Well Purging / Sampling Problems

Kevin Heaton, Senior Hydrogeologist

SAM Manual History on Well Purging Methods

January 1991 - SAM Manual: Standard Methods

- High flow methods
  - Standard fast recovery
  - Parameter based fast recovery
  - Standard slow recovery well

January 2002 - SAM Manual: Specialized Methods

- Non-purge
- Low flow

Purpose of Well Purging

Well purging is to ensure that the groundwater sample collected is representative of groundwater conditions below the site.

High Flow Methods

- Using casing volumes instead of borehole volumes
  - This results in insufficient amount of water being purged.
  - WQ parameters may be stable but only measuring stagnant water in the borehole and not from the formation .

Casing vs. Borehole Volumes

BH Diameter (inches)	Casing Size (inches)	Water column (ft)	BH volume (cu-ft)	Casing Volume (cu-ft)	Percent Difference
6	2	15	1.0	0.3	70%
6	2	25	1.6	0.5	69%
6	2	35	2.3	0.9	61%
8	4	15	2.3	1.3	43%
8	4	25	3.8	2.2	42%
8	4	35	5.3	3.1	42%
10	4	15	3.0	1.3	57%
10	4	25	5.0	2.2	56%
10	4	35	7.1	3.1	56%

High Flow Methods (Continued)

Key missing information in well purge logs

- Pumping rate
- Method of pumping
- Static water level (water level prior to purging)
- Water levels at time of testing water quality parameters
- Water level and the time when purging was terminated
- Water level at time of sampling

High Flow Methods (Continued)

Percent Recovery

- 75 - 80% of projects reviewed it is found that insufficient information is being provided to demonstrate 80% recovery has been achieved.
- Audited cases have shown over 60% of the time individuals are incorrectly calculating the Percent Recovery.

Percent Recovery

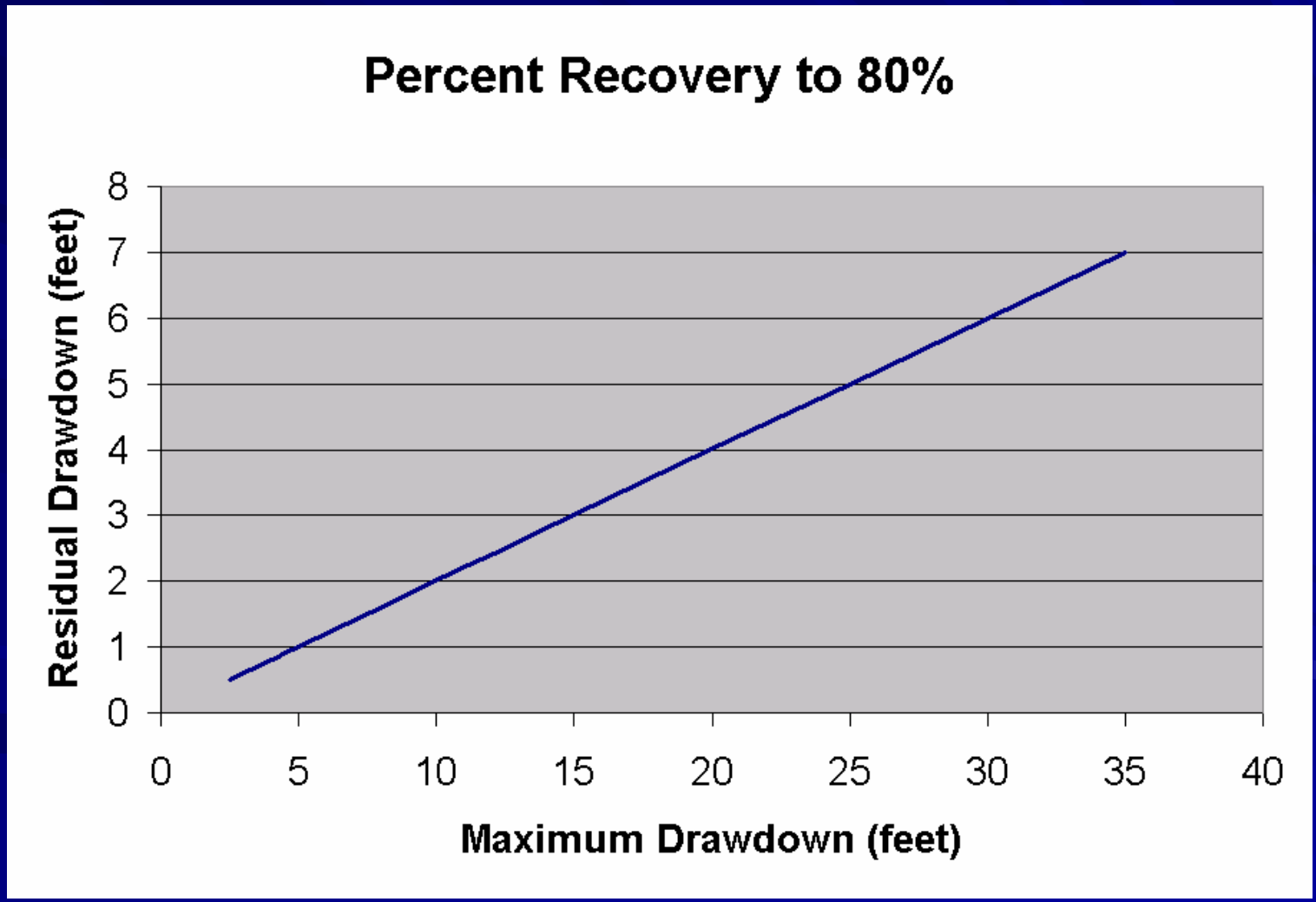
$$PR = \left(1 - \frac{RD}{MD}\right) \times 100$$

Where: **PR = the percent recovery (%)**

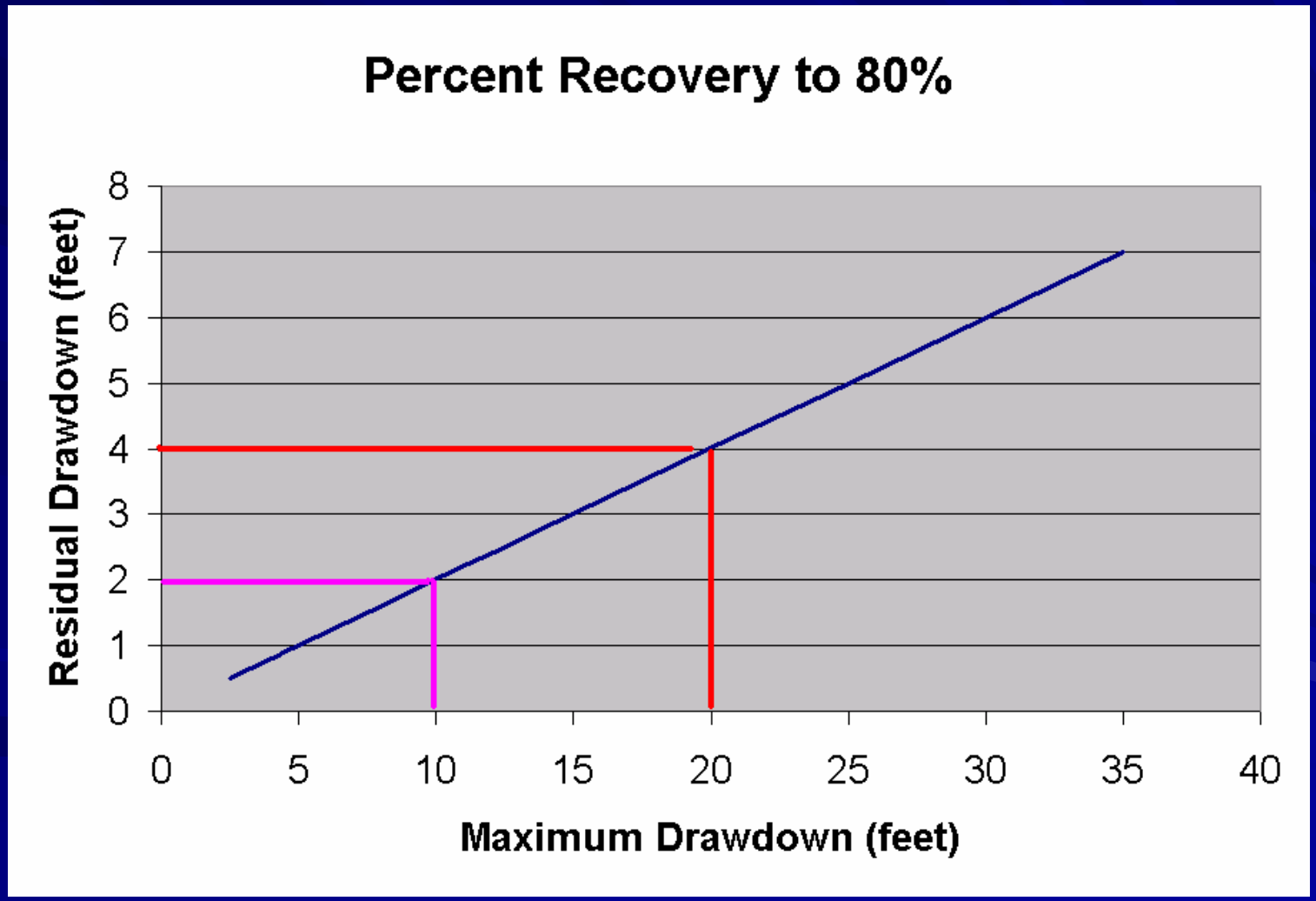
RD = the residual drawdown (ft) - the difference between the water level prior to purging and the measured water level at any time after purging.

MD = the maximum drawdown (ft) - the difference between the static water level prior to purging and the measured water level immediately after purging.

High Flow Methods - Percent Recovery (Continued)



High Flow Methods - Percent Recovery (Continued)



Low Flow Method

- This method assumes:
  - Groundwater flow is horizontal,
  - There is no vertical component of flow in well,
  - Water in the well is in equilibrium with the formation water and
  - Volatilization and oxidation in the well is insignificant.

Low Flow Method (Continued)

Problems with Method Implementation

- Installing pump and purging without allowing 2 hours prior to purging sampling.
- Poor documentation regarding pump placement in the well.
- No drawdown information provided documenting the compliance with the method.
- Not following the required indicator parameters and turbidity for evaluating stability.
- Using proper pump type for the method.

General Comment on Purging

It is common in reports and workplans to see the following statements:

- Work will be done or was done in general compliance with the SAM Manual
- Work will be done or was done in general accordance with the SAM Manual.

- These generalized statements imply and have been found to be used when the SAM Manual is not being followed.
- When these statement are used you will be asked to explain where the SAM Manual was not followed.

New Well Purging Log

To attempt to correct the problems we have observed DEH is requiring all well purging logs to contain the information listed on this form.

Company Name	WELL PURGING/SAMPLING LOG		
	Project Name:		Well No.:
	Project Number:		Date:
	Project Address:		
	Well GPS: Latitude:	Longitude:	
	Sampled by:	Checked by:	License #:

WELL SPECIFICATIONS & MEASUREMENTS		PURGING & SAMPLING EQUIPMENT	
Borehole Diameter (in.) (BD): 6 8 10 12 _____		Water Level Meter Type and ID:	
Casing Diameter (in.) (CD): 2 4 6 8 _____		Purging Equipment/Method:	Bladder Pump ___ Bailer ____ Centrifugal Pump ___ Other ____
Total Well Depth (ft.) (WD):	Product thickness (ft.):	pH/Temp/Conductivity Meter Type and ID:	
Static Water Level (ft.) (SWL)	Free product:	Sampler Type:	Teflon Bailer ___ Disposable Bailer Bladder Pump ___ Centrifugal Pump ___ Other _____
Water Column (ft.) (WC=WD-SWL): _____	Filter Pack Porosity (P): _____		
Borehole Volume (BV) Calculations		Decontamination Method:	____ Steam/High Pressure Wash ____ 3 Stage (Alconox, tap water & DI rinse) Other: _____
$BV\ (gal) = 0.041\ [CD^2 + P\ (BD^2 - CD^2)](WC)$ This equation applies to wells constructed straddling the water table only. For submerged screens, document all calculations. Porosity is expressed in decimal form. BV = _____ gallons			

PURGING AND SAMPLING METHODOLOGIES

Well Recovery Type

Fast – recovers 80% within 2 hours -Methods 1, 2, 3, & 5 Slow – more than 2 hours to recover 80% -Methods 3, 4, & 5

PURGING METHODS

___Method 1, remove 3 BV, sample after well recovers 80% of total purged drawdown

Method 2, remove 1 BV, test parameters until stable per SAM Manual, sample after well recovers 80% of total purged drawdown.

Method 3, Low-flow - install pump at least 2 hours prior to start of purging. Follow detailed methodology in SAM Manual.

List the date and time the pump was installed: Date:_____ Time: _____

___Method 4, remove 1 BV, sample after 2 hours. Note - if well recovers 80% of total purged drawdown, use another method.

___Method 5, non-purge method. Only with prior written approval from SAM

PURGING INFORMATION

Time	Water Level (feet below top of casing)	Drawdown (feet)	Water Volume Purged (gal)	Measured Parameters				
				Conductivity (µmhos)	Dissolved Oxygen	pH	Turbidity	Temp (°C)

Borehole Volume: (gal) Total Volume Purge Water: (gal) Average pumping rate: (gpm)

RECOVERY CALCULATIONS

Recovery of 80% of drawdown from purging = SWL – (0.2)(Maximum Drawdown during purging)

SAMPLING INFORMATION

Date & Time Sampled: _____ Depth to water at time of sampling (feet): _____

Quantity	Container Type	Filtered (Y/N)	Sample Preservatives	Analytical Methods to Perform

New Well Purging Log (Continued)

WELL PURGING/SAMPLING LOG		
Project Name:		Well No.:
Project Number:		Date:
Project Address:		
Well GPS: Latitude:	Longitude:	
Sampled by:	Checked by:	License #:

New Well Purging Log (Continued)

WELL SPECIFICATIONS & MEASUREMENTS	
Borehole Diameter (in.) (BD): 6 8 10 12 _____	
Casing Diameter (in.) (CD): 2 4 6 8 _____	
Total Well Depth (ft.) (WD):	Product thickness (ft.):
Static Water Level (ft.) (SWL):	Time measured:
Water Column (ft.) (WC=WD-SWL): _____	Filter Pack Porosity (P): _____

Borehole Volume (BV) Calculations

BV (gal) = 0.041 [CD^2 + P (BD^2-CD^2)](WC)

This equation applies to wells constructed straddling the water table only. For submerged screens, document all calculations. Porosity is expressed in decimal form. **BV =** _____ **gallons**

New Well Purging Log (Continued)

PURGING & SAMPLING EQUIPMENT		
Water Level Meter Type and ID:		
Purging Equipment/Method:	Bladder Pump _____ Bailer _____ Centrifugal Pump ____ Other _____	
pH/Temp/Conductivity Meter Type and ID:		
Sampler Type:	____Teflon Bailer	____ Disposable Bailer
	____Bladder Pump	____ Centrifugal Pump
	____Other: _____	
Decontamination Method:	_____ Steam/High Pressure Wash	
	_____ 3 Stage (Alconox, tap water & DI rinse)	
	_____ Other: _____	

New Well Purging Log (Continued)

PURGING AND SAMPLING METHODOLOGIES
Well Recovery Type
___ Fast -recovers 80% within 2 hours -Methods 1, 2, 3, & 5 ___ Slow - more than 2 hours to recover 80% -Methods 3, 4, & 5
PURGING METHODS
___Method 1, remove 3 BV, sample after well recovers 80% of total purged drawdown.
___Method 2, remove 1 BV, test parameters until stable per SAM Manual, sample after well recovers 80% of total purged drawdown.
___Method 3, Low-flow - install pump at least 2 hours prior to start of purging. Follow detailed methodology in SAM Manual. List the date and time the pump was installed: Date:_____ Time:_____
___Method 4, remove 1 BV, sample after 2 hours. Note - if well recovers 80% of total purged drawdown, use another method.
___Method 5, non-purge method. Only with prior written approval from SAM

New Well Purging Log (Continued)

PURGING INFORMATION								
Time	Water Level (feet below top of casing)	Drawdown (feet)	Water Volume Purged (gal)	Measured Parameters				
				Conductivity (µmhos)	Dissolved Oxygen	pH	Turbidity	Temp (°C)
Borehole Volume: _____ (gal)		Total Volume Purge Water: _____ (gal)			Average pumping rate: _____ (gpm)			
RECOVERY CALCULATIONS								
Recovery of 80% of drawdown from purging = SWL + (0.2)(Maximum Drawdown during purging)								
SAMPLING INFORMATION								
Date & Time Sampled: _____			Depth to water at time of sampling (feet): _____					
Quantity	Container Type	Filtered (Y/N)	Sample Preservatives	Analytical Methods to Perform				

New Well Purging Log

Go to What's New

SAM Web Page for the Purging Log

http://www.sdcounty.ca.gov/deh/lwq/sam/whats_new.html