLING LOCATION (2002-2009 SOIL MONITORING ACTIVITIES)
- SOIL SAMPLING LOCATION (2002 BASELINE INVESTIGATION)
- SLUDGE SAMPLING LOCATION (2006 SOIL MANAGEMENT ACTIVITIES-APPROXIMATE)
- SOIL SAMPLING LOCATION (2012 SOIL MONITORING ACTIVITIES)
- OPERATIONAL AREA
- FORMER EXCAVATED AREAS (APPROXIMATE)

INTERPRETED AREAS OF EXCEEDANCES

- HYDROCARBON CONCENTRATIONS EXCEED AB TIER 1 (2010) GUIDELINES FOR NATURAL LANDUSE
- EC AND / OR SAR VALUES EXCEED AB TIER 1 (2010) GUIDELINES FOR NATURAL LANDUSE AND ASSOCIATED CHLORIDE AND SODIUM VALUES EXCEED BACKGROUND CONCENTRATIONS
- STUCTURES REMOVED IN 2013
- ONGOING EXCAVATED AREAS (APPROXIMATE)
- 2013 EXCAVATED AREAS (APPROXIMATE)

Source: 2013 Soil Management Program Report – Dover In Situ Oil Sands Plant (WorleyParsons, 2014)

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UTF Environmental Summary – Air Emissions

- The only emission source at Dover originates from the BEST Field Pilot under EPEA Approval No. 705-02-00
- Dover has two passive air quality stations and monitors for Sulphur Dioxide (SO_2) and Hydrogen Sulphide (H_2S)
- No H_2S or SO_2 AAAQO exceedances at the Dover site

TABLE 1: APPROVED AIR EFFLUENT STREAM OVERVIEW AND STATUS UPDATE

Project	Source	Status
Original Facility	1.2 MW glycol heater exhaust stack	Not in operation
Original Facility	Three 7.3 MW steam generator exhaust stacks	Not in operation
Original Facility	Two 14.6 MW steam generator exhaust stacks	Not in operation
Original Facility	Central processing facility flare stack	Not in operation
BEST Field Pilot	2.75 MW glycol heater exhaust stack	Operating
BEST Field Pilot	high pressure flare stack	Operating
ESEIEH Project	172 kW glycol heater	Not constructed yet
ESEIEH Project	high pressure flare stack	Not constructed yet
ESEIEH Project	210 kW back-up diesel generator	Not constructed yet
Original Facility	Space ventilation exhaust stacks	Decommissioned
Original Facility	Space heater exhaust vents	Decommissioned

Source: 2013 Annual Air Emissions Summary and Evaluation Report – Dover Facility (Suncor, 2014)

Closure

- The UTF (Phase A, B and HASDRIVE) was operational from 1987 to 2004
- Resources immediately adjacent to the UTF area are depleted; consequently Suncor decided to proceed with final abandonment
- Wellhead abandonment and underground mine abandonment occurred in 2008 and 2013, respectively
- Suncor is currently considering reutilizing portions of the Plant site and repurposing certain buildings for a camp and/or other future developments
- Suncor will continue to ensure compliance with all regulatory approvals, decisions, regulations and conditions pertaining to the Dover Commercial Project

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