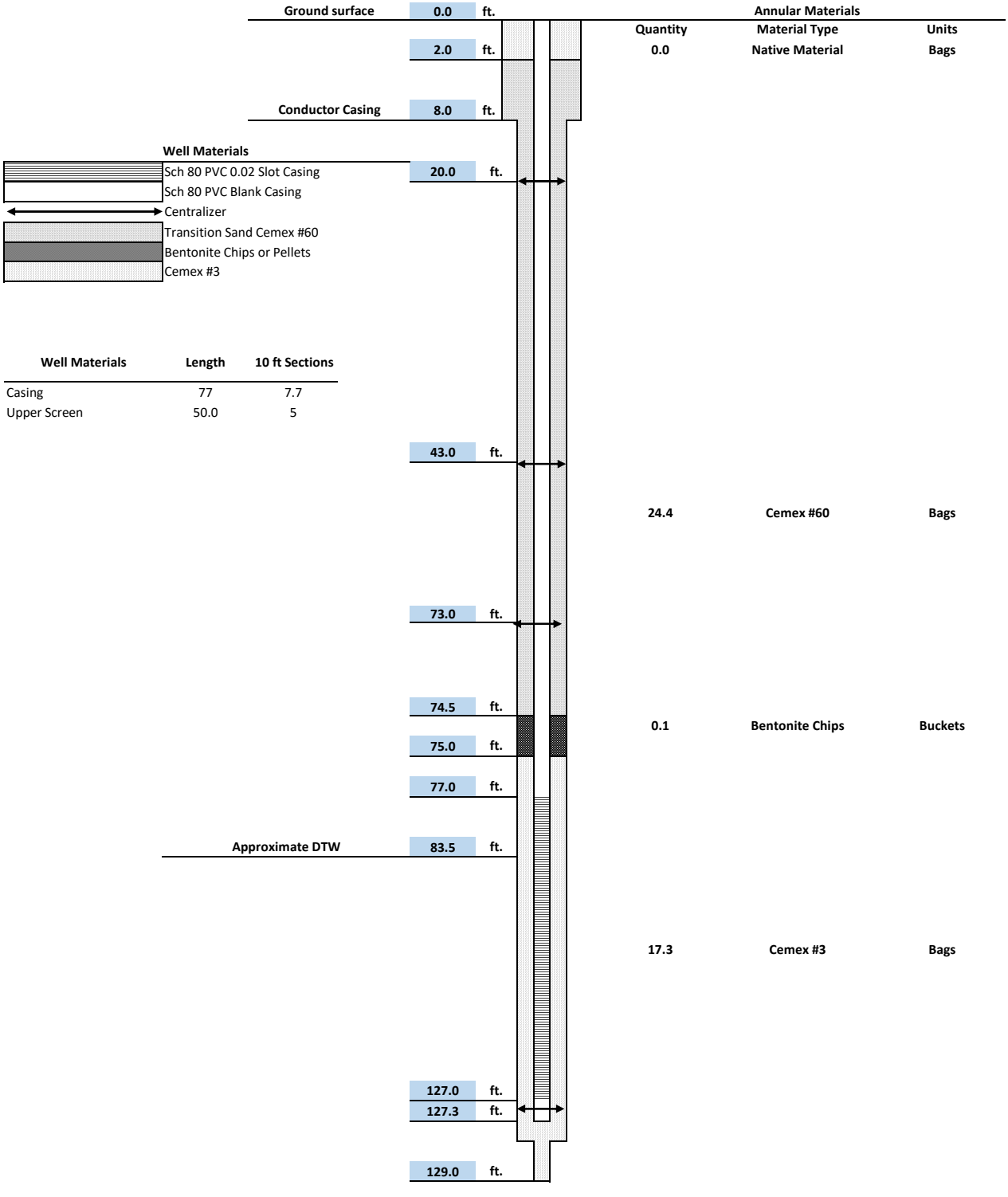
TWB-01 Temporay Final Well Design 3/31/22

Conductor casing Dia:	7	Well Casing Outer Diameter:	2.5
Drill casing Dia:	6	Well Casing Inner Diameter:	2
Rathole Dia:	4		

Surface Completion: TBD



Well Materials	Length	10 ft Sections
Casing	77	7.7
Upper Screen	50.0	5

Annular Materials

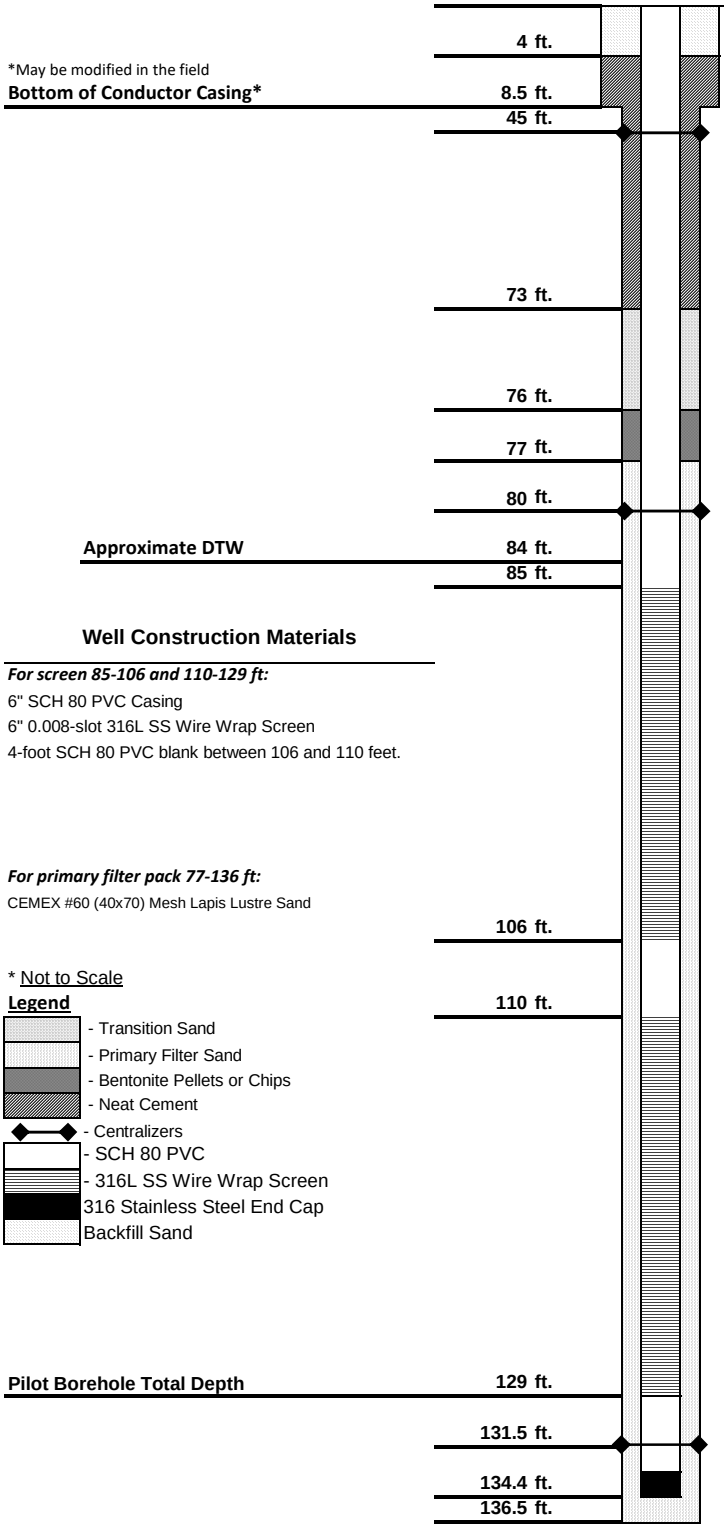
Quantity	Material Type	Units
0.0	Native Material	Bags
24.4	Cemex #60	Bags
0.1	Bentonite Chips	Buckets
17.3	Cemex #3	Bags

Final Well Design
TWB-01 (09/08/2022)

ARCADIS Design & Consultancy for natural and built assets

Well ID: TWB-01 **Well Purpose:** Remediation **Well Type:** Single Screened

Borehole Dia.: 10-12 in. **Well Diameter:** 6 in.



0 ft.
4 ft.
*May be modified in the field
Bottom of Conductor Casing* 8.5 ft.
45 ft.
73 ft.
76 ft.
77 ft.
80 ft.
Approximate DTW 84 ft.
85 ft.
106 ft.
110 ft.
Pilot Borehole Total Depth 129 ft.
131.5 ft.
134.4 ft.
136.5 ft.

Backfill Volumes

Quantity	Material	Units
4.4	Temp Backfill Sand	Bags
211.5	Neat Cement	Gallons
2.4	Bentonite Chips	Bags
0.6	Bentonite Chips	Bags
48.5	Sand Pack	bags

Well Construction Materials

For screen 85-106 and 110-129 ft:
6" SCH 80 PVC Casing
6" 0.008-slot 316L SS Wire Wrap Screen
4-foot SCH 80 PVC blank between 106 and 110 feet.

For primary filter pack 77-136 ft:
CEMEX #60 (40x70) Mesh Lapis Lustre Sand

* Not to Scale

Legend
- Transition Sand
- Primary Filter Sand
- Bentonite Pellets or Chips
- Neat Cement
- Centralizers
- SCH 80 PVC
- 316L SS Wire Wrap Screen
- 316 Stainless Steel End Cap
- Backfill Sand

82-87 ft bgs
Results: 870 ug/L

87-92 ft bgs
Results: <0.025 ug/l

97-102 ft bgs
Results: 1,200 ug/l

110-115 ft bgs
Results: 4,300 ug/l

122-127 ft bgs
Results: 1,700 ug/l

Well Construction Log

ARCADIS

Date Started:	03/31/2022	Surface Elevation:	538.84 ft amsl	**Well ID:**	**TWB-01 Temp**
Date Completed:	03/31/2022	Shallow Well Elevation:	538.34 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2100941.12	Project:	Final GW Remedy Phase 2A
Driller Name:	Matt Arnold	Easting (NAD83):	7615929.94	Location:	PG&E Topock, Needles California
Drilling Asst:	D Hoeppner / R West	Borehole Diameter:	4-7 inches		
Logger:	Ellen Redner	Static Water Level:	See Log for Depths	Project Number:	30126255
Editor:	Sean McGrane	Development End Date:	4/27/2022		
Total Depth:	129.5 ft bgs	Well Completion:	☒ Flush ☐ Stick-up ☐ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Construction Details	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
0		Fill	N/A		(0.0 - 1.0') Temporary well vault; (0.0 - 8.0') 7" Diameter Borehole		Note: 12-inch diameter vault
1–2		Alluvium Deposits	SM		(0.3 - 76.7') 2" Sch. 80 PVC Casing		
3–4		Alluvium Deposits	SW-SM				
5–6		Alluvium Deposits	SW-SM				
7–10	No Groundwater Samples Collected	Alluvium Deposits	SM		(8.0 - 127.0') 6" Diameter Borehole; (1.0 - 70.5') Cemex #60 (40x70) Lapis Lustre Sand	(1.0 - 70.5') 23.5 bags	(1.0 - 70.5') 27 bags (115%) Note: Temporary sand seal
11–12		Alluvium Deposits	GW-GM				
13–14		Alluvium Deposits	ML				
15–16		Alluvium Deposits	SW-SM				
17–18		Alluvium Deposits	SW-SM				
19–20		Alluvium	SM				

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, SS = Stainless Steal, NR = No Recovery, N/A = Not Applicable, GW = groundwater, ppb = parts per billion, Notes: Hollow blue water table marks represent depth to water (ft. bgs.) measured post development.

Well Construction Log

ARCADIS

Date Started:	03/31/2022	Surface Elevation:	538.84 ft amsl	**Well ID:**	**TWB-01 Temp**
Date Completed:	03/31/2022	Shallow Well Elevation:	538.34 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2100941.12	Project:	Final GW Remedy Phase 2A
Driller Name:	Matt Arnold	Easting (NAD83):	7615929.94	Location:	PG&E Topock, Needles California
Drilling Asst:	D Hoeppner / R West	Borehole Diameter:	4-7 inches		
Logger:	Ellen Redner	Static Water Level:	See Log for Depths	Project Number:	30126255
Editor:	Sean McGrane	Development End Date:	4/27/2022		
Total Depth:	129.5 ft bgs	Well Completion:	☒ Flush ☐ Stick-up ☐ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Construction Details	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
21	No Groundwater Samples Collected	Deposits Alluvium Deposits	SM		(0.3 - 76.7') 2" Sch. 80 PVC Casing		
22							
23		Alluvium Deposits	SM				
24							
25							
26							
27		Alluvium Deposits	SM				
28							
29							
30		Alluvium Deposits	SM		(1.0 - 70.5') Cemex #60 (40x70) Lapis Lustre Sand	(1.0 - 70.5') 23.5 bags	(1.0 - 70.5') 27 bags (115%) Note: Temporary sand seal
31							
32							
33							
34		Alluvium Deposits	SM				
35							
36							
37							
38		Alluvium Deposits	SM				
39							
40							

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, SS = Stainless Steal, NR = No Recovery, N/A = Not Applicable, GW = groundwater, ppb = parts per billion, Notes: Hollow blue water table marks represent depth to water (ft. bgs.) measured post development.

Well Construction Log

ARCADIS

Sheet: 3 of 7

Date Started:	03/31/2022	Surface Elevation:	538.84 ft amsl	**Well ID:**	**TWB-01 Temp**
Date Completed:	03/31/2022	Shallow Well Elevation:	538.34 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2100941.12	Project:	Final GW Remedy Phase 2A
Driller Name:	Matt Arnold	Easting (NAD83):	7615929.94	Location:	PG&E Topock, Needles California
Drilling Asst:	D Hoeppner / R West	Borehole Diameter:	4-7 inches		
Logger:	Ellen Redner	Static Water Level:	See Log for Depths	Project Number:	30126255
Editor:	Sean McGrane	Development End Date:	4/27/2022		
Total Depth:	129.5 ft bgs	Well Completion:	☒ Flush ☐ Stick-up ☐ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Construction Details	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
41	No Groundwater Samples Collected	Alluvium Deposits	SM		(0.3 - 76.7') 2" Sch. 80 PVC Casing		
42							
43							
44							
45							
46							
47							
48							
49		Alluvium Deposits	SW				
50					(1.0 - 70.5') Cemex #60 (40x70) Lapis Lustre Sand	(1.0 - 70.5') 23.5 bags	(1.0 - 70.5') 27 bags (115%) Note: Temporary sand seal
51		Alluvium Deposits	SM				
52							
53		Alluvium Deposits	SM				
54							
55		Alluvium Deposits	SW-SM				
56							
57							
58		Alluvium Deposits	SW-SM				
59							
60							

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Well Construction Log

ARCADIS

Date Started:	03/31/2022	Surface Elevation:	538.84 ft amsl	**Well ID:**	**TWB-01 Temp**
Date Completed:	03/31/2022	Shallow Well Elevation:	538.34 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2100941.12	Project:	Final GW Remedy Phase 2A
Driller Name:	Matt Arnold	Easting (NAD83):	7615929.94	Location:	PG&E Topock, Needles California
Drilling Asst:	D Hoeppner / R West	Borehole Diameter:	4-7 inches		
Logger:	Ellen Redner	Static Water Level:	See Log for Depths	Project Number:	30126255
Editor:	Sean McGrane	Development End Date:	4/27/2022		
Total Depth:	129.5 ft bgs	Well Completion:	☒ Flush ☐ Stick-up ☐ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Construction Details	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
61	No Groundwater Samples Collected	Alluvium Deposits	SW-SM		(0.3 - 76.7') 2" Sch. 80 PVC Casing		
62		Alluvium Deposits	SM				
63		Alluvium Deposits	SW				
64		Alluvium Deposits	SM				
65					(1.0 - 70.5') Cemex #60 (40x70) Lapis Lustre Sand	(1.0 - 70.5') 23.5 bags	(1.0 - 70.5') 27 bags (115%) Note: Temporary sand seal
66							
67		Alluvium Deposits	SM				
68							
69							
70		Alluvium Deposits	SW-SM				
71		Alluvium Deposits	SC		(70.5 - 72.0') Holeplug 3/8" Bentonite Chips	(70.5 - 72.0') 0.4 bags	(70.5 - 72.0') 0.5 bags (125%) Note: Benotnite seal
72		Alluvium Deposits	SM				
73							
74							
75		Alluvium Deposits	SW-SM				
76					(72.0 - 129.5') Cemex #3 (8x20) Lapis Lustre Sand	(72.0 - 129.5') 18.2 bags	(72.0 - 129.5') 27.5 bags (151%) Note: Filter pack, used >20% of the calculated volume due to potential voids forming during drilling.
77					(76.7 - 126.7') 2" 0.02-Slot Sch. 80 PVC Screen		
78		Alluvium Deposits	SM				
79							
80							

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Well Construction Log

ARCADIS

Date Started:	03/31/2022	Surface Elevation:	538.84 ft amsl	**Well ID:**	**TWB-01 Temp**
Date Completed:	03/31/2022	Shallow Well Elevation:	538.34 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2100941.12	Project:	Final GW Remedy Phase 2A
Driller Name:	Matt Arnold	Easting (NAD83):	7615929.94	Location:	PG&E Topock, Needles California
Drilling Asst:	D Hoeppner / R West	Borehole Diameter:	4-7 inches		
Logger:	Ellen Redner	Static Water Level:	See Log for Depths	Project Number:	30126255
Editor:	Sean McGrane	Development End Date:	4/27/2022		
Total Depth:	129.5 ft bgs	Well Completion:	☒ Flush ☐ Stick-up ☐ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Construction Details	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
81	No Groundwater Samples Collected	Alluvium Deposits	SM		(76.7 - 126.7') 2" 0.02-Slot Sch. 80 PVC Screen		
82							
83		Alluvium Deposits	SM				
84	TWB-1-VAS-82-87 (870 ppb) 3/18/2022 10:51						
85							
86							
87		Alluvium Deposits	SM				
88							
89	TWB-1-VAS-87-92 (<0.025 ppb) 3/20/2022 08:50						
90					(72.0 - 129.5') Cemex #3 (8x20) Lapis Lustre Sand	(72.0 - 129.5') 18.2 bags	(72.0 - 129.5') 27.5 bags (151%) Note: Filter pack, used >20% of the calculated volume due to potential voids forming during drilling.
91							
92							
93		Competent Bedrock - Conglomerate	N/A				
94							
95							
96							
97							
98	TWB-1-VAS-97-102 (1200 ppb) 3/20/2022 16:26	Alluvium Deposits	SP-SM				
99		Alluvium Deposits	SM				
100			N/A				

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Well Construction Log

ARCADIS

Date Started:	03/31/2022	Surface Elevation:	538.84 ft amsl	**Well ID:**	**TWB-01 Temp**
Date Completed:	03/31/2022	Shallow Well Elevation:	538.34 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2100941.12	Project:	Final GW Remedy Phase 2A
Driller Name:	Matt Arnold	Easting (NAD83):	7615929.94	Location:	PG&E Topock, Needles California
Drilling Asst:	D Hoeppner / R West	Borehole Diameter:	4-7 inches		
Logger:	Ellen Redner	Static Water Level:	See Log for Depths	Project Number:	30126255
Editor:	Sean McGrane	Development End Date:	4/27/2022		
Total Depth:	129.5 ft bgs	Well Completion:	☒ Flush ☐ Stick-up ☐ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Construction Details	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
101					(76.7 - 126.7') 2" 0.02-Slot Sch. 80 PVC Screen		
102							
103		Weathered Bedrock - Conglomerate	N/A				
104							
105							
106							
107		Weathered Bedrock - Conglomerate	N/A				
108							
109							
110					(72.0 - 129.5') Cemex #3 (8x20) Lapis Lustre Sand	(72.0 - 129.5') 18.2 bags	(72.0 - 129.5') 27.5 bags (151%) Note: Filter pack, used >20% of the calculated volume due to potential voids forming during drilling.
111							
112	TWB-1-VAS-110-115 (4300 ppb) 3/21/2022 11:16						
113							
114		Competent Bedrock - Conglomerate	N/A				
115							
116							
117							
118							
119							
120		Weathered Bedrock - Conglomerate	N/A				

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Well Construction Log

ARCADIS

Date Started:	03/31/2022	Surface Elevation:	538.84 ft amsl	**Well ID:**	**TWB-01 Temp**
Date Completed:	03/31/2022	Shallow Well Elevation:	538.34 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2100941.12	Project:	Final GW Remedy Phase 2A
Driller Name:	Matt Arnold	Easting (NAD83):	7615929.94	Location:	PG&E Topock, Needles California
Drilling Asst:	D Hoeppner / R West	Borehole Diameter:	4-7 inches		
Logger:	Ellen Redner	Static Water Level:	See Log for Depths	Project Number:	30126255
Editor:	Sean McGrane	Development End Date:	4/27/2022		
Total Depth:	129.5 ft bgs	Well Completion:	☒ Flush ☐ Stick-up ☐ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Construction Details	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
121		Weathered Bedrock - Conglomerate	N/A		(76.7 - 126.7') 2" 0.02-Slot Sch. 80 PVC Screen		
122							
123							
124	TWB-1-VAS-122-127 (1700 ppb) 3/21/2022 16:26	Competent Bedrock - Conglomerate	N/A		(72.0 - 129.5') Cemex #3 (8x20) Lapis Lustre Sand	(72.0 - 129.5') 18.2 bags	(72.0 - 129.5') 27.5 bags (151%) Note: Filter pack, used >20% of the calculated volume due to potential voids forming during drilling.
125							
126							
127					(126.7 - 126.9') SS End Cap		
128	No Groundwater Samples Collected				(127.0 - 129.0') 4" Diameter Rathole		
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							

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Well Construction Log

ARCADIS

Sheet: 1 of 7

Date Started:	09/09/2022	Surface Elevation:	538.84 ft amsl	**Well ID: TWB-01**	
Date Completed:	09/12/2022	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2100941.12	Project:	Final GW Remedy Phase 2A
Driller Name:	Matt Arnold	Easting (NAD83):	7615929.94	Location:	PG&E Topock, Needles California
Drilling Asst:	L.A. / I.S. / D.H.	Borehole Diameter:	10.5-12 inches		
Logger:	Kim Lapszynski	Static Water Level:	See Log for Depths	Project Number:	30126255
Editor:	Sean McGrane	Development End Date:	9/28/2022		
Total Depth:	137 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Construction Details	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
0		Fill	N/A				
1–3		Alluvium Deposits	SM		(0.0 - 4.0') Well Vault		Note: Well vault dimensions 4x5 feet by 4 feet deep.
3–5		Alluvium Deposits	SW-SM		(3.5 - 85.0') 6" Sch. 80 PVC Casing; (4.0 - 8.5') 12" Diameter Borehole		
5–7		Alluvium Deposits	SW-SM				(4.0 - 11.0') 6 bags (80%) Note: Grout seal third lift. Six bags of portland cement were added directly into the annular space and hydrated with water to top of the grout seal. The extraction well sanitary seal also serves as the sanitary seal for decommissioning of TWB-01 Temp Well from approximately 4 to 11 ft. bgs.
7–11	No Groundwater Samples Collected	Alluvium Deposits	SM		(4.0 - 11.0') Type I, II, and V Portland Cement with up to 6% Quik-Gel bentonite; (8.5 - 137.0') 10.5" Diameter Borehole	(4.0 - 11.0') 7.48 bags	
11–13		Alluvium Deposits	GW-GM		(13.0 - 14.0') Kwik-Zip Centralizer		Note: Kwik-Zip Centralizer had to be trimmed down to fit inside the sonic drill casing. (11.0 - 32.0') 100 gallons (159%) Note: Grout seal second lift, used >20% of the calculated volume due to potential voids that formed during drilling and grout migration into the formation. The extraction well sanitary seal also serves as the sanitary seal for decommissioning of TWB-01 Temp Well from approximately 11 to 32 ft. bgs.
13–15		Alluvium Deposits	ML				
15–17		Alluvium Deposits	SW-SM		(11.0 - 32.0') Type I, II, and V Portland Cement with up to 6% Quik-Gel bentonite	(11.0 - 32.0') 62.8 gallons	
17–20		Alluvium Deposits	SW-SM				

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, SS = Stainless Steel, NR = No Recovery, N/A = Not Applicable, GW = groundwater, ppb = parts per billion, Notes: Solid blue water table marks represent depth to water (ft. bgs.) measured post development.

Well Construction Log

ARCADIS

Date Started:	09/09/2022	Surface Elevation:	538.84 ft amsl	**Well ID: TWB-01**	
Date Completed:	09/12/2022	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2100941.12	Project:	Final GW Remedy Phase 2A
Driller Name:	Matt Arnold	Easting (NAD83):	7615929.94	Location:	PG&E Topock, Needles California
Drilling Asst:	L.A. / I.S. / D.H.	Borehole Diameter:	10.5-12 inches		
Logger:	Kim Lapszynski	Static Water Level:	See Log for Depths	Project Number:	30126255
Editor:	Sean McGrane	Development End Date:	9/28/2022		
Total Depth:	137 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Construction Details	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
21	No Groundwater Samples Collected	Alluvium Deposits	SM		(3.5 - 85.0') 6" Sch. 80 PVC Casing		
22							
23		Alluvium Deposits	SM				
24							
25							
26					(11.0 - 32.0') Type I, II, and V Portland Cement with up to 6% Quik-Gel bentonite	(11.0 - 32.0') 62.8 gallons	(11.0 - 32.0') 100 gallons (159%) Note: Grout seal second lift, used >20% of the calculated volume due to potential voids that formed during drilling and grout migration into the formation. The extraction well sanitary seal also serves as the sanitary seal for decommissioning of TWB-01 Temp Well from approximately 11 to 32 ft. bgs.
27							
28		Alluvium Deposits	SM				
29							
30		Alluvium Deposits	SM				
31							
32							
33		Alluvium Deposits	SM				
34							
35							
36					(32.0 - 73.0') Type I, II, and V Portland Cement with up to 6% Quik-Gel bentonite	(32.0 - 73.0') 122.6 gallons	(32.0 - 73.0') 200 gallons (163%) Note: Grout seal first lift, used >20% of the calculated volume due to potential voids that formed during drilling and grout migration into the formation. The extraction well sanitary seal also serves as the sanitary seal for decommissioning of TWB-01 Temp Well from approximately 32 to 73 ft. bgs.
37							
38		Alluvium Deposits	SM				
39							
40							

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, SS = Stainless Steel, NR = No Recovery, N/A = Not Applicable, GW = groundwater, ppb = parts per billion, Notes: Solid blue water table marks represent depth to water (ft. bgs.) measured post development.

Well Construction Log

ARCADIS

Date Started:	09/09/2022	Surface Elevation:	538.84 ft amsl	**Well ID: TWB-01**	
Date Completed:	09/12/2022	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2100941.12	Project:	Final GW Remedy Phase 2A
Driller Name:	Matt Arnold	Easting (NAD83):	7615929.94	Location:	PG&E Topock, Needles California
Drilling Asst:	L.A. / I.S. / D.H.	Borehole Diameter:	10.5-12 inches		
Logger:	Kim Lapszynski	Static Water Level:	See Log for Depths	Project Number:	30126255
Editor:	Sean McGrane	Development End Date:	9/28/2022		
Total Depth:	137 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Construction Details	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
41	No Groundwater Samples Collected	Alluvium Deposits	SM		(3.5 - 85.0') 6" Sch. 80 PVC Casing		
42							
43		Alluvium Deposits	SM				
44							
45							
46							
47							
48							
49		Alluvium Deposits	SW		(48.0 - 49.0') Kwik-Zip Centralizer		Note: Kwik-Zip Centralizer had to be trimmed down to fit inside the sonic drill casing.
50		Alluvium Deposits	SM		(32.0 - 73.0') Type I, II, and V Portland Cement with up to 6% Quik-Gel bentonite	(32.0 - 73.0') 122.6 gallons	(32.0 - 73.0') 200 gallons (163%) Note: Grout seal first lift, used >20% of the calculated volume due to potential voids that formed during drilling and grout migration into the formation. The extraction well sanitary seal also serves as the sanitary seal for decommissioning of TWB-01 Temp Well from approximately 32 to 73 ft. bgs.
51							
52							
53		Alluvium Deposits	SM				
54							
55							
56		Alluvium Deposits	SW-SM				
57							
58		Alluvium Deposits	SW-SM				
59							
60							

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, SS = Stainless Steel, NR = No Recovery, N/A = Not Applicable, GW = groundwater, ppb = parts per billion, Notes: Solid blue water table marks represent depth to water (ft. bgs.) measured post development.

Well Construction Log

ARCADIS

Date Started:	09/09/2022	Surface Elevation:	538.84 ft amsl	**Well ID: TWB-01**	
Date Completed:	09/12/2022	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2100941.12	Project:	Final GW Remedy Phase 2A
Driller Name:	Matt Arnold	Easting (NAD83):	7615929.94	Location:	PG&E Topock, Needles California
Drilling Asst:	L.A. / I.S. / D.H.	Borehole Diameter:	10.5-12 inches		
Logger:	Kim Lapszynski	Static Water Level:	See Log for Depths	Project Number:	30126255
Editor:	Sean McGrane	Development End Date:	9/28/2022		
Total Depth:	137 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Construction Details	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
61	No Groundwater Samples Collected	Alluvium Deposits	SW-SM		(3.5 - 85.0') 6" Sch. 80 PVC Casing		
62		Alluvium Deposits	SM				
63		Alluvium Deposits	SW				
64		Alluvium Deposits	SM				
65		Alluvium Deposits	SM		(32.0 - 73.0') Type I, II, and V Portland Cement with up to 6% Quik-Gel bentonite	(32.0 - 73.0') 122.6 gallons	(32.0 - 73.0') 200 gallons (163%) Note: Grout seal first lift, used >20% of the calculated volume due to potential voids that formed during drilling and grout migration into the formation. The extraction well sanitary seal also serves as the sanitary seal for decommissioning of TWB-01 Temp Well from approximately 32 to 73 ft. bgs.
66		Alluvium Deposits	SM				
67		Alluvium Deposits	SM				
68		Alluvium Deposits	SM				
69		Alluvium Deposits	SW-SM				
70		Alluvium Deposits	SC				
71		Alluvium Deposits	SM				
72		Alluvium Deposits	SM		(73.0 - 76.0') Cemex #60 Mesh (40x70) Lapis Lustre Sand	(73.0 - 76.0') 2.4 bags	(73.0 - 76.0') 4 bags (167%) Note: Transition sand, used >20% of the calculated volume due to potential voids forming during drilling.
73		Alluvium Deposits	SM				
74		Alluvium Deposits	SM				
75		Alluvium Deposits	SW-SM				
76		Alluvium Deposits	SW-SM		(76.0 - 77.0') Pel-Plug Bentonite Pellets 3/8" (TR30)	(76.0 - 77.0') 0.6 buckets	(76.0 - 77.0') 0.5 buckets (83%) Note: Bentonite seal
77		Alluvium Deposits	SW-SM				
78		Alluvium Deposits	SM		(77.0 - 136.5') Cemex #60 Mesh (40x70) Lapis Lustre Sand	(77.0 - 136.5') 48.5 bags	(77.0 - 136.5') 58 bags (120%) Note: Filter pack, used >20% of the calculated volume due to potential voids forming during drilling or filter pack filling void space in the remaining temporary well screen. Swabbed the filter pack for approximately 60 minutes prior to the installation of the bentonite seal.
79		Alluvium Deposits	SM				
80		Alluvium Deposits	SM				

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Well Construction Log

ARCADIS

Date Started:	09/09/2022	Surface Elevation:	538.84 ft amsl	**Well ID: TWB-01**	
Date Completed:	09/12/2022	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2100941.12	Project:	Final GW Remedy Phase 2A
Driller Name:	Matt Arnold	Easting (NAD83):	7615929.94	Location:	PG&E Topock, Needles California
Drilling Asst:	L.A. / I.S. / D.H.	Borehole Diameter:	10.5-12 inches		
Logger:	Kim Lapszynski	Static Water Level:	See Log for Depths	Project Number:	30126255
Editor:	Sean McGrane	Development End Date:	9/28/2022		
Total Depth:	137 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Construction Details	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
81	No Groundwater Samples Collected	Alluvium Deposits	SM		(80.0 - 81.0') Kwik-Zip Centralizer (3.5 - 85.0') 6" Sch. 80 PVC Casing		Note: Kwik-Zip Centralizer had to be trimmed down to fit inside the sonic drill casing.
82							
83		Alluvium Deposits	SM				
84	TWB-1-VAS-82-87 (870 ppb) 3/18/2022 10:51						
85					(85.0 - 106.0') 6" 8-Slot 316L SS Wire Wrap Screen		
86							
87		Alluvium Deposits	SM				
88							
89	TWB-1-VAS-87-92 (<0.025 ppb) 3/20/2022 08:50						(77.0 - 136.5') 58 bags (120%) Note: Filter pack, used >20% of the calculated volume due to potential voids forming during drilling or filter pack filling void space in the remaining temporary well screen. Swabbed the filter pack for approximately 60 minutes prior to the installation of the bentonite seal.
90					(77.0 - 136.5') Cemex #60 Mesh (40x70) Lapis Lustre Sand	(77.0 - 136.5') 48.5 bags	
91							
92							
93		Competent Bedrock - Conglomerate	N/A				
94							
95							
96							
97							
98	TWB-1-VAS-97-102 (1200 ppb) 3/20/2022 16:26	Alluvium Deposits	SP-SM				
99		Alluvium Deposits	SM				
100							

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Well Construction Log

ARCADIS

Date Started:	09/09/2022	Surface Elevation:	538.84 ft amsl	**Well ID: TWB-01**	
Date Completed:	09/12/2022	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2100941.12	Project:	Final GW Remedy Phase 2A
Driller Name:	Matt Arnold	Easting (NAD83):	7615929.94	Location:	PG&E Topock, Needles California
Drilling Asst:	L.A. / I.S. / D.H.	Borehole Diameter:	10.5-12 inches		
Logger:	Kim Lapszynski	Static Water Level:	See Log for Depths	Project Number:	30126255
Editor:	Sean McGrane	Development End Date:	9/28/2022		
Total Depth:	137 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Construction Details	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
101	TWB-1-VAS-97-102 (1200 ppb) 3/20/2022 16:26	Weathered Bedrock - Conglomerate	N/A		(85.0 - 106.0') 6" 8-Slot 316L SS Wire Wrap Screen		
102							
103							
104							
105							
106		Weathered Bedrock - Conglomerate	N/A		(106.0 - 110.0') 6" Sch. 80 PVC Casing		
107							
108							
109							(77.0 - 136.5') 58 bags (120%) Note: Filter pack, used >20% of the calculated volume due to potential voids forming during drilling or filter pack filling void space in the remaining temporary well screen. Swabbed the filter pack for approximately 60 minutes prior to the installation of the bentonite seal.
110					(77.0 - 136.5') Cemex #60 Mesh (40x70) Lapis Lustre Sand	(77.0 - 136.5') 48.5 bags	
111					(110.0 - 129.0') 6" 8-Slot 316L SS Wire Wrap Screen		
112	TWB-1-VAS-110-115 (4300 ppb) 3/21/2022 11:16						
113							
114		Competent Bedrock - Conglomerate	N/A				
115							
116							
117							
118							
119		Weathered Bedrock - Conglomerate	N/A				
120							

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Well Construction Log

ARCADIS

Date Started:	09/09/2022	Surface Elevation:	538.84 ft amsl	**Well ID: TWB-01**	
Date Completed:	09/12/2022	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2100941.12	Project:	Final GW Remedy Phase 2A
Driller Name:	Matt Arnold	Easting (NAD83):	7615929.94	Location:	PG&E Topock, Needles California
Drilling Asst:	L.A. / I.S. / D.H.	Borehole Diameter:	10.5-12 inches		
Logger:	Kim Lapszynski	Static Water Level:	See Log for Depths	Project Number:	30126255
Editor:	Sean McGrane	Development End Date:	9/28/2022		
Total Depth:	137 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Construction Details	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
121		Weathered Bedrock - Conglomerate	N/A		(110.0 - 129.0') 6" 8-Slot 316L SS Wire Wrap Screen		
122							
123							
124	TWB-1-VAS-122-127 (1700 ppb) 3/21/2022 16:26	Competent Bedrock - Conglomerate	N/A				
125							
126							
127							(77.0 - 136.5') 58 bags (120%) Note: Filter pack, used >20% of the calculated volume due to potential voids forming during drilling or filter pack filling void space in the remaining temporary well screen. Swabbed the filter pack for approximately 60 minutes prior to the installation of the bentonite seal.
128					(77.0 - 136.5') Cemex #60 Mesh (40x70) Lapis Lustre Sand	(77.0 - 136.5') 48.5 bags	
129		Competent Bedrock - Conglomerate	N/A				
130					(129.0 - 134.0') 6" Sch. 80 PVC Sump		
131	No Groundwater Samples Collected						Note: Kwik-Zip Centralizer had to be trimmed down to fit inside the sonic drill casing.
132					(131.0 - 132.0') Kwik-Zip Centralizer		
133							
134		Competent Bedrock - Conglomerate	N/A		(134.0 - 134.4') 6" 316L SS End Cap		
135							
136							
137					(136.5 - 137.0') Slough		Note: Formation not removed during borehole clean-out or material that settled in drill casing.
138							
139							
140							

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Boring Log

ARCADIS

Boring No.: TWB-01 Pilot

Date Started:	03/15/2022	Surface Elevation:	538.84 ft amsl	Client:	PG&E
Date Completed:	03/30/2022	Northing (NAD83):	2100941.12	Project:	Final GW Remedy Phase 2A
Drilling Co.:	Cascade	Easting (NAD83):	7615929.94	Location:	PG&E Topock, Needles California
Drilling Method:	Sonic Drilling	Total Depth:	129.5 ft bgs		
Drill Rig Type:	Boart Longyear drill head	Borehole Diameter:	4-7 inches		
Driller Name:	Matt Arnold	Depth to First Water:	82.0 ft bgs		
Drilling Asst:	D Hoeppner / R West	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	30126255
Logger:	S McGrane / G Willford	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (ft)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
0		No Sieve Samples Collected	No Groundwater Samples Collected	Fill	N/A		(0-0.5 ft) Grading for the drill pad.	(0.0 - 5.2') Air knifed for utility clearance. Logged soils disturbed.	(0.0 - 5.2') No drilling fluid used
1				Alluvium Deposits	SM		(0.5-3 ft) Silty sand with gravel (SM); brown (7.5YR 5/4); very fine to very coarse grained, angular to subround; little small to very large pebbles, angular to subangular; little silt; little granules, angular to subround; trace clay; dry; NOTE: Logged from air-knife cuttings.		
2									
3	5.2								
4				Alluvium Deposits	SW-SM		(3-5 ft) Well-graded sand with silt and gravel (SW-SM); brown (7.5YR 5/3); very fine to very coarse grained, angular to subround; little small to very large pebbles, angular to subround; little granules, angular to subround; little silt; trace clay; dry; NOTE: Logged from air-knife cuttings.		
5									
6	2			Alluvium Deposits	SW-SM		(5-7 ft) Well-graded sand with silt and gravel (SW-SM); brown (7.5YR 5/3); very fine to very coarse grained, angular to subround; little small to very large pebbles, angular to subround; little granules, angular to subround; little silt; dry.		
7									
8				Alluvium Deposits	SM		(7-11.75 ft) Silty sand with gravel (SM); brown (7.5YR 5/4); very fine to very coarse grained, angular to subround; some small to very large pebbles, angular to subangular; little granules, angular to subround; trace small cobbles, subangular; little silt; trace clay; dry.		
9									
10									
11	7.8								
12				Alluvium Deposits	GW-GM		(11.75-14 ft) Well-graded gravel with silt and sand (GW-GM); brown (7.5YR 4/3); small to very large pebbles, little granules, angular to subangular; and very fine to very coarse grained sand, angular to subround; little silt; dry.		
13									
14				Alluvium Deposits	ML		(14-15.5 ft) Sandy silt with gravel (ML); brown (10YR 5/3); low plasticity, no dilatancy; and very fine to very coarse grained sand, angular to subround; little small to large pebbles, angular to subangular; little granules, angular to subround; very soft; dry.		
15								(15.0') Hard drilling had to trip back in to collect 15 to 17 ft. bgs.	(15.0') No drilling fluid used
16	1.5			Alluvium Deposits	SW-SM		(15.5-17 ft) Well-graded sand with silt and gravel (SW-SM); brown (10YR 5/3); very fine to very coarse grained, angular to subround; little small to very large pebbles, angular; little granules, angular to subround; little silt; trace clay; dry.		
17									
18				Alluvium Deposits	SW-SM		(17-19.5 ft) Well-graded sand with silt and gravel (SW-SM); brown (10YR 5/3); very fine to very coarse grained, angular to subround; some small to very large pebbles, angular to subangular; little granules, angular to subangular; trace small cobbles, subangular; little silt; trace clay; dry.	(17.0 - 27.0') Hard drilling	(17.0 - 27.0') No drilling fluid used
19	8.8								
20				Alluvium	SM				

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Boring Log

ARCADIS

Boring No.: TWB-01 Pilot

Date Started:	03/15/2022	Surface Elevation:	538.84 ft amsl	Client:	PG&E
Date Completed:	03/30/2022	Northing (NAD83):	2100941.12	Project:	Final GW Remedy Phase 2A
Drilling Co.:	Cascade	Easting (NAD83):	7615929.94	Location:	PG&E Topock, Needles California
Drilling Method:	Sonic Drilling	Total Depth:	129.5 ft bgs		
Drill Rig Type:	Boart Longyear drill head	Borehole Diameter:	4-7 inches		
Driller Name:	Matt Arnold	Depth to First Water:	82.0 ft bgs		
Drilling Asst:	D Hoeppner / R West	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	30126255
Logger:	S McGrane / G Willford	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (ft)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
21		No Sieve Samples Collected	No Groundwater Samples Collected	Alluvium Deposits	SM		(19.5-22 ft) Silty sand with gravel (SM); yellowish brown (10YR 5/4); very fine to very coarse grained, angular to subround; some small to very large pebbles, angular to subangular; little granules, angular to subangular; little silt; dry.		
22									
23	8.8			Alluvium Deposits	SM		(22-27 ft) Silty sand with gravel (SM); brown (7.5YR 5/3); very fine to very coarse grained, angular to subround; some granules, angular to subangular; some small to very large pebbles, angular to subangular; little silt; dry; NOTE: Cementation with white matrix, potentially caliche.		
24									
25							(25 ft) Trace small cobble; subangular.		
26									
27									
28				Alluvium Deposits	SM		(27-29 ft) Silty sand with gravel (SM); brown (7.5YR 4/4); very fine to very coarse grained, angular to subround; some granules, angular to subround; some small to very large pebbles, angular to subangular; little silt; dry; NOTE: Some sediments moderately cemented with white matrix, potentially caliche.		
29									
30				Alluvium Deposits	SM		(29-33 ft) Silty sand with gravel (SM); brown (7.5YR 4/3); very fine to very coarse grained, angular to subround; some granules, angular to subround; little small to very large pebbles, subangular to subround; little silt; dry; NOTE: Some cementation with white matrix, potentially caliche.		
31									
32	7							(32.0 - 37.0') hard drilling	(32.0 - 37.0') No drilling fluid used
33									
34				Alluvium Deposits	SM		(33-37 ft) Silty sand with gravel (SM); brown (7.5YR 4/3); very fine to medium grained, some coarse to very coarse grained sand, angular to subround; some silt; some small to large pebbles, subangular to subround; trace granules, angular to subround; dry.		
35							(34.5 ft) Trace very large pebble; angular.		
36									
37							(36 ft) Rip up clasts of weakly cemented sand with white matrix, potentially caliche.		
38	2.9			Alluvium Deposits	SM		(37-40.5 ft) Silty sand with gravel (SM); brown (7.5YR 4/4); very fine to very coarse grained, angular to subround; some granules, angular to subround; little small to very large pebbles, angular to subround; little silt; dry; NOTE: Some weak cementation with white matrix, potentially caliche.		
39									
40									

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, NR = No Recovery, N/A = Not Applicable, GW = groundwater, ppb = parts per billion, Notes: Solid blue and hollow blue water table marks represent depth to water (ft. bgs.) first encountered from logging and depth to water measured during the first VAS interval, respectively. Apparent partial recoveries can be the result of potential compaction of sediments in the core bag.

Boring Log

ARCADIS

Boring No.: TWB-01 Pilot

Date Started:	03/15/2022	Surface Elevation:	538.84 ft amsl	Client:	PG&E
Date Completed:	03/30/2022	Northing (NAD83):	2100941.12	Project:	Final GW Remedy Phase 2A
Drilling Co.:	Cascade	Easting (NAD83):	7615929.94	Location:	PG&E Topock, Needles California
Drilling Method:	Sonic Drilling	Total Depth:	129.5 ft bgs		
Drill Rig Type:	Boart Longyear drill head	Borehole Diameter:	4-7 inches		
Driller Name:	Matt Arnold	Depth to First Water:	82.0 ft bgs		
Drilling Asst:	D Hoeppner / R West	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	30126255
Logger:	S McGrane / G Willford	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (ft)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
					SM				
41	2.9			Alluvium Deposits	SM		(40.5-42 ft) Silty sand with gravel (SM); brown (7.5YR 4/4); very fine to medium grained, and very fine to very coarse grained sand, angular to subround; and silt; little small to large pebbles, angular to subround; little granules, angular to subround; dry; NOTE: Some sands weakly cemented with white matrix, potentially caliche.		
42									
43	5.5			Alluvium Deposits	SM		(42-48.75 ft) Well-graded sand with silt and gravel (SW-SM); brown (7.5YR 4/4); very fine to very coarse grained, angular to subround; some granules, angular to subround; some small to very large pebbles, angular to subround; little silt; trace clay; dry; NOTE: Some weak cementation with white matrix, potentially caliche.		
44									
45									
46									
47								(47.0 - 50.0') Soft drilling	(47.0 - 50.0') No drilling fluid used
48									
49				Alluvium Deposits	SW		(48.75-50 ft) Well-graded sand with gravel (SW); brown (7.5YR 4/3); very fine to very coarse grained, angular to subround; some granules, angular to subround; some small to large pebbles, angular to subangular; trace silt; trace clay; dry.		
50		No Sieve Samples Collected	No Groundwater Samples Collected						
51				Alluvium Deposits	SM		(50-52 ft) Silty sand with gravel (SM); brown (7.5YR 4/3); very fine to medium grained, some coarse to very coarse grained sand, subangular to subround; and silt; little granules, subangular to subround; little small pebbles, subangular to subround; trace clay; dry; NOTE: Some weak cementation with white matrix, potentially caliche.		
52									
53				Alluvium Deposits	SM		(52-54.5 ft) Silty sand with gravel (SM); brown (7.5YR 4/4); very fine to medium grained, some coarse to very coarse grained sand, subangular to subround; and silt; little small to medium pebbles, angular to subround; trace granules, angular to subround; trace clay; dry; NOTE: Some weak cementation with white matrix, potentially caliche.	(53.0 - 57.0') Hard drilling	(53.0 - 57.0') No drilling fluid used
54	6.2								
55				Alluvium Deposits	SW-SM		(54.5-57 ft) Well-graded sand with silt and gravel (SW-SM); brown (7.5YR 5/3); very fine to very coarse grained, angular to subround; some small to very large pebbles, angular to subangular; little granules, angular to subround; little silt; trace clay; trace small cobbles, angular; dry; NOTE: Trace weak cementation with white matrix, potentially caliche.		
56									
57									
58	7.7			Alluvium Deposits	SW-SM		(57-62 ft) Well-graded sand with silt and gravel (SW-SM); brown (7.5YR 4/4); very fine to very coarse grained, angular to subround; some small to very large pebbles, angular to subround; little granules, angular to subround; little silt; trace clay; trace small cobbles, angular; dry.	(57.0 - 77.0') Normal drilling	(57.0 - 77.0') No drilling fluid used
59									
60									

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, NR = No Recovery, N/A = Not Applicable, GW = groundwater, ppb = parts per billion, Notes: Solid blue and hollow blue water table marks represent depth to water (ft. bgs.) first encountered from logging and depth to water measured during the first VAS interval, respectively. Apparent partial recoveries can be the result of potential compaction of sediments in the core bag.

Boring Log

ARCADIS

Boring No.: TWB-01 Pilot

Date Started:	03/15/2022	Surface Elevation:	538.84 ft amsl		
Date Completed:	03/30/2022	Northing (NAD83):	2100941.12		
Drilling Co.:	Cascade	Easting (NAD83):	7615929.94	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	129.5 ft bgs	Project:	Final GW Remedy Phase 2A
Drill Rig Type:	Boart Longyear drill head	Borehole Diameter:	4-7 inches	Location:	PG&E Topock, Needles California
Driller Name:	Matt Arnold	Depth to First Water:	82.0 ft bgs		
Drilling Asst:	D Hoeppner / R West	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	30126255
Logger:	S McGrane / G Willford	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (ft)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
61				Alluvium Deposits	SW-SM		(57-62 ft) Well-graded sand with silt and gravel (SW-SM); brown (7.5YR 4/4); very fine to very coarse grained, angular to subround; some small to very large pebbles, angular to subround; little granules, angular to subround; little silt; trace clay; trace small cobbles, angular; dry.		
62				Alluvium Deposits	SM		(62-63.5 ft) Silty sand with gravel (SM); brown (7.5YR 4/4); very fine to very coarse grained, angular to subround; some granules, angular to subround; little small to very large pebbles, angular to subround; little silt; trace clay; dry; NOTE: Some weak cementation with white matrix, potentially caliche.		
63	7.7			Alluvium Deposits	SW		(63.5-64.5 ft) Well-graded sand with gravel (SW); reddish brown (5YR 4/4); very fine to very coarse grained, angular to subround; some granules, angular to subround; some small to large pebbles, trace very large pebbles, angular angular to subround; trace silt; trace clay; dry.		
64									
65				Alluvium Deposits	SM		(64.5-67 ft) Silty sand with gravel (SM); reddish yellow (5YR 6/6); very fine to very coarse grained, angular to subround; some small to very large pebbles, angular to subround; little granules, angular to subround; little silt; trace clay; dry; NOTE: Trace weak cementation with white matrix, potentially caliche.		
66									
67									
68		No Sieve Samples Collected	No Groundwater Samples Collected	Alluvium Deposits	SM		(67-70.5 ft) Silty sand with gravel (SM); brown (7.5YR 5/4); very fine to very coarse grained, angular to subround; little silt; little small to very large pebbles, angular to subround; little granules, angular to subround; trace clay; trace small cobbles, angular; dry.		
69									
70									
71				Alluvium Deposits	SW-SM		(70-72 ft) Well-graded sand with silt and gravel (SW-SM); reddish brown (5YR 4/4); very fine to very coarse grained, angular to subround; some granules, angular to subround; some small to large pebbles, angular to subround; little silt; trace clay; dry; NOTE: Some moderate cementation with white matrix, potentially caliche.		
72	7			Alluvium Deposits	SC		(71-72 ft) Clayey sand with gravel (SC); reddish brown (5YR 4/3); very fine to very coarse grained, angular to subround; little granules, angular to subround; little small to large pebbles, angular to subround; little clay; trace silt; dry.		
73				Alluvium Deposits	SM		(72-74.5 ft) Silty sand with gravel (SM); reddish brown (5YR 4/4); very fine to very coarse grained, angular to subround; some small to very large pebbles, angular to subround; little granules, angular to subround; little silt; trace clay; trace small cobbles, angular; dry.		
74									
75				Alluvium Deposits	SW-SM		(74.5-77 ft) Well-graded sand with silt and gravel (SW-SM); reddish brown (5YR 4/4); very fine to very coarse grained, angular to subround; some granules, angular to subround; some small to very large pebbles, angular to subround; trace silt; trace clay; trace small cobbles, subangular; dry.		
76									
77									
78	6.3	TWB-1-SS-77-83 3/31/2022 15:45		Alluvium Deposits	SM		(77-83 ft) Silty sand with gravel (SM); dark reddish gray (5YR 4/2); very fine to very coarse grained, angular to subround; some large to very large pebbles, angular to subround; little granules, angular to subround; little silt; little clay; trace small cobbles, angular; moist.	(77.0') Driller stated he things they drilled trough a boulder.	(77.0') No drilling fluid used
79									
80									

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, NR = No Recovery, N/A = Not Applicable, GW = groundwater, ppb = parts per billion, Notes: Solid blue and hollow blue water table marks represent depth to water (ft. bgs.) first encountered from logging and depth to water measured during the first VAS interval, respectively. Apparent partial recoveries can be the result of potential compaction of sediments in the core bag.

Boring Log

ARCADIS

Boring No.: TWB-01 Pilot

Date Started:	03/15/2022	Surface Elevation:	538.84 ft amsl		
Date Completed:	03/30/2022	Northing (NAD83):	2100941.12		
Drilling Co.:	Cascade	Easting (NAD83):	7615929.94	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	129.5 ft bgs	Project:	Final GW Remedy Phase 2A
Drill Rig Type:	Boart Longyear drill head	Borehole Diameter:	4-7 inches	Location:	PG&E Topock, Needles California
Driller Name:	Matt Arnold	Depth to First Water:	82.0 ft bgs		
Drilling Asst:	D Hoeppner / R West	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	30126255
Logger:	S McGrane / G Willford	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (ft)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
81			No Groundwater Samples Collected	Alluvium Deposits	SM		(77-83 ft) Silty sand with gravel (SM); dark reddish gray (5YR 4/2); very fine to very coarse grained, angular to subround; some large to very large pebbles, angular to subround; little granules, angular to subround; little silt; little clay; trace small cobbles, angular; moist.		
82							(82 ft) Wet to moist		
83									
84	6.3	TWB-1-SS-83-84.5 3/31/2022 15:40	TWB-1-VAS-82-87 (870 ppb) 3/18/2022 10:51	Alluvium Deposits	SM		(83-84.5 ft) Silty sand with gravel (SM); dark reddish gray (5YR 4/2); very fine to very coarse grained, angular to subround; some granules, angular to subround; little silt; little small to very large pebbles, angular to subround; moist to wet; NOTE: Some moderate cementation white matrix, potentially caliche.		
85							(84.5-89.5 ft) Silty sand with gravel (SM); reddish brown (5YR 4/3); very fine to very coarse grained, angular to subangular; little granules, angular to subangular; little small to very large pebbles, angular to subangular; little silt; trace clay; moist to wet.		
86									
87		TWB-1-SS-84.5-89.5 3/31/2022 15:35		Alluvium Deposits	SM		(87 ft) Moist to wet.	(87.0 - 97.0') Hard drilling	(87.0 - 97.0') 30 gallons of water used; 0 gallons of water recovered; 30 gallons of water lost
88									
89			TWB-1-VAS-87-92 (<0.025 ppb) 3/20/2022 08:50						
90							(89.5-97 ft) Sedimentary Rock - Conglomerate; reddish brown (5YR 5/4); fine grained to coarse grained; angular; friable; dry. NOTE: Rock pulverized into mostly powder by the sonic drilling methodology.		
91									
92	7.3								
93		TWB-1-SS-89.5-97 3/31/2022 15:30		Competent Bedrock - Conglomerate	N/A				
94									
95									
96									
97									
98	8	TWB-1-SS-97-98 3/31/2022 15:25	TWB-1-VAS-97-102 (1200 ppb) 3/20/2022 16:26	Alluvium Deposits	SP-SM		(97-98 ft) Poorly graded sand with silt (SP-SM); reddish brown (5YR 5/4); very fine to medium grained, angular to subround; little silt; trace clay; wet.	(97.0 - 102.0') Core barrel got stuck had to use water and run casing over core barrel. Lost core sample down hole, tripped back in	(97.0 - 102.0') 50 gallons of water used; 0 gallons of water recovered; 50 gallons of water lost
99		TWB-1-SS-98-99.5 3/31/2022 15:20		Alluvium Deposits	SM		(98-99.5 ft) Silty sand with gravel (SM); reddish brown (5YR 5/4); very fine to very coarse grained, angular to subangular; little granules, angular to subangular; little small to very large pebbles, angular to subangular; little silt; wet.		
100					N/A				

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Boring Log

ARCADIS

Sheet: 6 of 7

Date Started:	03/15/2022	Surface Elevation:	538.84 ft amsl	**Boring No.:**	**TWB-01 Pilot**
Date Completed:	03/30/2022	Northing (NAD83):	2100941.12		
Drilling Co.:	Cascade	Easting (NAD83):	7615929.94	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	129.5 ft bgs	Project:	Final GW Remedy Phase 2A
Drill Rig Type:	Boart Longyear drill head	Borehole Diameter:	4-7 inches	Location:	PG&E Topock, Needles California
Driller Name:	Matt Arnold	Depth to First Water:	82.0 ft bgs		
Drilling Asst:	D Hoeppner / R West	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	30126255
Logger:	S McGrane / G Willford	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (ft)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
101							(99.5-106 ft) Sedimentary Rock - Conglomerate; reddish brown (5YR 5/4); fine grained to coarse grained, angular; highly weathered; moist; NOTE: Very dark gray to black staining.	to recover, core disturbed.	
102									
103	8	TWB-1-SS-99.5–106 3/31/2022 15:15		Weathered Bedrock - Conglomerate	N/A			(102.0 - 106.0') Drilled to 106 ft bgs to plug the core barrel and retrieve the 97 to 102 sample.	(102.0 - 106.0') No drilling fluid used
104									
105									
106									
107	4	TWB-1-SS-106-110 3/31/2022 15:10		Weathered Bedrock - Conglomerate	N/A		(106-110 ft) Sedimentary Rock - Conglomerate; reddish brown (5YR 5/4); fine grained to coarse grained, angular; moderately weathered; moist; NOTE: Rock clasts within conglomerate composed of mixed lithology.	(106.0 - 110.0') Very hard drilling could not advance a full 10 ft.	(106.0 - 110.0') No drilling fluid used
108									
109									
110									
111	5	TWB-1-SS-110-119 3/31/2022 15:05	TWB-1-VAS-110-115 (4300 ppb) 3/21/2022 11:16	Competent Bedrock - Conglomerate	N/A		(110-119 ft) Sedimentary Rock - Conglomerate; reddish brown (5YR 5/4); fine grained to coarse grained, angular; friable; dry; NOTE: Rock clasts within conglomerate composed of mixed lithology.		
112									
113									
114									
115									
116									
117									
118	1.5							(117.0') Depth 6-inch diameter casing was drilled 4-inch diamter rathole to 127 ft bgs. 6-inch diameter casing	(117.0') No drilling fluid used (117.1 - 119.0') No drilling fluid used
119									
120	6.5			Weathered Bedrock - Conglomerate	N/A				(119.0 - 124.5') No drilling fluid

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Boring Log

ARCADIS

Sheet: 7 of 7

Boring No.: TWB-01 Pilot

Date Started:	03/15/2022	Surface Elevation:	538.84 ft amsl		
Date Completed:	03/30/2022	Northing (NAD83):	2100941.12		
Drilling Co.:	Cascade	Easting (NAD83):	7615929.94	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	129.5 ft bgs	Project:	Final GW Remedy Phase 2A
Drill Rig Type:	Boart Longyear drill head	Borehole Diameter:	4-7 inches	Location:	PG&E Topock, Needles California
Driller Name:	Matt Arnold	Depth to First Water:	82.0 ft bgs		
Drilling Asst:	D Hoeppner / R West	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	30126255
Logger:	S McGrane / G Willford	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (ft)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
121		TWB-1-SS-119-123.25 3/31/2022 15:00		Weathered Bedrock - Conglomerate	N/A		(119-123.25 ft) Sedimentary Rock - Conglomerate; reddish brown (5YR 5/4); fine grained to coarse grained, angular; moderately weathered; moist; NOTE: Rock clasts within conglomerate composed of mixed lithology.	advanced to 127 ft. bgs on 3/30/22. (117.1 - 119.0') Auger bit locked up cut run short. (119.0 - 124.5') Very hard drilling	used
122									
123									
124	6.5		TWB-1-VAS-122-127 (1700 ppb) 3/21/2022 16:26						
125		TWB-1-SS-123.25-129 3/31/2022 14:55		Competent Bedrock - Conglomerate	N/A		(123.25-129.5 ft) Sedimentary Rock - Conglomerate; reddish brown (5YR 5/4); fine grained to coarse grained, angular; medium hard; friable; dry; NOTE: Rock clasts within conglomerate composed of mixed lithology.	(124.5 - 127.0') Drilling smoother. Casing remained in place from 3/22 until resumed on 3/30/22.	(124.5 - 127.0') No drilling fluid used
126									
127									
128	2		No Groundwater Samples Collected					(127.0 - 129.0') Drilled 4-inch diameter rathole for temp well installation.	(127.0 - 129.0') 350 gallons of water used; 350 gallons of water recovered; 0 gallons of water lost
129							End of Boring at 129.5 ft bgs.		
130									
131									
132									
133									
134									
135									
136									
137									
138									
139									
140									

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, NR = No Recovery, N/A = Not Applicable, GW = groundwater, ppb = parts per billion, Notes: Solid blue and hollow blue water table marks represent depth to water (ft. bgs.) first encountered from logging and depth to water measured during the first VAS interval, respectively. Apparent partial recoveries can be the result of potential compaction of sediments in the core bag.

Drilling Log

Sheet: 1 of 7

Date Started:	08/16/2022	Surface Elevation:	538.84 ft amsl	**Boring No.:**	**TWB-01**
Date Completed:	09/08/2022	Northing (NAD83):	2100941.12		
Drilling Co.:	Cascade	Easting (NAD83):	7615929.94	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	137.0 ft bgs	Project:	Final GW Remedy Phase 2A
Drill Rig Type:	Boart Longyear Sonic	Conductor Casing Diameter:	12 inches	Location:	PG&E Topock, Needles California
Driller Name:	Matt Arnold	Drill Casing Diameter:	10.5 inches		
Drilling Asst:	L.A. / I.S. / D.H.	Drill Bit:	8 & 10-inch Cutting Shoe	Project Number:	30126255
Tool-Pusher:	Arnold Lamon	Depth to First Water:	82.0 ft bgs		
Rig Geologist:	J.A. / K.L.	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run (ft) and Average Penetration Rate	USCS Code	USCS Class	Description (See Pilot boring log for full geologic descriptions)	Drilling notes and observations during overdrilling for the decommissioning of TWB-01 Temp Well and borehole reaming for the installation of TWB-01 extraction well.	Drilling Fluid
0		N/A		(0-0.5 ft) Grading for the drill pad.	(0.0 - 7.0') Aligned drill casing so that the TWB-01 Temp Well casing was centered on DR drill casing. Observed Cemex #60 (40x70) Lapis Lustre Sand and formation sediment including fine to coarse grained sand with trace small pebbles. Removed approximately 7 ft of 2-inch Schedule 80 PVC well casing.	(0.0 - 7.0') No drilling fluid used
1		SM		(0.5-3 ft) Silty sand with gravel (SM); brown (7.5YR 5/4).		
2						
3	(0.0 - 7.0) 0.43 mins/ft	SW-SM		(3-5 ft) Well-graded sand with silt and gravel (SW-SM).		
4						
5		SW-SM		(5-7 ft) Well-graded sand with silt and gravel (SW-SM); brown (7.5YR 5/3).		
6						
7		SM		(7-11.75 ft) Silty sand with gravel (SM); brown (7.5YR 5/4).	(7.0 - 17.0') Observed Cemex #60 (40x70) Lapis Lustre Sand, and formation sediment including very fine to coarse grained sand with trace small pebbles. Removed approximately 10 feet of 2-inch Schedule 80 PVC well casing.	(7.0 - 17.0') No drilling fluid used
8						
9						
10						
11						
12	(7.0 - 17.0) 0.80 mins/ft	GW-GM		(11.75-14 ft) Well-graded gravel with silt and sand (GW-GM); brown (7.5YR 4/3).		
13						
14		ML		(14-15.5 ft) Sandy silt with gravel (ML); brown (10YR 5/3).		
15						
16		SW-SM		(15.5-17 ft) Well-graded sand with silt and gravel (SW-SM); brown (10YR 5/3).		
17						
18	(17.0 - 27.0) 0.70 mins/ft	SW-SM		(17-19.5 ft) Well-graded sand with silt and gravel (SW-SM); brown (10YR 5/3).	(17.0 - 27.0') Observed Cemex #60 (40x70) Lapis Lustre Sand, and formation sediment including very fine to coarse grained sand with trace small pebbles. Removed approximately 10 feet of 2-inch Schedule 80 PVC well casing.	(17.0 - 27.0') No drilling fluid used
19						
20		SM				

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, Notes: Solid blue water table marks represent depth to water (ft. bgs.) depth to water measured during the first VAS interval of the pilot borehole. TWB-01 Temp Well materials not removed by overdrilling below approximately 75 ft. bgs will be decommissioned in place when the TWB-01 extraction well is decommissioned by pressure grouting.

Drilling Log

Date Started:	08/16/2022	Surface Elevation:	538.84 ft amsl	**Boring No.:**	**TWB-01**
Date Completed:	09/08/2022	Northing (NAD83):	2100941.12		
Drilling Co.:	Cascade	Easting (NAD83):	7615929.94	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	137.0 ft bgs	Project:	Final GW Remedy Phase 2A
Drill Rig Type:	Boart Longyear Sonic	Conductor Casing Diameter:	12 inches	Location:	PG&E Topock, Needles California
Driller Name:	Matt Arnold	Drill Casing Diameter:	10.5 inches		
Drilling Asst:	L.A. / I.S. / D.H.	Drill Bit:	8 & 10-inch Cutting Shoe	Project Number:	30126255
Tool-Pusher:	Arnold Lamon	Depth to First Water:	82.0 ft bgs		
Rig Geologist:	J.A. / K.L.	Converted to Well:	[X] Yes [ ] No		

Depth (ft)	Drilling Run (ft) and Average Penetration Rate	USCS Code	USCS Class	Description (See Pilot boring log for full geologic descriptions)	Drilling notes and observations during overdrilling for the decommissioning of TWB-01 Temp Well and borehole reaming for the installation of TWB-01 extraction well.	Drilling Fluid
21		SM		(19.5-22 ft) Silty sand with gravel (SM); yellowish brown (10YR 5/4).		
22						
23	(17.0 - 27.0) 0.70 mins/ft	SM		(22-27 ft) Silty sand with gravel (SM); brown (7.5YR 5/3).		
24						
25				(25 ft) Trace small cobble; subangular.		
26						
27		SM		(27-29 ft) Silty sand with gravel (SM); brown (7.5YR 4/4).	(27.0 - 34.0') Observed Cemex #60 (40x70) Lapis Lustre Sand, and formation sediment including very fine to coarse grained sand with trace small pebbles. Removed approximately 7 feet of 2-inch Schedule 80 PVC well casing.	(27.0 - 34.0') No drilling fluid used
28						
29		SM		(29-33 ft) Silty sand with gravel (SM); brown (7.5YR 4/3).		
30	(27.0 - 34.0) 0.29 mins/ft					
31						
32						
33						
34		SM		(33-37 ft) Silty sand with gravel (SM); brown (7.5YR 4/3).		
35				(34.5 ft) Trace very large pebble; angular.	(34.0 - 44.0') Observed Cemex #60 (40x70) Lapis Lustre Sand, and formation sediment including fine to coarse grained sand with trace small to medium pebbles. 2-inch schedule 80 PVC was not observed when the core barrel was retrieved. The core barrel was tripped back in and removed approximately 7 feet of 2-inch Schedule 80 PVC well casing.	(34.0 - 44.0') No drilling fluid used
36				(36 ft) Rip up clasts of weakly cemented sand with white matrix, potentially caliche.		
37	(34.0 - 44.0) 0.50 mins/ft					
38		SM		(37-40.5 ft) Silty sand with gravel (SM); brown (7.5YR 4/4).		
39						
40						

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, Notes: Solid blue water table marks represent depth to water (ft. bgs.) depth to water measured during the first VAS interval of the pilot borehole. TWB-01 Temp Well materials not removed by overdrilling below approximately 75 ft. bgs will be decommissioned in place when the TWB-01 extraction well is decommissioned by pressure grouting.

Drilling Log

Date Started:	08/16/2022	Surface Elevation:	538.84 ft amsl	**Boring No.:**	**TWB-01**
Date Completed:	09/08/2022	Northing (NAD83):	2100941.12		
Drilling Co.:	Cascade	Easting (NAD83):	7615929.94	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	137.0 ft bgs	Project:	Final GW Remedy Phase 2A
Drill Rig Type:	Boart Longyear Sonic	Conductor Casing Diameter:	12 inches	Location:	PG&E Topock, Needles California
Driller Name:	Matt Arnold	Drill Casing Diameter:	10.5 inches		
Drilling Asst:	L.A. / I.S. / D.H.	Drill Bit:	8 & 10-inch Cutting Shoe	Project Number:	30126255
Tool-Pusher:	Arnold Lamon	Depth to First Water:	82.0 ft bgs		
Rig Geologist:	J.A. / K.L.	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run (ft) and Average Penetration Rate	USCS Code	USCS Class	Description (See Pilot boring log for full geologic descriptions)	Drilling notes and observations during overdrilling for the decommissioning of TWB-01 Temp Well and borehole reaming for the installation of TWB-01 extraction well.	Drilling Fluid
41		SM				
		SM		(40.5-42 ft) Silty sand with gravel (SM); brown (7.5YR 4/4).		
42	(34.0 - 44.0) 0.50 mins/ft					
		SM		(42-48.75 ft) Well-graded sand with silt and gravel (SW-SM); brown (7.5YR 4/4).		
43						
44						
45						
46						
47					(47.0 - 54.0') Observed Cemex #60 (40x70) Lapis Lustre Sand, and formation sediment including fine to coarse grained sand with trace small pebbles. Removed approximately 7 feet of 2-inch Schedule 80 PVC well casing.	(47.0 - 54.0') No drilling fluid used
48						
49	(44.0 - 54.0) 0.80 mins/ft	SW		(48.75-50 ft) Well-graded sand with gravel (SW); brown (7.5YR 4/3).		
50						
		SM		(50-52 ft) Silty sand with gravel (SM); brown (7.5YR 4/3).		
51						
52						
53		SM		(52-54.5 ft) Silty sand with gravel (SM); brown (7.5YR 4/4).		
54						
55					(54.0 - 57.0') Observed Cemex #60 (40x70) Lapis Lustre Sand, and formation sediment including fine to coarse grained sand with trace small to medium pebbles. Removed broken fragments of 2-inch Schedule 80 PVC w ell casing.	(54.0 - 57.0') No drilling fluid used
56	(54.0 - 57.0) 4.33 mins/ft	SW-SM		(54.5-57 ft) Well-graded sand with silt and gravel (SW-SM); brown (7.5YR 5/3).		
57						
58					(57.0 - 67.0') Observed Cemex #60 (40x70) Lapis Lustre Sand, and formation sediment including fine grained sand with trace small to medium pebbles. Removed broken fragments of 2-inch Schedule 80 PVC well casing.	(57.0 - 67.0') No drilling fluid used
59	(57.0 - 67.0) 2.10 mins/ft	SW-SM		(57-62 ft) Well-graded sand with silt and gravel (SW-SM); brown (7.5YR 4/4).		
60						

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Drilling Log

ARCADIS

Date Started:	08/16/2022	Surface Elevation:	538.84 ft amsl	**Boring No.:**	**TWB-01**
Date Completed:	09/08/2022	Northing (NAD83):	2100941.12		
Drilling Co.:	Cascade	Easting (NAD83):	7615929.94	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	137.0 ft bgs	Project:	Final GW Remedy Phase 2A
Drill Rig Type:	Boart Longyear Sonic	Conductor Casing Diameter:	12 inches	Location:	PG&E Topock, Needles California
Driller Name:	Matt Arnold	Drill Casing Diameter:	10.5 inches		
Drilling Asst:	L.A. / I.S. / D.H.	Drill Bit:	8 & 10-inch Cutting Shoe	Project Number:	30126255
Tool-Pusher:	Arnold Lamon	Depth to First Water:	82.0 ft bgs		
Rig Geologist:	J.A. / K.L.	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run (ft) and Average Penetration Rate	USCS Code	USCS Class	Description (See Pilot boring log for full geologic descriptions)	Drilling notes and observations during overdrilling for the decommissioning of TWB-01 Temp Well and borehole reaming for the installation of TWB-01 extraction well.	Drilling Fluid
61	(57.0 - 67.0) 2.10 mins/ft	SW-SM		(57-62 ft) Well-graded sand with silt and gravel (SW-SM); brown (7.5YR 4/4).		
62		SM		(62-63.5 ft) Silty sand with gravel (SM); brown (7.5YR 4/4).		
63						
64		SW		(63.5-64.5 ft) Well-graded sand with gravel (SW); reddish brown (5YR 4/4).		
65		SM		(64.5-67 ft) Silty sand with gravel (SM); reddish yellow (5YR 6/6).		
66						
67						
68	(67.0 - 72.0) 2.40 mins/ft	SM		(67-70.5 ft) Silty sand with gravel (SM); brown (7.5YR 5/4).	(67.0 - 72.0') Observed Cemex #60 (40x70) Lapis Lustre Sand, and formation sediment including fine to coarse grained sand with small to medium pebbles of weathered bedrock. Removed approximately 7 feet of 2-inch schedule 80 PVC well casing.	(67.0 - 72.0') No drilling fluid used
69						
70		SW-SM		(70-72 ft) Well-graded sand with silt and gravel (SW-SM); reddish brown (5YR 4/4).		
71		SC		(71-72 ft) Clayey sand with gravel (SC); reddish brown (5YR 4/3).		
72						
73	(72.0 - 85.0) 1.00 mins/ft	SM		(72-74.5 ft) Silty sand with gravel (SM); reddish brown (5YR 4/4).	(72.0 - 85.0') Observed Cemex #3 (8x20) Lapis Lustre Sand and formation sediment including fine to very coarse grained sand, granules and small to medium pebbles. 2-inch schedule 80 PVC well casing material was not observed. The lack of well casing materials observed in the drill cuttings suggest the overdrill casing was not aligned with the TWB-01-Temp well below approximately 75 feet bgs. Well casing materials not removed during overdrilling is planned to be decommissioned in place when the TWB-01 extraction well is decommissioned by pressure grouting.	(72.0 - 85.0') No drilling fluid used
74						
75		SW-SM		(74.5-77 ft) Well-graded sand with silt and gravel (SW-SM); reddish brown (5YR 4/4).		
76						
77						
78		SM		(77-83 ft) Silty sand with gravel (SM); dark reddish gray (5YR 4/2).		
79						
80						

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, Notes: Solid blue water table marks represent depth to water (ft. bgs.) depth to water measured during the first VAS interval of the pilot borehole. TWB-01 Temp Well materials not removed by overdrilling below approximately 75 ft. bgs will be decommissioned in place when the TWB-01 extraction well is decommissioned by pressure grouting.

Drilling Log

Date Started:	08/16/2022	Surface Elevation:	538.84 ft amsl	**Boring No.:**	**TWB-01**
Date Completed:	09/08/2022	Northing (NAD83):	2100941.12		
Drilling Co.:	Cascade	Easting (NAD83):	7615929.94	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	137.0 ft bgs	Project:	Final GW Remedy Phase 2A
Drill Rig Type:	Boart Longyear Sonic	Conductor Casing Diameter:	12 inches	Location:	PG&E Topock, Needles California
Driller Name:	Matt Arnold	Drill Casing Diameter:	10.5 inches		
Drilling Asst:	L.A. / I.S. / D.H.	Drill Bit:	8 & 10-inch Cutting Shoe	Project Number:	30126255
Tool-Pusher:	Arnold Lamon	Depth to First Water:	82.0 ft bgs		
Rig Geologist:	J.A. / K.L.	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run (ft) and Average Penetration Rate	USCS Code	USCS Class	Description (See Pilot boring log for full geologic descriptions)	Drilling notes and observations during overdrilling for the decommissioning of TWB-01 Temp Well and borehole reaming for the installation of TWB-01 extraction well.	Drilling Fluid
81	(72.0 - 85.0) 1.00 mins/ft	SM		(77-83 ft) Silty sand with gravel (SM); dark reddish gray (5YR 4/2).		
82				(82 ft) Wet to moist		
83		SM		(83-84.5 ft) Silty sand with gravel (SM); dark reddish gray (5YR 4/2).		
84						
85		SM		(84.5-89.5 ft) Silty sand with gravel (SM); reddish brown (5YR 4/3).		
86	(85.0 - 87.0) 8.00 mins/ft				(85.0 - 87.0') Observed Cemex #3 (8x20) Lapis Lustre Sand and moist formation sediment including medium to very coarse grained sand, granules, and small to medium pebbles.	(85.0 - 87.0') No drilling fluid used
87				(87 ft) Moist to wet.		
88	(87.0 - 95.0) 1.13 mins/ft				(87.0 - 95.0') Observed Cemex #3 (8x20) Lapis Lustre Sand and moist formation sediment including medium to very coarse grained sand, granules, and small to medium pebbles.	(87.0 - 95.0') No drilling fluid used
89						
90		N/A		(89.5-97 ft) Sedimentary Rock; reddish brown (5YR 5/4).		
91						
92						
93						
94						
95						
96	(95.0 - 100.0) 1.80 mins/ft				(95.0 - 100.0') Observed Cemex #3 (8x20) Lapis Lustre Sand and moist formation sediment including medium to very coarse grained sand, small-medium pebble, granules, moist.	(95.0 - 100.0') No drilling fluid used
97		SP-SM		(97-98 ft) Poorly graded sand with silt (SP-SM); reddish brown (5YR 5/4).		
98		SM		(98-99.5 ft) Silty sand with gravel (SM); reddish brown (5YR 5/4).		
99						
100		N/A				

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Drilling Log

Sheet: 6 of 7

Date Started:	08/16/2022	Surface Elevation:	538.84 ft amsl	**Boring No.:**	**TWB-01**
Date Completed:	09/08/2022	Northing (NAD83):	2100941.12		
Drilling Co.:	Cascade	Easting (NAD83):	7615929.94	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	137.0 ft bgs	Project:	Final GW Remedy Phase 2A
Drill Rig Type:	Boart Longyear Sonic	Conductor Casing Diameter:	12 inches	Location:	PG&E Topock, Needles California
Driller Name:	Matt Arnold	Drill Casing Diameter:	10.5 inches		
Drilling Asst:	L.A. / I.S. / D.H.	Drill Bit:	8 & 10-inch Cutting Shoe	Project Number:	30126255
Tool-Pusher:	Arnold Lamon	Depth to First Water:	82.0 ft bgs		
Rig Geologist:	J.A. / K.L.	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run (ft) and Average Penetration Rate	USCS Code	USCS Class	Description (See Pilot boring log for full geologic descriptions)	Drilling notes and observations during overdrilling for the decommissioning of TWB-01 Temp Well and borehole reaming for the installation of TWB-01 extraction well.	Drilling Fluid
101	(100.0 - 107.0) 0.57 mins/ft	N/A		(99.5-106 ft) Sedimentary Rock - Conglomerate; reddish brown (5YR 5/4).	(100.0 - 107.0') Observed Cemex #3 (8x20) Lapis Lustre Sand and moist formation sediment including medium to coarse grained sand, silt, granules, and small to medium pebbles.	(100.0 - 107.0') No drilling fluid used
102						
103						
104						
105						
106		N/A		(106-110 ft) Sedimentary Rock - Conglomerate; reddish brown (5YR 5/4).		
107					(107.0 - 112.0') Observed moist formation sediment including medium to very coarse grained sand, silt, granules and small pebbles. Cemex #3 (8x20) Lapis Lustre Sand was not observed. The lack of Cemex #3 (8x20) Lapis Lustre Sand in the drill cutting suggests that the overdrill casing was not aligned with the TWB-01 Pilot borehole used to install the TWB-01-Temp well below approximately 107 feet bgs.	(107.0 - 112.0') No drilling fluid used
108						
109	(107.0 - 112.0) 2.40 mins/ft					
110						
111		N/A		(110-119 ft) Sedimentary Rock - Conglomerate; reddish brown (5YR 5/4).	(110.0') After reaching total depth PG&E requested the drill casing remain in the borehole during discussions with stakeholders to discuss options to determine a path forward for the decommissioning of TWB-01 Temp Well materials left in place below approximately 75 ft. bgs. Cascade had concerns that the 10-inch drill casing would lock up in the formation. To prevent the casing from becoming locked up the 10-inch casing was retracted to approximately 110 ft. bgs and the borehole below temporarily backfilled with Cemex #1/20 (20x40) Lapis Lustre Sand to support the casing and allow the rig to be moved to and alternate location until a path forward could be determined.	
112						(112.0 - 120.0') No drilling fluid used
113						
114					(112.0 - 120.0') Observed formation sediment including very fine to coarse grained sand, granules, and trace small pebbles.	
115					(115.0') Observed temporary backfill Cemex #1/20 (20x40) Lapis lustre sand in drill cuttings.	
116	(112.0 - 120.0) 2.13 mins/ft					
117						
118						
119						
120		N/A		(119-123.25 ft) Sedimentary Rock - Conglomerate; reddish brown (5YR 5/4).		

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, Notes: Solid blue water table marks represent depth to water (ft. bgs.) depth to water measured during the first VAS interval of the pilot borehole. TWB-01 Temp Well materials not removed by overdrilling below approximately 75 ft. bgs will be decommissioned in place when the TWB-01 extraction well is decommissioned by pressure grouting.

ARCADIS Drilling Log

Date Started:	08/16/2022	Surface Elevation:	538.84 ft amsl	**Boring No.:**	**TWB-01**
Date Completed:	09/08/2022	Northing (NAD83):	2100941.12		
Drilling Co.:	Cascade	Easting (NAD83):	7615929.94	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	137.0 ft bgs	Project:	Final GW Remedy Phase 2A
Drill Rig Type:	Boart Longyear Sonic	Conductor Casing Diameter:	12 inches	Location:	PG&E Topock, Needles California
Driller Name:	Matt Arnold	Drill Casing Diameter:	10.5 inches		
Drilling Asst:	L.A. / I.S. / D.H.	Drill Bit:	8 & 10-inch Cutting Shoe	Project Number:	30126255
Tool-Pusher:	Arnold Lamon	Depth to First Water:	82.0 ft bgs		
Rig Geologist:	J.A. / K.L.	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run (ft) and Average Penetration Rate	USCS Code	USCS Class	Description (See Pilot boring log for full geologic descriptions)	Drilling notes and observations during overdrilling for the decommissioning of TWB-01 Temp Well and borehole reaming for the installation of TWB-01 extraction well.	Drilling Fluid
121	(120.0 - 125.0) 1.80 mins/ft	N/A		(119-123.25 ft) Sedimentary Rock - Conglomerate; reddish brown (5YR 5/4).	(120.0 - 125.0') Observed moist formation sediment including medium to very coarse grained sand, silt, granules, small pebbles.	(120.0 - 125.0') No drilling fluid used
122						
123						
124		N/A		(123.25-129 ft) Sedimentary Rock - Conglomerate; reddish brown (5YR 5/4).		
125						
126	(125.0 - 131.0) 1.50 mins/ft				(125.0 - 131.0') Collect and logged from 129-131 feet bgs (see Description) to supplement TWB-01 Pilot Borehole Log drilled to approximately 129.5 bgs. The 8-inch diamter core barrel became stuck in the formation, flushed the 10-inch diameter drill casing over the core barrel to free it. The 10-inch diameter drill casing almost became stuck.	(125.0 - 131.0') Water used for drilling, volumes used and recovered not documented
127						
128					(126.0') Observed temporary backfill Cemex #1/20 (20x40) Lapis lustre sand in drill cuttings.	
129						
130		N/A		(129-131 ft) Sedimentary Rock - Conglomerate; reddish brown (7.5YR 5/4); fine grained to coarse grained, subangular; weathering fresh; medium hard; rock clasts within conglomerate composed of mixed lithology; NOTE: Competent bedrock pulverized by drilling process.		
131						
132	(131.0 - 136.0) 2.20 mins/ft				(131.0 - 136.0') Collect and logged from 129-131 feet bgs (see Description) to supplement TWB-01 Pilot Borehole Log drilled to approximately 129.5 bgs.	(131.0 - 136.0') Water used for drilling, volumes used and recovered not documented
133						
134		N/A		(131-136 ft) Sedimentary Rock - Conglomerate; reddish brown (7.5YR 5/4); fine grained to coarse grained, subangular; weathering fresh; medium hard; moderately fractured; massive; NOTE: Majority of larger clasts within matrix composed of metadiorite. From 131-132' the bedrock is fractured into 2-4 inch thick pieces.. (131-131.3 ft) Fracture, 90 degree vertical, smooth, fracture surface covered with silt. (132-133 ft) Mechanical fracture, horizontal, rough surface on fracture face. (133-134.16 ft) Mechanical fracture, horizontal, rough surface on fracture face. (134.2-135.08 ft) Mechanical fracture, horizontal, rough surface on fracture face. (135.08-136 ft) Mechanical fracture, horizontal, rough surface on fracture face.		
135						
136					(136.0') A preliminary alignment test was conducted by running 40 feet of 8-inch outer diameter core barrel within the 9.5-inch inner diameter of the drill casing to a depth of approximately 136 ft bgs. During the test Cascade did not encounter any resistance indicating that drill casing is likely plumb.	
137				End of Boring at 137 ft bgs.	(136.5') Flushed casing in preparation for well installation.	(136.5') 900 gallons of water used; 150 gallons of water recovered; 750 gallons of water lost
138						
139						
140						

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