

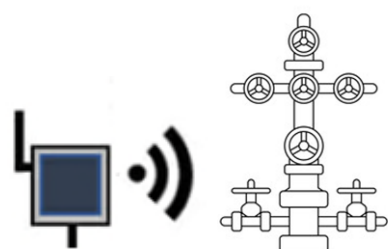
APPENDIX 5:

INJECTION AND MONITORING WELL SCHEMATICS

CTV II STORAGE PROJECT

The following schematics provide depictions of the proposed injection and monitoring wells associated with CTV II project. This includes the well construction details and the type and location of monitoring equipment within the wellbore and relative to the geologic storage complex. Perforations and gross monitoring intervals have been indicated. For wells that have not yet been drilled, actual completion and monitoring intervals will be confirmed during the pre-operations phase of the project.

Additionally, schematics of the proposed abandonment configurations of all injection and monitoring show proposed cement plug depths to ensure confinement and non-endangerment of USDW. Cement plug descriptions have been provided in tabular format.



Surface Measurements (w/ alarms on each):
Injection Pressure, Injection Rate, Annular Pressure, Annular Volume
Surface Equipment:
Wellhead Surface Safety Valve (SSV) for automatic shut-off
Comms to Central Control Facility (24-hr monitoring)

MD
(TVD)

1,000
(999)

2,000
(1,997)

USDW @ 2381'

3,000
(2,996)

4,000
(3,995)

Domengine @
4,730'

5,000
(4,993)

Capay Shale @
5,331'

Moke @ 5,566'

6,000
(5,981)

7,000
(6,945)

H & T Shale @
7,338'
Starkey Fm @
7,443'

8,000
(7,914)

9,000
(8,891)

Winters @ 9,692'

10,000
(9,867)

Casing	Depth Interval	Open Hole Diameter	Outer Diameter	Inner Diameter	Weight	Grade	Design Coupling	Thermal Conductivity @ 77 °F	Burst Strength	Collapse Strength	Tensile Strength
	(feet)	(inches)	(inches)	(inches)	(lb/ft)	(API)	(short or long threaded)	(BTU/ft hr, °F)	(psi)	(psi)	(lbf)
Surface	0' - 376'	17.5	13.375	12.715	48	H-40	Short	2.62	1,730	770	540,960
Intermediate	0' - 3588'	12.25	9.625	8.755	43.5	N-80	Long	2.62	6,330	3,810	1,004,720
Long-String	0' - 2186'	8.5	7	6.184	29	N-80	Long	2.62	8,160	7,020	675,960
	2186' - 9540'			6.276	26	N-80			7,240	5,410	603,930
Liner	9352' - 9995'	6.5	5	4.276	18	N-80	Long	2.62	10,140	10,490	421,970

Tubing	Depth Interval	Outer Diameter	Inner Diameter	Weight	Grade	Design Coupling	Burst Strength	Collapse Strength	Tensile Strength
	(feet)	(inches)	(inches)	(lb/ft)	(API)	(short or long threaded)	(psi)	(psi)	(lb)
3-1/2"	9300'	3.5	2.992	9.3	L-80 CRA	Premium	10,160	10,530	207,220
2-7/8"	9592'	2.875	2.441	6.5	L-80 CRA	Premium	10,570	11,170	144,960

Temperature (DTS)
@ 2310' - 2330'

Packer Type and Material	Packer Setting Depth	Length	Nominal Casing Weight	Outer Diameter	Inner diameter
	(feet)	(inches)	(lb/ft)	(inches)	(inches)
Hydraulic Retrievable, CRA Mandrel	9200	30.3	26 - 29	5.968	3.000

Tensile Rating	Burst Rating	Collapse Rating	Max Casing Inner Diameter	Min Casing Inner Diameter
(lbs)	(psi)	(psi)	(inches)	(inches)
70,000	7,500	7,500	6.276	6.136

Temperature (DTS)
@ 5720' - 5840'

Mokelumne River Monitoring Interval, 5720' – 5840'

Packer Type and Material	Packer Setting Depth	Length	Nominal Casing Weight	Outer Diameter	Inner diameter
	(feet)	(inches)	(lb/ft)	(inches)	(inches)
Permanent Sealbore Packer, CRA	9562	36.9	15 - 21	3.968	2.688

Tensile Rating	Burst Rating	Collapse Rating	Max Casing Inner Diameter	Min Casing Inner Diameter
(lbs)	(psi)	(psi)	(inches)	(inches)
200,000	7,500	7,500	4.408	4.125

Starkey – Sawtooth Confining Zone

Temperature (DTS),
Injection Pressure Gauge
@ 9552'

Winters Injection Zone

Figure 1. Sonol Securities 1-A, Proposed CO₂ Injection Schematic

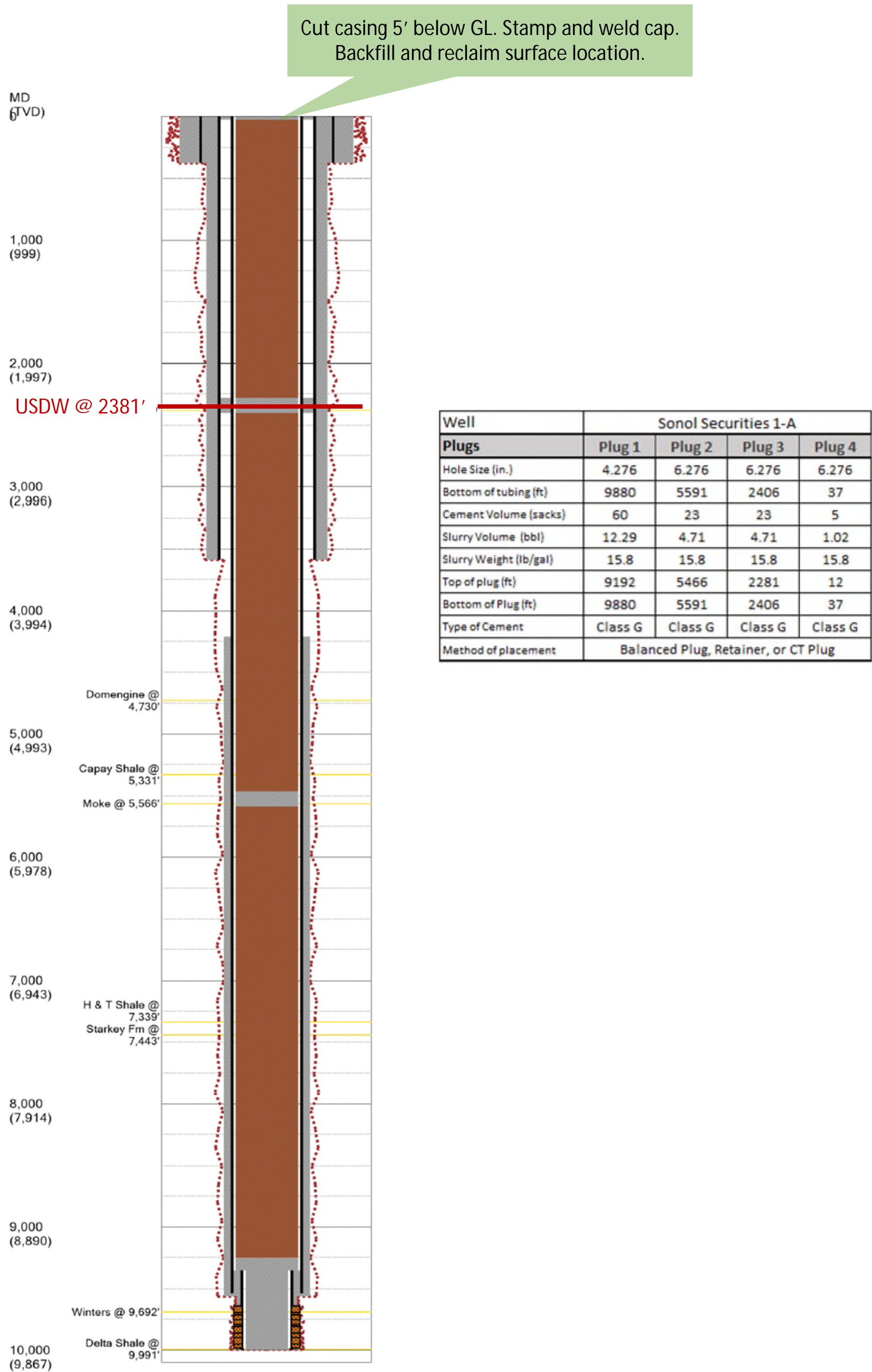
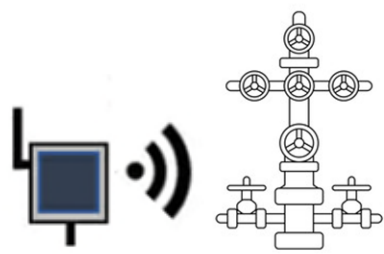


Figure 2. Sonol Securities 1-A, Proposed Abandonment Schematic



Surface Measurements (w/ alarms on each):
Injection Pressure, Injection Rate, Annular Pressure, Annular Volume
Surface Equipment:
Wellhead Surface Safety Valve (SSV) for automatic shut-off
Comms to Central Control Facility (24-hr monitoring)

MD
(TVD)

1,000

2,000

3,000

4,000

5,000

6,000

7,000

8,000

9,000

10,000

USDW @ 2374'

Casing	Depth Interval	Open Hole Diameter	Outer Diameter	Inner Diameter	Weight	Grade	Design Coupling	Thermal Conductivity @ 77 °F	Burst Strength	Collapse Strength	Tensile Strength
	(feet)	(Inches)	(inches)	(inches)	(lb/ft)	(API)	(short or long threaded)	(BTU/ft hr,°F)	(psi)	(psi)	(lbf)
Surface	0' - 1007'	17.5	13.375	12.615	54.5	K-55	Short	2.62	2730	1130	853240
Intermediate	0' - 4754'	12.25	9.625	8.835	40	K-55 N-80	Long	2.62	3950	2570	629960
	4754' - 5618'								5750	3090	916300
Long-String	0' - 8184'	8.625	5.5	4.892	17	N-80	Long	2.62	7740	6390	396990
	8184' - 9927'			4.778					8990	8830	466260

Tubing	Depth Interval	Outer Diameter	Inner Diameter	Weight	Grade	Design Coupling	Burst Strength	Collapse Strength	Tensile Strength
	(feet)	(inches)	(inches)	(lb/ft)	(API)	(short or long threaded)	(psi)	(psi)	(lbf)
3-1/2"	9570	3.5	2.992	9.3	L-80 CRA	Premium	10,160	10,530	207,220

Temperature (DTS)
@ 2340' – 2360'

Packer Type and Material	Packer Setting Depth	Length	Nominal Casing Weight	Outer Diameter	Inner diameter
	(feet)	(inches)	(lb/ft)	(inches)	(inches)
Permanent Sealbore Packer, CRA	9540	30.3	23-32	5.687	3.25

Tensile Rating	Burst Rating	Collapse Rating	Max Casing Inner Diameter	Min Casing Inner Diameter
(lbs)	(psi)	(psi)	(inches)	(inches)
200,000	7,500	7,500	6.366	6.049

Temperature (DTS)
@ 6297' – 6383'

Mokelumne River Monitoring Interval, 6297' - 6383'

Starkey – Sawtooth Confining Zone

Temperature (DTS),
Injection Pressure Gauge
@ 9530'

Winters Injection Zone

Stockton Arch Fault @ 6,214'
Moke @ 6,215'

H & T Shale @ 7,250'
Starkey Fm @ 7,338'

Winters @ 9,592'
Delta Shale @ 9,916'

Packer @ 9540'

Perforations:
9620' – 9910'

Figure 3. Sonol Securities 3, Proposed CO₂ Injection Schematic

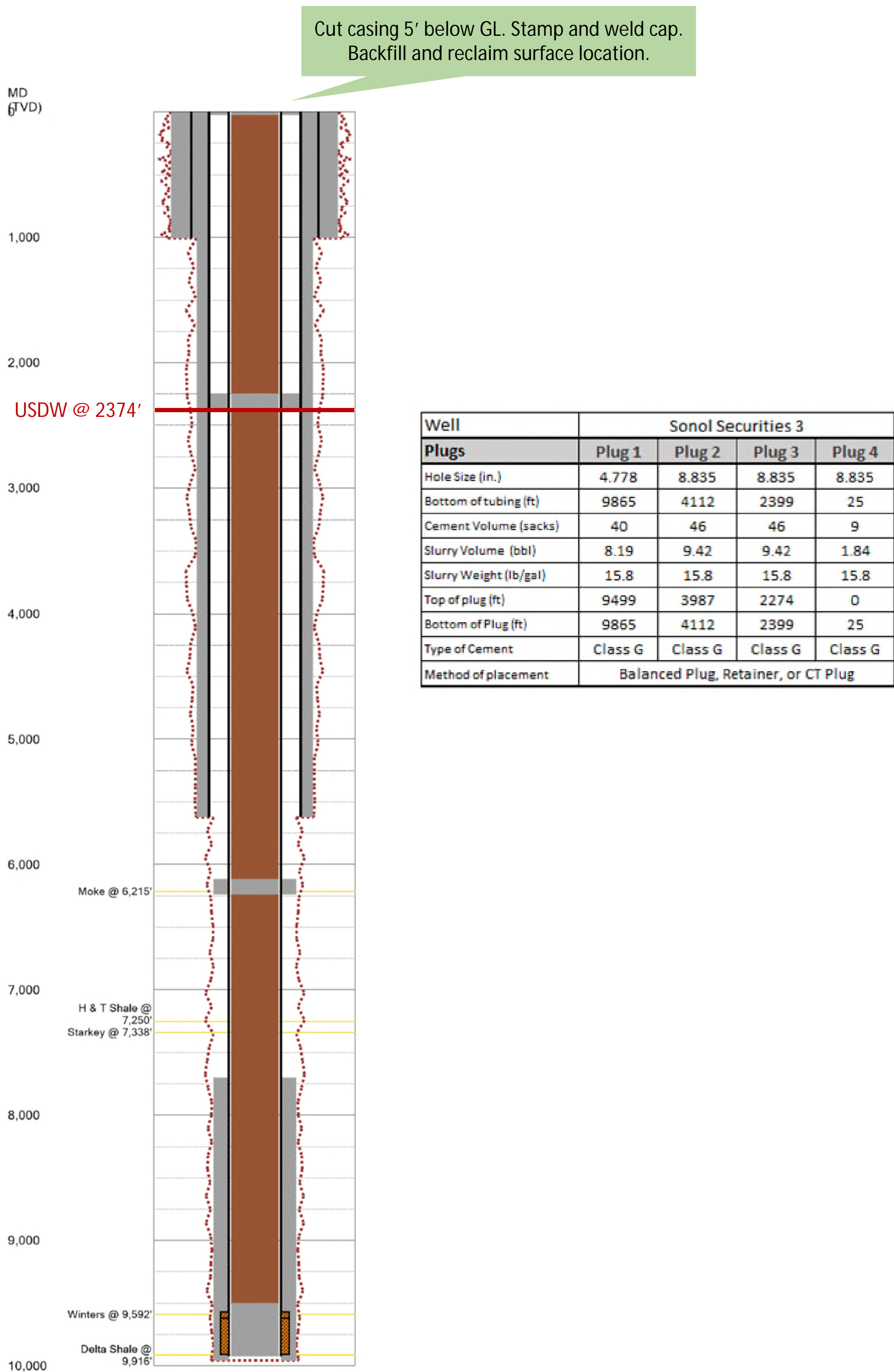
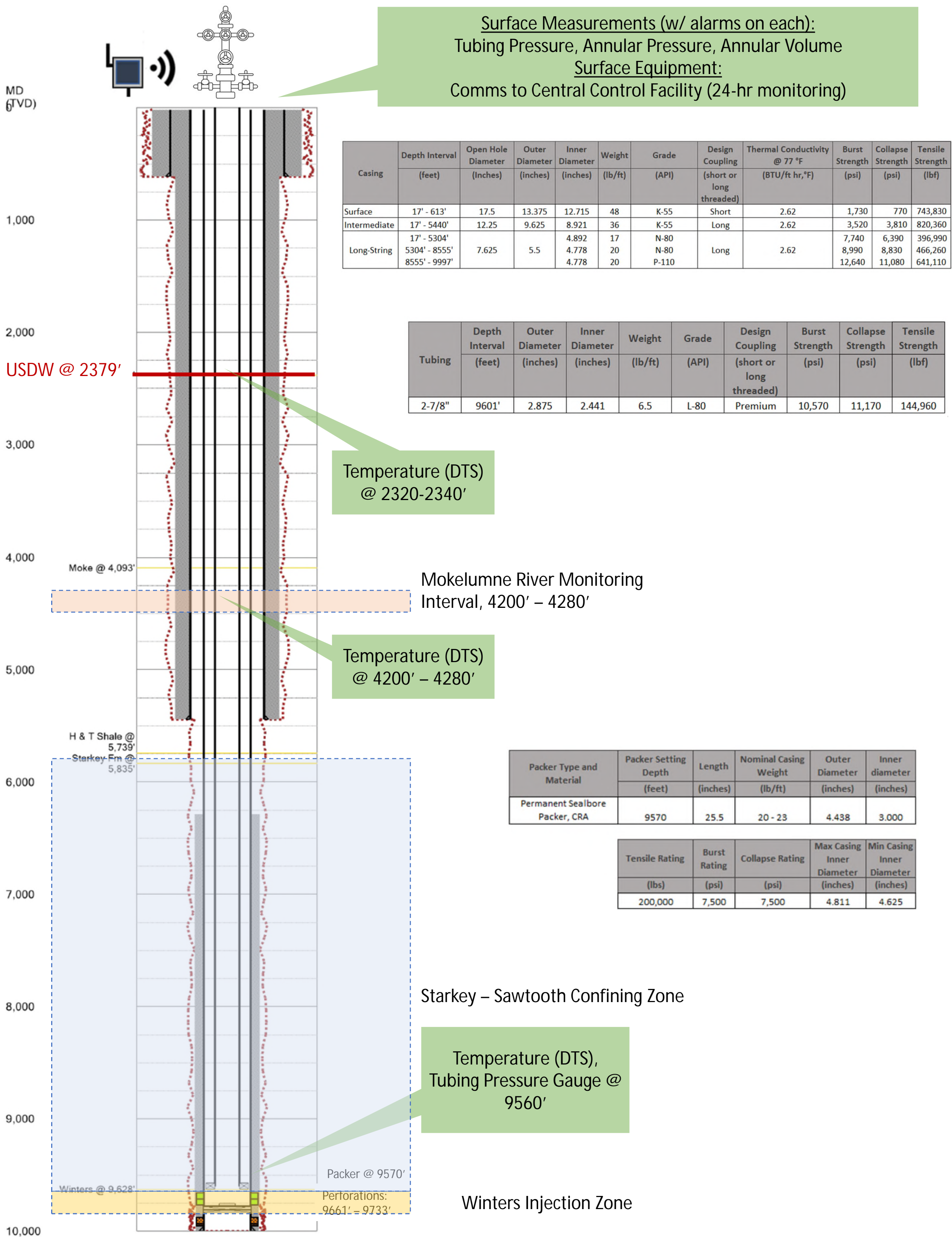


Figure 4. Sonol Securities 3, Proposed Abandonment Schematic



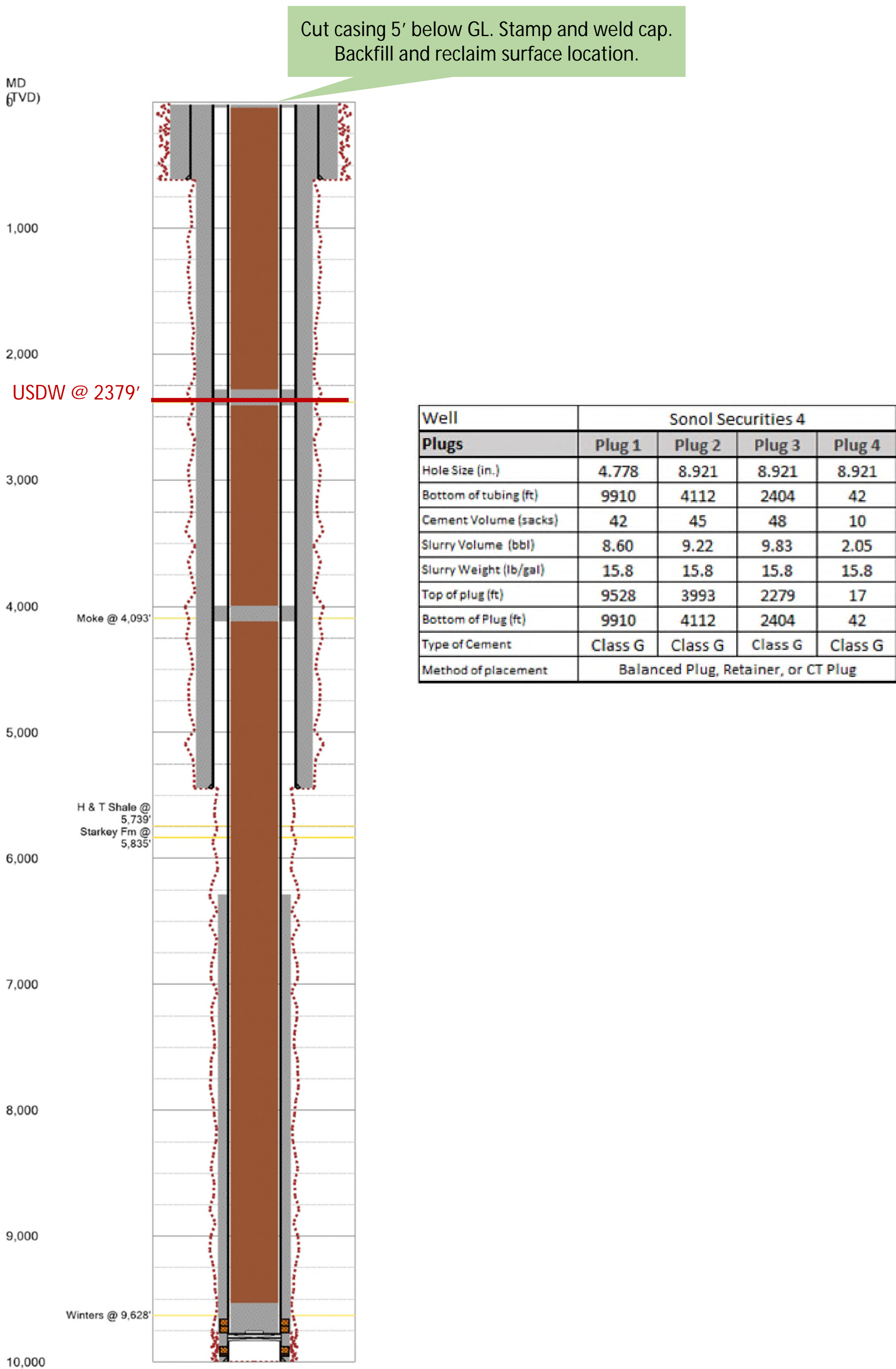
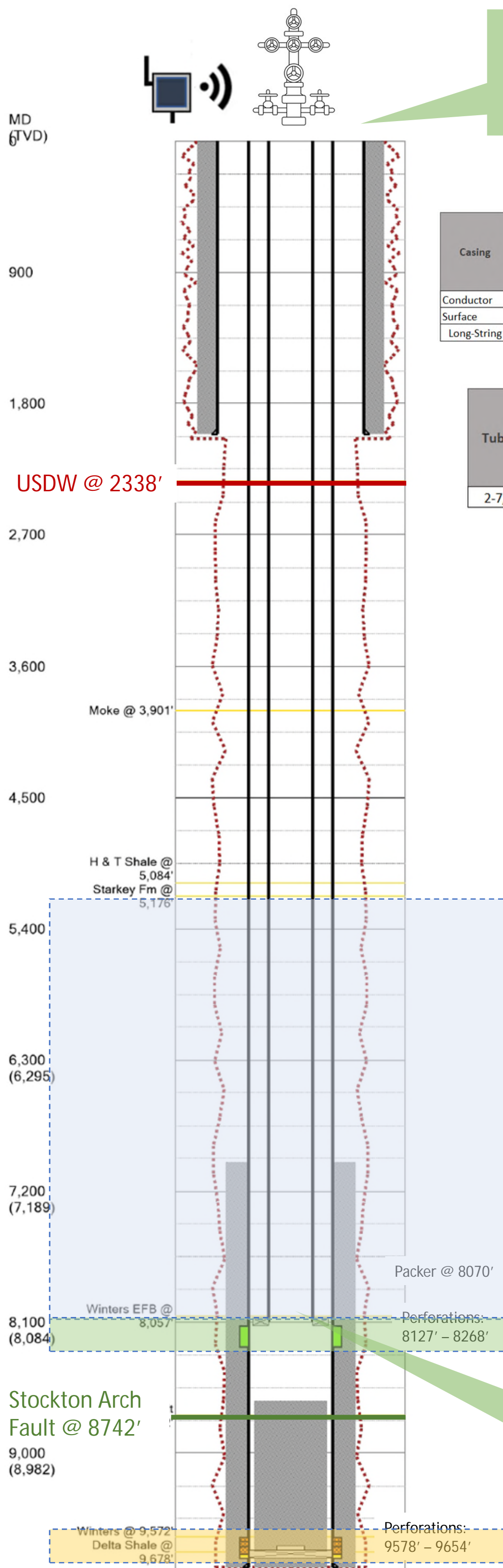


Figure 6. Sonol Securities 4, Proposed Abandonment Schematic



Surface Measurements (w/ alarms on each):
Tubing Pressure, Annular Pressure, Annular Volume
Surface Equipment:
Comms to Central Control Facility (24-hr monitoring)

Casing	Depth Interval (feet)	Open Hole Diameter (Inches)	Outer Diameter (inches)	Inner Diameter (inches)	Weight (lb/ft)	Grade (API)	Design Coupling (short or long threaded)	Thermal Conductivity @ 77 °F (BTU/ft hr,°F)	Burst Strength (psi)	Collapse Strength (psi)	Tensile Strength (lbf)
Conductor	0' - 40'	24	20	19.124	94	-	-	2.62	-	-	-
Surface	0' - 2011'	12.25	9.625	8.921	36	K-55	Short	2.62	3,520	3,810	564,000
Long-String	0' - 9783	8.5	5.5	4.778	20	N-80	Long	2.62	8,990	8,830	466,260

Tubing	Depth Interval (feet)	Outer Diameter (inches)	Inner Diameter (inches)	Weight (lb/ft)	Grade (API)	Design Coupling (short or long threaded)	Burst Strength (psi)	Collapse Strength (psi)	Tensile Strength (lbf)
2-7/8"	9601'	2.875	2.441	6.5	L-80	Premium	10,570	11,170	144,960

Packer Type and Material	Packer Setting Depth	Length	Nominal Casing Weight	Outer Diameter	Inner diameter
	(feet)	(inches)	(lb/ft)	(inches)	(inches)
Mechanical, Low Carbon Alloy Steel	8030	95.4	20 - 23	4.5	2.37

Tensile Rating	Burst Rating	Collapse Rating	Max Casing Inner Diameter	Min Casing Inner Diameter
(lbs)	(psi)	(psi)	(inches)	(inches)
100,000	8,000	8,000	4.578	4.868

Starkey – Sawtooth Confining Zone

Winters East of
Stockton Arch Fault –
Monitoring Zone

Temperature (DTS),
Tubing Pressure Gauge @
8060'

**The portion of the wellbore above
the fault is located outside the AoR**

Winters Injection Zone

Figure 7. Brooks 10-1 RD1, Proposed Injection Zone Monitoring Schematic

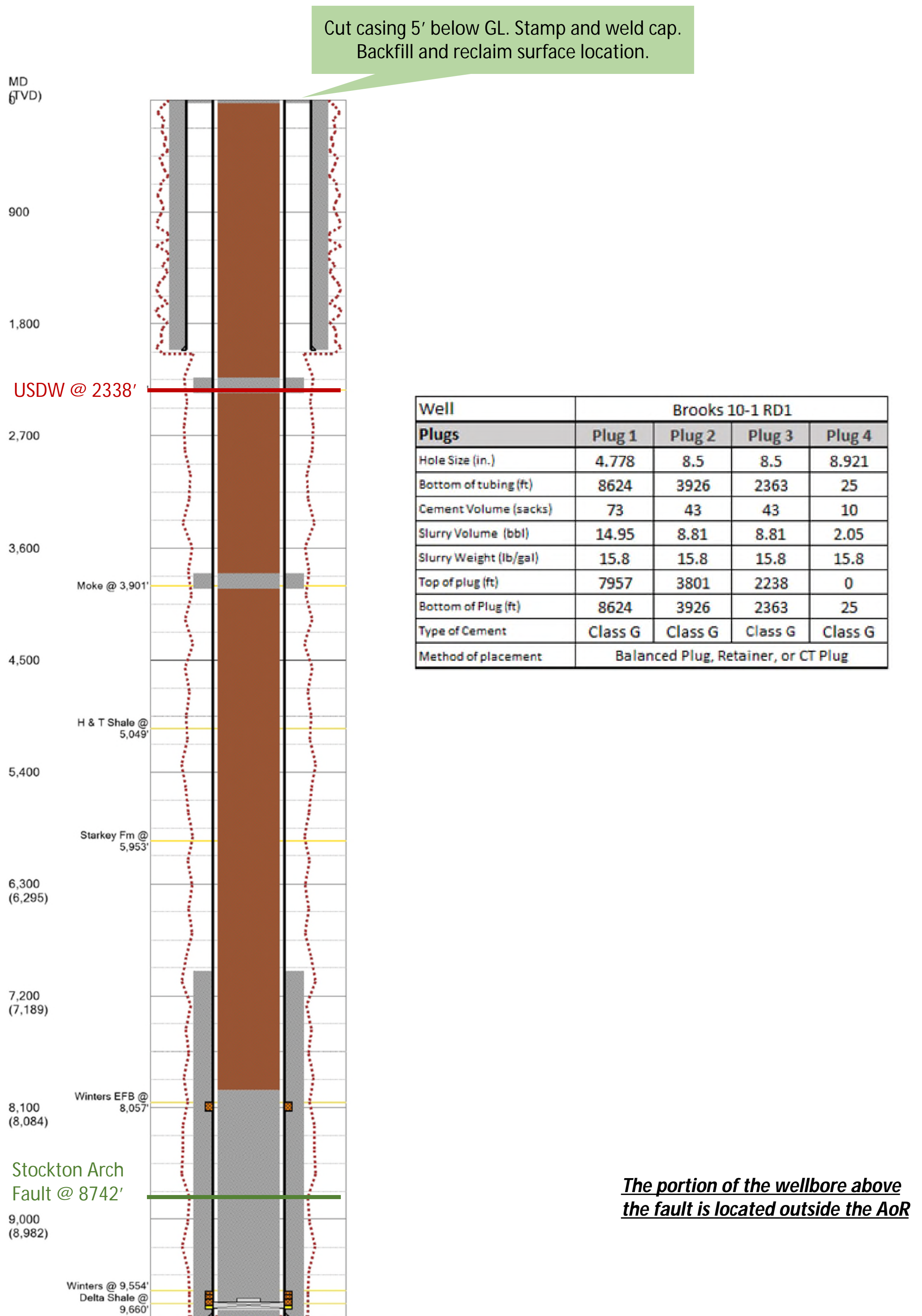
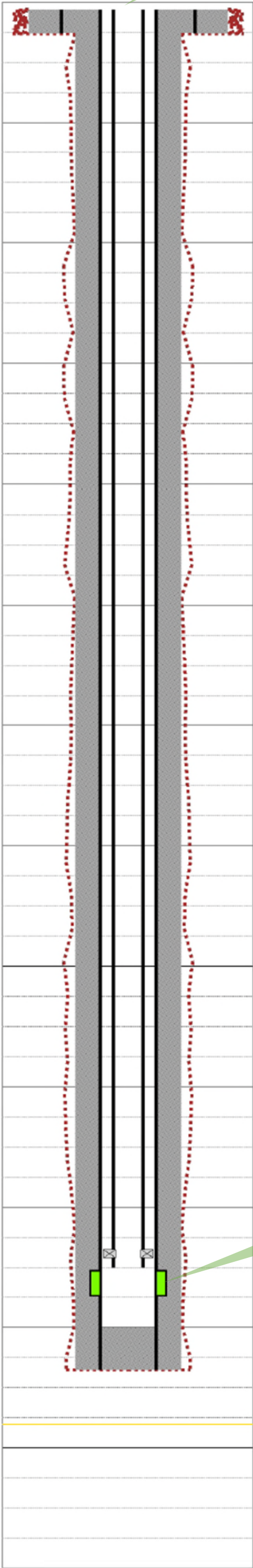


Figure 8. Brooks 10-1 RD1, Proposed Abandonment Schematic

Fluid Sampling

MD
(TVD)

200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200
2,400
2,600



Casing	Depth Interval	Open Hole Diameter	Outer Diameter	Inner Diameter	Weight	Grade	Design Coupling	Thermal Conductivity @ 77 °F	Burst Strength	Collapse Strength	Tensile Strength
	(feet)	(Inches)	(inches)	(inches)	(lb/ft)	(API)	(short or long threaded)	(BTU/ft hr, °F)	(psi)	(psi)	(lbf)
Conductor	12' - 52'	16	10.75	10.05	40.5	H-40	-	2.62	2,280	1,420	457,420
Casing	12' - 2270'	8.5	4.5	4	11.6	J-55	Long	2.62	5,350	4,960	183,590

Tubing	Depth Interval	Outer Diameter	Inner Diameter	Weight	Grade	Design Coupling	Burst Strength	Collapse Strength	Tensile Strength
	(feet)	(inches)	(inches)	(lb/ft)	(API)	(short or long threaded)	(psi)	(psi)	(lbf)
2-3/8"	2100'	2.375	1.995	4.7	J-55	Short	7,700	8,100	71,730

Packer Type and Material	Packer Setting Depth	Length	Nominal Casing Weight	Outer Diameter	Inner diameter
	(feet)	(inches)	(lb/ft)	(inches)	(inches)
Mechanical, Low Carbon Alloy Steel	2070'	27	9.5 - 13.5	3.771	1.885

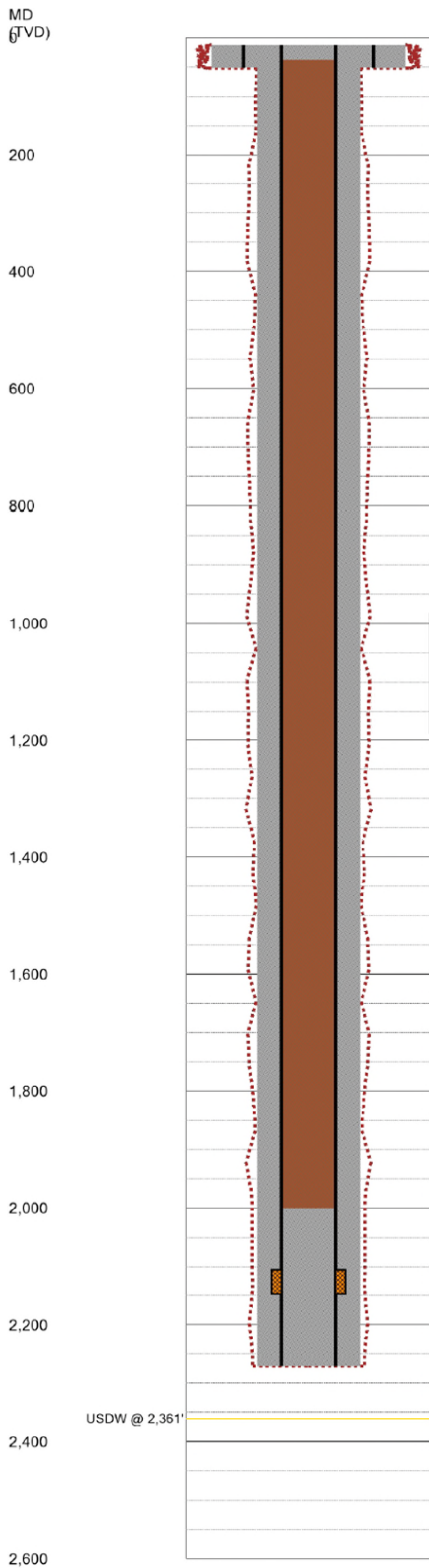
Pressure, Temperature
(gauge) @ 2060'

Packer @ 2070'

Perforations 2105' - 2147'

USDW @ 2,361'

Figure 9. USDW Monitoring Well – US-1, Proposed Monitoring Schematic



Well	US-1	
Plugs	Plug 1	Plug 2
Diameter of boring in which plug will be placed (in.)	4	4
Depth to bottom of tubing or drill pipe (ft)	2200	37
Sacks of Cement to be used (each plug)	16	2
Slurry Volume to be pumped (bbl)	2.48	0.31
Slurry Weight (lb/gal)	15.8	15.8
Calculated top of plug (ft)	2000	12
Bottom of Plug (ft)	2200	37
Type of Cement or other material	Portland	
Method of placement (e.g., balance method, retainer method, or two-plug method)	Balanced Plug, Retainer, or CT Plug	

Figure 10. USDW Monitoring Well – US-1, Proposed Abandonment Schematic

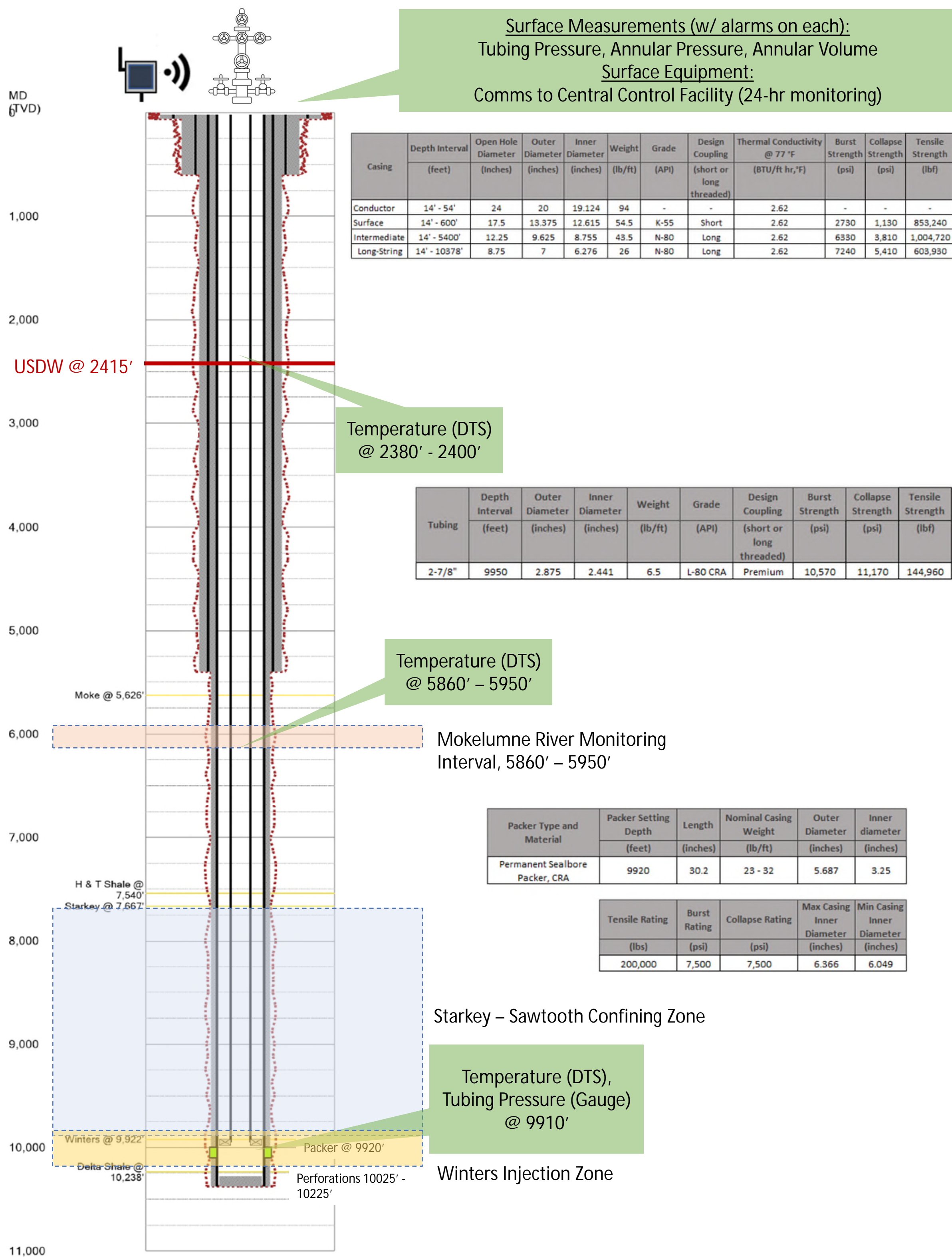


Figure 11. Well M-1, Proposed Injection Zone Monitoring Schematic

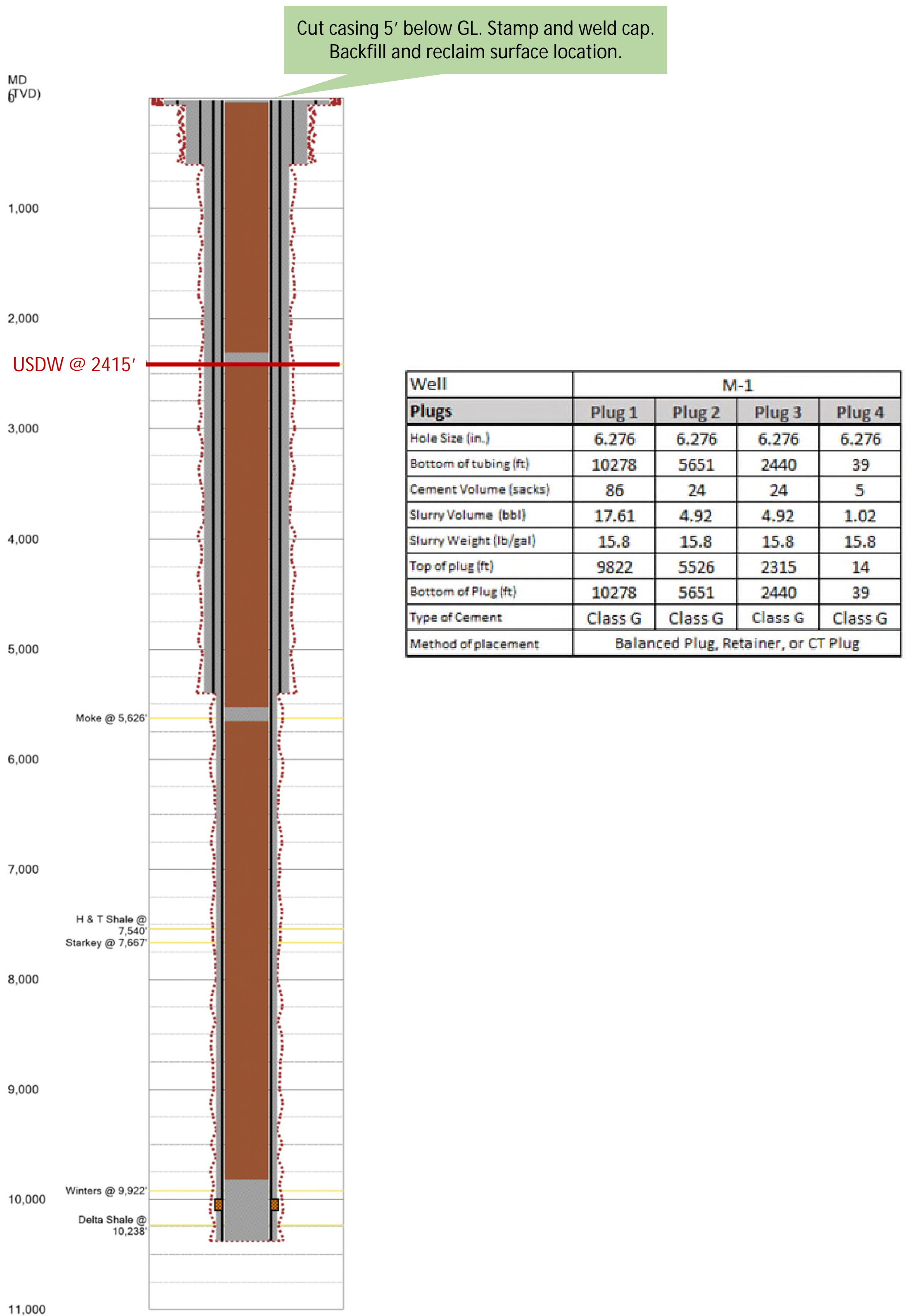


Figure 12. Well M-1, Proposed Abandonment Schematic

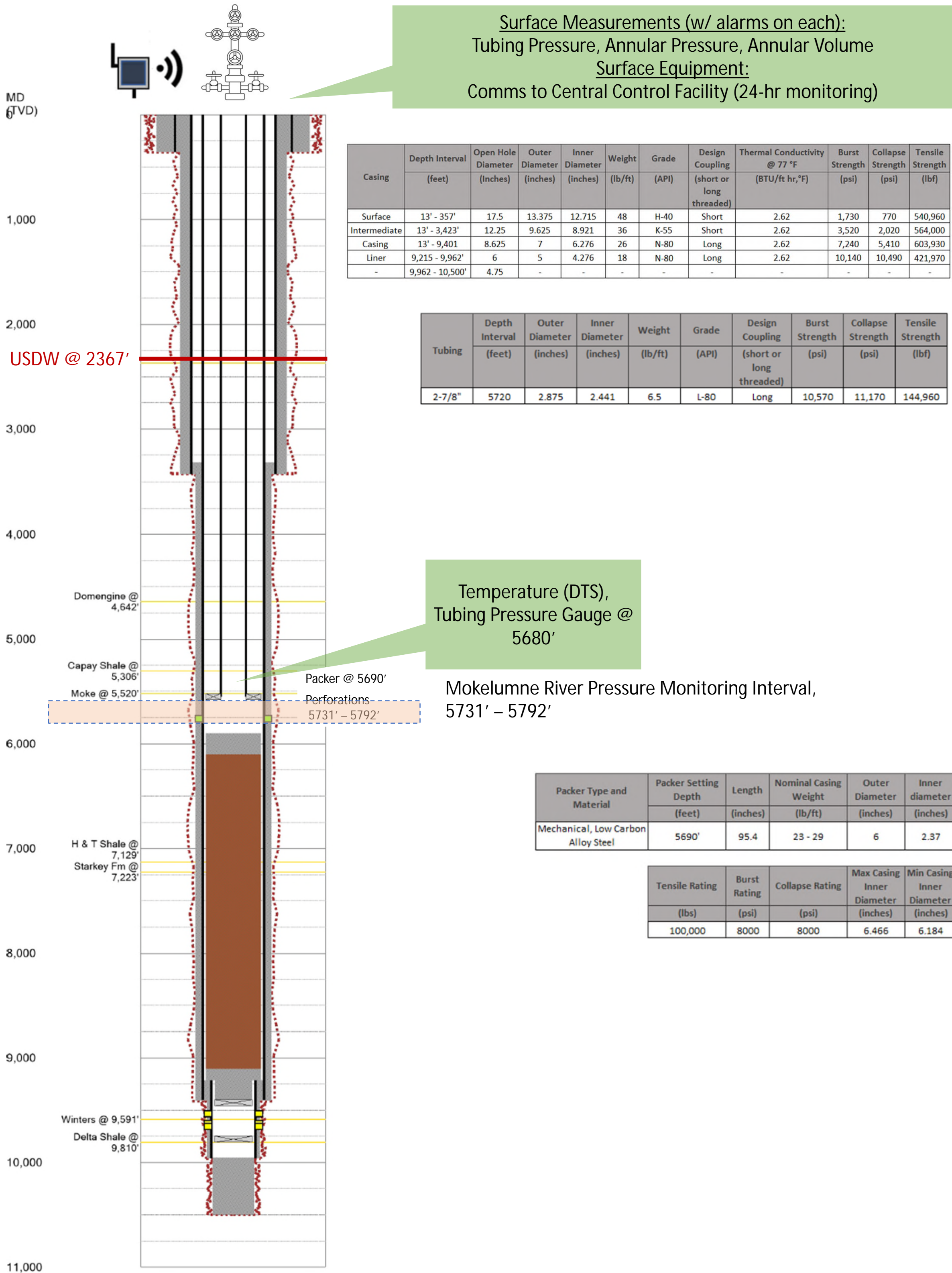


Figure 13. Sonol Securities 2, Proposed Above Zone Monitoring Schematic

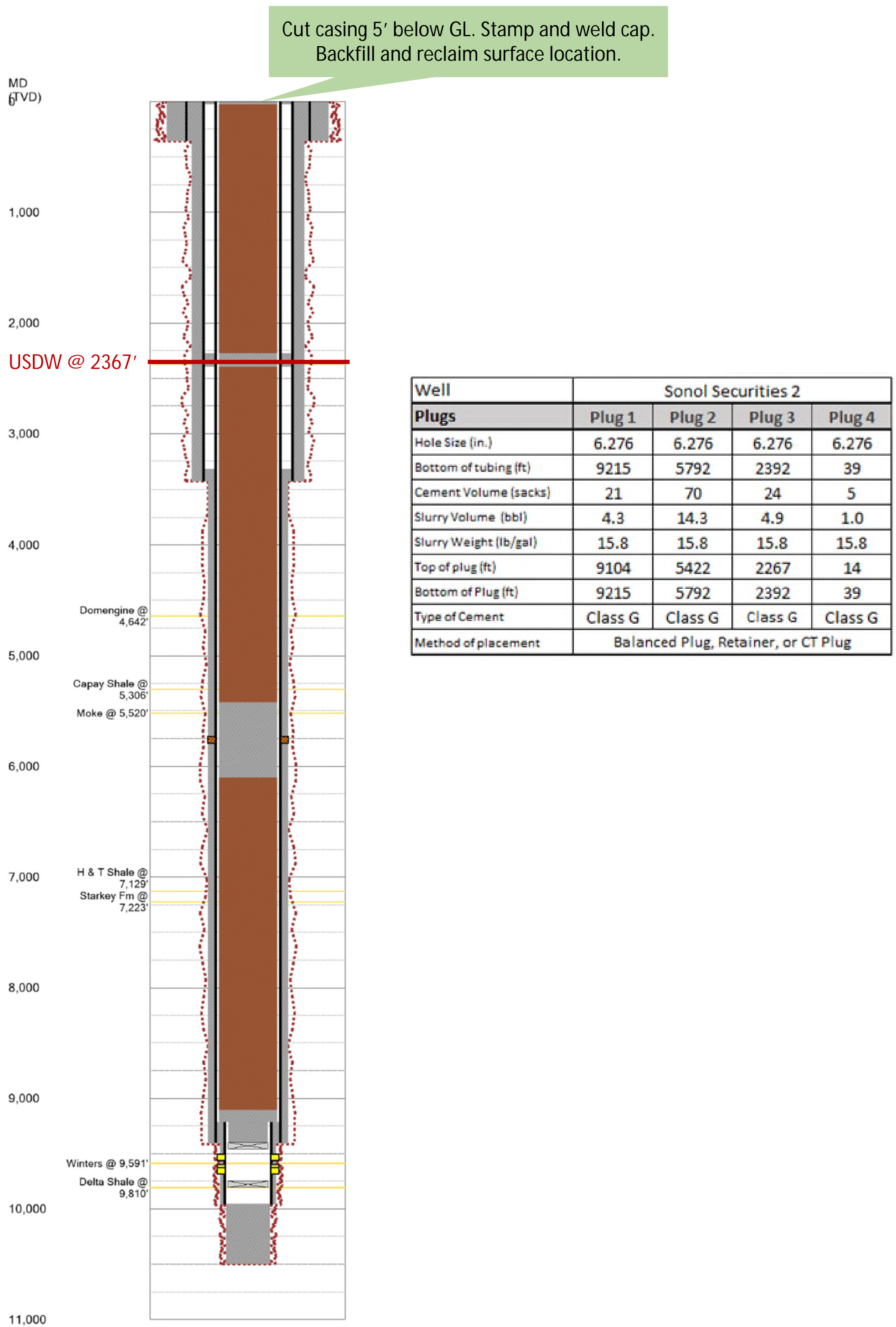


Figure 14. Sonol Securities 2, Proposed Abandonment Schematic

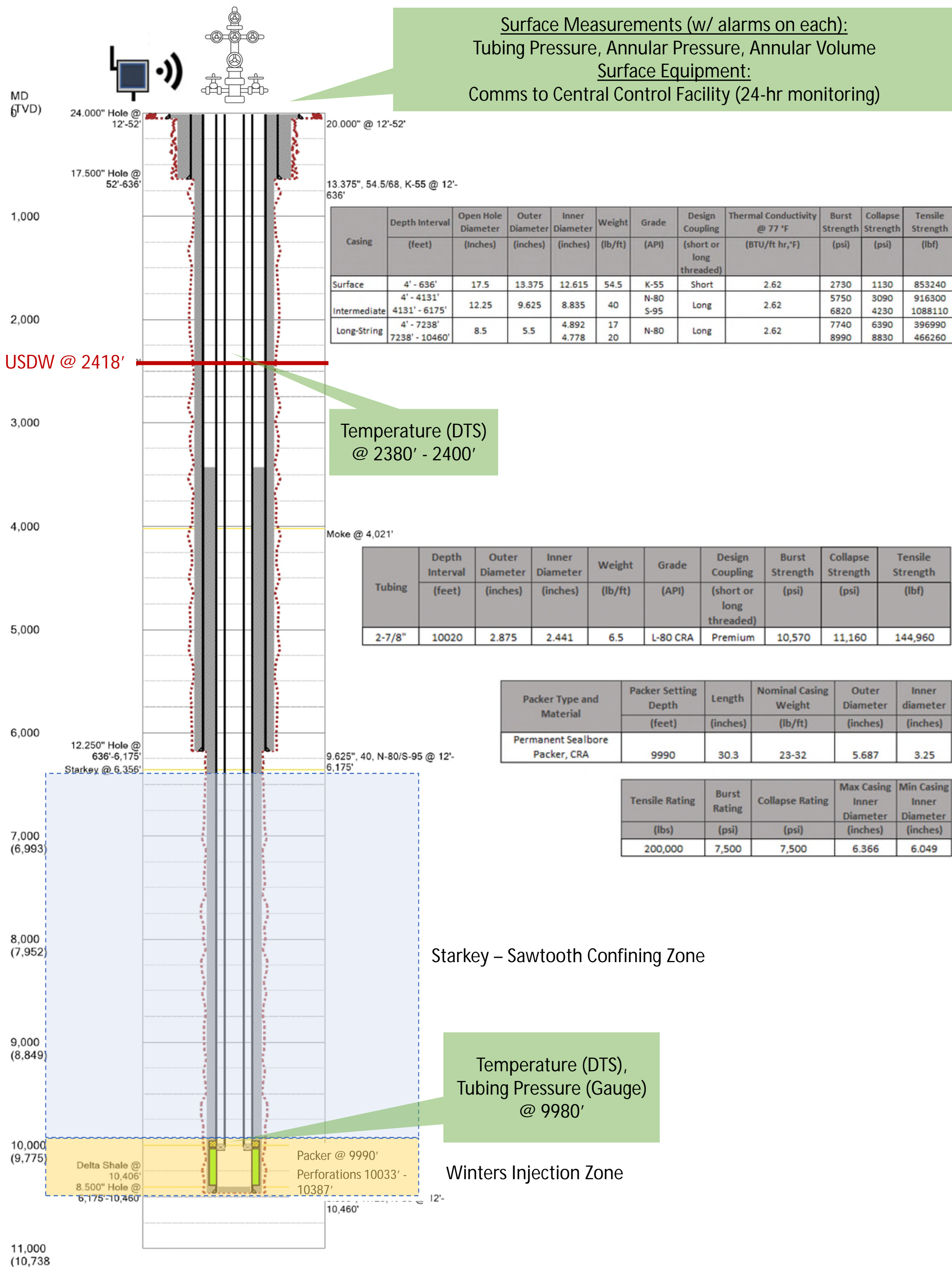
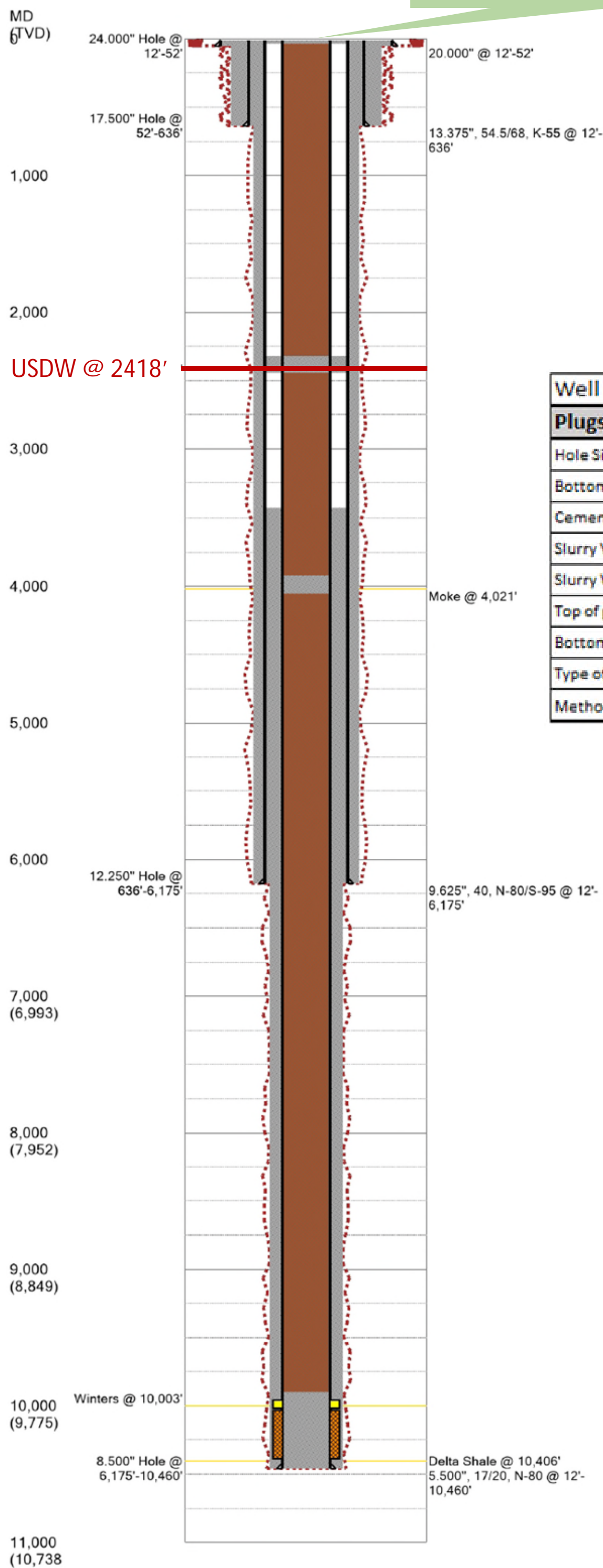


Figure 15. Pool B-2, Proposed CO₂ Injection Schematic

Cut casing 5' below GL. Stamp and weld cap.
Backfill and reclaim surface location.



Well	Pool B-2			
Plugs	Plug 1	Plug 2	Plug 3	Plug 4
Hole Size (in.)	4.778	4.778	8.755	8.755
Bottom of tubing (ft)	10460	4046	2443	37
Cement Volume (sacks)	102	23	77	15
Slurry Volume (bbl)	12.42	2.77	9.31	1.86
Slurry Weight (lb/gal)	15.8	15.8	15.8	15.8
Top of plug (ft)	9900	3921	2318	12
Bottom of Plug (ft)	10460	4046	2443	37
Type of Cement	Class G	Class G	Class G	Class G
Method of placement	Balanced Plug, Retainer, or CT Plug			

Figure 16. Pool B-2, Proposed Abandonment Schematic

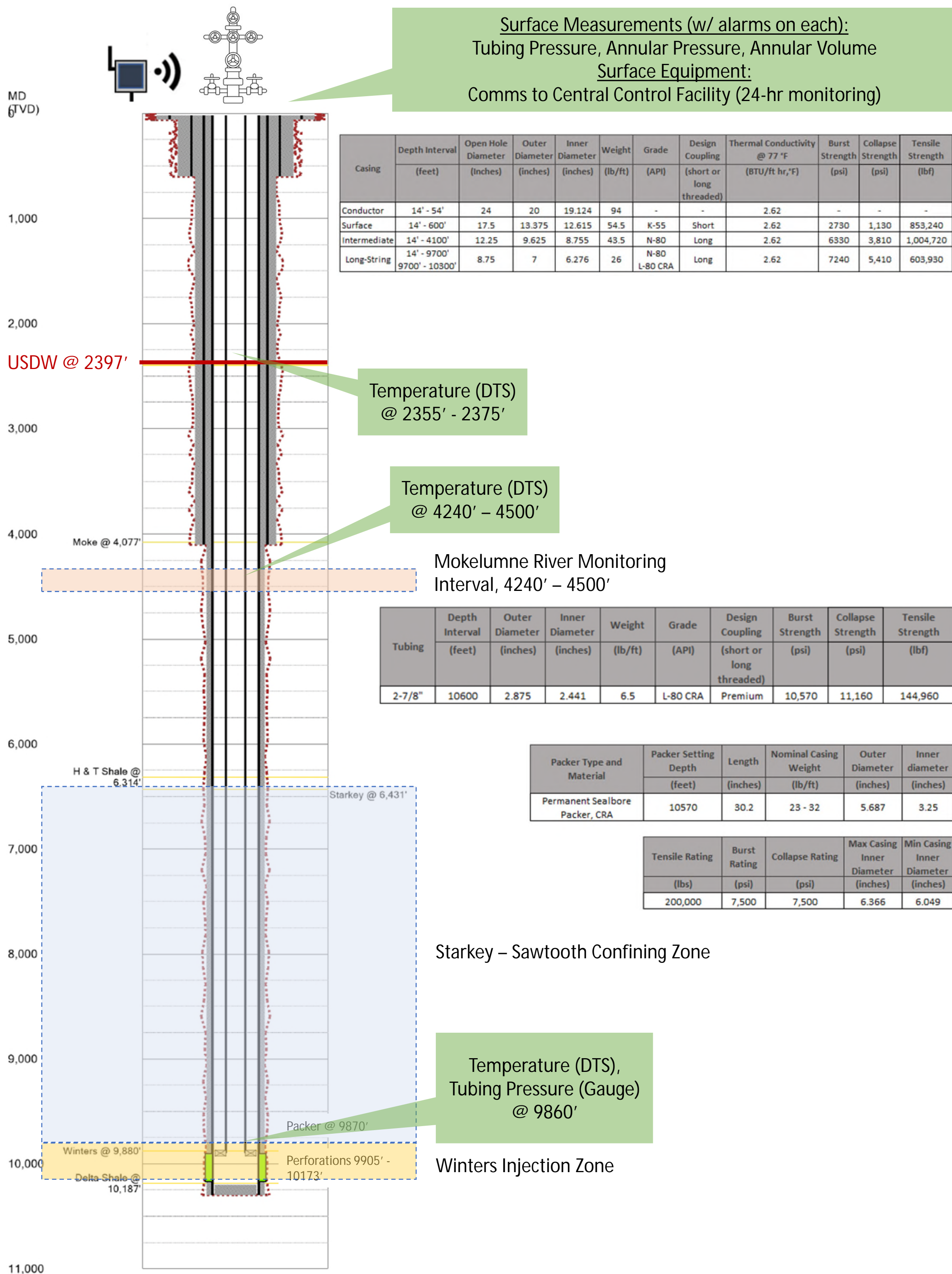


Figure 17. UI Inj 1, Proposed CO₂ Injection Schematic

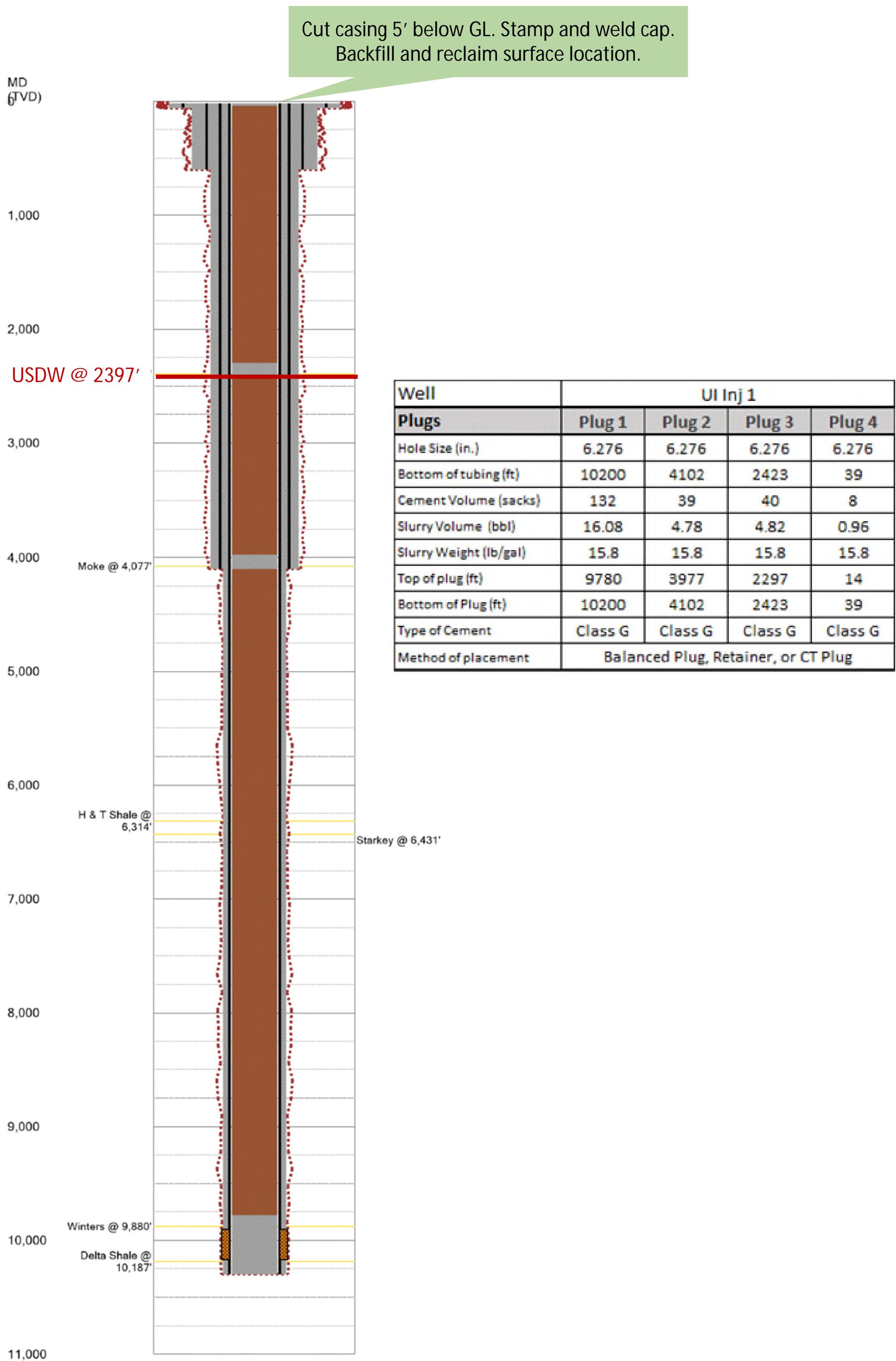


Figure 18. UI Inj 1, Proposed Abandonment Schematic

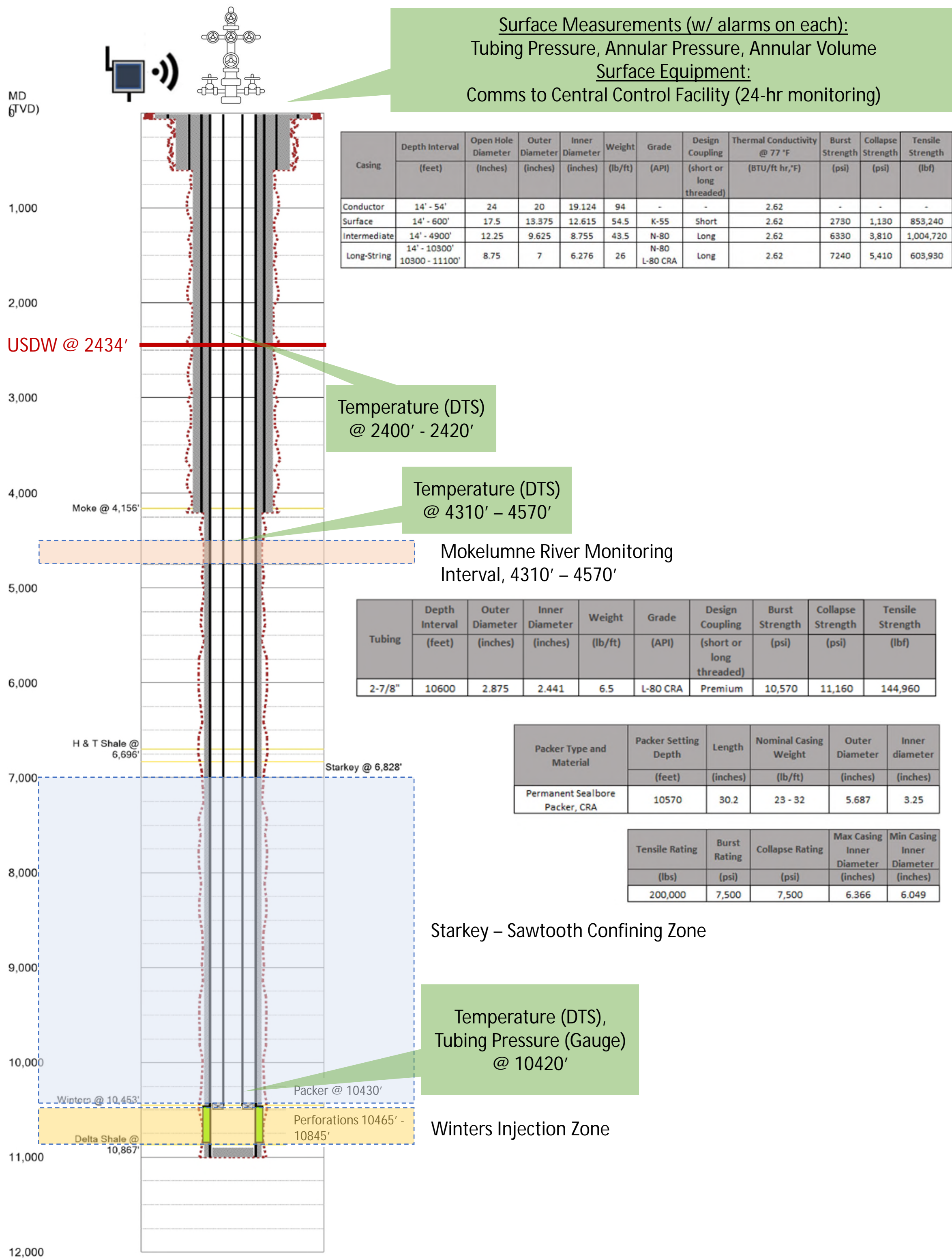


Figure 19. UI Inj 2, Proposed CO₂ Injection Schematic

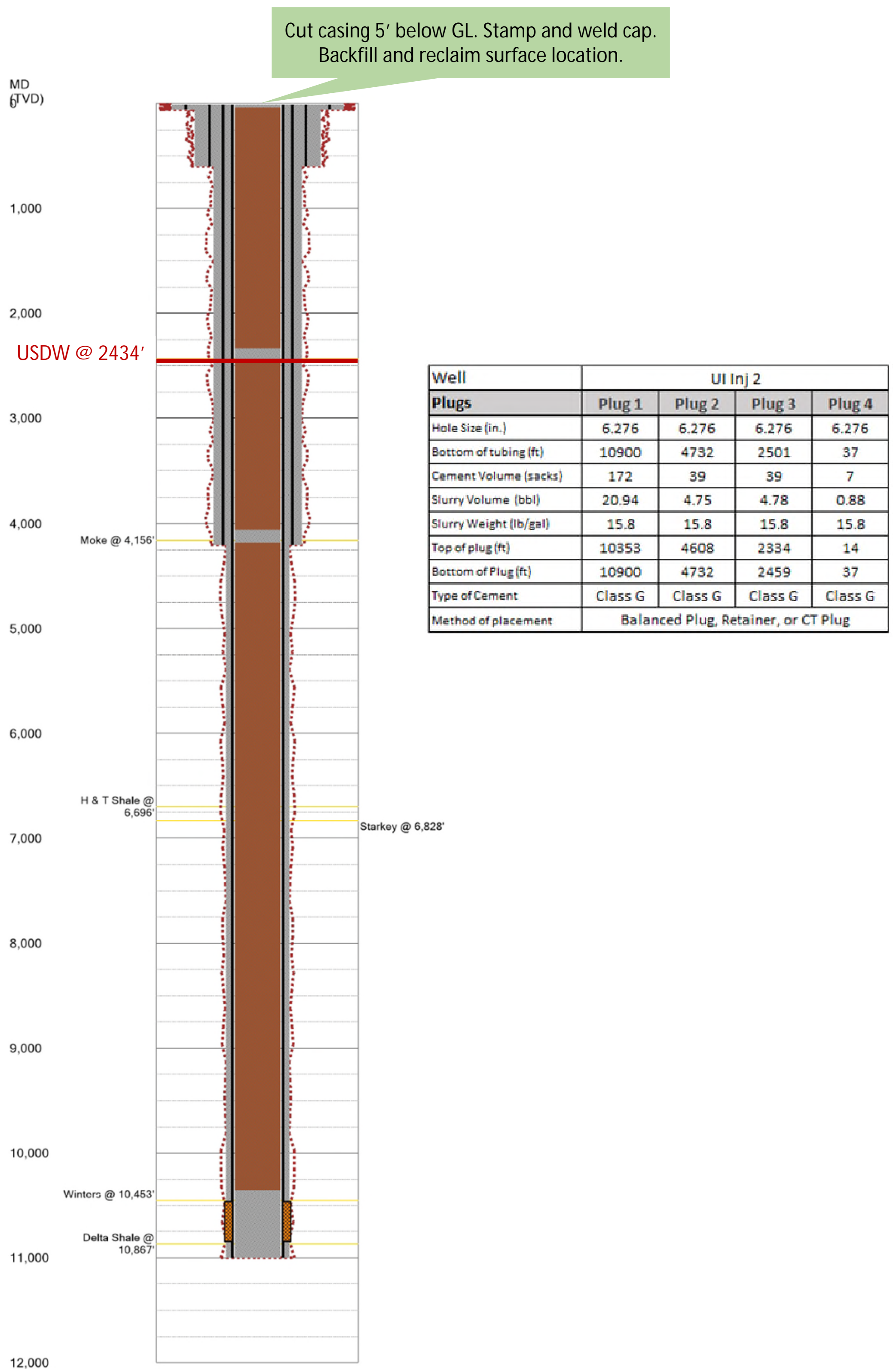


Figure 20. UI Inj 2, Proposed Abandonment Schematic

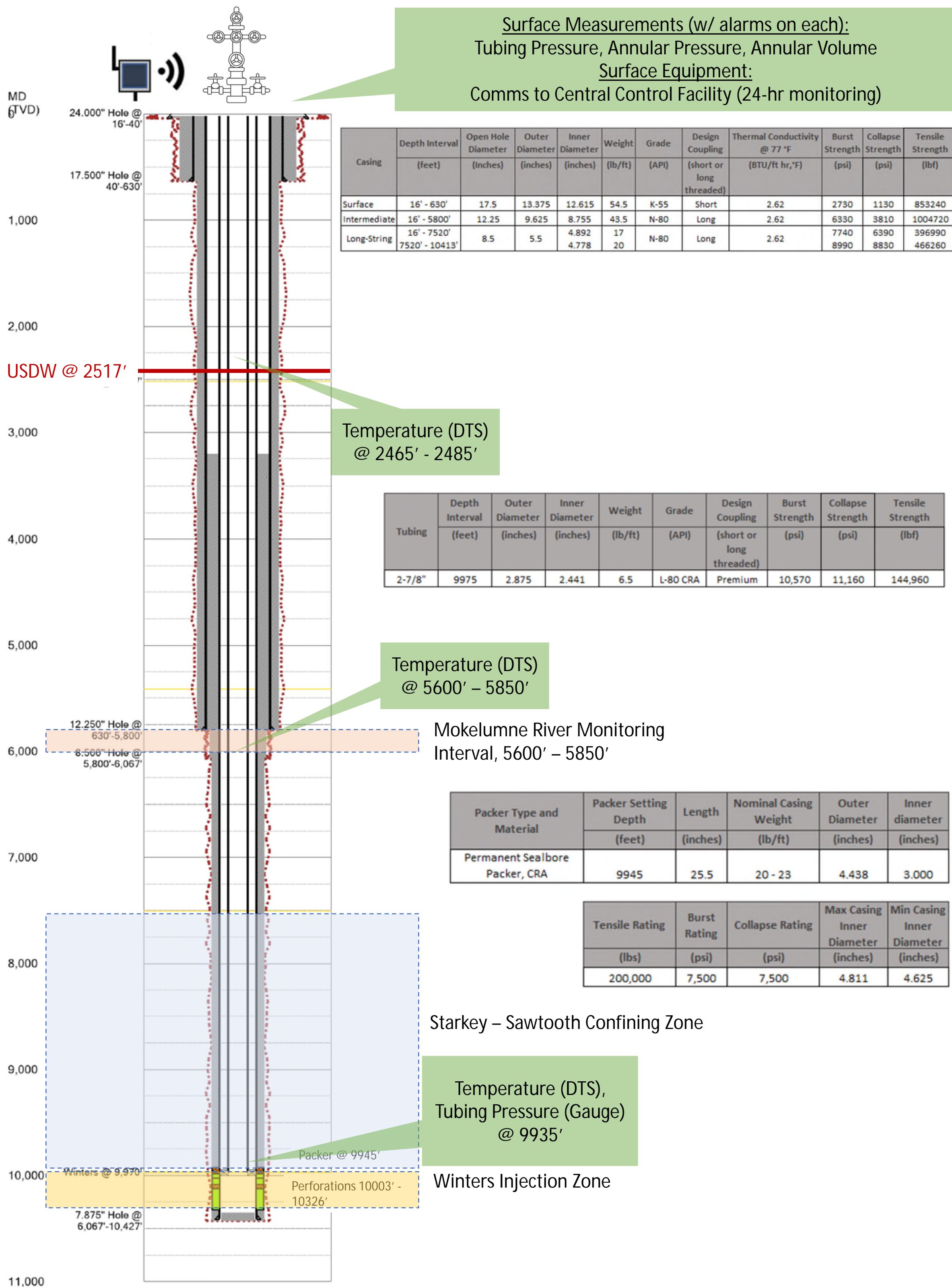


Figure 21. Yamada Brothers 2, Proposed Injection Zone Monitoring Schematic

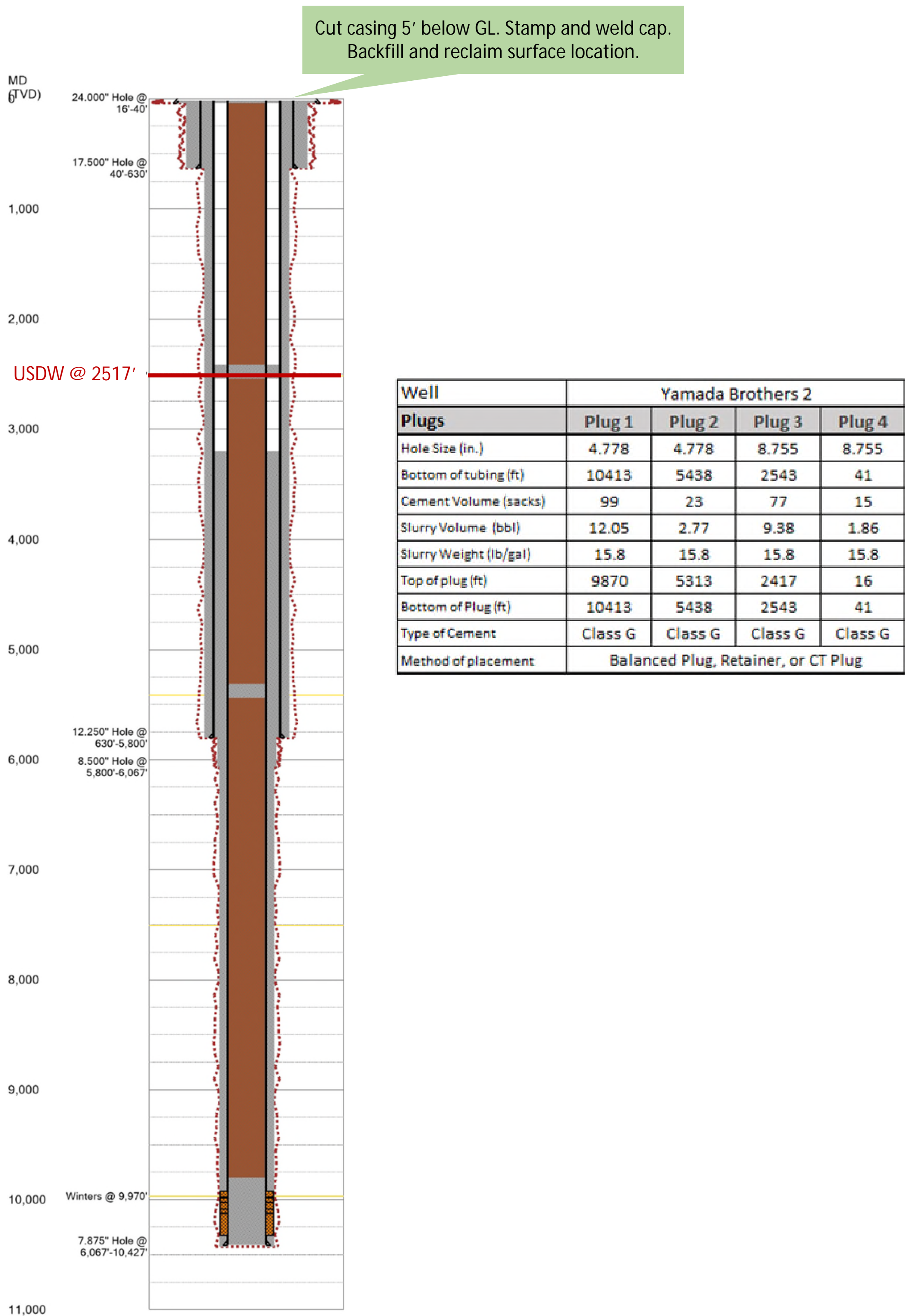


Figure 22. Yamada Brothers 2, Proposed Abandonment Schematic

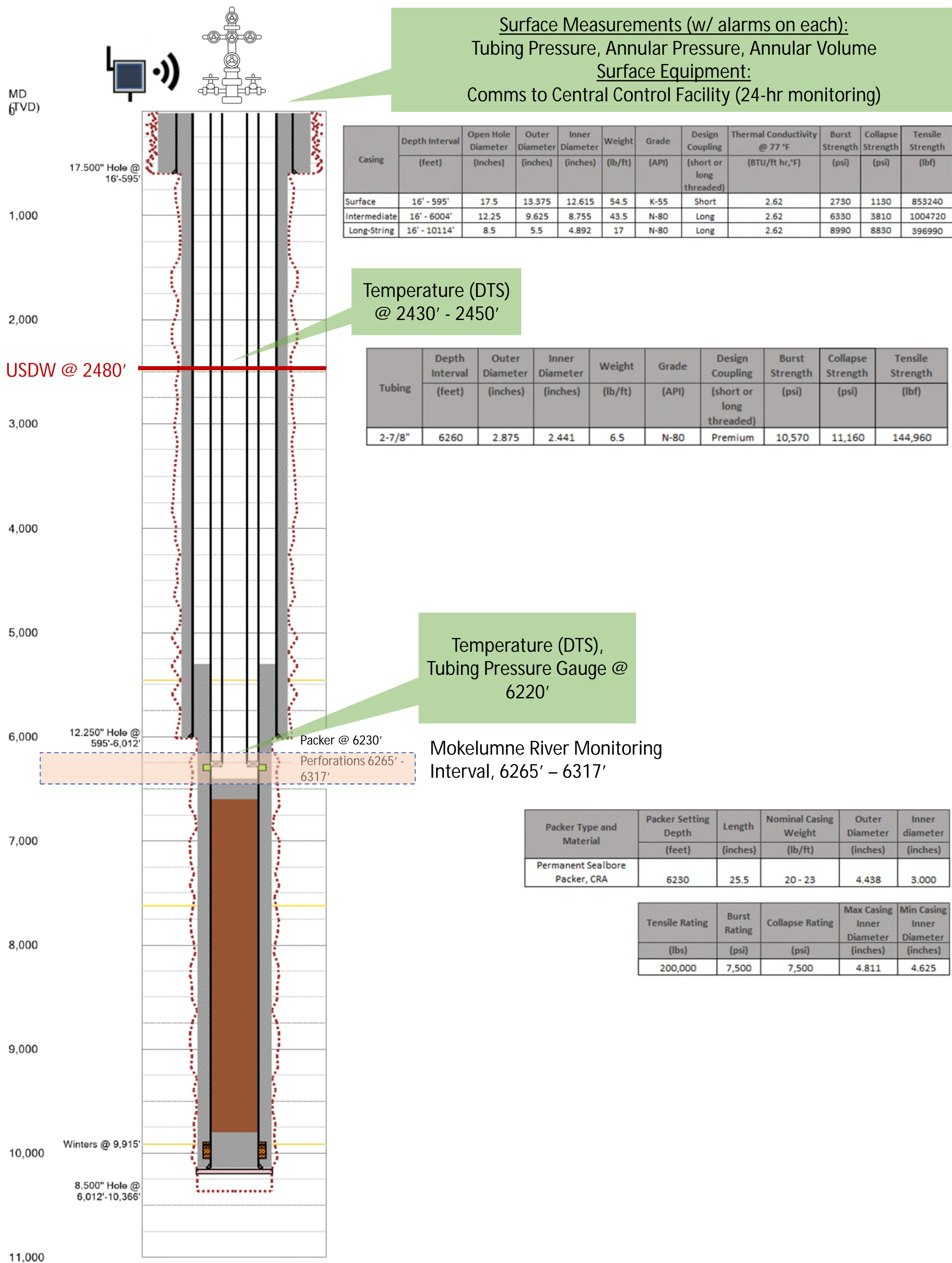


Figure 23. Phillips Yamada Bros 1, Proposed Above Zone Monitoring Schematic

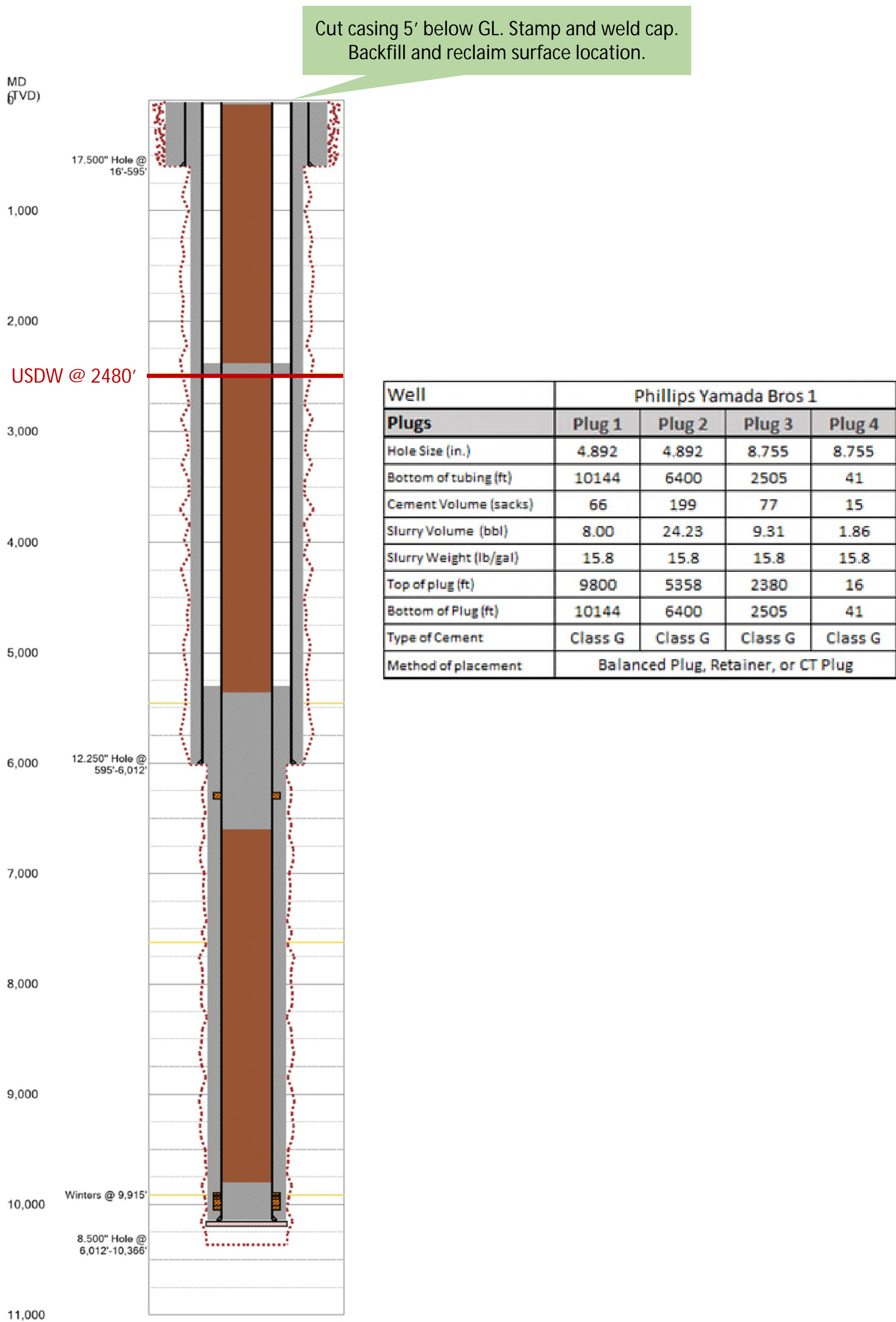


Figure 24. Phillips Yamada Bros 1, Proposed Abandonment Schematic

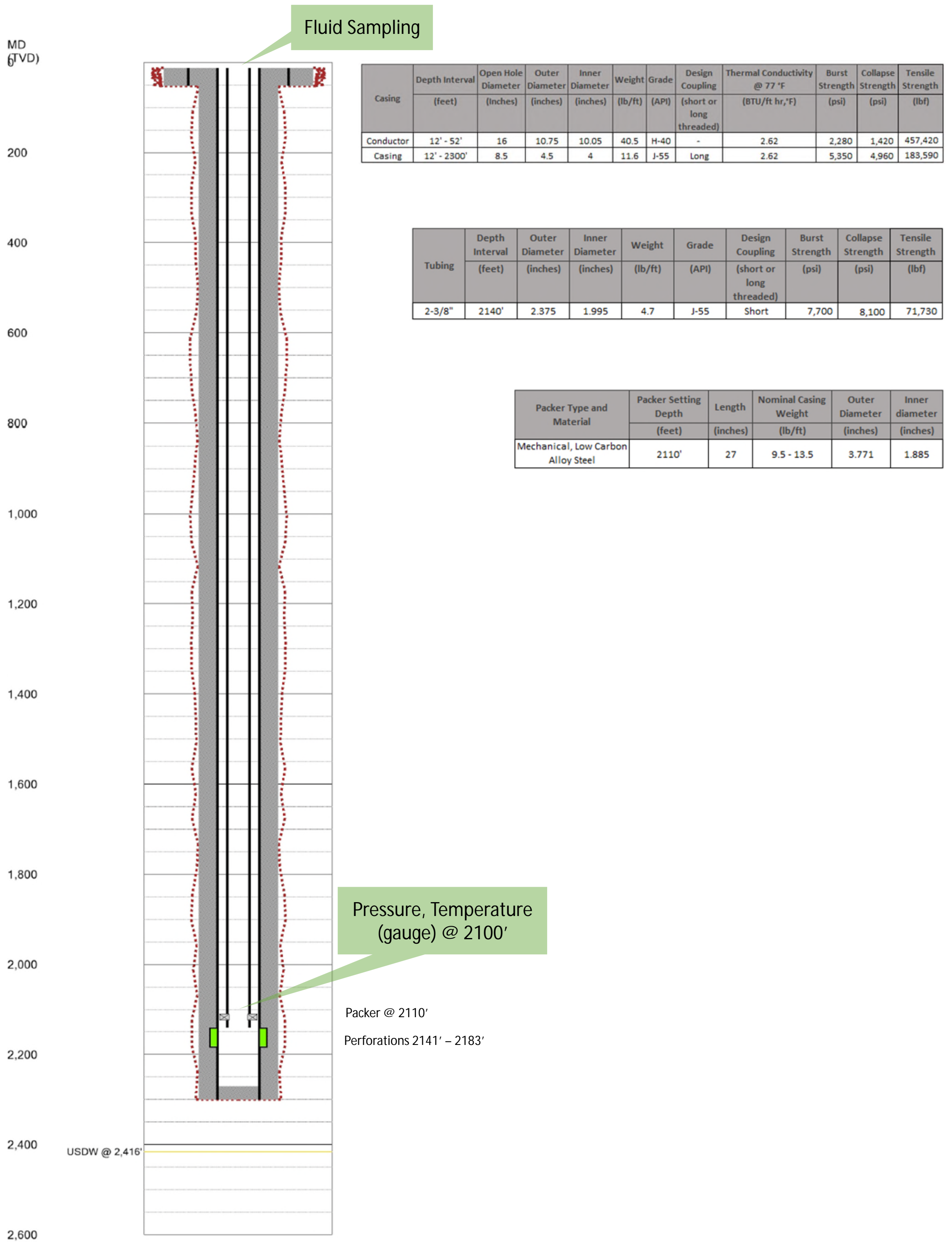
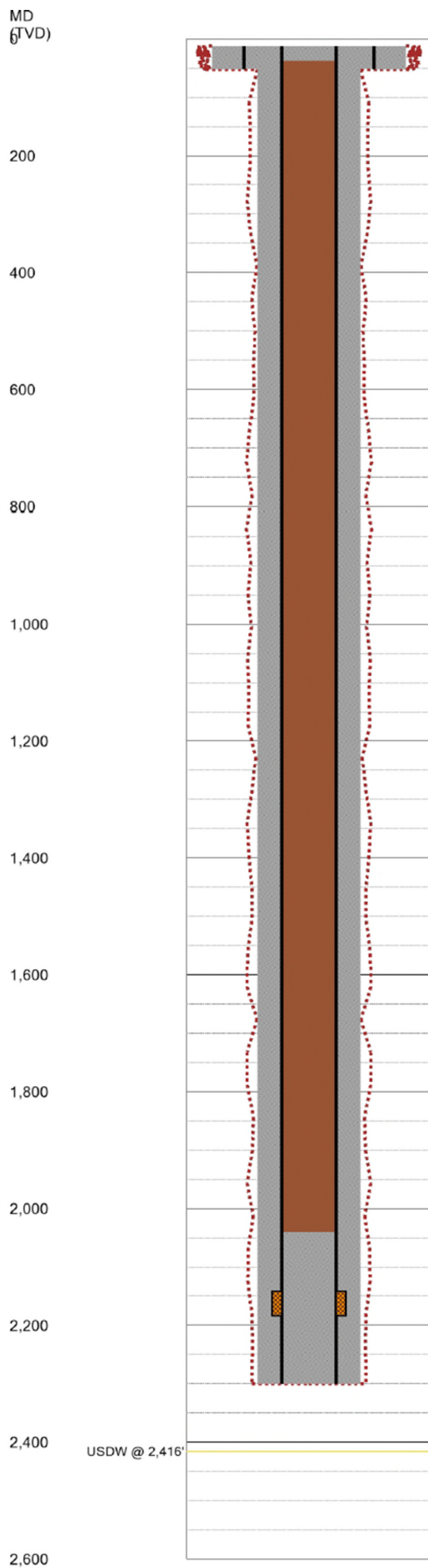


Figure 25. USDW Monitoring Well – US-2, Proposed Monitoring Schematic



Well	US-2	
Plugs	Plug 1	Plug 2
Diameter of boring in which plug will be placed (in.)	4	4
Depth to bottom of tubing or drill pipe (ft)	2270	37
Sacks of Cement to be used (each plug)	18	2
Slurry Volume to be pumped (bbl)	2.79	0.31
Slurry Weight (lb/gal)	15.8	15.8
Calculated top of plug (ft)	2040	12
Bottom of Plug (ft)	2270	37
Type of Cement or other material	Portland	
Method of placement (e.g., balance method, retainer method, or two-plug method)	Balanced Plug, Retainer, or CT Plug	

Figure 26. USDW Monitoring Well – US-2, Proposed Abandonment Schematic

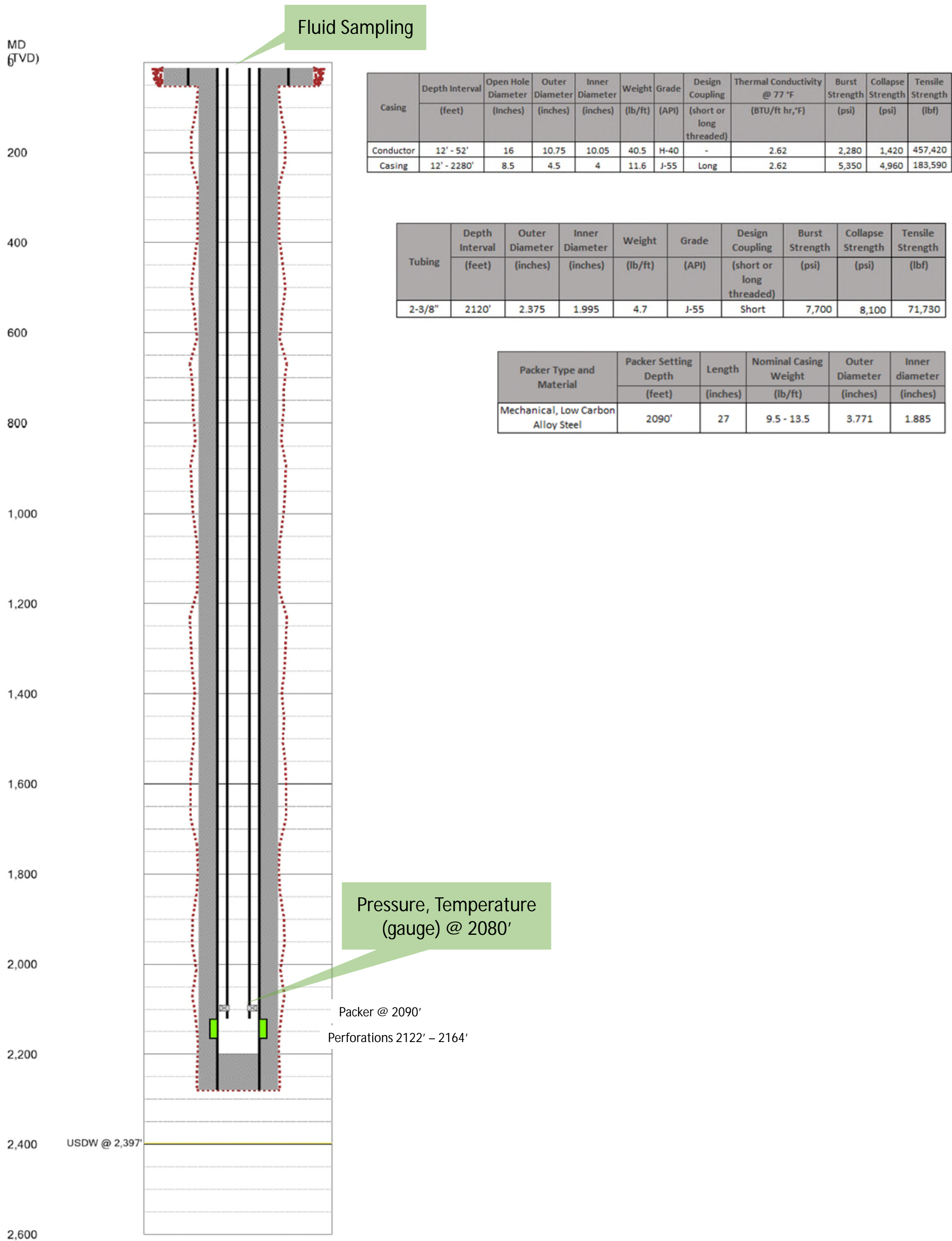
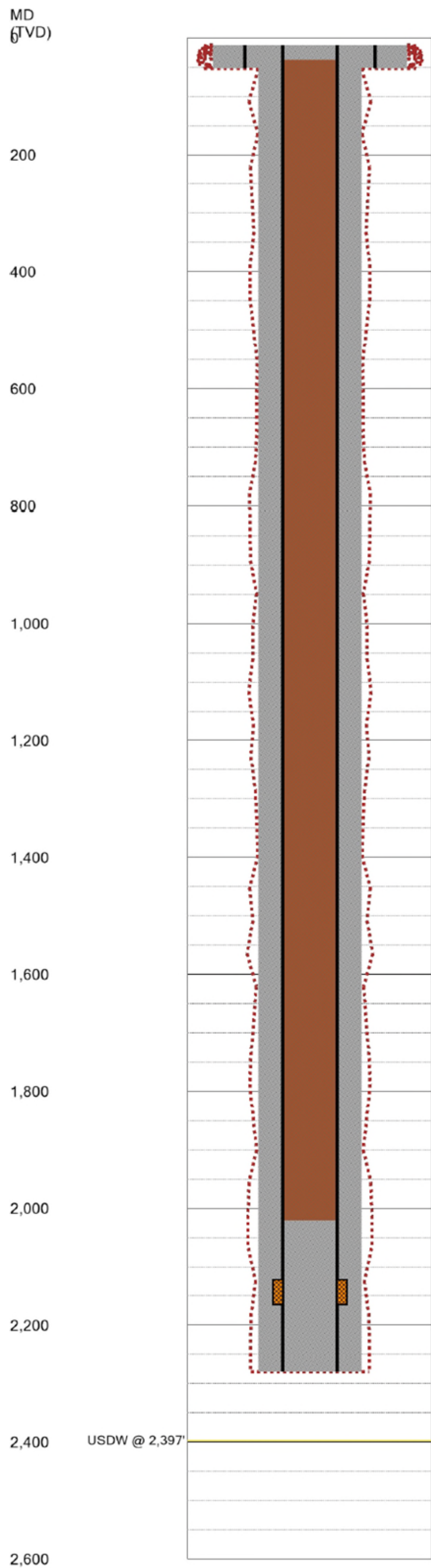


Figure 27. USDW Monitoring Well – US-3, Proposed Monitoring Schematic



Well	US-3	
Plugs	Plug 1	Plug 2
Diameter of boring in which plug will be placed (in.)	4	4
Depth to bottom of tubing or drill pipe (ft)	2200	37
Sacks of Cement to be used (each plug)	14	2
Slurry Volume to be pumped (bbl)	2.17	0.31
Slurry Weight (lb/gal)	15.8	15.8
Calculated top of plug (ft)	2020	12
Bottom of Plug (ft)	2200	37
Type of Cement or other material	Portland	
Method of placement (e.g., balance method, retainer method, or two-plug method)	Balanced Plug, Retainer, or CT Plug	

Figure 28. USDW Monitoring Well – US-3, Proposed Abandonment Schematic