Well Construction Log

Sheet: 1 of 8

Date Started:	06/26/2019	Surface Elevation:	500.0 ft amsl	**Well ID: IRZ-23**	
Date Completed:	06/30/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102535.3	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615825.8	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	17.5-24 inches		
Logger:	Athony Mack	Water Level Start:	46.85 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	8/11/2019		
Total Depth:	150.4 ft bgs	Well Completion:	☒ Flush ☐ Stick-up		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
1–5		Topock - Fluvial Deposits	SP-SM		(0.0 - 92.1') 10" Suregrip 17 Casing		
3–5		Topock - Fluvial Deposits	GM		(0.0 - 6.0') #0/30 sand	(0.0 - 6.0') 31.1 bags	(0.0 - 6.0') 35 bags (13%) Note: Lapis Lustre Sand
5		Topock - Fluvial Deposits	SW-SM				
5–6		Topock - Fluvial Deposits	GM				
6–10		Topock - Fluvial Deposits	SP-SM		(0.0 - 21.5') 24.0" Borehole		
10–13		Topock - Fluvial Deposits	SP-SM		(6.0 - 66.5') Portland Cement 3% Bentonite	(6.0 - 66.5') 737.1 gallons	(6.0 - 66.5') 1060 gallons (44%) Note: Type I, II and V and Benseal, used >20% of the calculated volume due to potential grout migration and voids forming during drilling
17–18		Topock - Fluvial Deposits	SM				
20			SM				

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Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	06/26/2019	Surface Elevation:	500.0 ft amsl	**Well ID: IRZ-23**	
Date Completed:	06/30/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102535.3	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615825.8	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	17.5-24 inches		
Logger:	Athony Mack	Water Level Start:	46.85 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	8/11/2019		
Total Depth:	150.4 ft bgs	Well Completion:	☒ Flush ☐ Stick-up		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
21		Topock - Fluvial Deposits	SM		(0.0 - 92.1') 10" Suregrip 17 Casing; (0.0 - 21.5') 24.0" Borehole		
23		Topock - Fluvial Deposits	ML				
24		Topock - Fluvial Deposits	GW-GM				
27		Topock - Fluvial Deposits	GM		(27.5 - 28.5') Centralizer; (6.0 - 66.5') Portland Cement 3% Bentonite; (21.5 - 39.2') 18.0" Borehole	(6.0 - 66.5') 737.1 gallons	(6.0 - 66.5') 1060 gallons (44%) Note: Type I, II and V and Benseal, used >20% of the calculated volume due to potential grout migration and voids forming during drilling
31		Topock - Fluvial Deposits	SM				
32		Topock - Fluvial Deposits	ML				
33		Topock - Alluvium Deposits	ML				
35		Topock - Alluvium Deposits	ML				
37		Topock - Alluvium Deposits	ML		(39.2 - 59.0') 18.0" Borehole		
40							

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, U = not detected above the laboratory reporting limit, groundwater data was collected during drilling of the pilot borehole

ARCADIS Design & Consultancy for natural and built assets

Well Construction Log

Date Started:	06/26/2019	Surface Elevation:	500.0 ft amsl	**Well ID: IRZ-23**	
Date Completed:	06/30/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102535.3	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615825.8	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	17.5-24 inches		
Logger:	Athony Mack	Water Level Start:	46.85 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	8/11/2019		
Total Depth:	150.4 ft bgs	Well Completion:	☒ Flush ☐ Stick-up		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
41–60	IRZ-23-VAS-57-62 (5.3 ppb) 11/30/2018 12:46	Topock - Alluvium Deposits	ML		(0.0 - 92.1') 10" Suregrip 17 Casing	(6.0 - 66.5') 737.1 gallons	(6.0 - 66.5') 1060 gallons (44%) Note: Type I, II and V and Benseal, used >20% of the calculated volume due to potential grout migration and voids forming during drilling
47–48		Topock - Alluvium Deposits	SM		(6.0 - 66.5') Portland Cement 3% Bentonite		
49–52		Topock - Alluvium Deposits	SM		(39.2 - 59.0') 18.0" Borehole		
53–57		Topock - Alluvium Deposits	ML				
58–60			SM		(59.0 - 79.0') 18.0" Borehole		

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Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	06/26/2019	Surface Elevation:	500.0 ft amsl	**Well ID: IRZ-23**	
Date Completed:	06/30/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102535.3	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615825.8	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	17.5-24 inches		
Logger:	Athony Mack	Water Level Start:	46.85 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	8/11/2019		
Total Depth:	150.4 ft bgs	Well Completion:	☒ Flush ☐ Stick-up		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
61	IRZ-23-VAS-57-62 (5.3 ppb) 11/30/2018 12:46	Topock - Alluvium Deposits	SM		(0.0 - 92.1') 10" Suregrip 17 Casing		
62							
63					(6.0 - 66.5') Portland Cement 3% Bentonite	(6.0 - 66.5') 737.1 gallons	(6.0 - 66.5') 1060 gallons (44%) Note: Type I, II and V and Benseal, used >20% of the calculated volume due to potential grout migration and voids forming during drilling
64					(63.6 - 64.6') Centralizer		
65		Topock - Alluvium Deposits	SM				
66							
67					(66.5 - 68.6') Bentonite seal chips	(66.5 - 68.6') 3.56 bags	(66.5 - 68.6') 4 bags (12%) Note: Puregold Medium Chips, installed bentonite seal at the request of the drillers to prevent grout migration
68							
69	IRZ-23-VAS-67-72 (85 ppb) 12/1/2018 08:50				(59.0 - 79.0') 18.0" Borehole		
70		Topock - Alluvium Deposits	SM		(68.6 - 72.0') Cemex #60 (40x70 mesh)	(68.6 - 72.0') 7.3 bags	(68.6 - 72.0') 11 bags (51%) Note: Lapis Lustre Sand, used >20% of the calculated volume due to potential voids forming during drilling
71							
72							
73							
74							
75							
76		Topock - Alluvium Deposits	ML		(72.0 - 150.4') Cemex 30 mesh (30x70) sand	(72.0 - 150.4') 194.8 bags	(72.0 - 150.4') 209 bags (7%) Note: Lapis Lustre Sand, swabbed filter pack for approximately 2.5 hours prior to installing transition sand
77							
78							
79							
80					(79.0 - 94.0') 18.0" Borehole		

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Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	06/26/2019	Surface Elevation:	500.0 ft amsl	**Well ID: IRZ-23**	
Date Completed:	06/30/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102535.3	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615825.8	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	17.5-24 inches		
Logger:	Athony Mack	Water Level Start:	46.85 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	8/11/2019		
Total Depth:	150.4 ft bgs	Well Completion:	☒ Flush ☐ Stick-up		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
81		Topock - Alluvium Deposits	ML		(0.0 - 92.1') 10" Suregrip 17 Casing		
82							
83		Topock - Alluvium Deposits	SM				
84							
85		Topock - Alluvium Deposits	ML				
86							
87					(79.0 - 94.0') 18.0" Borehole		
88		Topock - Alluvium Deposits	SM				
89							
90					(72.0 - 150.4') Cemex 30 mesh (30x70) sand	(72.0 - 150.4') 194.8 bags	(72.0 - 150.4') 209 bags (7%) Note: Lapis Lustre Sand, swabbed filter pack for approximately 2.5 hours prior to installing transition sand
91							
92					(92.1 - 142.0') 10" 10-slot 316 SS Wire Wrap Screen		
93							
94	IRZ-23-VAS-92-97 (<0.033 U ppb) 12/3/2018 11:47						
95		Topock - Alluvium Deposits	SM				
96					(94.0 - 98.6') 18.0" Borehole		
97							
98		Topock - Alluvium Deposits	SM				
99							
100					(98.6 - 118.3') 18.0" Borehole		

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ARCADIS Design & Consultancy for natural and built assets

Well Construction Log

Well ID: IRZ-23

Date Started:	06/26/2019	Surface Elevation:	500.0 ft amsl	Client:	PG&E
Date Completed:	06/30/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Project:	Final GW Remedy Phase 1
Drilling Method:	Dual Rotary	Northing (NAD83):	2102535.3	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Easting (NAD83):	7615825.8		
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	17.5-24 inches		
Logger:	Athony Mack	Water Level Start:	46.85 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	8/11/2019		
Total Depth:	150.4 ft bgs	Well Completion:	☒ Flush ☐ Stick-up		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
101		Topock - Alluvium Deposits	SM		(92.1 - 142.0') 10" 10-slot 316 SS Wire Wrap Screen		
102		Topock - Alluvium Deposits	GM				
103							
104		Topock - Alluvium Deposits	SM				
105							
106							
107							
108		Topock - Alluvium Deposits	GM				
109					(98.6 - 118.3') 18.0" Borehole		
110					(72.0 - 150.4') Cemex 30 mesh (30x70) sand	(72.0 - 150.4') 194.8 bags	(72.0 - 150.4') 209 bags (7%) Note: Lapis Lustre Sand, swabbed filter pack for approximately 2.5 hours prior to installing transition sand
111							
112							
113							
114							
115							
116							
117							
118		Topock - Alluvium Deposits	SM				
119					(118.3 - 139.2') 18.0" Borehole		
120							

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Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	06/26/2019	Surface Elevation:	500.0 ft amsl	**Well ID: IRZ-23**	
Date Completed:	06/30/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102535.3	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615825.8	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	17.5-24 inches		
Logger:	Athony Mack	Water Level Start:	46.85 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	8/11/2019		
Total Depth:	150.4 ft bgs	Well Completion:	☒ Flush ☐ Stick-up		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
121		Topock - Alluvium Deposits	SM		(92.1 - 142.0') 10" 10-slot 316 SS Wire Wrap Screen		
122							
123							
124	IRZ-23-VAS-122-127 (2000 ppb) 12/2/2018 09:24	Topock - Alluvium Deposits	ML				
125							
126							
127							
128							
129							
130		Topock - Alluvium Deposits	SM		(72.0 - 150.4') Cemex 30 mesh (30x70) sand	(72.0 - 150.4') 194.8 bags	(72.0 - 150.4') 209 bags (7%) Note: Lapis Lustre Sand, swabbed filter pack for approximately 2.5 hours prior to installing transition sand
131							
132							
133					(118.3 - 139.2') 18.0" Borehole		
134		Topock - Alluvium Deposits	ML				
135							
136							
137		Topock - Alluvium Deposits	GM				
138		Topock - Alluvium Deposits	GM				
139							
140			SM		(139.2 - 147.0') 17.5" Borehole		

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Well Construction Log

Sheet: 8 of 8

ARCADIS Design & Consultancy for natural and built assets

Date Started:	06/26/2019	Surface Elevation:	500.0 ft amsl	**Well ID: IRZ-23**	
Date Completed:	06/30/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102535.3	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615825.8	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	17.5-24 inches		
Logger:	Athony Mack	Water Level Start:	46.85 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	8/11/2019		
Total Depth:	150.4 ft bgs	Well Completion:	☒ Flush ☐ Stick-up		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
141	IRZ-23-VAS-139-144 (3000 ppb) 12/2/2018 14:17	Topock - Weathered Bedrock - conglomerate	SM		(92.1 - 142.0') 10" 10-slot 316 SS Wire Wrap Screen		
142							
143					(139.2 - 147.0') 17.5" Borehole		
144							
145		Topock - Competent Bedrock - conglomerate			(144.0 - 145.0') Centralizer (72.0 - 150.4') Cemex 30 mesh (30x70) sand	(72.0 - 150.4') 194.8 bags	(72.0 - 150.4') 209 bags (7%) Note: Lapis Lustre Sand, swabbed filter pack for approximately 2.5 hours prior to installing transition sand
146							
147					(142.0 - 147.4') Sump and End Cap		
148							
149					(147.0 - 150.4') 17.5" Borehole		
150					End of Boring at 150.4 'bgs.		
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							

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ARCADIS Design & Consultancy for natural and built assets

Drilling Log

Boring No.: IRZ-23

Date Started:	06/17/2019	Surface Elevation:	500.0 ft amsl		
Date Completed:	06/25/2019	Northing (NAD83):	2102535.3		
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	150.4 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	24 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	18 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	17 Tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	49.49 ft bgs		
Rig Geologist:	E. Redner / A. Mack	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling Notes	Drilling Fluid
1–20	(0.0 - 21.5) 4.24 mins/ft	SP-SM		(0.0 - 21.5') 24.0" Steel Casing	(0.0 - 2.0') Topock - Fluvial Deposits; Poorly graded sand with silt and gravel (SP-SM); brown (7.5YR 5/3)	(0.0 - 21.5') Loss of drilling fluid.	(0.0 - 21.5') 24.4 gallons of water used; 0 gallons of water recovered; 24.4 gallons of water lost
		GM			(2.0 - 4.5') Topock - Fluvial Deposits; Silty gravel with sand (GM); brown (7.5YR 5/3)		
		SW-SM			(4.5 - 5.0') Topock - Fluvial Deposits; Well graded sand with silt (SW-SM); very pale brown / grayish orange (10YR 7/4)	(5.0') Observed trace amounts of Cemex #3 MESH (8x10) Lapis Lustre Sand and some amount of Cemex #0/30 MESH (30/50) Lapis Lustre Sand in drill cuttings (See Photo Log).	
		GM			(5.0 - 7.0') Topock - Fluvial Deposits; Silty gravel with sand (GM); brown (7.5YR 5/3)		
		SP-SM			(7.0 - 17.0') Topock - Fluvial Deposits; Poorly graded sand with silt and gravel (SP-SM)	(10.0') Observed trace amounts of Cemex #3 MESH (8x10) Lapis Lustre Sand in drill cuttings (see Photo Log).	
						(14.0 - 15.0') Rough drilling.	
						(15.0 - 17.0') Normal drilling, observed trace to little amounts of Cemex #3 MESH (8x10) Lapis Lustre Sand in drill cuttings (See Photo Log).	
		SM			(17.0 - 19.5') Topock - Fluvial Deposits; Silty sand (SM); reddish brown (5YR 5/3) with brownish yellow / dark yellowish orange (10YR 6/6)	(17.0 - 18.0') Rough drilling.	
		SM			(19.5 - 23.0') Topock - Fluvial		

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Remarks: blue water table symbol represents depth to water measured during the first VAS interval

Drilling Log

Boring No.: IRZ-23

Date Started:	06/17/2019	Surface Elevation:	500.0 ft amsl		
Date Completed:	06/25/2019	Northing (NAD83):	2102535.3		
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	150.4 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	24 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	18 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	17 Tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	49.49 ft bgs		
Rig Geologist:	E. Redner / A. Mack	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling Notes	Drilling Fluid
21	(0.0 - 21.5) 4.24 mins/ft	SM		(0.0 - 21.5') 24.0" Steel Casing	Deposits; Silty sand with gravel (SM); brown (10YR 5/3)	(20.0') Observed trace amounts of Cemex #3 MESH (8x10) Lapis Lustre Sand in drill cuttings (see Photo Log).	
22						(21.5 - 39.2') Loss of drilling fluid.	(21.5 - 39.2') 30.5 gallons of water used; 0 gallons of water recovered; 30.5 gallons of water lost
23		ML			(23.0 - 23.5') Topock - Fluvial Deposits; Silt with sand (ML); gray (10YR 5/1)		
24		GW-GM			(23.5 - 27.0') Topock - Fluvial Deposits; Well graded gravel with silt and sand (GW-GM); light brown (7.5YR 6/3)		
25						(25.0') Observed trace amounts of Cemex #3 MESH (8x10) Lapis Lustre Sand in drill cuttings (See Photo Log).	
26						(26.0 - 28.0') Rough drilling.	
27							
28		GM			(27.0 - 30.5') Topock - Fluvial Deposits; Silty gravel (GM); brown (10YR 5/3)	(28.0 - 38.0') Slow drilling, encountered very hard boulder 28 ft. to 30 ft. bgs.	
29							
30	(21.5 - 39.2) 5.07 mins/ft			(21.5 - 39.2') 18.0" Steel Casing			
31		SM			(30.5 - 31.5') Topock - Fluvial Deposits; Silty sand with gravel (SM); light yellowish brown (10YR 6/4)		
32		ML			(31.5 - 32.0') Topock - Fluvial Deposits; Silt with sand (ML); gray (10YR 5/1)		
33		ML			(32.0 - 35.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); brown (7.5YR 5/3)		
34							
35							
36		ML			(35.0 - 37.0') Topock - Alluvium Deposits; Gravelly silt with sand (ML); brown (7.5YR 5/3)	(35.0') Observed trace amounts of Cemex #3 MESH (8x10) Lapis Lustre Sand in drill cuttings (See Photo Log).	
37							
38		ML			(37.0 - 47.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML)		
39							
40	(39.2 - 59.0) 2.02 mins/ft			(39.2 - 59.0') 18.0" Steel Casing		(39.2 - 59.0') Loss of drilling fluid.	(39.2 - 59.0') 6.1 gallons of water used; 0 gallons of

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater

Remarks: blue water table symbol represents depth to water measured during the first VAS interval

ARCADIS Design & Consultancy for natural and built assets

Drilling Log

Boring No.: IRZ-23

Date Started:	06/17/2019	Surface Elevation:	500.0 ft amsl		
Date Completed:	06/25/2019	Northing (NAD83):	2102535.3		
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	150.4 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	24 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	18 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	17 Tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	49.49 ft bgs		
Rig Geologist:	E. Redner / A. Mack	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling Notes	Drilling Fluid
41							water recovered; 6.1 gallons of water lost
42							
43		ML					
44							
45						(45.0') Observed trace amounts of Cemex #3 MESH (8x10) Lapis Lustre Sand in drill cuttings (See Photo Log).	
46							
47					(47.0 - 49.5') Topock - Alluvium Deposits; Silty sand (SM)		
48		SM					
49	(39.2 - 59.0) 2.02 mins/ft			(39.2 - 59.0') 18.0" Steel Casing			
50					(49.5 - 52.0') Topock - Alluvium Deposits; Silty sand with gravel (SM)		
51		SM					
52					(52.0 - 59.5') Topock - Alluvium Deposits; Silt with sand (ML)		
53							
54							
55						(55.0') Observed trace amounts of Cemex #3 MESH (8x10) Lapis Lustre Sand in drill cuttings (See Photo Log).	
56		ML					
57							
58							
59							
60	(59.0 - 79.0) 1.65 mins/ft	SM		(59.0 - 79.0') 18.0" Steel Casing	(59.5 - 62.0') Topock - Alluvium	(59.0 - 79.0') Loss of drilling fluid.	(59.0 - 79.0') 6.1 gallons of water used; 0 gallons of water recovered; 6.1

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater

Remarks: blue water table symbol represents depth to water measured during the first VAS interval

ARCADIS Design & Consultancy for natural and built assets

Drilling Log

Boring No.: IRZ-23

Date Started:	06/17/2019	Surface Elevation:	500.0 ft amsl		
Date Completed:	06/25/2019	Northing (NAD83):	2102535.3		
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	150.4 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	24 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	18 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	17 Tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	49.49 ft bgs		
Rig Geologist:	E. Redner / A. Mack	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling Notes	Drilling Fluid
61		SM			Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3)		gallons of water lost
62					(62.0 - 69.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3)		
63							
64							
65						(65.0') Observed little amounts of Cemex #3 MESH (8x10) Lapis Lustre Sand in drill cuttings (See Photo Log).	
66		SM					
67							
68							
69	(59.0 - 79.0) 1.65 mins/ft			(59.0 - 79.0') 18.0" Steel Casing			
70					(69.5 - 72.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3)		
71		SM					
72					(72.0 - 82.0') Topock - Alluvium Deposits; Silt with sand (ML); reddish brown (5YR 5/3)	(72.0 - 73.0') Drill rods chattering, rough drilling potential hard rock	
73							
74							
75						(75.0') Observed little amounts of Cemex #3 MESH (8x10) Lapis Lustre Sand in drill cuttings (See Photo Log).	
76		ML					
77							
78							
79							
80	(79.0 - 94.0) 3.53 mins/ft			(79.0 - 94.0') 18.0" Steel Casing		(79.0 - 98.6') Drilled with water.	(79.0 - 98.6') 24.4 gallons of water used; 157 gallons of water recovered; 132.6

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater

Remarks: blue water table symbol represents depth to water measured during the first VAS interval

ARCADIS Design & Consultancy for natural and built assets

Drilling Log

Boring No.: IRZ-23

Date Started:	06/17/2019	Surface Elevation:	500.0 ft amsl		
Date Completed:	06/25/2019	Northing (NAD83):	2102535.3		
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	150.4 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	24 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	18 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	17 Tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	49.49 ft bgs		
Rig Geologist:	E. Redner / A. Mack	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling Notes	Drilling Fluid
81		ML					gallons of water gained
82					(82.0 - 84.5') Topock - Alluvium Deposits; Silty sand (SM); brown (7.5YR 4/4)		
83		SM					
84							
85					(84.5 - 87.0') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown (5YR 5/4)	(85.0') Observed little amounts of Cemex #3 MESH (8x10) Lapis Lustre Sand in drill cuttings (See Photo Log).	
86		ML					
87	(79.0 - 94.0) 3.53 mins/ft			(79.0 - 94.0') 18.0" Steel Casing	(87.0 - 94.5') Topock - Alluvium Deposits; Silty sand (SM); brown (7.5YR 4/4)		
88							
89						(89.0 - 90.0') Rough drilling.	
90							
91		SM					
92							
93							
94						(94.0 - 96.0') Slow drilling.	
95		SM			(94.5 - 97.0') Topock - Alluvium Deposits; Silty sand (SM); reddish brown (5YR 5/4)		
96	(94.0 - 98.6) 4.18 mins/ft			(94.0 - 98.6') 18.0" Steel Casing			
97					(97.0 - 102.0') Topock - Alluvium Deposits; Silty sand (SM); dark yellowish brown (10YR 4/4)		
98		SM					
99	(98.6 - 118.3) 4.41 mins/ft			(98.6 - 118.3') 18.0" Steel Casing		(98.6 - 118.3') Drilled with water.	(98.6 - 118.3') 2403.4 gallons of water used; 4200 gallons of water recovered; 1796.6 gallons of water gained
100							

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ARCADIS Design & Consultancy for natural and built assets

Drilling Log

Boring No.: IRZ-23

Date Started:	06/17/2019	Surface Elevation:	500.0 ft amsl		
Date Completed:	06/25/2019	Northing (NAD83):	2102535.3		
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	150.4 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	24 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	18 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	17 Tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	49.49 ft bgs		
Rig Geologist:	E. Redner / A. Mack	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling Notes	Drilling Fluid
101		SM				(101.0') Rough drilling.	
102		GM			(102.0 - 103.0') Topock - Alluvium Deposits; Silty gravel (GM); brown (7.5YR 4/4)		
103		SM			(103.0 - 107.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); dark yellowish brown (10YR 4/4)		
104							
105						(105.0') Observed trace amounts of Cemex #3 MESH (8x10) Lapis Lustre Sand in drill cuttings (See Photo Log).	
106							
107		GM			(107.0 - 117.0') Topock - Alluvium Deposits; Silty gravel (GM); brown (10YR 4/3)		
108							
109	(98.6 - 118.3) 4.41 mins/ft			(98.6 - 118.3') 18.0" Steel Casing			
110							
111							
112							
113							
114							
115						(115.0') Observed trace amounts of Cemex #3 MESH (8x10) Lapis Lustre Sand in drill cuttings (See Photo Log).	
116						(115.1 - 118.3') Slow drilling/hard rock.	
117					(117.0 - 122.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4)		
118		SM					
119	(118.3 - 139.2) 4.30 mins/ft			(118.3 - 139.2') 18.0" Steel Casing		(118.3 - 147.0') Drilled with water.	(118.3 - 147.0') 608.48 gallons of water used; 6040 gallons of water recovered; 5431.52 gallons of water gained
120							

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Remarks: blue water table symbol represents depth to water measured during the first VAS interval

ARCADIS Design & Consultancy for natural and built assets

Drilling Log

Date Started:	06/17/2019	Surface Elevation:	500.0 ft amsl	**Boring No.:**	**IRZ-23**
Date Completed:	06/25/2019	Northing (NAD83):	2102535.3		
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	150.4 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	24 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	18 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	17 Tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	49.49 ft bgs		
Rig Geologist:	E. Redner / A. Mack	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling Notes	Drilling Fluid
121		SM					
122					(122.0 - 127.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); yellowish red (5YR 4/6)		
123							
124		ML					
125						(125.0') Observed trace to little amounts of Cemex #3 MESH (8x10) Lapis Lustre Sand in drill cuttings (See Photo Log).	
126							
127					(127.0 - 133.0') Topock - Alluvium Deposits; Silty sand (SM); (5YR 4/8)		
128							
129							
130	(118.3 - 139.2) 4.30 mins/ft	SM		(118.3 - 139.2') 18.0" Steel Casing			
131							
132							
133					(133.0 - 136.5') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown (5YR 4/3)		
134							
135		ML				(135.0') Observed trace amounts of Cemex #3 MESH (8x10) Lapis Lustre Sand in drill cuttings (See Photo Log).	
136						(136.0 - 139.0') Rough drilling.	
137		GM			(136.5 - 137.0') Topock - Alluvium Deposits; Silty gravel (GM); dark gray (7.5YR 4/1)		
138		GM			(137.0 - 139.5') Topock - Alluvium Deposits; Silty gravel with sand (GM); reddish brown / moderate brown (5YR 4/4)		
139							
140	(139.2 - 147.0) 2.57 mins/ft	SM			(139.5 - 142.0') Topock -		

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Remarks: blue water table symbol represents depth to water measured during the first VAS interval

Drilling Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	06/17/2019	Surface Elevation:	500.0 ft amsl	**Boring No.:**	**IRZ-23**
Date Completed:	06/25/2019	Northing (NAD83):	2102535.3		
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	150.4 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	24 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	18 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	17 Tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	49.49 ft bgs		
Rig Geologist:	E. Redner / A. Mack	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling Notes	Drilling Fluid
141		SM			Weathered Bedrock - conglomerate; Silty sand (SM); yellowish red (5YR 4/6)		
142					(142.0 - 150.4') Topock - Competent Bedrock - conglomerate; yellowish red (5YR 4/6); No Recovery overdrilled with DR rig for well installation	(142.0') Observed trace amounts of Plastering Sand in drill cuttings (See Photo Log).	
143	(139.2 - 147.0) 2.57 mins/ft			(139.2 - 147.0') 17.5" Open Hole			
144							
145							
146							
147							
148	(147.0 - 150.4) 20.59 mins/ft			(147.0 - 150.4') 17.5" Open Hole		(147.0 - 150.4') Drilled with water.	
149							
150							
151					End of Boring at 150.4 'bgs.		
152							
153							
154							
155							
156							
157							
158							
159							
160							

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Remarks: blue water table symbol represents depth to water measured during the first VAS interval

Boring Log

Sheet: 1 of 8

Date Started:	11/28/2018	Surface Elevation:	500.0 ft amsl	**Boring No.:**	**IRZ-23 Pilot**
Date Completed:	12/03/2018	Northing (NAD83):	2102535.3		
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	147 ft bgs	Project:	Final Groundwater Remedy Phase
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Location:	1
Driller Name:	Steve Vasquez	Depth to First Water:	47 ft bgs		PG&E Topock, Needles, California
Drilling Asst:	N. Dominguez/C. Alverez	Sampling Method:	4 inch x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	Connor Mills	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☐ Yes ☒ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
1–7	84			Topock - Fluvial Deposits	SP-SM		(0.0 - 2.0') Topock - Fluvial Deposits; Poorly graded sand with silt and gravel (SP-SM); brown (7.5YR 5/3); very fine grained to medium grained, angular to subround; little granule to very large pebbles, subangular to round; little silt; trace cobbles, subangular to round; dry		(0.0 - 147.0') No water used
2–4				Topock - Fluvial Deposits	GM		(2.0 - 4.5') Topock - Fluvial Deposits; Silty gravel with sand (GM); brown (7.5YR 5/3); granules to large pebbles, angular to subround; some very fine to medium grained sand, angular to subround; some silt; trace cobbles, angular to subangular; dry; 2 inch streak of orangish silt is through out the core		
5				Topock - Fluvial Deposits	SW-SM		(4.5 - 5.0') Topock - Fluvial Deposits; Well graded sand with silt (SW-SM); very pale brown / grayish orange(10YR 7/4); very fine grained to coarse grained, angular to round; little silt; dry		
6–7				Topock - Fluvial Deposits	GM		(5.0 - 7.0') Topock - Fluvial Deposits; Silty gravel with sand (GM); brown (7.5YR 5/3); granules to large pebbles, angular to subangular; some very fine to medium grained sand, angular to subangular; trace cobbles, angular to subangular; dry		
8–17	120			Topock - Fluvial Deposits	SP-SM		(7.0 - 17.0') Topock - Fluvial Deposits; Poorly graded sand with silt and gravel (SP-SM); very fine grained to medium grained, subangular to subround; some granule to very large pebbles, angular to round; little silt; trace cobbles, angular to subround; dry		
18–19	60			Topock - Fluvial Deposits	SM		(17.0 - 19.5') Topock - Fluvial Deposits; Silty sand (SM); reddish brown (5YR 5/3) with brownish yellow / dark yellowish orange(10YR 6/6); very fine grained to fine grained, angular to subround; little silt; trace boulders; dry (18') very dark grayish brown (10YR 3/2); 1.5 ft solid core from a boulder with a frothy texture, basalt		
20					SM		(19.5 - 23.0') Topock - Fluvial Deposits; Silty sand with gravel (SM);		

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Boring Log

Sheet: 2 of 8

ARCADIS Design & Consultancy for natural and built assets

Date Started:	11/28/2018	Surface Elevation:	500.0 ft amsl	**Boring No.:**	**IRZ-23 Pilot**
Date Completed:	12/03/2018	Northing (NAD83):	2102535.3		
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	147 ft bgs	Project:	Final Groundwater Remedy Phase
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Location:	1
Driller Name:	Steve Vasquez	Depth to First Water:	47 ft bgs		PG&E Topock, Needles, California
Drilling Asst:	N. Dominguez/C. Alverez	Sampling Method:	4 inch x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	Connor Mills	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☐ Yes ☒ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
21	60			Topock - Fluvial Deposits	SM		brown (10YR 5/3); very fine grained to coarse grained, angular to subround; some granule to very large pebbles, angular to subround; some silt; trace cobbles, angular to subangular; dry		(0.0 - 147.0') No water used
22									
23				Topock - Fluvial Deposits	ML		(23.0 - 23.5') Topock - Fluvial Deposits; Silt with sand (ML); gray (10YR 5/1); no plasticity; little very fine to coarse grained sand, angular to subround; trace granule to medium pebbles, angular to subround; dry; soft		
24	60			Topock - Fluvial Deposits	GW-GM		(23.5 - 27.0') Topock - Fluvial Deposits; Well graded gravel with silt and sand (GW-GM); light brown (7.5YR 6/3); granules to very large pebbles; some very fine to coarse grained sand, angular to subround; little silt; dry		
25									
26									
27				Topock - Fluvial Deposits	GM		(27.0 - 30.5') Topock - Fluvial Deposits; Silty gravel (GM); brown (10YR 5/3); granules to very large pebbles, angular to subround; and silt; little fine to medium grained sand, angular to subround; trace cobbles, angular; dry; large pebbles and cobbles composed of 1-4 in. metadiorite, cobbles were pulverized into a silty powder		
28									
29	108								
30									
31				Topock - Fluvial Deposits	SM		(30.5 - 31.5') Topock - Fluvial Deposits; Silty sand with gravel (SM); light yellowish brown (10YR 6/4); very fine grained to coarse grained, subangular to subround; and granule to large pebble, subangular to subround; some silt; dry		
32				Topock - Fluvial Deposits	ML		(31.5 - 32.0') Topock - Fluvial Deposits; Silt with sand (ML); gray (10YR 5/1); no plasticity; little very fine to coarse grained sand, angular to subround; trace granule to medium pebbles, angular to subround; dry; soft; 4.5 inch boulder of basalt at end of core		
33				Topock - Alluvium Deposits	ML		(32.0 - 35.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); brown (7.5YR 5/3); no plasticity; some very fine to coarse grained sand, angular to subround; little granule to large pebbles, angular to subangular; dry		
34									
35									
36	120			Topock - Alluvium Deposits	ML		(35.0 - 37.0') Topock - Alluvium Deposits; Gravelly silt with sand (ML); brown (7.5YR 5/3); no plasticity; some granule to very large pebbles, angular to subangular; little very fine to coarse grained sand, angular to subangular; dry		
37									
38				Topock - Alluvium Deposits	ML		(37.0 - 47.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); no plasticity; some very fine to coarse grained sand, angular to subangular; little small to medium pebbles, angular to subangular; dry; soft		
39									
40									

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Sheet: 3 of 8

Date Started:	11/28/2018	Surface Elevation:	500.0 ft amsl	**Boring No.:**	**IRZ-23 Pilot**
Date Completed:	12/03/2018	Northing (NAD83):	2102535.3		
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	147 ft bgs	Project:	Final Groundwater Remedy Phase
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Location:	1
Driller Name:	Steve Vasquez	Depth to First Water:	47 ft bgs		PG&E Topock, Needles, California
Drilling Asst:	N. Dominguez/C. Alverez	Sampling Method:	4 inch x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	Connor Mills	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☐ Yes ☒ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
41	120			Topock - Alluvium Deposits	ML				(0.0 - 147.0') No water used
42									
43									
44								(44.0 - 47.0') Moist Sediments	
45									
46									
47	108	IRZ-23-SS-45-50 12/4/2018 09:00		Topock - Alluvium Deposits	SM		(47.0 - 49.5') Topock - Alluvium Deposits; Silty sand (SM); fine grained to very coarse grained, subangular to subround; some silt; little granule to large pebbles, angular to subangular; poorly sorted; wet	(47.0') Approximate depth of water table	
48									
49									
50				Topock - Alluvium Deposits	SM		(49.5 - 52.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); very fine grained to coarse grained, angular to subround; some silt; little granule to very large pebbles, angular to subangular; trace cobbles, angular to subangular; wet		
51		IRZ-23-SS-50-55 12/4/2018 09:05							
52				Topock - Alluvium Deposits	ML		(52.0 - 59.5') Topock - Alluvium Deposits; Silt with sand (ML); no plasticity; little fine to coarse grained sand, angular to subround; trace medium to very large pebble, angular to subangular; wet	(52.0 - 57.0') Tight formation	
53									
54									
55									
56	120								
57		IRZ-23-SS-55-60 12/4/2018 09:15							
58			IRZ-23-VAS-57-62 (5.3 ppb) 11/30/2018 12:46						
59									
60					SM		(59.5 - 62.0') Topock - Alluvium Deposits; Silty sand with gravel (SM);		

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, U = not detected above the laboratory reporting limit, blue water table symbol represents depth to water measured during the first VAS interval

Boring Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	11/28/2018	Surface Elevation:	500.0 ft amsl	**Boring No.:**	**IRZ-23 Pilot**
Date Completed:	12/03/2018	Northing (NAD83):	2102535.3		
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	147 ft bgs	Project:	Final Groundwater Remedy Phase
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Location:	1
Driller Name:	Steve Vasquez	Depth to First Water:	47 ft bgs		PG&E Topock, Needles, California
Drilling Asst:	N. Dominguez/C. Alverez	Sampling Method:	4 inch x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	Connor Mills	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☐ Yes ☒ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
61	120		IRZ-23-VAS-57-62 (5.3 ppb) 11/30/2018 12:46	Topock - Alluvium Deposits	SM		brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some silt; little granule to medium pebbles, angular to subround; wet	(57.0 - 62.0') Sample screen had ~4 ft of water and did not produce well, driller thought 6-inch casing to be broken down hole, pulled 6-inch casing from borehole it was plugged with sediment, issues with the casing resulted in the sample being collected greater than 5 ft below first water	(0.0 - 147.0') No water used
62		IRZ-23-SS-60-65 12/4/2018 09:15							
63				Topock - Alluvium Deposits	SM		(62.0 - 69.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3); fine grained to very coarse grained, angular to subround; some granule to very large pebbles, subangular to subround; little silt; trace cobbles, subangular to round; wet	(62.0 - 72.0') Sediments were very saturated, driller indicated that there was cave in of the borehole	
64									
65									
66									
67	120	IRZ-23-SS-65-70 12/4/2018 09:20							
68									
69			IRZ-23-VAS-67-72 (85 ppb) 12/1/2018 08:50						
70				Topock - Alluvium Deposits	SM		(69.5 - 72.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3); fine grained to very coarse grained, angular to subround; little granules to very large pebbles, subangular to subround; little silt; trace cobbles, subangular to round; wet		
71									
72		IRZ-23-SS-70-75 12/4/2018 09:25							
73							(72.0 - 82.0') Topock - Alluvium Deposits; Silt with sand (ML); reddish brown (5YR 5/3); no plasticity; little very fine to medium grained sand, angular to subround; trace granule to small pebbles, angular to subangular; dry; potential contact of older and younger alluvium	(72.0 - 82.0') Drilling was tough, core came out hot and steaming	
74									
75									
76	120			Topock - Alluvium Deposits	ML				
77		IRZ-23-SS-75-80 12/4/2018 09:30							
78									
79									
80									

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Boring Log

Boring No.: IRZ-23 Pilot

Date Started:	11/28/2018	Surface Elevation:	500.0 ft amsl	Client:	PG&E
Date Completed:	12/03/2018	Northing (NAD83):	2102535.3		
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8		
Drilling Method:	Sonic Drilling	Total Depth:	147 ft bgs	Project:	Final Groundwater Remedy Phase
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Location:	1
Driller Name:	Steve Vasquez	Depth to First Water:	47 ft bgs		PG&E Topock, Needles, California
Drilling Asst:	N. Dominguez/C. Alverez	Sampling Method:	4 inch x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	Connor Mills	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☐ Yes ☒ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
81	120			Topock - Alluvium Deposits	ML			(72.0 - 82.0') Drilling was tough, core came out hot and steaming	(0.0 - 147.0') No water used
82		IRZ-23-SS-80-85 12/4/2018 09:35		Topock - Alluvium Deposits	SM		(82.0 - 84.5') Topock - Alluvium Deposits; Silty sand (SM); brown (7.5YR 4/4); very fine grained to coarse grained, angular to subangular; and silt; little granule to large pebbles, angular to subangular; wet		
83									
84									
85				Topock - Alluvium Deposits	ML		(84.5 - 87.0') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown (5YR 5/4); no plasticity; little granule to medium pebbles, angular to subangular; little very fine to coarse grained sand, angular to subangular; moist; medium stiff		
86		IRZ-23-SS-85-90 12/4/2018 09:40							
87	108								
88				Topock - Alluvium Deposits	SM		(87.0 - 94.5') Topock - Alluvium Deposits; Silty sand (SM); brown (7.5YR 4/4); very fine grained to coarse grained, angular to subangular; some silt; little granule to large pebbles, angular to subangular; little clay; wet		
89									
90									
91									
92		IRZ-23-SS-90-95 12/4/2018 09:45	IRZ-23-VAS-92-97 (<0.033 U ppb) 12/3/2018 11:47						
93									
94	54								
95				Topock - Alluvium Deposits	SM		(94.5 - 97.0') Topock - Alluvium Deposits; Silty sand (SM); reddish brown (5YR 5/4); fine grained to very coarse grained, angular to subround; some silt; little granule to medium pebbles, angular to subround; wet		
96									
97		IRZ-23-SS-95-100 12/4/2018 09:50							
98				Topock - Alluvium Deposits	SM		(97.0 - 102.0') Topock - Alluvium Deposits; Silty sand (SM); dark yellowish brown (10YR 4/4); fine grained to very coarse grained, angular to subround; some silt; trace granule to large pebbles, angular to subangular; wet		
99	120								
100									

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Date Started:	11/28/2018	Surface Elevation:	500.0 ft amsl	**Boring No.:**	**IRZ-23 Pilot**
Date Completed:	12/03/2018	Northing (NAD83):	2102535.3		
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	147 ft bgs	Project:	Final Groundwater Remedy Phase
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Location:	1
Driller Name:	Steve Vasquez	Depth to First Water:	47 ft bgs		PG&E Topock, Needles, California
Drilling Asst:	N. Dominguez/C. Alverez	Sampling Method:	4 inch x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	Connor Mills	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☐ Yes ☒ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
101				Topock - Alluvium Deposits	SM				(0.0 - 147.0') No water used
102		IRZ-23-SS-100-105 12/4/2018 09:55		Topock - Alluvium Deposits	GM		(102.0 - 103.0') Topock - Alluvium Deposits; Silty gravel (GM); brown (7.5YR 4/4); granules to very large pebbles, angular to subangular; some silt; little very fine to medium grained sand, angular to subround; trace cobbles, angular to subangular; dry		
103									
104	120			Topock - Alluvium Deposits	SM		(103.0 - 107.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); dark yellowish brown (10YR 4/4); fine grained to very coarse grained, subangular to subround; some silt; little granule to large pebbles, angular to subangular; wet		
105									
106									
107		IRZ-23-SS-105-110 12/4/2018 10:00		Topock - Alluvium Deposits	GM		(107.0 - 117.0') Topock - Alluvium Deposits; Silty gravel (GM); brown (10YR 4/3); granules to large pebbles, subangular to subround; little fine to very coarse grained sand, angular to subround; little silt; little clay; dry; potential contact of older and younger alluvium		
108									
109									
110									
111									
112	120	IRZ-23-SS-110-115 12/4/2018 10:05							
113									
114									
115									
116									
117		IRZ-23-SS-115-120 12/4/2018 10:10		Topock - Alluvium Deposits	SM		(117.0 - 122.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4); very fine grained to coarse grained, angular to subround; and silt; little granule to medium pebbles, angular to subangular; wet; tight formation, potential contact of weathered bedrock.	(117.0 - 127.0') Hard driling, dry	
118	120								
119									
120									

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Boring Log

Sheet: 7 of 8

Date Started:	11/28/2018	Surface Elevation:	500.0 ft amsl	**Boring No.:**	**IRZ-23 Pilot**
Date Completed:	12/03/2018	Northing (NAD83):	2102535.3		
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	147 ft bgs	Project:	Final Groundwater Remedy Phase
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Location:	1
Driller Name:	Steve Vasquez	Depth to First Water:	47 ft bgs		PG&E Topock, Needles, California
Drilling Asst:	N. Dominguez/C. Alverez	Sampling Method:	4 inch x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	Connor Mills	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☐ Yes ☒ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
121				Topock - Alluvium Deposits	SM			(117.0 - 127.0') Hard driling, dry	(0.0 - 147.0') No water used
122		IRZ-23-SS-120-125 12/4/2018 10:15					(122.0 - 127.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); yellowish red (5YR 4/6); no plasticity; little granule to medium pebbles, angular to subangular; little fine to medium grained sand, angular to subangular; wet		
123	120		IRZ-23-VAS-122-127 (2000 ppb) 12/2/2018 09:24	Topock - Alluvium Deposits	ML				
124									
125									
126									
127		IRZ-23-SS-125-130 12/4/2018 10:20					(127.0 - 133.0') Topock - Alluvium Deposits; Silty sand (SM); (5YR 4/8); fine grained to coarse grained, angular to subround; some silt; little granule to medium pebbles, angular to subangular; wet; granules and pebbles composed of trace pieces of metadiorite 1-4 in. dia.		
128									
129									
130				Topock - Alluvium Deposits	SM				
131									
132	114	IRZ-23-SS-130-135 12/4/2018 10:25							
133							(133.0 - 136.5') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown (5YR 4/3); no plasticity; some very fine to medium grained sand, angular to subround; trace granule to medium pebbles, angular to subround; wet		
134									
135				Topock - Alluvium Deposits	ML				
136									
137				Topock - Alluvium Deposits	GM		(136.5 - 137.0') Topock - Alluvium Deposits; Silty gravel (GM); dark gray (7.5YR 4/1); granules to very large pebbles, angular to subangular; some silt; little very fine to medium grained sand, angular to subangular; dry		
138		IRZ-23-SS-135-140 12/4/2018 10:30		Topock - Alluvium Deposits	GM		(137.0 - 139.5') Topock - Alluvium Deposits; Silty gravel with sand (GM); reddish brown / moderate brown(5YR 4/4); granules to large pebbles, angular to subangular; some silt; little fine to coarse grained sand, angular to subround; trace clay; wet; trace pebbles of metadiorite 20-70 mm		
139	120								
140					SM		(139.5 - 142.0') Topock - Weathered Bedrock - conglomerate; Silty		

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: IRZ-23 Pilot

Date Started:	11/28/2018	Surface Elevation:	500.0 ft amsl	Client:	PG&E
Date Completed:	12/03/2018	Northing (NAD83):	2102535.3	Project:	Final Groundwater Remedy Phase
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8	Location:	1
Drilling Method:	Sonic Drilling	Total Depth:	147 ft bgs		PG&E Topock, Needles, California
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Project Number:	RC000753.0051
Driller Name:	Steve Vasquez	Depth to First Water:	47 ft bgs		
Drilling Asst:	N. Dominguez/C. Alverez	Sampling Method:	4 inch x 10 ft Core Barrel		
Logger:	Connor Mills	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☐ Yes ☒ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
141	120	IRZ-23-SS-140-147 12/4/2018 10:35	IRZ-23-VAS-139-144 (3000 ppb) 12/2/2018 14:17	Topock - Weathered Bedrock - conglomerate	SM		sand (SM); yellowish red (5YR 4/6); very fine grained to coarse grained, angular to subround; and silt; trace granule to medium pebbles, angular to subround; wet; trace pieces of metadiorite 10-40 mm		(0.0 - 147.0') No water used
142									
143				Topock - Competent Bedrock - conglomerate			(142.0 - 147.0') Topock - Competent Bedrock - conglomerate; yellowish red (5YR 4/6); little very fine to coarse grained sand, subangular to round; dry; hard; strong cementation; friable	(142.0 - 147.0') Drill was tough with rig chattering.	
144									
145									
146									
147							End of Boring at 147.0 'bgs.		
148									
149									
150									
151									
152									
153									
154									
155									
156									
157									
158									
159									
160									

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Temporary Backfill Log

Sheet: 1 of 8

Date Started:	11/28/2018	Surface Elevation:	500.0 ft amsl	**Well ID: IRZ-23 Pilot**	
Date Completed:	12/03/2018	Northing (NAD83):	2102535.3		
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	147 ft bgs	Project:	Final Groundwater Remedy Phase
Driller Name:	Steve Vasquez	Borehole Diameter:	6-12 inches	Location:	1
Drilling Asst:	N. Dominguez/C. Alverez	Depth to First Water:	47 ft bgs		PG&E Topock, Needles, California
Logger:	Connor Mills	Editor:	Sean McGrane	Project Number:	RC000753.0051

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
0					(0.0 - 0.5') Temporary Steel Plate with BMP	(0.0 - 0.5') 1 plate	(0.0 - 0.5') 1 plate (0%)
1		Topock - Fluvial Deposits	SP-SM				
2					(0.0 - 4.0') 12" Borehole		
3		Topock - Fluvial Deposits	GM		(0.5 - 5.0') Cemex #0/30 MESH (30x50)	(0.5 - 5.0') 7.9 bags	(0.5 - 5.0') 6 bags (-24%) Note: Lapis Lustre Sand
4							
5		Topock - Fluvial Deposits	SW-SM				
6		Topock - Fluvial Deposits	GM				
7							
8							
9							
10							
11							
12		Topock - Fluvial Deposits	SP-SM		(4.0 - 147.0') 6" Borehole	(5.0 - 137.0') 55.3 bags	(5.0 - 137.0') 68 bags (23%) Note: Lapis Lustre Sand
13					(5.0 - 137.0') Cemex #3 MESH (8x10)		
14							
15							
16							
17							
18		Topock - Fluvial Deposits	SM				
19							
20			SM				

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ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Well ID: IRZ-23 Pilot

Date Started:	11/28/2018	Surface Elevation:	500.0 ft amsl	Client:	PG&E
Date Completed:	12/03/2018	Northing (NAD83):	2102535.3	Project:	Final Groundwater Remedy Phase
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8	Location:	1
Drilling Method:	Sonic Drilling	Total Depth:	147 ft bgs		PG&E Topock, Needles, California
Driller Name:	Steve Vasquez	Borehole Diameter:	6-12 inches		
Drilling Asst:	N. Dominguez/C. Alverez	Depth to First Water:	47 ft bgs		
Logger:	Connor Mills	Editor:	Sean McGrane	Project Number:	RC000753.0051

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
21		Topock - Fluvial Deposits	SM				
22							
23		Topock - Fluvial Deposits	ML				
24		Topock - Fluvial Deposits	GW-GM				
25							
26							
27		Topock - Fluvial Deposits	GM				
28							
29							
30					(5.0 - 137.0') Cemex #3 MESH (8x10)	(5.0 - 137.0') 55.3 bags	(5.0 - 137.0') 68 bags (23%) Note: Lapis Lustre Sand
31		Topock - Fluvial Deposits	SM				
32		Topock - Fluvial Deposits	ML				
33		Topock - Alluvium Deposits	ML				
34							
35							
36		Topock - Alluvium Deposits	ML				
37							
38		Topock - Alluvium Deposits	ML				
39							
40							

(4.0 - 147.0') 6" Borehole

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Temporary Backfill Log

ARCADIS Design & Consultancy for natural and built assets

Well ID: IRZ-23 Pilot

Date Started:	11/28/2018	Surface Elevation:	500.0 ft amsl	Client:	PG&E
Date Completed:	12/03/2018	Northing (NAD83):	2102535.3	Project:	Final Groundwater Remedy Phase
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8	Location:	1
Drilling Method:	Sonic Drilling	Total Depth:	147 ft bgs		PG&E Topock, Needles, California
Driller Name:	Steve Vasquez	Borehole Diameter:	6-12 inches		
Drilling Asst:	N. Dominguez/C. Alverez	Depth to First Water:	47 ft bgs		
Logger:	Connor Mills	Editor:	Sean McGrane	Project Number:	RC000753.0051

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
41–47		Topock - Alluvium Deposits	ML				
47–49		Topock - Alluvium Deposits	SM				
49–52		Topock - Alluvium Deposits	SM		(5.0 - 137.0') Cemex #3 MESH (8x10); (4.0 - 147.0') 6" Borehole	(5.0 - 137.0') 55.3 bags	(5.0 - 137.0') 68 bags (23%) Note: Lapis Lustre Sand
52–57		Topock - Alluvium Deposits	ML				
57–58	IRZ-23-VAS-57-62 (5.3 ppb) 11/30/2018 12:46						
58–60			SM				

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ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Date Started:	11/28/2018	Surface Elevation:	500.0 ft amsl	**Well ID: IRZ-23 Pilot**	
Date Completed:	12/03/2018	Northing (NAD83):	2102535.3		
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	147 ft bgs	Project:	Final Groundwater Remedy Phase
Driller Name:	Steve Vasquez	Borehole Diameter:	6-12 inches	Location:	1
Drilling Asst:	N. Dominguez/C. Alverez	Depth to First Water:	47 ft bgs		PG&E Topock, Needles, California
Logger:	Connor Mills	Editor:	Sean McGrane	Project Number:	RC000753.0051

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
61	IRZ-23-VAS-57-62 (5.3 ppb) 11/30/2018 12:46	Topock - Alluvium Deposits	SM				
62							
63							
64							
65		Topock - Alluvium Deposits	SM				
66							
67							
68							
69	IRZ-23-VAS-67-72 (85 ppb) 12/1/2018 08:50						
70					(5.0 - 137.0') Cemex #3 MESH (8x10)	(5.0 - 137.0') 55.3 bags	(5.0 - 137.0') 68 bags (23%) Note: Lapis Lustre Sand
71		Topock - Alluvium Deposits	SM				
72							
73							
74							
75							
76		Topock - Alluvium Deposits	ML				
77							
78							
79							
80							

(4.0 - 147.0') 6" Borehole

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, U = not detected above the laboratory reporting limit, blue water table symbol represents depth to water measured during the first VAS interval Note: Granule backfill material will be excavated from the pilot borehole during drilling for the construction of the well.

ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Sheet: 5 of 8

Well ID: IRZ-23 Pilot

Date Started:	11/28/2018	Surface Elevation:	500.0 ft amsl
Date Completed:	12/03/2018	Northing (NAD83):	2102535.3
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8
Drilling Method:	Sonic Drilling	Total Depth:	147 ft bgs
Driller Name:	Steve Vasquez	Borehole Diameter:	6-12 inches
Drilling Asst:	N. Dominguez/C. Alverez	Depth to First Water:	47 ft bgs
Logger:	Connor Mills	Editor:	Sean McGrane

Client: PG&E
Project: Final Groundwater Remedy Phase
Location: 1
PG&E Topock, Needles, California
Project Number: RC000753.0051

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
81		Topock - Alluvium Deposits	ML				
82							
83		Topock - Alluvium Deposits	SM				
84							
85		Topock - Alluvium Deposits	ML				
86							
87							
88							
89							
90		Topock - Alluvium Deposits	SM		(5.0 - 137.0') Cemex #3 MESH (8x10)	(5.0 - 137.0') 55.3 bags	(5.0 - 137.0') 68 bags (23%) Note: Lapis Lustre Sand
91					(4.0 - 147.0') 6" Borehole		
92							
93							
94	IRZ-23-VAS-92-97 (<0.033 U ppb) 12/3/2018 11:47						
95		Topock - Alluvium Deposits	SM				
96							
97							
98		Topock - Alluvium Deposits	SM				
99							
100							

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, U = not detected above the laboratory reporting limit, blue water table symbol represents depth to water measured during the first VAS interval Note: Granule backfill material will be excavated from the pilot borehole during drilling for the construction of the well.

ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Sheet: 6 of 8

Well ID: IRZ-23 Pilot

Date Started:	11/28/2018	Surface Elevation:	500.0 ft amsl	Client:	PG&E
Date Completed:	12/03/2018	Northing (NAD83):	2102535.3	Project:	Final Groundwater Remedy Phase
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8	Location:	1
Drilling Method:	Sonic Drilling	Total Depth:	147 ft bgs		PG&E Topock, Needles, California
Driller Name:	Steve Vasquez	Borehole Diameter:	6-12 inches		
Drilling Asst:	N. Dominguez/C. Alverez	Depth to First Water:	47 ft bgs		
Logger:	Connor Mills	Editor:	Sean McGrane	Project Number:	RC000753.0051

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
101		Topock - Alluvium Deposits	SM				
102		Topock - Alluvium Deposits	GM				
103							
104		Topock - Alluvium Deposits	SM				
105							
106							
107							
108		Topock - Alluvium Deposits	GM				
109							
110					(5.0 - 137.0') Cemex #3 MESH (8x10)	(5.0 - 137.0') 55.3 bags	(5.0 - 137.0') 68 bags (23%) Note: Lapis Lustre Sand
111							
112							
113							
114							
115							
116							
117							
118		Topock - Alluvium Deposits	SM				
119							
120							

(4.0 - 147.0') 6" Borehole

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, U = not detected above the laboratory reporting limit, blue water table symbol represents depth to water measured during the first VAS interval Note: Granule backfill material will be excavated from the pilot borehole during drilling for the construction of the well.

ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Sheet: 7 of 8

Date Started:	11/28/2018	Surface Elevation:	500.0 ft amsl	**Well ID: IRZ-23 Pilot**	
Date Completed:	12/03/2018	Northing (NAD83):	2102535.3		
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	147 ft bgs	Project:	Final Groundwater Remedy Phase
Driller Name:	Steve Vasquez	Borehole Diameter:	6-12 inches	Location:	1
Drilling Asst:	N. Dominguez/C. Alverez	Depth to First Water:	47 ft bgs		PG&E Topock, Needles, California
Logger:	Connor Mills	Editor:	Sean McGrane	Project Number:	RC000753.0051

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
121		Topock - Alluvium Deposits	SM				
122							
123							
124	IRZ-23-VAS-122-127 (2000 ppb) 12/2/2018 09:24	Topock - Alluvium Deposits	ML				
125							
126							
127							
128					(5.0 - 137.0') Cemex #3 MESH (8x10)	(5.0 - 137.0') 55.3 bags	(5.0 - 137.0') 68 bags (23%) Note: Lapis Lustre Sand
129							
130		Topock - Alluvium Deposits	SM		(4.0 - 147.0') 6" Borehole		
131							
132							
133							
134		Topock - Alluvium Deposits	ML				
135							
136							
137		Topock - Alluvium Deposits	GM				
138		Topock - Alluvium Deposits	GM		(137.0 - 147.0') Plastering Sand	(137.0 - 147.0') 2.8 bags	(137.0 - 147.0') 4 bags (43%) Note: Wildcat Washed
139							
140			SM				

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ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Sheet: 8 of 8

Well ID: IRZ-23 Pilot

Date Started:	11/28/2018	Surface Elevation:	500.0 ft amsl	Client:	PG&E
Date Completed:	12/03/2018	Northing (NAD83):	2102535.3	Project:	Final Groundwater Remedy Phase
Drilling Co.:	Cascade	Easting (NAD83):	7615825.8	Location:	1
Drilling Method:	Sonic Drilling	Total Depth:	147 ft bgs		PG&E Topock, Needles, California
Driller Name:	Steve Vasquez	Borehole Diameter:	6-12 inches		
Drilling Asst:	N. Dominguez/C. Alverez	Depth to First Water:	47 ft bgs		
Logger:	Connor Mills	Editor:	Sean McGrane	Project Number:	RC000753.0051

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
141	IRZ-23-VAS-139-144 (3000 ppb) 12/2/2018 14:17	Topock - Weathered Bedrock - conglomerate	SM				
142							
143							
144		Topock - Competent Bedrock - conglomerate			(137.0 - 147.0') Plastering Sand; (4.0 - 147.0') 6" Borehole	(137.0 - 147.0') 2.8 bags	(137.0 - 147.0') 4 bags (43%) Note: Wildcat Washed
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, U = not detected above the laboratory reporting limit, blue water table symbol represents depth to water measured during the first VAS interval Note: Granule backfill material will be excavated from the pilot borehole during drilling for the construction of the well.