Curt Russell
Topock Project Manager
Environmental Remediation

Topock Compressor Station
145453 National Trails Hwy
Needles, CA 92363

Mailing Address
P.O. Box 337
Needles, CA 92363

760.791.5884
Fax: 760.326.5542
Email: gcr4@pge.com

November 26, 2018

Mr. Aaron Yue
Project Manager
California Environmental Protection Agency,
Department of Toxic Substances Control
5796 Corporate Avenue
Cypress, CA 90630

Subject: Proposed Modifications, Assessments, and Monitoring Approaches for TW-01, MW-58BR, MW-64BR, and PGE-08BR at PG&E Topock Compressor Station

Dear Mr. Yue:

This letter addresses four wells used for groundwater monitoring at the Pacific Gas and Electric Company (PG&E) Topock Compressor Station in Needles, California (PG&E Topock). Plans are presented for groundwater sampling approach, well modification, or well condition assessment for these four wells (TW-01, MW-58BR, MW-64BR, and PGE-08BR). The California Department of Toxic Substances Control (DTSC), in 2017 correspondence and related March and August 2018 teleconference discussions, requested updated sampling approaches for these wells as a follow-up to DTSC approval of low-flow sampling or sampling trials at other existing monitoring wells. The majority of monitoring wells at PG&E Topock were approved by the DTSC for low-flow sampling or sampling trials (DTSC, 2014, 2017a-b). The four abovementioned wells were not included in those previous approvals for sampling modifications. Sampling approaches at these four wells were discussed with DTSC while changes were implemented at other wells.

This letter presents modified sampling approaches for TW-01, MW-58BR, and MW-64BR to be used under the site-wide groundwater monitoring program (GMP) and later under the groundwater monitoring program for the Final Remedy for groundwater at PG&E Topock. This letter also presents an approach for a new evaluation of PGE-08BR. Figure 1 shows these well locations. The approaches presented in this letter are based on review of historical data and discussions with the DTSC.

Details of Proposed Approaches

TW-01

TW-01 was installed as part of a 2003 pilot study to evaluate source area removal of chromium in groundwater and acquire information necessary for final remedy design (CH2M HILL, Inc. [CH2M], 2003) (see Figure 2, TW-01 Construction Diagram). Groundwater velocity log and depth-specific groundwater sampling were conducted in TW-01 with the pilot study. TW-01 has since been sampled under the GMP using a three-volume purge method.

This letter proposes a trial of low-flow sampling in TW-01 to better monitor the proposed dual-depth injection well TCS-01 which will be installed as part of the Final Remedy. TW-01 and the proposed location for TCS-01 are located within approximately 50 feet of each other (Figure 1). Two depths within TW-01 are proposed for low-flow sampling to provide monitoring support at both injection horizons of

TCS-01. This sampling approach is intended to establish baseline conditions, and to monitor the effectiveness of TCS-01.

The TW-01 well screen was designed to sit on top of the bedrock contact and capture the full saturated thickness of unconsolidated aquifer (logged as sands and silty sands) and is screened from 168 to 268 feet below ground surface (ft bgs). The water table is at approximately 160 ft bgs and the bedrock contact (cemented conglomerate) is at approximately 270 ft bgs. In 2003, groundwater velocity logging and depth-specific groundwater sampling were conducted at TW-1. Velocity logging results indicated three groundwater production zones. The upper zone is between 168 and 188 ft bgs, the middle zone is a between 198 and 210-ft bgs, and the deep zone is between 220 and 235 ft bgs. Between 168 and 248 ft bgs, seven depth-specific groundwater samples were collected and analyzed for total chromium (Cr[T]) and hexavalent chromium (Cr[VI]) (CH2M, 2003).

The analytical results were combined with the depth-specific groundwater velocity results and interpreted depth-specific chromium concentrations were calculated (CH2M, 2003). These results were used for a depth-dependent contaminant mass flux calculation (see Table 1). Based on these interpreted results, the aquifer horizon between 198 and 210 ft bgs contributes the largest amount of mass flux measured as Cr(VI) and Cr(T). The TW-01 aquifer horizon between 220 and 235 ft bgs represents the second highest contribution of contaminant mass measured as Cr(VI) and Cr(T). The highest interpreted concentration of Cr(VI) is from the aquifer horizon between 188 and 198 ft bgs.

The TCS-01 design calls for a dual-depth injection well with an upper interval between approximately 170 and 220 ft bgs and a lower interval between approximately 230 and 270 ft bgs.

It is proposed that samples from TW-01 for the ongoing GMP, and for subsequent Final Remedy groundwater monitoring samples, be collected using low-flow methods at approximately 198 ft bgs (upper sampling depth) and 230 ft bgs (lower sampling depth). These selected TW-01 sampling intervals are based on the planned screened intervals of TCS-01, and on results of the 2003 groundwater velocity survey at TW-01. The upper sampling depth is between the aquifer horizon which contributed the highest amount of calculated contaminant mass (198-210 ft bgs), and the highest interpreted concentration of Cr(VI) (188 to 198 ft bgs). The lower sampling depth (230 ft bgs) coincides with the area of the aquifer with the second highest contribution of contaminant mass (220 to 235-ft bgs).

Sampling will be in accordance with Standard Operating Procedure (SOP) A-18 for minimum drawdown sampling (CH2M, 2015). Sampling the upper depth zone first, then the lower zone is suggested to allow for equilibration of the water column. Dedicated tubing would be used for consistent sampling depths. Fixed depth dedicated pumps will be considered to minimize field effort and disturbance to the water column. Pump deployment will include safety cables. For the lower sampling depth, a bladder pump is suggested; a specification sheet for one applicable pump is included with Attachment 1.

Semiannual GMP sampling frequency is recommended for TW-01 at these low-flow sampling depths after this new sampling approach begins and until Final Remedy monitoring supersedes the GMP. Until the Remedy startup and operation of TCS-01, the low-flow sampling results from TW-01 should be compared with historical testing results (CH2M, 2003) and the subsequent three-volume purge monitoring results in annual GMP reports. It is recommended that a longer sampling frequency for TW-01 be evaluated when TCS-01 injection fluids are detected in the samples, representing break-through at TW-01.

If during the installation of TCS-01 a decision is made to change the injection depths, TW-01 sample intervals should be reevaluated.

MW-58BR and MW-64BR

Groundwater monitoring wells MW-58BR and MW-64BR are located within the East Ravine Area, southeast of Topock Compressor Station and west of the Colorado River (Figure 1). MW-58BR and MW-64BR are bedrock wells with open borehole completions. The wells were installed in 2009 as part of an investigation to evaluate the presence of chromium measured as Cr(VI) within bedrock, then incorporated with GMP monitoring (CH2M, 2009). As part of the initial bedrock investigation, hydrophysical testing (or hydrophysics) was conducted. This method involves the placement of deionized water in the borehole and measurement of the variations in electrical conductivity between distinct groundwater intervals to identify and quantify groundwater production zones. It also includes depth-specific groundwater sample collection; the hydrophysical logs from this testing for MW-58BR and MW-64BR are presented in Attachment 2. Hydraulic data collected during subsequent investigations indicate that groundwater is present in the bedrock within relatively widely spaced, discrete fractures (CH2M, 2013).

At present these wells are sampled with low-flow methods. The wells have been sampled using different sampling procedures (three-volume purge, then limited drawdown or low-flow sampling beginning in first quarter 2013) and with various well configurations (open-borehole, FLUTe system multiple discrete depth sampler, inflatable packer). Based on available information, a limited amount of chromium may be transmitted through fractures in bedrock. The contaminant signal appears to be lost with dilution under some well configurations or sampling procedures. These wells are included in the Final Remedy groundwater monitoring program.

MW-58BR

At MW-58BR groundwater is measured at 66 ft bgs, and the bedrock interface is at approximately 55 ft bgs. Hydrophysical testing indicates three groundwater production zones. The deepest of these zones, from approximately 180 ft bgs to 206 ft bgs, contributes the highest flow of water into the well and the highest concentrations of Cr(VI).

The well has been sampled under different configurations (Figure 3). In March 2009 MW-58BR was advanced to 115 ft bgs. In May of 2009 the well was advanced deeper, to 206 ft bgs. A FLUTe liner was installed, designed based on hydrophysical results, with two discrete groundwater intervals: between 95 and 115 ft bgs and between 160 and 206 ft bgs. Samples collected from the FLUTe system had lower chromium concentrations than those collected from an open borehole. The FLUTe system began to fail from a loss of hydrostatic seal with the borehole wall and in 2010 it was removed, and the well was sampled again as an open borehole to total depth. Between September and October 2010 an inflatable packer was placed between 113 and 117 ft bgs. In February 2011 the packer was re-installed between 158 and 162-ft bgs. While the packer was fully functional this configuration was able to isolate the lower portion of the aquifer which contributes Cr(VI) to the well column. In the fourth quarter of 2011, Cr(VI) concentrations were lower, likely due to dilution as the inflatable packer began to lose seal integrity because the air inflation system leaked. The packer was removed, and the well was sampled again as an open borehole in 2012. In first quarter 2013 the DTSC approved a change from three-volume purge to low-flow sampling. MW-58BR continues to be sampled using low-flow methods and a pump depth of 190 feet.

This letter proposes installation of a different packer than previously used, a packer incorporating a bentonite seal. The packer will be placed between 158 and 162 ft bgs to recreate the conditions that existed from February to August 2011 for groundwater sampling from the lower portion of the bedrock borehole. This aligns with results of the 2009 hydrophysical testing which indicated that the greatest Cr(VI) flux is from the deeper portions (between 180 and 206 ft bgs) of this well.

In addition, alterations are recommended to the MW-58BR surface wellhead completion to protect it from floodwaters (Figure 4). The well is installed at a low point in the East Ravine where floodwaters pond upstream of a berm. Ponded floodwaters do not endanger the well from the lateral force of streamflow but can submerge the wellhead. After a flood event standing water infiltrates and evaporates until access to the well is restored. It is proposed to recomplete the well pad and emplace a 12- or 14-inch-diameter blank well casing from approximately 5 feet below grade to 3 to 4 feet above surface and cement it in place. A flush threaded cap with a rubber O-ring will be used to seal the top of the new monument between sampling events to prevent ponded water from entering the wellhead completion. Checking that flush threads are clean and the O-ring is intact and seated in place will become added well maintenance checks for MW-58BR. Because the well is located inside the Compressor Station fence for security, the flush threaded cap will not be drilled to install a hasp for locking the well so that watertight integrity is preserved.

MW-64BR

At MW-64BR groundwater is observed at approximately 120 ft bgs and there are bedrock outcrops at the ground surface. Since installation in May 2009 MW-64BR has been sampled under several configurations (Figure 5). The first configuration is the borehole open to a total depth of 260 ft bgs. The 2009 hydrophysical testing indicated that this well has low yield without distinct productive zones. Ambient groundwater flow over the entire saturated interval was observed to occur at less than 0.001 gallon per minute (gpm) (CH2M, 2013). In July 2009 a FLUTe multi-depth discrete groundwater sampling system was installed with three sampling zones. The upper zone was from the water table (approximately 120 ft bgs to 150 ft bgs). The middle zone ranged from 175 to 205 ft bgs, and the lower zone ranged from 230 to 260 ft bgs. The borehole from 150 to 175 ft bgs and from 205 to 230 ft bgs was sealed under this configuration. In December 2010 the FLUTe system was removed (due to a loss of seal, like the FLUTe at MW-58BR) and an inflatable packer was emplaced between 148 and 152 ft bgs, creating upper and lower sampling zones. The highest detections of Cr(VI) occurred in samples from the January/February 2011 sampling event. The inflatable packer subsequently failed (again, like the inflatable packer at MW-58BR), and was removed, with the well sampled again as an open borehole. In first quarter 2013 the DTSC approved a change from three-volume purge to low-flow sampling. MW-64BR continues to be sampled using low-flow methods.

The 2009 hydrophysical survey indicates that this well has an extremely low yield of 0.001 to 0.01 gpm. Low-flow sampling is not optimal due to drawdown. A trial for three quarters is proposed to compare the current low-flow sampling method with HydraSleeve sampling from the mid-point of the open borehole at approximately 184 ft bgs. After the HydraSleeve sample is retrieved, MW-64BR would be sampled with low-flow methods the following day. If the results are comparable over three sampling quarters, a change to HydraSleeve sampling is proposed.

PGE-08BR

Injection well PGE-08BR (also referred to as PGE-8) is located on the lower bench of the Topock Compressor Station property (Figure 1). It was advanced by PG&E in 1969 in support of industrial operations (wastewater injection) at the compressor station. At 550 ft deep, PGE-08BR is unique for being the deepest PG&E well that is a part of the investigation. Accessible portions of the well were inspected between November 2006 and November 2007; findings are reported in the *Summary Report for Hydraulic Testing in Bedrock Wells PG&E Topock Compressor Station* (CH2M, 2008). While completing work described in that report it was discovered that the well is partially obstructed between 360 and 405-ft bgs.

The PGE-08BR casing is 6.2-inch mild steel blank casing from the surface to 405 feet bgs, then 4-inch type 316 stainless steel Johnson well screen from 405 to 550 feet bgs. The Johnson well screen is

assumed to be hung on the shoe of the upper casing, possibly from the packer at the base of the 6.2-inch-diameter casing. The maximum borehole depth is 562 ft bgs; however, cuttings fill the borehole to approximately 555 ft bgs, and the bottom of the 4-inch-diameter well screen is at 550 ft bgs. The upper casing is sealed by a mechanical packer reportedly placed at 405 ft bgs. The packer has a 3-inch-diameter pass-through pipe (also referred to as injection piping) that was used to inject waste; the pass-through pipe is now broken and appears to extend from the packer up to 362 ft bgs. Depth to static water is approximately 140 ft bgs. Well construction details and key findings of video surveys are shown in Figure 6. A well construction diagram dated August 28, 1970 describes the mechanical packer as Baker no. 47A4; the diagram and packer cut-sheet are included in Attachment 3.

A cement bond log and a gamma-ray log were performed in November 2006 on accessible portions of the well (0 to 362 ft bgs). The cement bond log indicates relatively good cement bond from the ground surface to 360 ft bgs. The 2006 gamma-ray log was comparable to the gamma-ray log conducted during the time of well construction in April 1969. PGE-8 was video surveyed in 2006 and again in 2007 (representative still photographs from the video surveys are presented in Attachment 4). The 2006 video survey ended when the downhole camera was unable to pass the 3-inch-diameter pipe encountered during the survey. Still images from this survey show that the pass-through pipe is bent near its top at approximately 362 ft bgs. In 2007 the video survey was attempted again with a narrow diameter camera. During this event passage was obstructed by sediment accumulated on top of the packer; the top of the sediment was observed at 382 ft bgs. Attempts to guide the camera into the pass-through pipe were unsuccessful. The camera was lowered between the pass-through pipe and the blank casing to view the top of the sediment. The source and rate of accumulation of the sediment are undetermined, the point of entry of sediment into the well is unknown, and it is unclear whether sediment accumulation is ongoing.

PGE-08BR is currently sampled using a three-volume purge with the pump set above the packer, relying on the pass-through pipe to convey water from the bedrock well screen below the packer. The objective for this well is to collect new information to evaluate the feasibility of sampling groundwater from below 405 ft bgs.

PG&E proposes the following inspections to evaluate PGE-08BR:

1. A new video log should be run of the blank casing above the packer.
2. If the casing appears intact in step 1, a magnetic flux log should be run to evaluate steel casing integrity. If casing weakness is discovered, further mechanical action may not be recommended.
3. Over 10 years have elapsed since the last cement bond log was completed. If the steel casing is in good condition a cement bond log should be run again to provide an updated status of cement bond integrity.
4. The plumbness and alignment of the well should be measured to determine tolerance to use rigid tools and piping.
5. If steps 1-4 are successful, then a direct video inspection of the packer could be attempted. First, the accumulated sediment above the packer needs to be removed. This may be completed by air-lifting accumulated sediment. Time may be required for the well to clear after airlifting, before video inspection.
6. If step 5 is successful in restoring direct access to the packer, then attempt to cut or completely remove the pass-through piping as practicable.
7. If step 6 is successful, attempt to lower a camera for video log inspection through the packer into the lower 4-inch screen.

The steps listed above can be completed by a single crew in one or two mobilizations to PGE-08BR. The well might need time to allow suspended sediment to settle out before a video is attempted after airlifting.

After completing step 7, results of the attempts will be reported to DTSC via email with interpretation and recommendations. If step 7 is successful it may be possible to lower a pump capable of sampling the aquifer below 405 ft bgs. If not, the mechanical packer may need to be removed if sampling this well with a pump below the packer is still pursued. The risks from more aggressive or intrusive actions should be weighed against any benefit from a modified sampling depth at this well. Complicating factors for this well that need to be considered include:

- PGE-08BR is uniquely deep, and samples collected from the well indicate natural reducing conditions (oxidation reduction potential or ORP ranging from -150 to -300 millivolts), in which Cr(VI) is not expected to occur. This is consistent with non-detect results for Cr(VI) throughout PGE-08BR monitoring since the first sampling in 1997.
- More than 50 feet of drawdown are observed in the water column above the packer when the well is sampled in its present configuration, with a three-volume purge at approximately 5 to 7 gpm to remove a purge volume of 1,900 gallons.
- The Cr(VI) distribution in alluvium and underlying bedrock is vertically delineated with more shallow wells, many of which were installed after the 2006-2007 investigations at PGE-08BR.
- Notes from the 2006-2007 video logs indicated light to moderate corrosion of the 6-inch-diameter blank casing.
- Additionally, little is known about the installation of the 4-inch-diameter screen in bedrock, the connection between the 6-inch-diameter casing and 4-inch-diameter screen, and installation of the mechanical packer near the base of the 6-inch-diameter casing.

Any benefit that a deep groundwater sampling point in PGE-08BR from below the packer would provide should be weighed against the risk of damaging well integrity. If obtaining deep bedrock aquifer samples is determined necessary, other alternatives should also be considered, including relying on monitoring of other wells installed since the 2006-2007 PGE-08BR inspections, drilling a new well, or extending an existing well.

Proposed Schedule

We propose to integrate these well modifications and evaluations into the Final Remedy well drilling mobilization and ongoing GMP sampling, following DTSC approval of the proposed approaches. The well modifications would be completed before the start of Remedy Baseline Groundwater Monitoring. Your review and approval are requested by November 16, 2018.

Please contact me at 760-791-5884 if you have any questions about these proposed actions and monitoring approach.

Sincerely,

Curt Russell
Topock Project Manager

Enclosures:

Table 1 Interpreted Depth-Specific Sampling Results

Figure 1 Well Locations
Figure 2 TW-01 Construction Diagram
Figure 3 MW-58BR Data Summary
Figure 4 MW-58BR Wellhead Modification Plan
Figure 5 MW-64BR Data Summary
Figure 6 PGE-08BR Construction Diagram

Attachment 1 Bladder Pump Specification Sheet
Attachment 2 Hydrophysical Logs for MW-58BR and MW-64BR
Attachment 3 PGE-08BR Construction Diagram (circa 1970) and Mechanical Packer Cut Sheet
Attachment 4 PGE-08BR Video Survey Stills, 2006 and 2007

cc: Chris Guerre/DTSC
Karen Baker/DTSC
Pam Innis/DOI

References

California Department of Toxic Substances Control (DTSC). 2014. "PG&E Topock: DTSC response to Section 7 2013 Annual Report Recommendations." Email from Chris Guerre/DTSC to Yvonne Meeks/PG&E. June 27.

California Department of Toxic Substances Control (DTSC). 2017a. *Memorandum. "Proposal for Alternative Groundwater Sampling Trial; Pacific Gas and Electric Company (PG&E) Topock Compressor Station Site, Needles, California (EPA ID No. CAT080011729)."* April 6.

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CH2M HILL, Inc. (CH2M). 2015. *SOP-A18, Purging and Sampling Groundwater Monitoring Wells, Minimal Drawdown Method Standard Operating Procedure for PG&E Topock Program. Final (100%) Design Submittal for the Final Groundwater Remedy, PG&E Topock Compressor Station. Volume 2 Operations and Maintenance Manual. Appendix A Standard Operating Procedures for Groundwater Surface Water and Process Water Sampling.* November.

Table

Table 1

Interpreted Depth Specific Sampling Results

		Interval Flow/Concentration										
Interval	Interval ft BTOC	Flow gpm	Flow lpm	TDS mg/L	Cr(VI) mg/L	Cr(T) mg/L	Cr(VI) mg/min	Cr(T) mg/min	Lab SC uS/cm	Chloride mg/L	Bromide mg/L	Boron mg/L
1	168 to 188	2.5	9.5	2610.0	5.0	4.6	47.5	15.3	4,190	909	1.44	0.85
2	188 to 198	0.7	2.6	2930.0	5.4	4.5	14.3	11.9	4,693	1,110	2.17	1.10
3	198 to 210	9.3	35.2	3124.0	4.4	3.8	155.9	135.2	4,905	1,110	2.20	1.01
4	210 to 220	1.5	5.7	3570.0	1.8	1.0	10.2	5.4	5,683	977	1.02	2.53
5	220 to 235	4.2	15.9	5497.0	3.2	3.1	50.4	49.9	7,927	1,233	4.11	1.80
6	235 to 248	1.8	6.8	3074.0	4.0	4.8	27.5	32.6	4,338	1,544	0.77	0.86
7	248 to 258	1.5	5.7	5013.0	4.5	3.8	25.4	21.7	5,737	2,430	2.15	1.69

Notes:

BTOC = below top of casing
gpm = gallons/minute
lpm = liters/minute
mg/l = milligrams per liter
mg/min = milligrams per minute

- Sample from 265.5 feet was a bulk sample collected from pump discharge (pump was set at 265.5 feet and was not a true depth specific sample.
- Flow rates determined from velocity logging with pump set at bottom of well.
- 1 L = 0.2642 gallons
- mg/min = (gpm/0.2642)*mg/min

Draft Copy for Review Only

Figures

Legend

- Well Location
- Proposed Well Location
- Property Parcel Boundaries
- Topock Compressor Station Fence

0 100 200 400
Feet

N

FIGURE 1
Well Locations
PG&E Topock Compressor Station
Needles, California

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BAO \\BROOKSIDEFILES\GIS_SHARE\ENBG\00_PROJ\P\PGE\TOPOCK\MAPFILES\2018\MISC\FIG1_WELLS.MXD GMOON 9/18/2018 4:16:02 PM

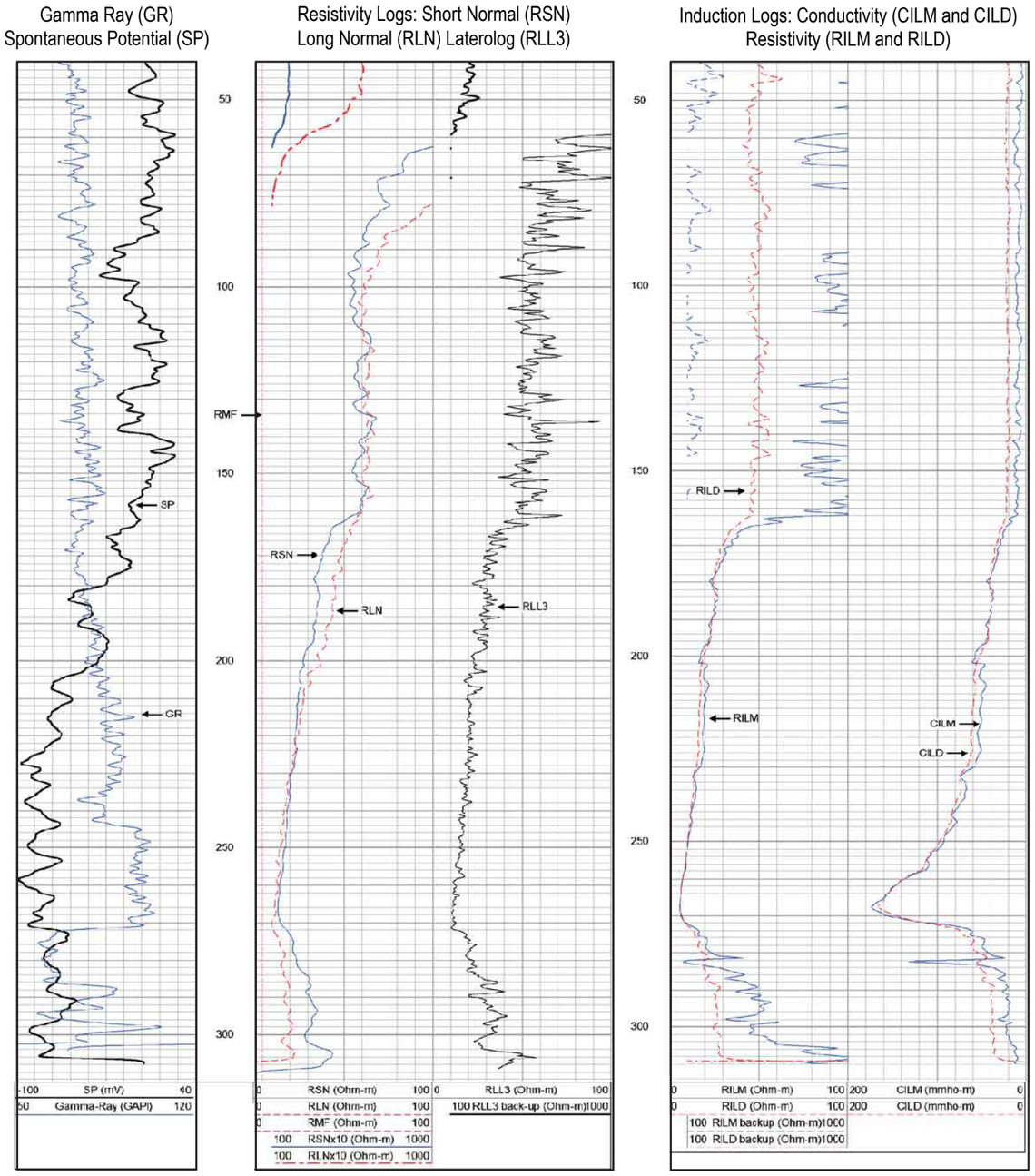

FIGURE 2
TW-1 Well Completion Showing Geophysical Logs,
Core Collection and Lithology
PG&E Topock Compressor Station
Needles, California

DRAFT FOR DISCUSSION PURPOSES ONLY

* Adapted from Figure 3, CH2M 2003, Exploratory Drilling Results and Evaluation of Groundwater Pilot Test Extraction Sites (Plan A/ Plan B).

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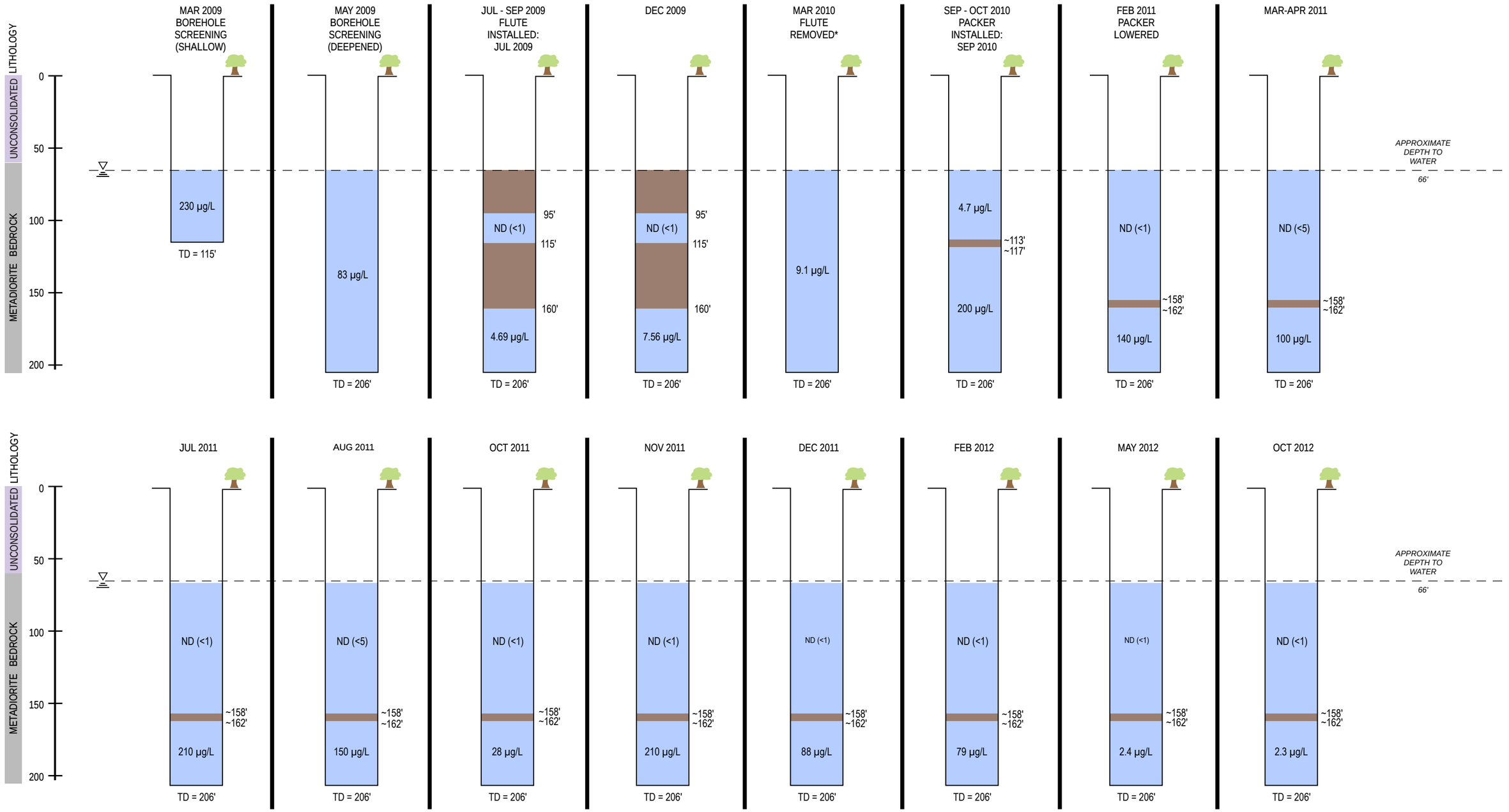

LEGEND

- Portion of borehole exposed during sample collection
- Portion of borehole sealed during sample collection

NOTES:
– Scale is approximate.
– All depths presented as feet below ground surface.
– The maximum validated laboratory result for Cr(VI) are posted when multiple data points exist for a given borehole condition.
– Concentrations are presented in micrograms per liter (µg/L).

* The FLUTE monitoring system was removed in March 2010 due to storm damage

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FIGURE 3
MW-58BR Data Summary
PG&E Topock Compressor Station
Needles, California

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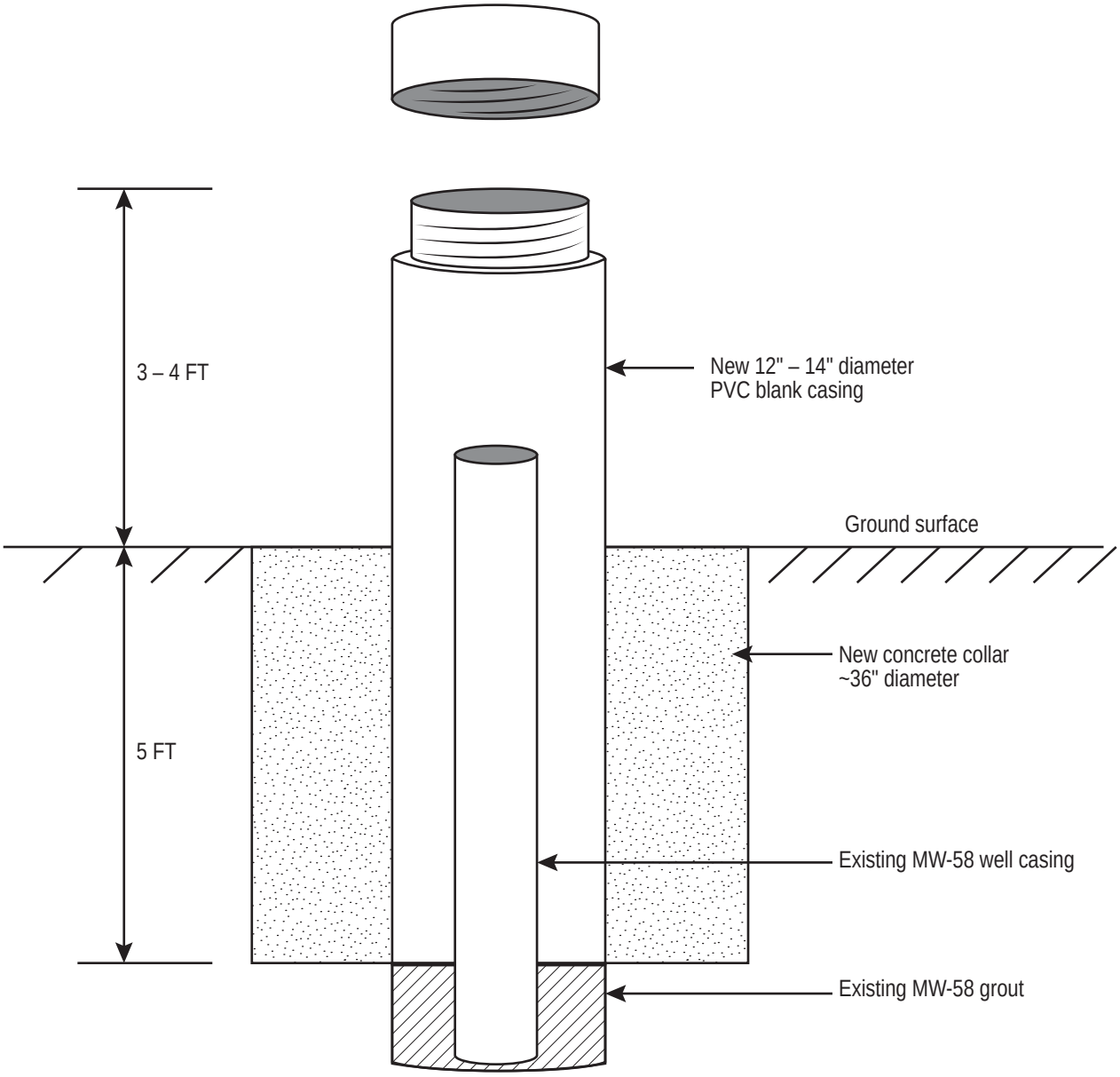

Not drawn to scale.

Figure 4. New Wellhead Completion Plan MW-58 BR
PG&E Topock Compressor Station
Needles, California

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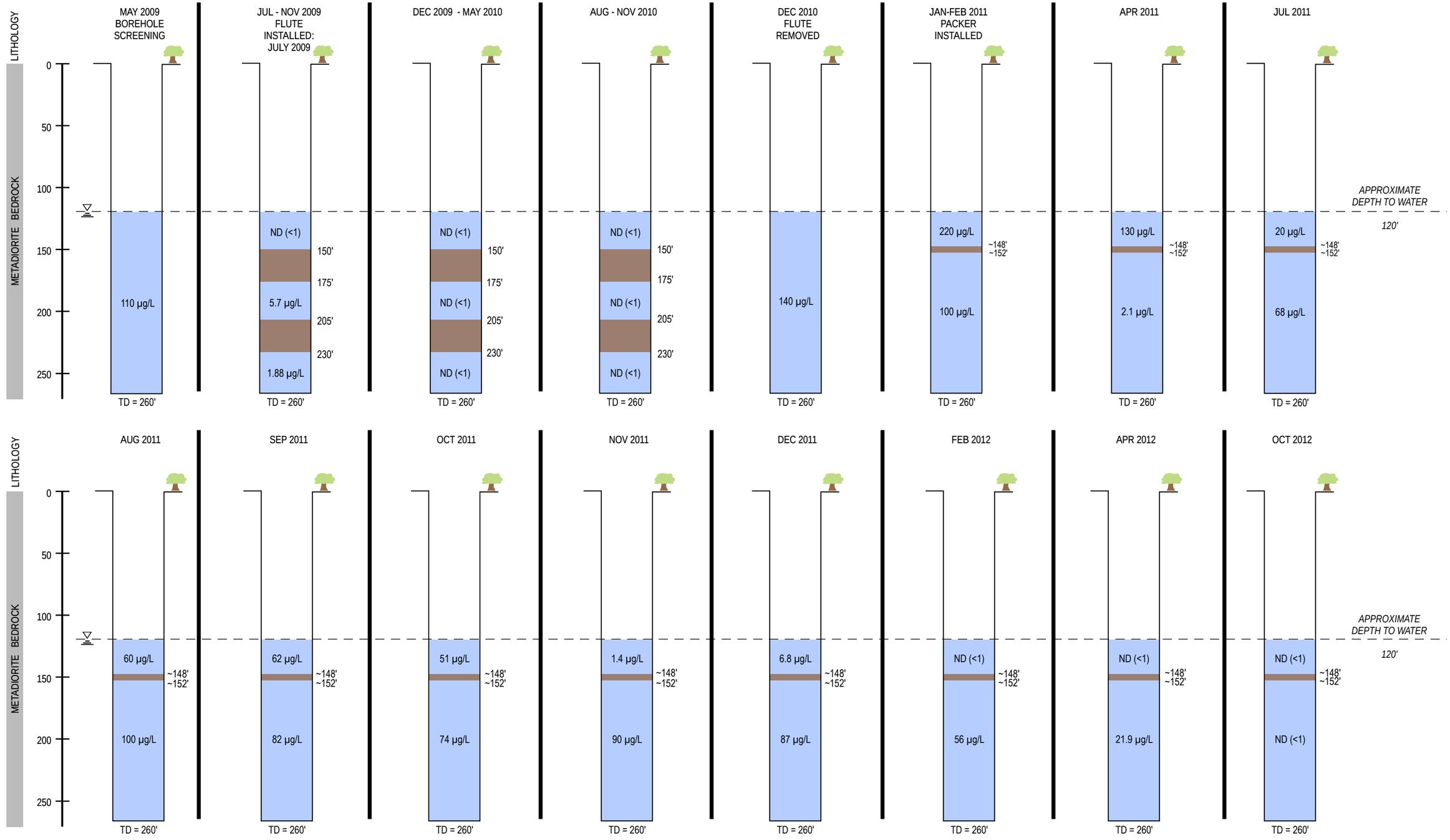
AX0917181056LAS



LEGEND

- Portion of borehole exposed during sample collection
- Portion of borehole sealed during sample collection

NOTES:

– Scale is approximate.
– All depths presented as feet below ground surface.
– The maximum validated laboratory result for Cr(VI) are posted when multiple data points exist for a given borehole condition.
– Concentrations are presented in micrograms per liter (µg/L).

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FIGURE **5**
MW-64BR Data Summary
PG&E Topock Compressor Station
Needles, California

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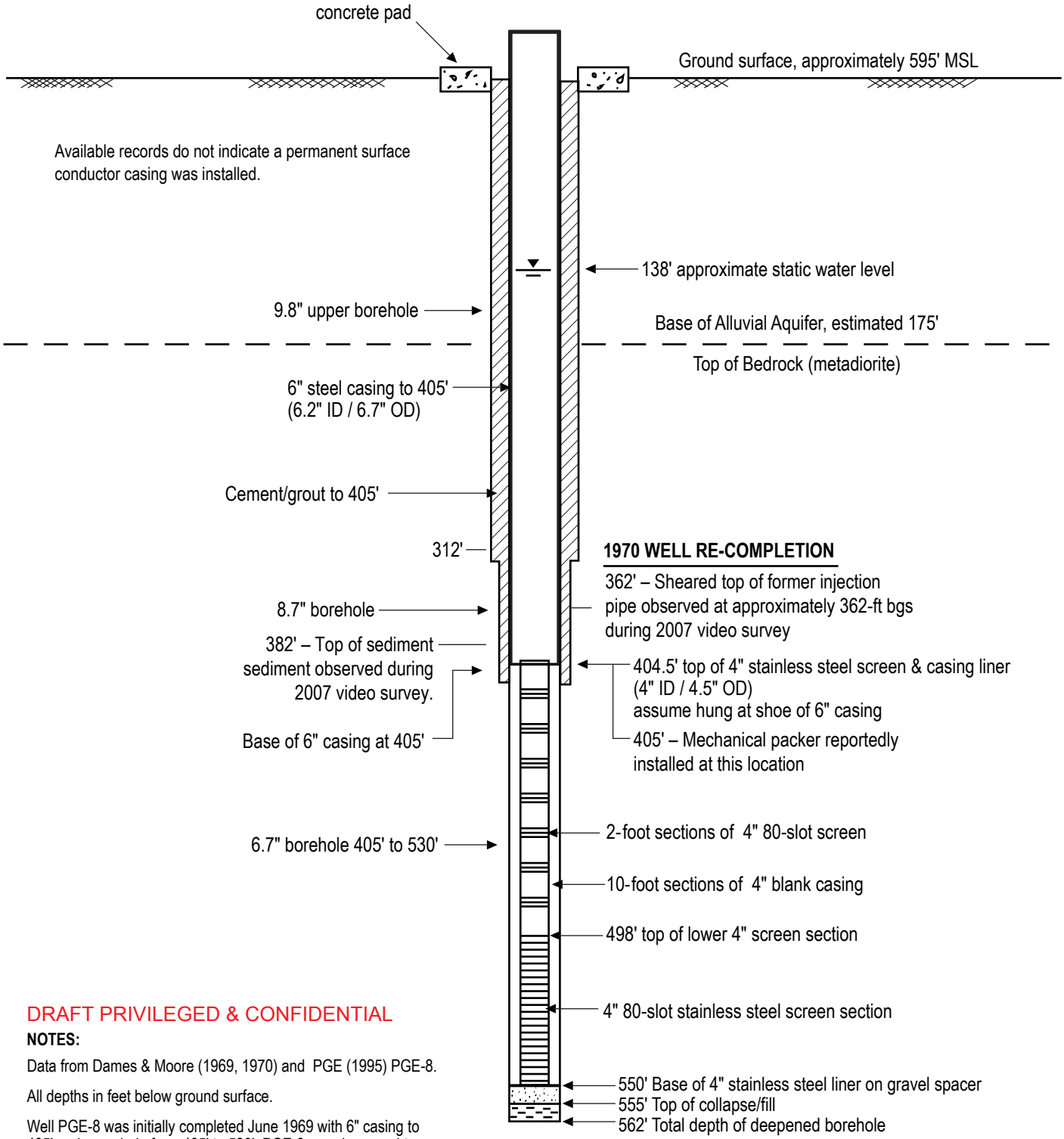
ES100510163544BAO_MW-64BR-DataSummary_v3.ai 092118_lho

Not to Scale

Schematic Well Diagram

PGE – 8



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NOTES:

Data from Dames & Moore (1969, 1970) and PGE (1995) PGE-8.

All depths in feet below ground surface.

Well PGE-8 was initially completed June 1969 with 6" casing to 405' and open-hole from 405' to 530'. PGE-8 was deepened to 562' and 4" screen & casing liner installed June 1970.

Pipe and packer equipment installed for injection 1969-1974 not shown. The sheared top of a 3-inch injection pipe (362') is attached to a mechanical packer that was reportedly installed to a depth of 405' btoc. Sediment has accumulated in the well up to 382' btoc.

CH2M 2008, *Summary Report for Hydraulic Testing in Bedrock Wells,* PG&E Topock Compressor Station, Needles, California.

FIGURE 6
Well Schematic Diagram of Inactive Supply Well PGE-8
PG&E Topock Compressor Station
Needles, California

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Attachment 1
Bladder Pump Specification Sheet

GO TO GEOTECH

Bladder Pumps, Groundwater Sampling

Geotech Bladder Pumps

Together with the USGS, Geotech designed the original bladder pump for groundwater quality and pollution monitoring. Geotech Bladder Pumps can pump from as deep as 1000 feet (305 meters) with minimal agitation for the best representative samples.

FEATURES

- **True low flow capability for less agitation**
- **Proprietary resin grade virgin PTFE bladder for long life**
- **Constructed of #316 SS for durability**
- **Dedicated or portable turnkey systems**
- **Robust screened intake extends bladder life**
- **Optional Drop-Tube assembly available for sampling from greater depths**
- **Limited lifetime warranty on dedicated stainless steel systems**
- **Compatible with the Geocontrol PRO and BP Controller units**

BLADDER PUMP MODELS

A. 1.66, 36" (4 cm, 91 cm)
Made from SS for maximum durability. Highest volume rate for a low flow pump. For 2" (5 cm) wells or larger. Available in High Pressure and Low Pressure models to meet site specic requirements.

B. 1.66, 18" (4 cm, 46 cm)
The same as above but for lower pump volume requirements.

C. .850, 18" (2.2 cm, 46 cm)
Made from high-grade SS for maximum durability.
Extra slim design provides excellent performance for its size.

D. .675, 18" (1.7 cm, 46 cm)
Our smallest bladder pump, fits in any well .75" (1.9 cm) or larger. Made with the same polished stainless steel as our other top-of-the-line pumps.

SPECIFICATIONS

	1.66, 36"	1.66, 18"	.850, 18"	.675, 18"
Pump Housing	316 SS	316 SS	316 SS	316 SS
Bladder Material	Virgin PTFE	Virgin PTFE	Virgin PTFE	Virgin PTFE
O.D.	1.66" (4.2 cm)	1.66" (4.2 cm)	.850" (2.2 cm)	.675" (1.7 cm)
Length w/Screen	38" (96.5 cm)	20" (51 cm)	18 5/8" (47.3 cm)	18 3/4" (47.6 cm)
Weight	5.5 lbs. (2.5 kg)	3.5 lbs. (1.6 kg)	1.1 lbs. (.5 kg)	.83 lbs. (.4 kg)
Volume / Cycle	22 oz. (650 ml)	11 oz. (325 ml)	.9 oz. (29 ml)	.5 oz. (15 ml)
Min. Well I.D.	2" (50 mm)	2" (50 mm)	1.00" (2.5 mm)	.75" (1.9 mm)
Operating Pressure				
Low Pressure BP:	10-125 psi (.7-8.6 bar)	10-125 psi (.7-8.6 bar)	100 psi (6.9 bar)	100 psi (6.9 bar)
High Pressure BP:	10-500 psi (.7-34 bar)	10-500 psi (.7-34 bar)	N/A	N/A
Min. Operating Pressure	5 psi (.34 bar) ash*	5 psi (.34 bar) ash*	5 psi (.3 bar) ash*	5 psi (.3 bar) ash*
Maximum Depth				
Low Pressure BP:	290' (88 m)	290' (88 m)	200' (61 m)	200' (61 m)
High Pressure BP:	1000' (305 m)	1000' (305 m)	N/A	N/A
Air Line (ID x OD)				
Low Pressure BP:	.17" x .25" (4 mm x 6 mm)	.17" x .25" (4 mm x 6 mm)	.17" x .25" (4 mm x 6 mm)	.17" x .25" (4 mm x 6 mm)
High Pressure BP:	.25" x .375" (6 mm x 10 mm)	.25" x .375" (6 mm x 10 mm)	N/A	N/A
Discharge Line (ID x OD)	.25" x .375" (6 mm x 10 mm)	.25" x .375" (6 mm x 10 mm)	.25" x .375" (6 mm x 10 mm)	.25" x .375" (6 mm x 10 mm)

*ash = above static head

CALL GEOTECH TODAY (800) 833-7958

Geotech Environmental Equipment, Inc.
2650 East 40th Avenue • Denver, Colorado 80205
(303) 320-4764 • **(800) 833-7958** • FAX (303) 322-7242
email: sales@geotechenv.com website: www.geotechenv.com

Attachment 2
Hydrophysical Logs for MW-58BR, MW-64BR

WELL: MW-58BR

PROJECT: CH2M Hill - PG&E Topock Compressor Station - Needles, California

RAS Integrated Subsurface Evaluation
PH 303.526.4432 • FAX 303.526.4426
email: bpedler@rasinc.org • www.rasinc.org

LEGEND

GEOPHYSICAL LOGS

Gamma
Standard gamma ray (includes K, U, and Th)

Resistivity/Conductivity
By Dual Induction Type

Hole Size
Caliper - Drillhole diameter from three arm caliper

All Geophysical Logs conducted after borehole completion??

LITHOLOGY

- Unconsolidated Sediment
- Conglomerate Bedrock
- Metadiorite Bedrock

HYDROPHYSICAL LOGGING RESULTS:

Interval Specific Flow rate derived from Ambient Flow Characterization (AFC) and Slug Test After Emplacement (SAE) hydrophysical data.

HPL FEC logs presented were collected during Slug Test After Emplacement (SAE) conditions.

- FEC 1711
- FEC 1721
- FEC 1730

FEC XXXX where XXXX is military time at start of log.

Horizontal flow observed during ambient conditions, inflows also evaluated during stressed (constant pumping or slug test) conditions. Horizontal flowrates base on integral method for q (Lowe, et. al., 1989).

Fluid Resistivity and Fluid temperature Logs performed during ambient conditions

Hydraulic conductivity estimates based on Hvorslev (1962), (Pedler, *et al.* 1988) and Theim, G. *Hydrolgische Methoden*. Leipzig: Gebhart, 1906, p 56. Flow and velocity estimates based on hydrophysical logging results only.

Flow Zones, in percent of total fluid contribution

- <20%
- >20% and <35%
- >35% and <50%
- >50%

HEXAVALENT CHROMIUM EXPLANATION

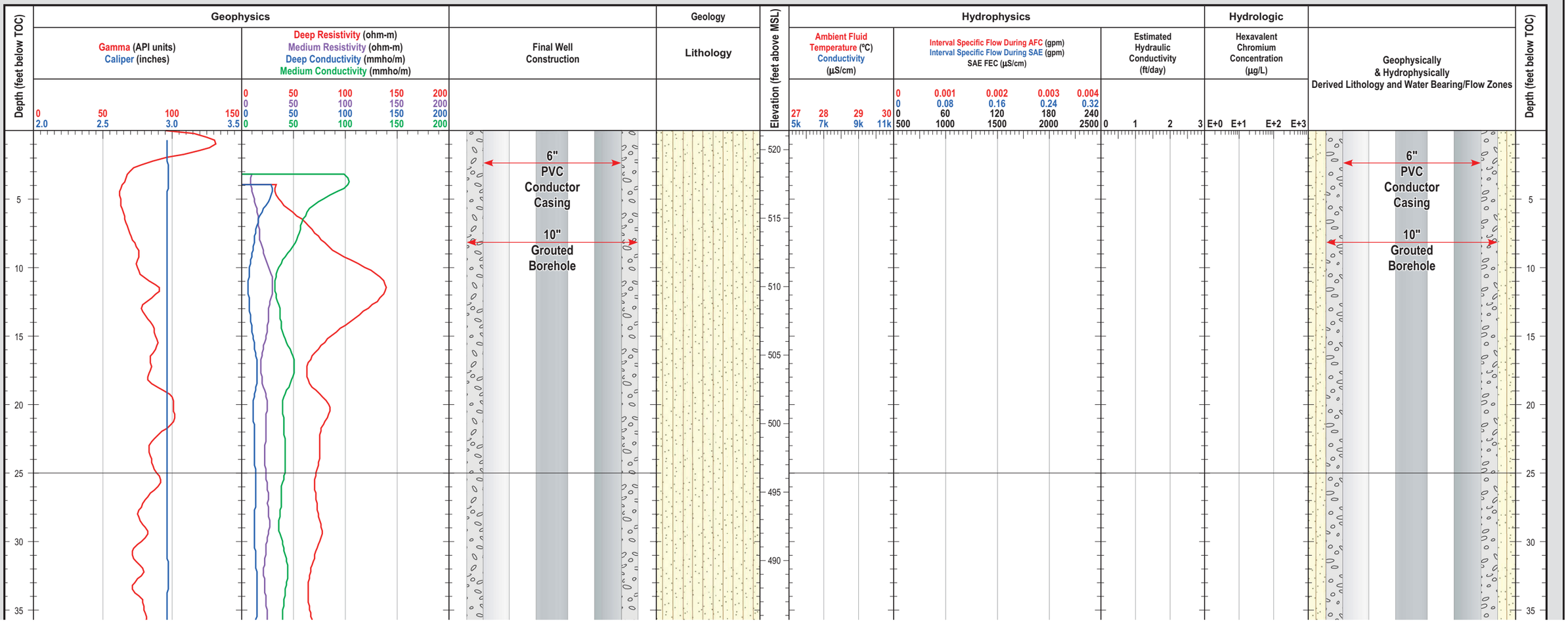
Hexavalent Chromium - Cr (VI), in micrograms per liter (µg/L)

- Calculated Interval specific concentrations (Intervals)
- Observed concentrations ambient conditions (point)
- Observed concentrations pumping conditions (points)
- Pump after sampling (point)

Contaminant concentrations based on samples collected in open borehole conditions.

MISCELLANEOUS NOTES:

1. Top of casing elevation: 521.4 feet (NAD83).
2. All depths referenced to top of PVC casing.
3. Coordinates of well: Northing: 7616131.91 Easting: 2100612.36
4. Lithology from CH2M Hill.
5. Well construction from CH2M Hill.
6. Geophysical logging conducted by Pacific Surveys on July 16, 2008 & December 2, 2008.
7. Hexavalent chromium results provided by CH2M Hill.
8. Hydrophysical logging conducted by RAS, Inc. from March 3 to March 5, 2008.



Fabric Liner Directly Against Open Borehole

Water Level 66' (approx)

3.8" Borehole with Fabric Liner

Fabric Liner Held Slightly away from Borehole Wall

0.00 gpm

0.07 gpm

1.5 ft/day

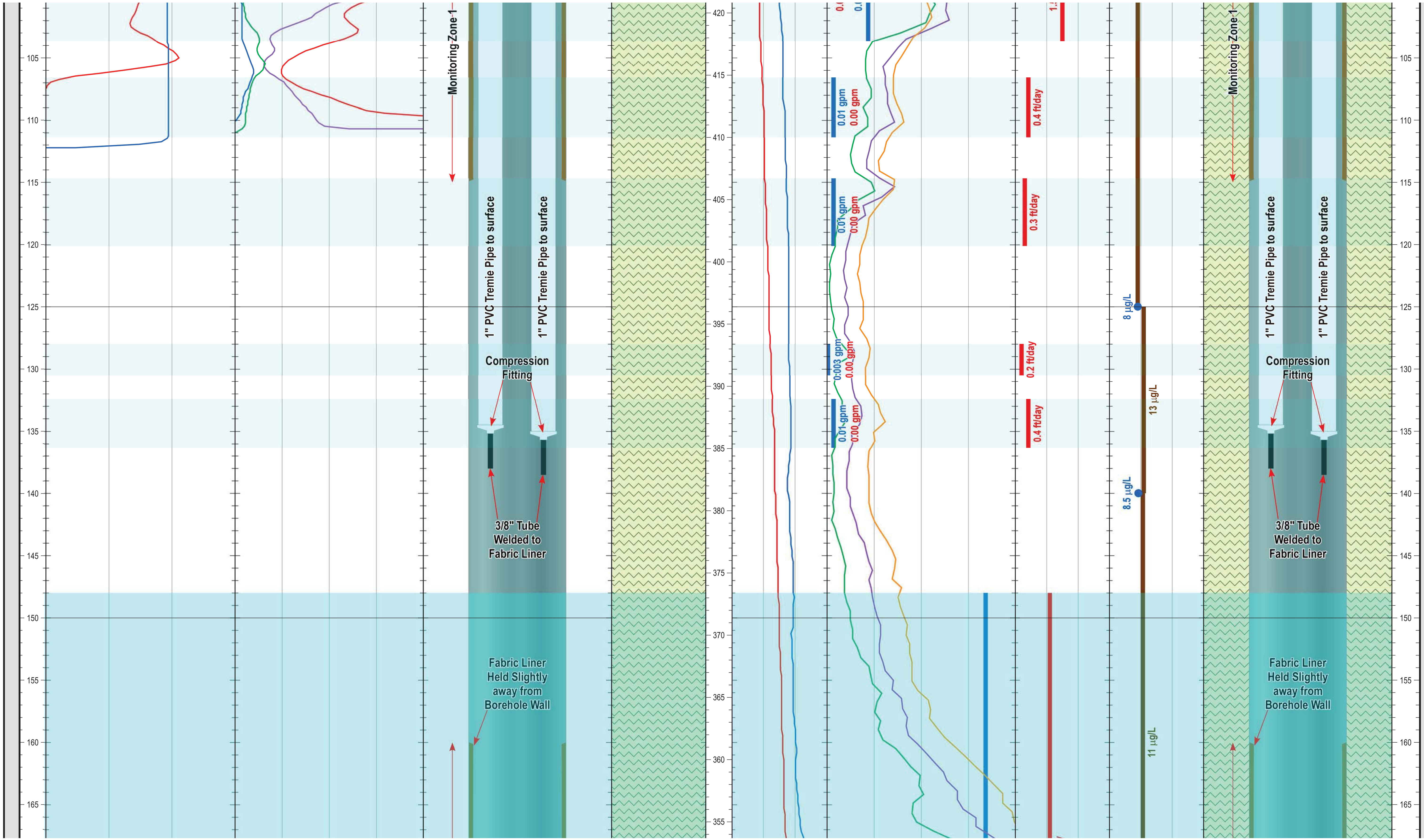
8 µg/L

Fabric Liner Directly Against Open Borehole

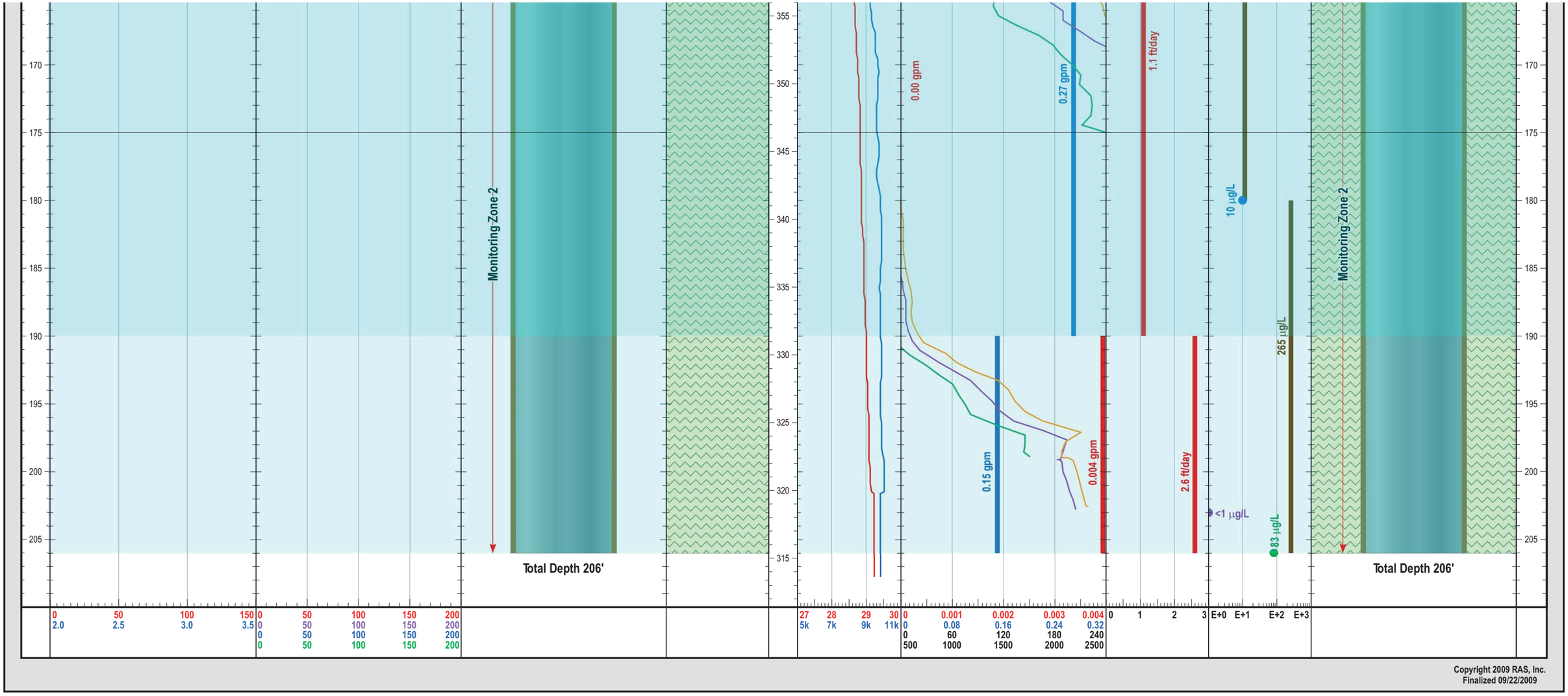
Water Level 66' (approx)

3.8" Borehole with Fabric Liner

Fabric Liner Held Slightly away from Borehole Wall



105
110
115
120
125
130
135
140
145
150
155
160
165
Monitoring Zone-1
1" PVC Tremie Pipe to surface
1" PVC Tremie Pipe to surface
Compression Fitting
3/8" Tube Welded to Fabric Liner
Fabric Liner Held Slightly away from Borehole Wall
420
415
410
405
400
395
390
385
380
375
370
365
360
355
0.01 gpm
0.00 gpm
0.4 ft/day
0.01 gpm
0.00 gpm
0.3 ft/day
0.003 gpm
0.00 gpm
0.2 ft/day
0.01 gpm
0.00 gpm
0.4 ft/day
8 µg/L
13 µg/L
8.5 µg/L
11 µg/L
Monitoring Zone-1
1" PVC Tremie Pipe to surface
1" PVC Tremie Pipe to surface
Compression Fitting
3/8" Tube Welded to Fabric Liner
Fabric Liner Held Slightly away from Borehole Wall
105
110
115
120
125
130
135
140
145
150
155
160
165



WELL: MW-64BR

PROJECT: CH2M Hill - PG&E Topock Compressor Station - Needles, California

RAS Integrated Subsurface Evaluation
PH 303.526.4432 • FAX 303.526.4426
email: bpedler@rasinc.org • www.rasinc.org

LEGEND

LITHOLOGY

- Unconsolidated Sediment
- Conglomerate Bedrock
- Metadiorite Bedrock

HYDROPHYSICAL LOGGING RESULTS:

Interval Specific Flow rate derived from Ambient Flow Characterization (AFC) and Slug Test After Emplacement (SAE) hydrophysical data.

HPL FEC logs presented were collected during Slug Test after Emplacement conditions.

- FEC 0843
- FEC 1546
- FEC 1835

FEC XXXX where XXXX is military time at start of log.

Horizontal flow observed during ambient conditions, inflows also evaluated during stressed (constant pumping or slug test) conditions. Horizontal flowrates base on integral method for q (Lowe, et. al., 1989).

Fluid Resistivity and Fluid temperature Log performed during ambient conditions

Hydraulic conductivity estimates based on Hvorslev (1962), (Pedler, *et al.* 1988) and Theim, G. *Hydrolgische Methoden*. Leipzig: Gebhart, 1906, p 56. Flow and velocity estimates based on hydrophysical logging results only.

Flow Zones, in percent of total fluid contribution

- <20%
- >20% and <35%
- >35% and <50%
- >50%

HEXAVALENT CHROMIUM EXPLANATION

Hexavalent Chromium - Cr (VI), in micrograms per liter (µg/L)

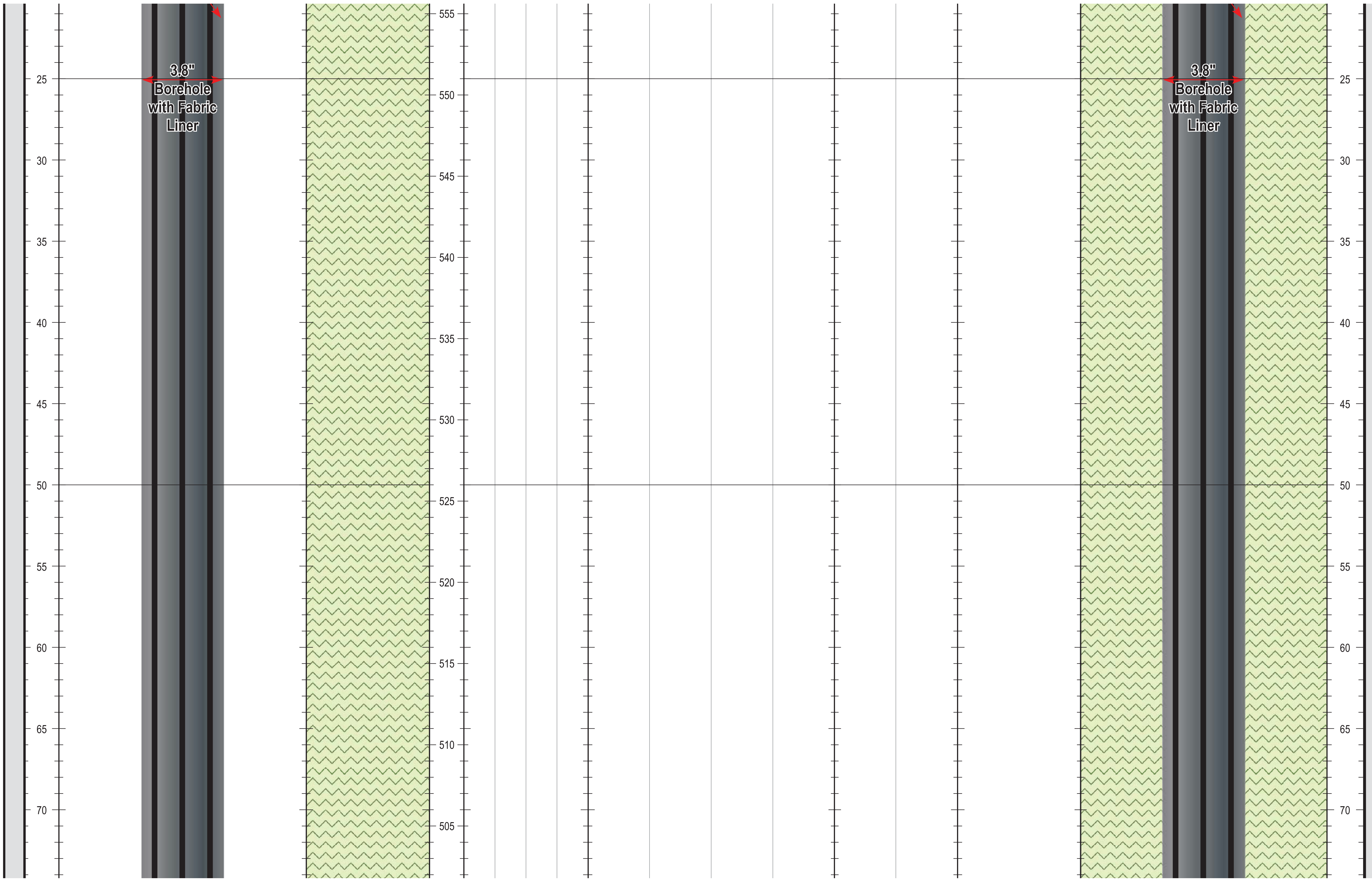
- Calculated Interval specific concentrations (Intervals)
- Observed concentrations ambient conditions (point)
- Observed concentrations pumping conditions (points)
- Pump after sampling (point)

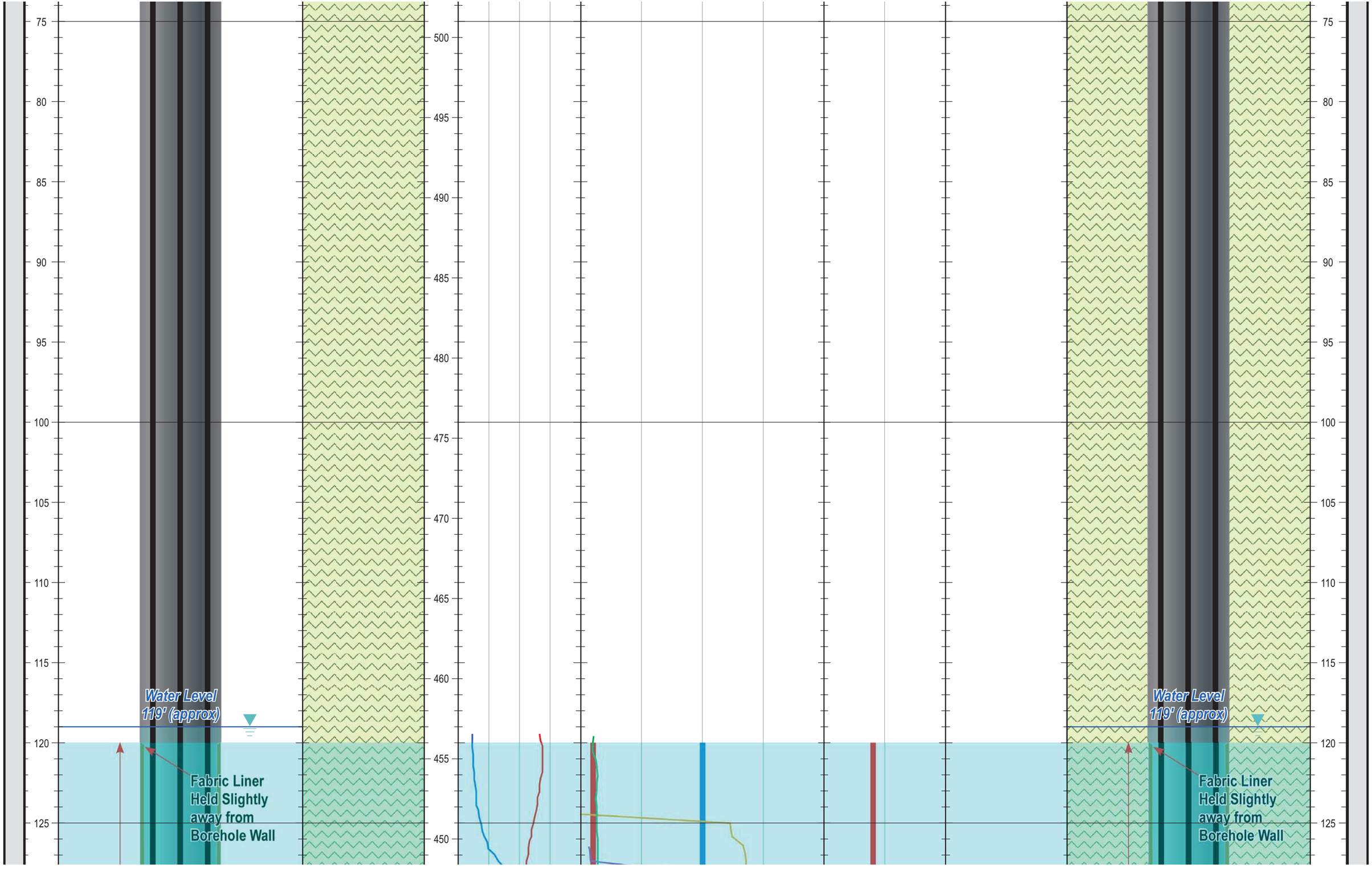
Contaminant concentrations based on samples collected in open borehole conditions.

MISCELLANEOUS NOTES:

1. Top of casing elevation: 576.0 feet (NAD83).
2. All depths referenced to top of PVC casing.
3. Coordinates of well: Northing: 7616939.41 Easting: 2100520.49
4. Lithology from CH2M Hill.
5. Well construction from CH2M Hill.
6. Hexavalent chromium results provided by CH2M Hill.
7. Hydrophysical logging conducted by RAS, Inc. from May 27 to June 1, 2009.

Depth (feet below TOC)	Final Well Construction	Geology: Lithology	Elevation (feet above MSL)	Hydrophysics: Ambient Fluid Temperature (°C) / Conductivity (µS/cm)	Hydrophysics: Interval Specific Flow During AFC (gpm) / Interval Specific Flow During SAE (gpm) / SAE FEC (µS/cm)	Hydrophysics: Estimated Hydraulic Conductivity (ft/day)	Hydrologic: Hexavalent Chromium Concentration (µg/L)	Hydrophysically Derived Lithology and Water Bearing/Flow Zones	Depth (feet below TOC)
				27 28 29 (°C)	0.000 0.004 0.008 0.012 0.016	E-2 E-1 E+0			
				4k 8k 12k (µS/cm)	0.000 0.004 0.008 0.012 0.016				
					0 400 800 1200 1600				
5	6" PVC Conductor Casing; 10" Grouted Borehole; Fabric Liner Directly Against Open Borehole		575					6" PVC Conductor Casing; 10" Grouted Borehole; Fabric Liner Directly Against Open Borehole	5
10			570						10
15			565						15
20			560						20
			555						


25
30
35
40
45
50
55
60
65
70
3.8" Borehole with Fabric Liner
555
550
545
540
535
530
525
520
515
510
505
3.8" Borehole with Fabric Liner
25
30
35
40
45
50
55
60
65
70


75
80
85
90
95
100
105
110
115
120
125
500
495
490
485
480
475
470
465
460
455
450
Water Level
119' (approx)
Fabric Liner
Held Slightly
away from
Borehole Wall
Water Level
119' (approx)
Fabric Liner
Held Slightly
away from
Borehole Wall

Borehole Wall

Monitoring Zone 1

3/8" Tube Welded to Fabric Liner - Extends to Surface

Fabric Liner Held Slightly away from Borehole Wall

130
135
140
145
150
155
160
165
170
175

450
445
440
435
430
425
420
415
410
405
400

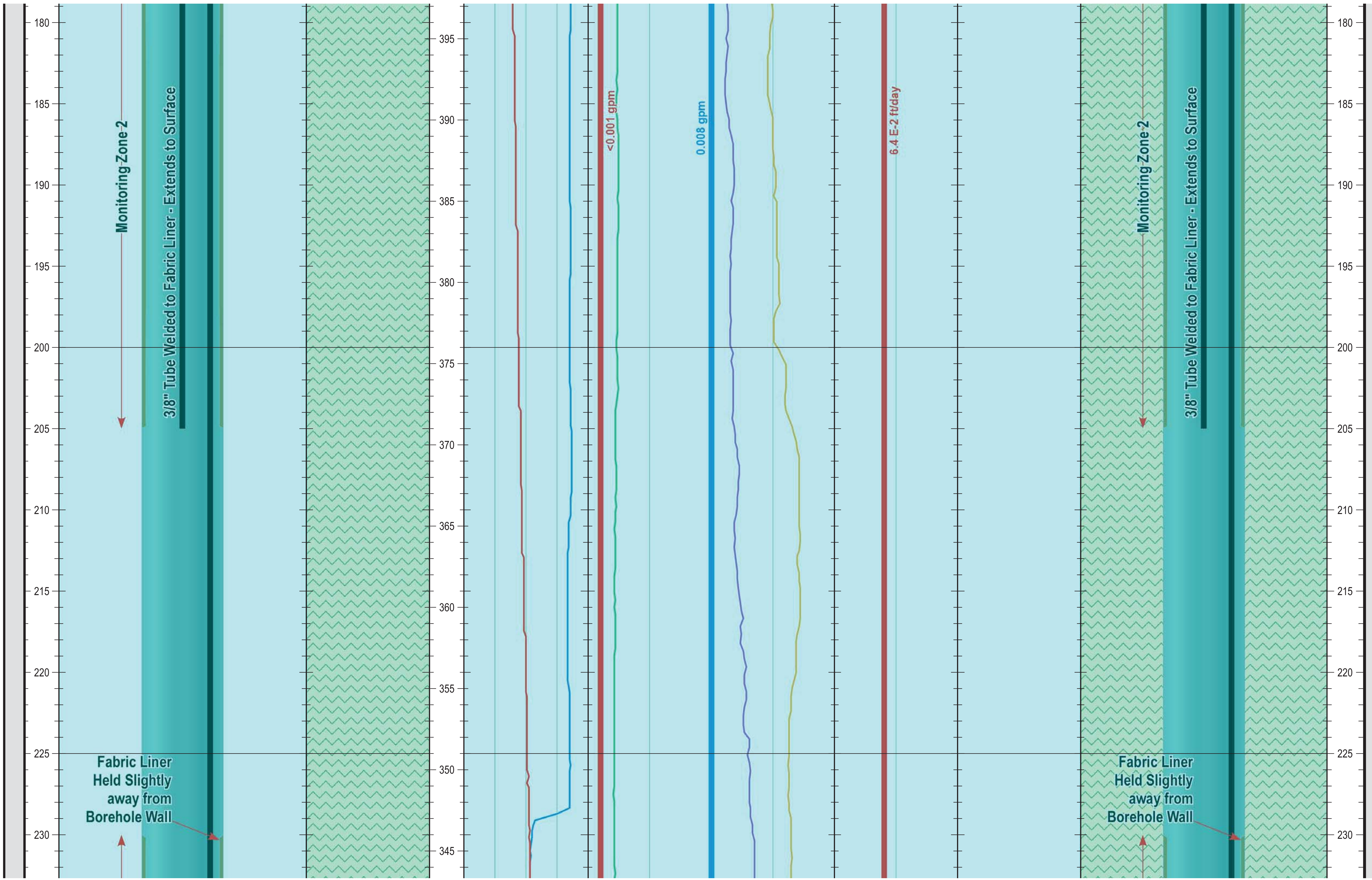
Borehole Wall

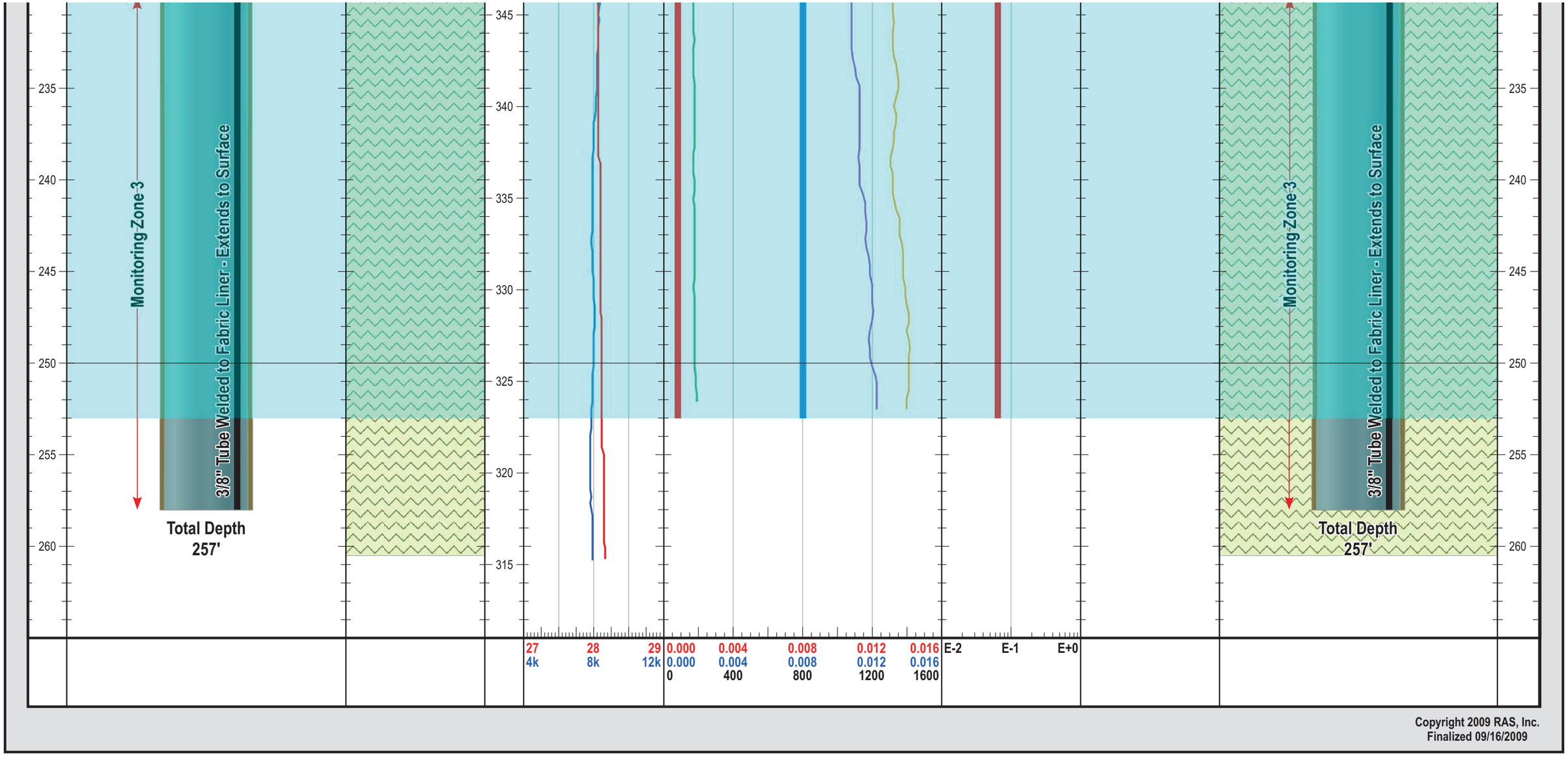
Monitoring Zone 1

3/8" Tube Welded to Fabric Liner - Extends to Surface

Fabric Liner Held Slightly away from Borehole Wall

130
135
140
145
150
155
160
165
170
175


180
185
190
195
200
205
210
215
220
225
230
Monitoring Zone 2
3/8" Tube Welded to Fabric Liner - Extends to Surface
Fabric Liner Held Slightly away from Borehole Wall
395
390
385
380
375
370
365
360
355
350
345
<0.001 gpm
0.008 gpm
6.4 E-2 ft/day



Attachment 3
PGE-08BR Construction Diagram (c. 1970)
and Mechanical Packer Cut Sheet

PGE-8 Final Completion

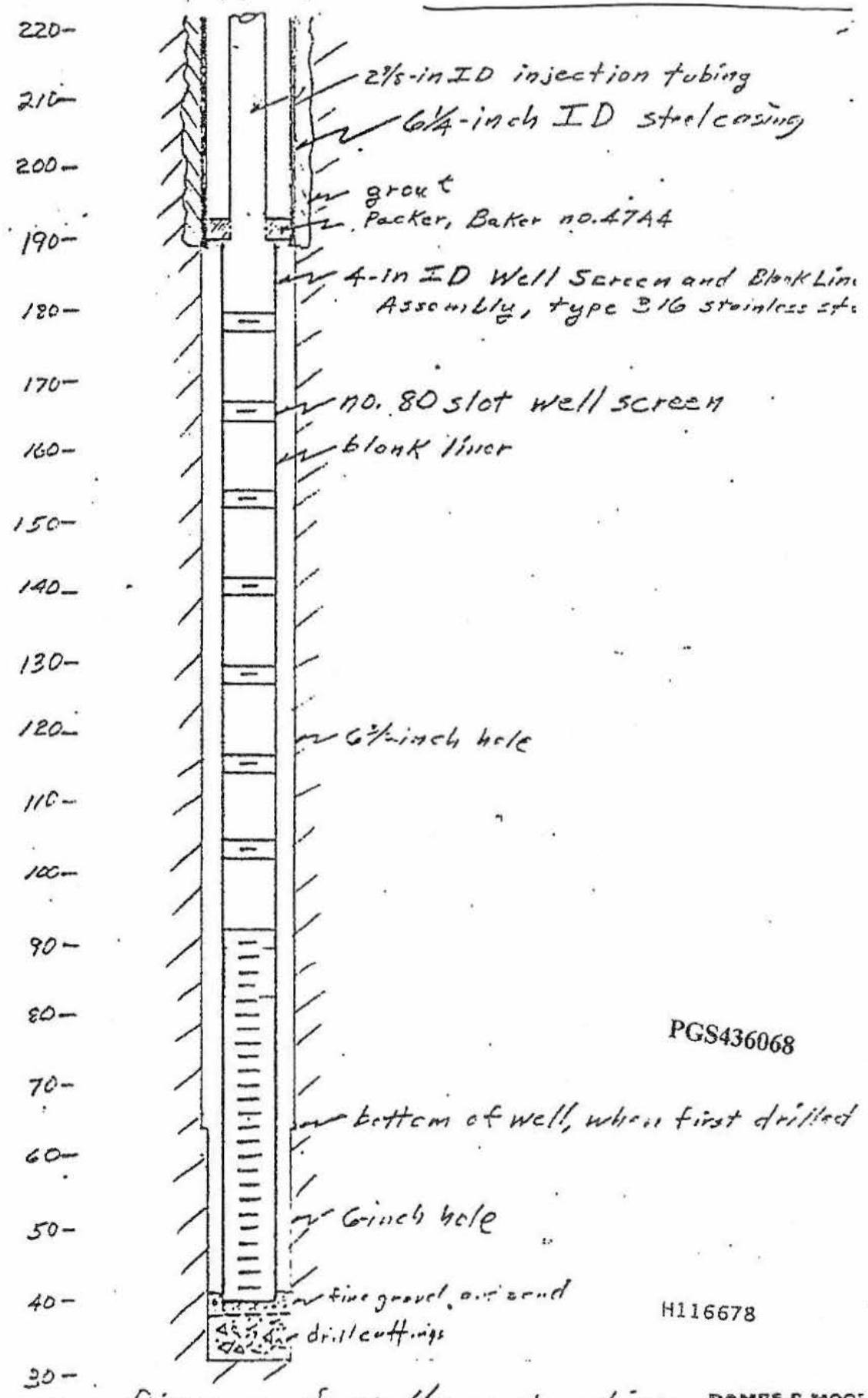


Diagram of well construction

DAMES & MOORE APPLIED EARTH SCIENCE

H116678

PGS436068

REVISIONS BY DATE

BY [signature] DATE 8-28-70
CHECKED BY

FILE 160-148-02

The "**Lock-Set Retrievable Casing Packer"** is a Full Bore Double-Grip Retrievable Packer with an integral Unloader. Opposed, non-transferring dovetail Slips prevent movement of the Packer in either direction due to pressure differentials, while allowing landing of the tubing in tension, compression or neutral. The Lock Segments serve as a releasable Lock Ring to maintain pack-off once the packer is set and locks the Unloader in the closed position until the tool is released. The Split Lock and Control Segments allow the tools to be both set and released with right-hand rotation.

"A-2" LOCK SET

Features

The Packer holds pressure from above or below while allowing the tubing to be landed in tension, compression or in a neutral condition. The setting and releasing are controlled by right-hand tubing rotation.

Running Procedure

Hang the Packer to completely stretch it out before starting in the hole. Immediately prior to running in, rotate the Drag Block Housing several turns to the left to make sure the Segments are functioning properly. Do not rotate the Drag Block Housing to the right as this will bind the Control Segments and prevent them from moving after reaching setting depth. Upon reaching setting depth, slowly lower the packer while applying approximately two turns of right-hand rotation at the tool, until the tool takes weight. Set down a minimum of 6,000 lbs to initially set the Upper Slips. Lowering of the tool must take place while rotating for the tool to set properly. To fully engage the Lower Slips, apply an up-strain against the tool. When the tubing is to be landed in tension, a strain greater than the landing strain should be applied during the setting operation. The tubing may now be hung in tension, compression or neutral.

Specification Guide

Casing		Packer Size	Preferred Range of Csg ID's		Gage Ring OD	Packing Element OD	Packing Element Spacer OD	Absolute Limits of Slip Travel		Drag Block Min. Comp. Height	Thread Spec. Box Up & Pin Down
OD	T & C Wt (lb)		Min	Max				Min	Max		
4-1/2	11.6-13.5	43A2	3.910	4.000	3.771	3.625	3.771	3.687	4.207	3.750	2-3/8 OD EU 8 Rd & 2-3/8 OD NU 10 Rd
	9.5-10.5	43A4	4.001	4.090						3.938	
5	15-18	43B	4.250	4.408	4.125	3.938	4.125	4.062	4.582	4.125	
	11.5-15	43C	4.408	4.560	4.250	4.156	4.250				
5-1/2	26										
	20-23	45A2	4.625	4.778	4.500	4.375	4.500	4.437	5.221	4.500	2-3/8 OD EU 8 Rd
	15.5-20	45A4	4.778	4.950	4.641						
	13-15.5	45B	4.950	5.190	4.781	4.688	4.781			4.688	
6	26										
	20-23	45C	5.191	5.390	5.062	4.938	5.062	5.000	5.784	5.000	
	15-18	45D	5.391	5.560	5.156						
6-5/8	34	45	5.561	5.609	5.406	5.250	5.406			5.468	
	24-32	45F	5.610	5.921	5.484			5.437	6.221		
	17-24	45G	5.922	6.135	5.781	5.688	5.781				
7	24	47A2	5.830	5.937	5.656	5.500	5.656	5.562	6.665	5.500	
	38										
6-5/8	17-20	47A4	5.938	6.135	5.812						
7	32-35										
	26-29	47B2	6.136	6.276	5.968	5.750	5.968			5.936	2-7/8 OD EU 8 Rd
	23-26	47B4	6.276	6.366	6.078						
	17-20	47C2	6.456	6.578	6.266	6.125	6.266	6.200	7.303	6.375	
7-5/8	33.7-39	47C4	6.579	6.797	6.453						
	24-29.7	47D2	6.798	7.025	6.672	6.500	6.672				
	20-24	47D4	7.025	7.125	6.812						
8-5/8	44-49	49A2	7.511	7.687	7.312	7.000	7.312	7.250	8.276	7.250	
	32-40	49A4	7.688	7.921	7.531						
	20-28	49B	7.922	8.191	7.781	7.500	7.781			7.750	4 OD NU 8 Rd
9-5/8	47-53.5	51A2	8.343	8.681	8.218	7.938	8.218	8.125	9.283	8.125	
	40-47	51A4	8.681	8.835	8.437						
	29.3-36	51B	8.836	9.063	8.593	8.375	8.593				

Attachment 4
PGE-08RB Video Survey Stills, 2006 and 2007

Vid-Pac

Wellbore Video Report

welenco

Company CAL M HILL
Address
City State Zip
Requested by BARRY P.O.
Copy to
Reason for Survey GENERAL INSPECTION, LOOK FOR PACKER
Operator DAN IHDE

Job Ticket 8459 Run No. ONE
Well No. PG&E 8
Survey Date 11-13-07
Well Owner PG&E
Camera SUM SIDE SCAN
Zero Datum TOP OF CASING
Well Depth Vehicle No. T-03

Location PG&E COMPRESSOR STATION, TOPOC
Casing I.D. at Surface 6 I.D. Reference MEASURED Build-Up

Survey Start Time: 10:47
Survey End Time: 12:00

34 42 50
114 29 37

TRUE DEPTHS	WELLBORE/CASING INFORMATION
0 FT	RECORDING STARTS, ZEROED ON SIDE VIEW
	CAMERA RUNNING TO ONE SIDE DUE
	TO NO CENTRALIZERS SET TRYING
	TO ACCESS PACKER
140	STATIC WATER LEVEL - POOR VISIBILITY
237	TOP OF WIRE - SOUNDING CABLE
249	SEVERAL SECTIONS OF WIRE
382	NO VISIBILITY - END OF SURVEY
362	TOP OF PIPE SECTION

Notes: NO CENTRALIZERS

welenco, inc.
5201 Woodmere Dr.
Bakersfield, CA 93313
www.welenco.com
e-mail: welenco@welenco.com
Phone: (800) 445-9914
Fax: (661) 834-2550
CA Contractor Lic. #722372

Vid-Pac — Wellbore Video Report

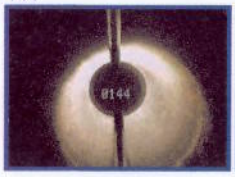
welenco
(800) 445-9914

Company: Ch2MHILL **Job Ticket:** 6819 **Run No.:** 1
Address: 33 New Mongomery Street Suite 2000 **Well Number:** PGE-8
City: San Francisco **State:** CA **Zip:** 94105 **Survey Date:** November 17, 2006
Requested By: Isaac Woods **P.O.:** **Well Owner:** PG & E
Copy To: **Camera:** CCV S.S. Color Camera - Long L.H.
Reason For Survey: General Inspection **Zero Datum:** Top of Casing
Operator: Larry Hock **Lat.:** 34° 42' 50.3" **Long.** 114° 29' 39.6" **Sec:** 8 **Twp:** 7N **Rge:** 24E **Meridian:** San Bernardinc
Location: PG & E Facility (Topock) **Well Depth:** 560' **Van:** L-18
Casing I.D. At Surface: 6" **I.D. Reference:** Estimate from Video **Casing Corrosion:** Light

(NOTE: Latitude and Longitude values determined using a recreational GPS accurate to +/- 45'. The SEC, TWP, RGE and Meridian then determined using the TRS conversion program, accuracy not guaranteed

SELECTED WELLBORE SNAPSHOTS

144'



145' (See Other Side)

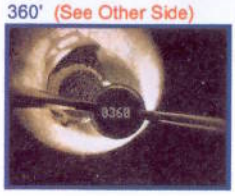
152' (See Other Side)

165'

203' (See Other Side)

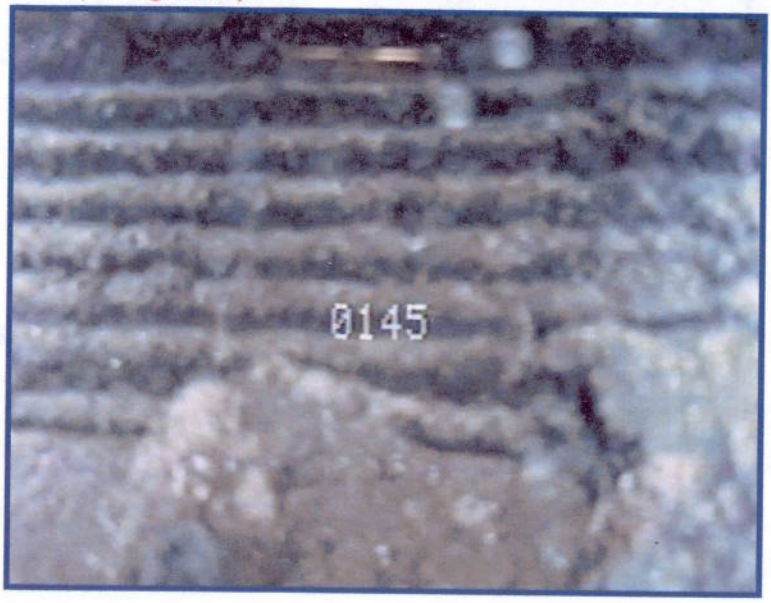
305' (See Other Side)

360' (See Other Side)

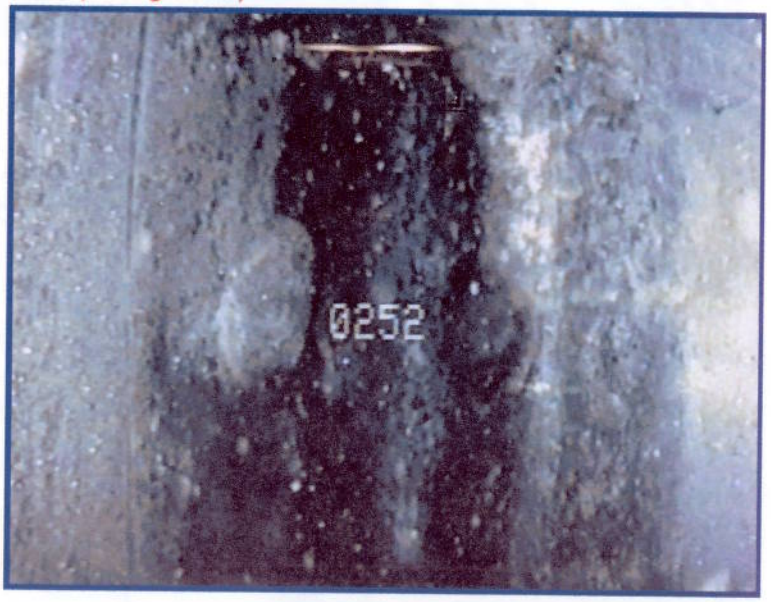


TRUE DEPTHS (SideScan - Feet)	WELLBORE / CASING INFORMATION
	Downview Depths are 22" deeper than SideScan Depths
0'	Recording Starts - Zeroed on Sideview Lens at top of casing
39'	Stop recording, pull out of well, clean lens
35'	Resume survey
139'	Static water level
144'	Downview of casing @ 145'
145'	Casing joint
165'	Casing joint
203'	Nodule on casing wall
252'	Marks on casing wall
305'	Casing joint
360'	Fish in hole, possible pipe in well, unable to get camera past this point
359'	Stop recording and survey

145' (Enlargement)



152' (Enlargement)



203' (Enlargement)

305' (Enlargement)

360' (Enlargement)