



MONTARA WATER AND SANITARY DISTRICT AGENDA

For Meeting Of: November 16, 2023

TO: BOARD OF DIRECTORS

FROM: Clemens Heldmaier, General Manager *CH*

SUBJECT: Alta Vista Groundwater Monitoring Update

For the initial 5 years of operation of the District's Alta Vista Well, MWSD was charged with the implementation of a groundwater monitoring program. MWSD chose to extend the groundwater monitoring beyond the required term and expanded the program to include other scientific measures that increase the understanding of the aquifer.

The Alta Vista Well is drilled deep into solid bedrock of granitic type unlike most drinking water wells in California that are in non-consolidated sediments. Therefore, usual draw down and recovery tests are not suited to evaluate production rates and pumping sustainability.

Mark Woysner with Balance Hydrologics will be available to present the most recent monitoring results. The attached slide show containing the information was presented at the most recent Groundwater Resources Association of California.

RECOMMENDATION:

Receive presentation about the District's management of the underlying granitic aquifer in Montara.

Attachment

WESTERN GROUNDWATER CONGRESS

THE SIXTH
ANNUAL

SEPTEMBER 12-14, 2023 | BURBANK



Groundwater
Resources
Association
of California
EST. 1992

Welcome!

TRACK 2 – GROUNDWATER QUALITY

Sustainable Management of a Fractured Granitic
Aquifer in Coastal California

Sustainable Management of a Fractured Granitic Aquifer in Coastal California

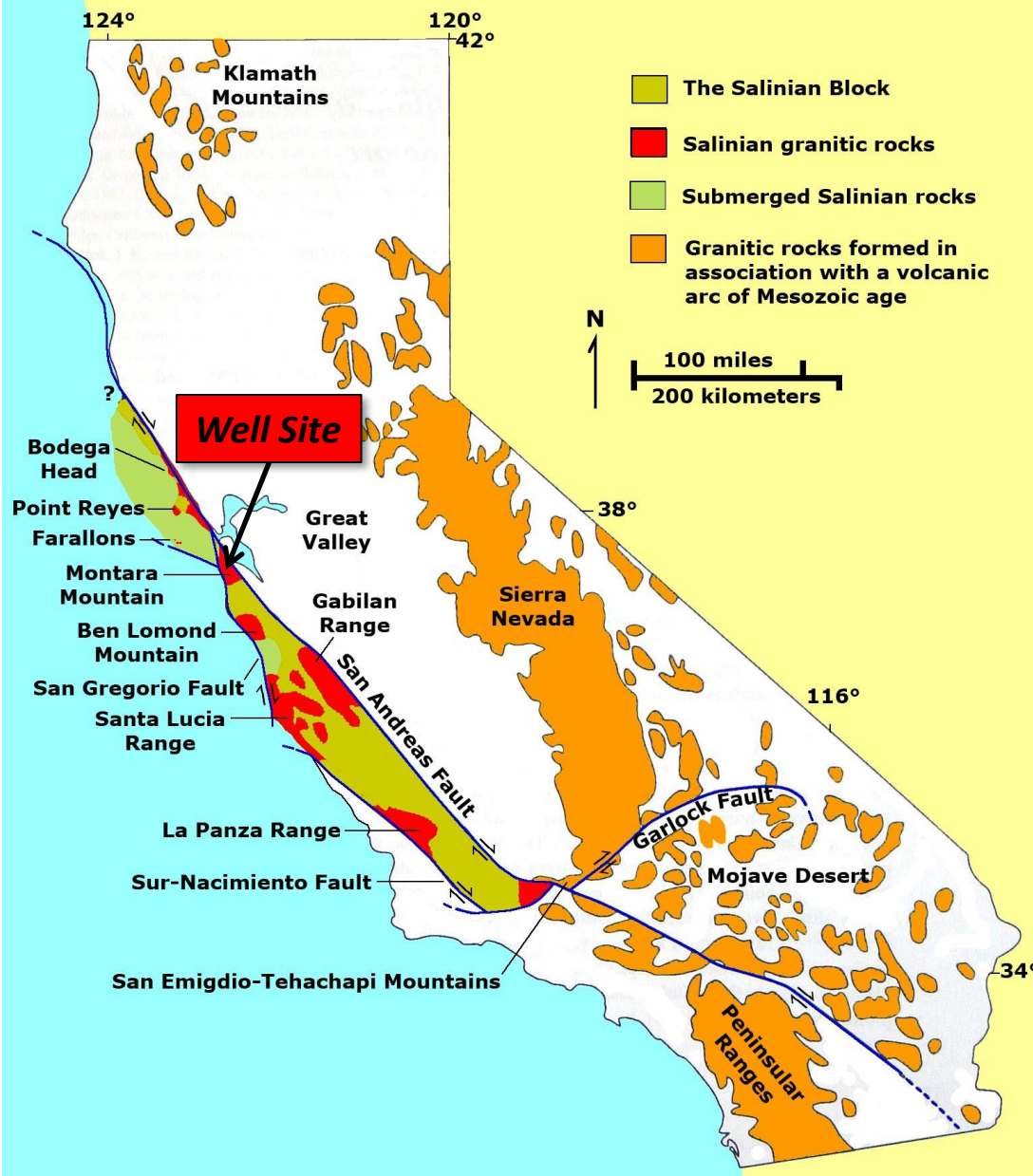
Mark Woyshner, Clemens Heldmaier, Barry Hecht,
Emma Goodwin, and Jason Parke



Methods to Evaluate Sustainability

- ✓ **Geologic framework** of aquifer: Fracture orientation and boundaries
- ✓ **Hydrologic monitoring** across a cycle of major recharge and drought years
- ✓ **General mineral**: Piper diagram
- ✓ **Groundwater age techniques**:
 - Modern water (Tritium-helium, CFCs, SF6)
 - Pre-modern water (Radiogenic helium, ^{14}C)
 - Paleoclimate indicators (^{18}O and ^2H , Noble-gas recharge temperature)
- ✓ **Groundwater modeling**: Water balance and recharge area estimates
- ✓ **Historical records / Indigenous traditions**





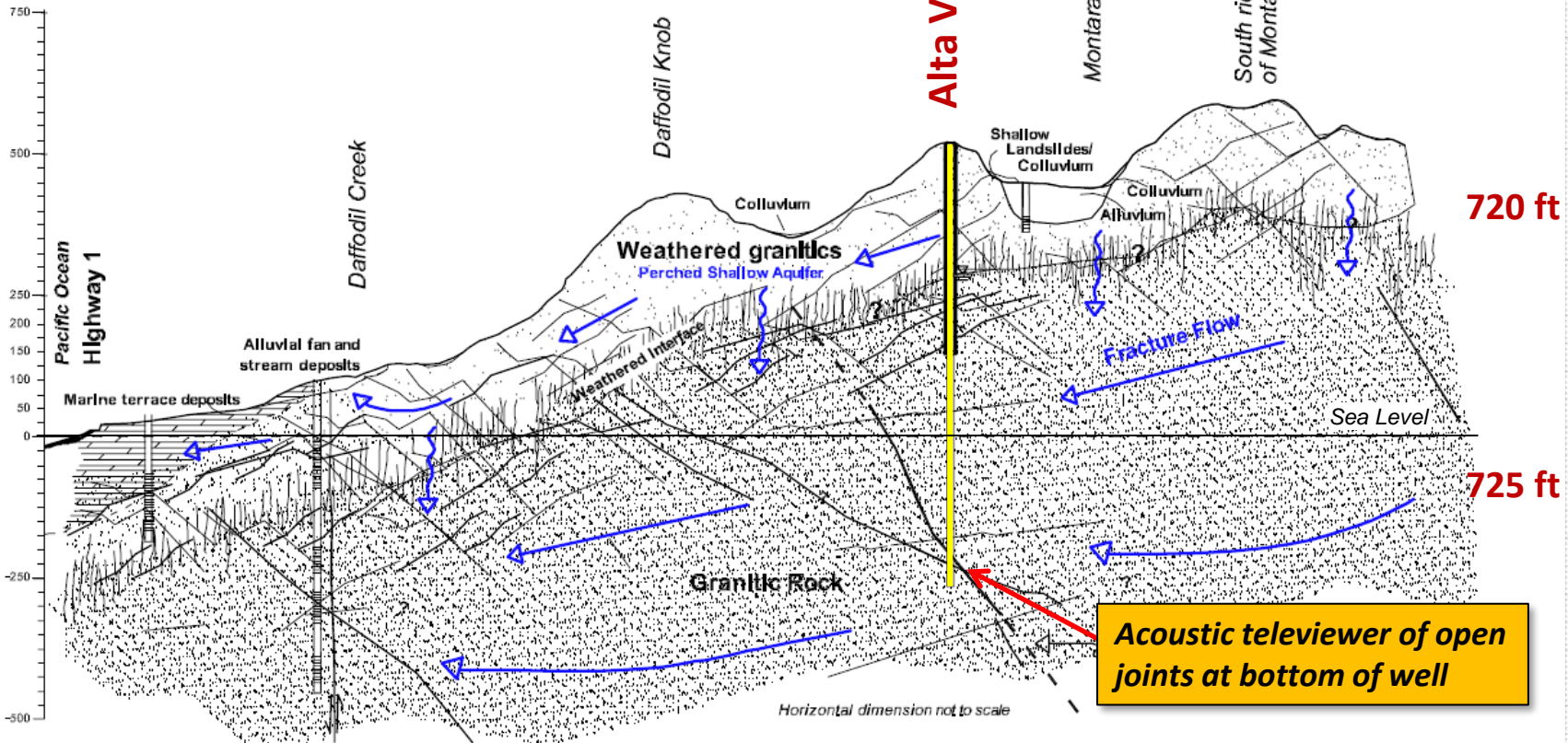
Non-glaciated, deeply weathered granitic rock promotes recharge, provides storage and sustains baseflows.



West

East

Alta Vista Well



Following well completion in 2004: a 5-day test at 300 gpm,
 a 60-day test at 40 gpm. Specific Capacity = 1.4 gpm/ft

715 ft
 720 ft
 725 ft
 730 ft
 735 ft

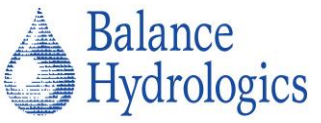


Air-rotary hammer drilling after intersecting open joints



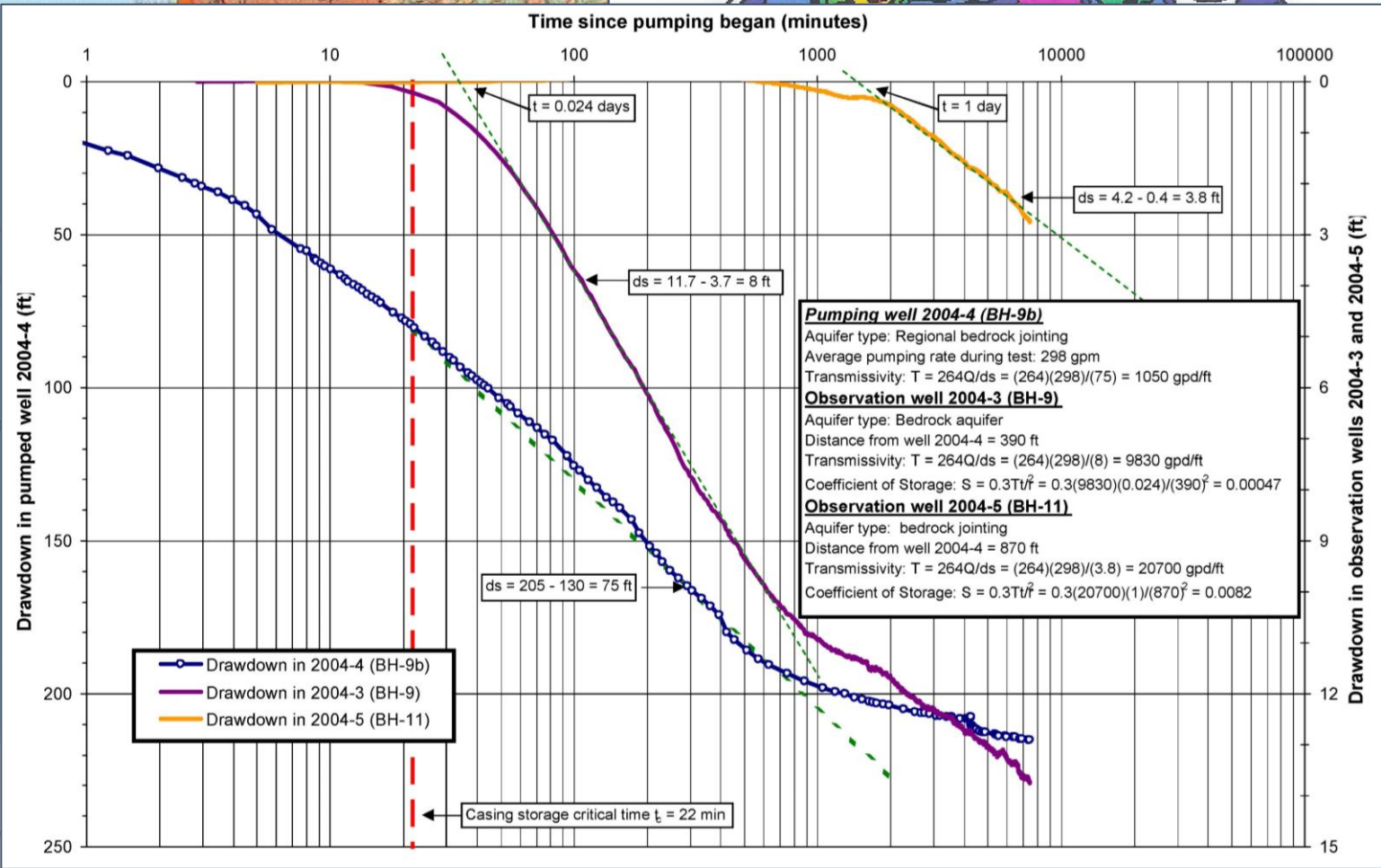
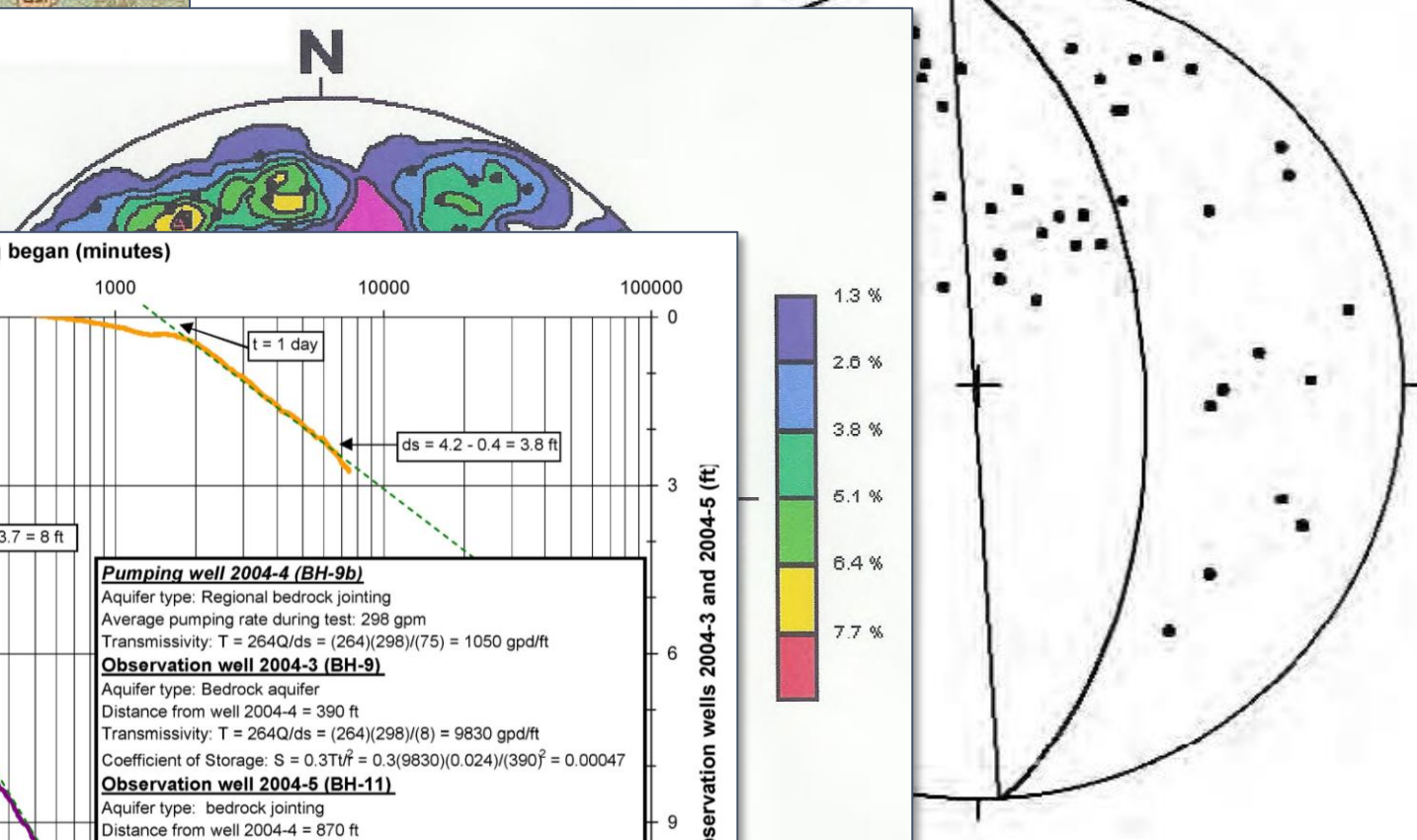
2-ft open joint
 dip 58 deg N003W

1-ft open joint
 dip 40 deg N021E





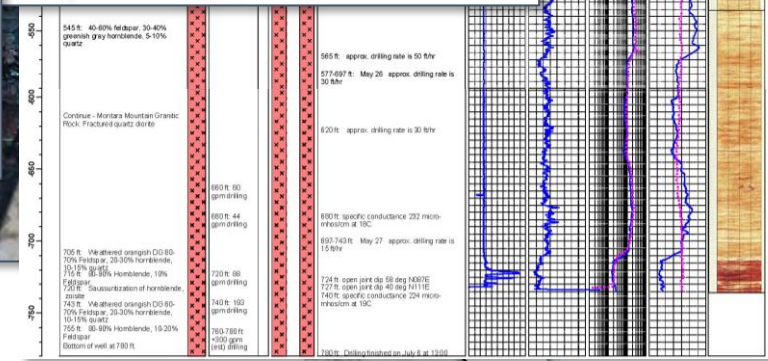
Schmidt-net plot of discontinuities

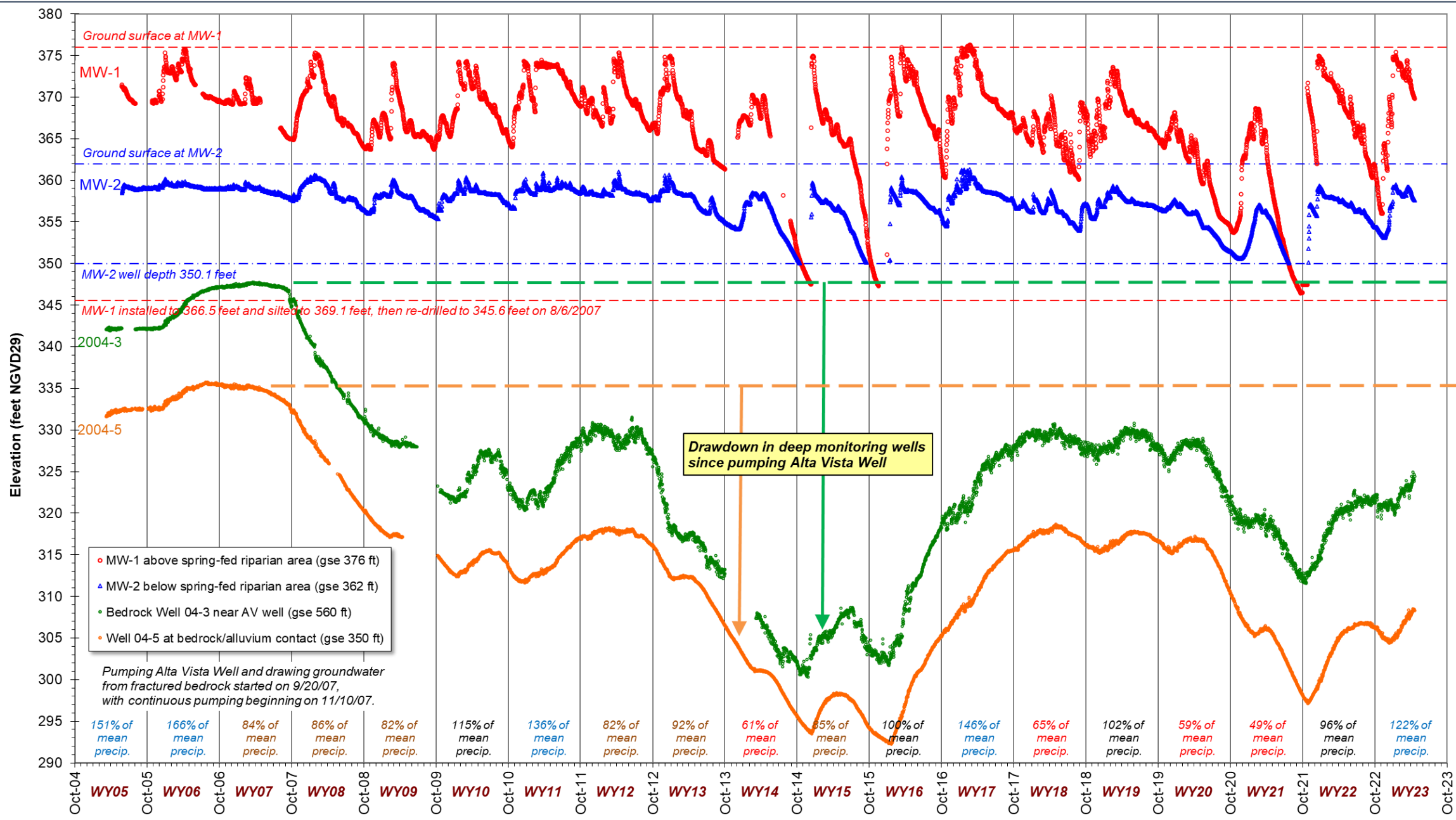


Pumping well 2004-4 (BH-9b)
 Aquifer type: Regional bedrock jointing
 Average pumping rate during test: 298 gpm
 Transmissivity: $T = 264Q/ds = (264)(298)/(75) = 1050 \text{ gpd/ft}$

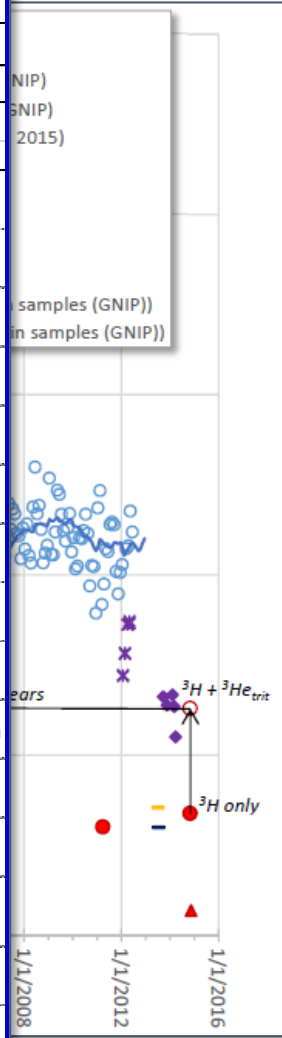
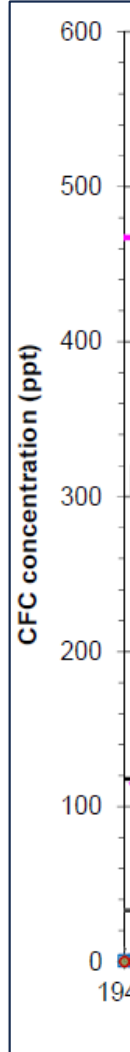
Observation well 2004-3 (BH-9)
 Aquifer type: Bedrock aquifer
 Distance from well 2004-4 = 390 ft
 Transmissivity: $T = 264Q/ds = (264)(298)/(8) = 9830 \text{ gpd/ft}$
 Coefficient of Storage: $S = 0.3Tt/t^2 = 0.3(9830)(0.024)/(390)^2 = 0.00047$

Observation well 2004-5 (BH-11)
 Aquifer type: bedrock jointing
 Distance from well 2004-4 = 870 ft
 Transmissivity: $T = 264Q/ds = (264)(298)/(3.8) = 20700 \text{ gpd/ft}$
 Coefficient of Storage: $S = 0.3Tt/t^2 = 0.3(20700)(1)/(870)^2 = 0.0082$





CONDITIONS					RESPONSES					INDICATORS					
Water Year	Rainfall at Alta Vista Gage			AV Well	Discharge at Stream Gages			Dry-Season Minimum ^[1]		Alta Vista Well Groundwater Age ^[2]					
	Water Type ^[3]	Annual Total (inches)	Percent of Mean	Volume Pumped (ac-ft)	Martini Cr (unimpaired) (ac-ft)	Daffodil Cyn (unimpaired) (ac-ft)	Montara Cr (impaired) (ac-ft)	MW-1 Elevation (ft NGVD29)	MW-2 Elevation (ft NGVD29)	Sample Date	Modern Water Recharge Year ^[4]	Modern Water Method	Pre-Modern Water Result (P/A)	Pre-Modern Water Methods	
2005	Wet	43.9	152%	0	678	not gaged	not gaged	369	359	--	--	--	--	--	
2006	Extremely Wet	48.5	168%	0	1116	not gaged	not gaged	369	359	--	--	--	--	--	
2007	Drought	Dry	24.5	85%	0	411	not gaged	not gaged	365	358	--	--	--	--	
2008		Dry	25.0	87%	87.5	361	not gaged	not gaged	364	356	--	--	--	--	
2009		Dry	23.8	83%	112	partial record	15	1	364	355	--	--	--	--	
2010	Above Average	33.6	117%	97.4	408	37	138	364	357	--	--	--	--	--	
2011	Wet	39.6	138%	99.2	partial record	127	325	367	358	3/28/11	Inconclusive but present	³ H- ³ He	Absent	Carbon-14 Radiogenic helium	
2012	Drought	Dry	24.0	83%	84.7	partial record	27	71	366	358	--	--	--	--	--
2013		Dry	26.8	93%	151	356	50	40	361	354	--	--	--	--	--
2014		Extremely Dry	17.6	61%	186	226	30	0	347	< 350 (well dry)	10/30/14	1991 ± 4 yrs	³ H- ³ He	Absent	Radiogenic helium
2015	Dry	24.7	86%	141	213	27	23	347	< 350 (well dry)	10/27/15	1966 to 1972	CFCs	Present	Carbon-14	
2016	Average	29.2	102%	113	410	57	151	360	354	10/20/16	1975 to 1989	CFCs	Absent	Carbon-14	
2017	Wet	42.5	148%	81.0	965	127	542	366	357	8/23/17	1975 to 1988	CFCs, SF ₆ , ³ H- ³ He	Absent	Carbon-14 Radiogenic helium	
2018	Extremely Dry	19.0	66%	99.1	352	30	77	360	354	--	--	--	--	--	
2019	Average	29.7	103%	86.5	479	66	92	364	356	--	--	--	--	--	
2020	Drought	Extremely Dry	17.1	59%	104	272	7.6	13	354	351	--	--	--	--	--
2021		Extremely Dry	14.2	49%	123	167	8.0	0.9	346	< 350 (well dry)	10/19/21	2011	³ H- ³ He	Absent	Carbon-14
2022	Average	27.8	97%	90.4	419	107	163	356	354	--	--	--	--	--	
2023	Wet	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	CFCs, SF ₆	pending	Carbon-14	
Mean	--	28.8	100%	110	513	52	134	--	--	--	--	--	--	--	



Qualitative Check

- ✓ Since start of pumping in 2007, the Alta Vista well has been pumped at an average (continuous) rate of 68 gpm or 110 acre-feet per year.
- ✓ Recharge area estimates

Average annual recharge	8	6	4	inches
Average annual groundwater pumping	110	110	110	acre-feet
Estimated recharge area needed	165	221	331	acres
Percent of 360-acre topographic watershed upstream of the well	46%	61%	92%	percent

The guidelines for the Honorable Harvest are not written down, or even consistently spoken of as a whole—they are reinforced in small acts of daily life. But if you were to list them, they might look something like this:

Geologic framework and monitoring across a cycle of wet and dry years

Know the ways of the ones who take care of you, so that you may take care of them.

Introduce yourself. Be accountable as the one who comes asking for life.

Ask permission before taking. Abide by the answer.

Never take the first. Never take the last.

Take only what you need.

Take only that which is given.

Never take more than half. Leave some for others.

Harvest in a way that minimizes harm.

Use it respectfully. Never waste what you have taken.

Share.

Give thanks for what you have been given.

Give a gift, in reciprocity for what you have taken.

Sustain the ones who sustain you and the earth will last forever.

ons

and a capacity for

Adaptive management

Master plan update

Recharge area estimate

CEQA compliance

Conservation programs

65th anniversary celebration



Thank You!

We believe this is a successful habitat-responsible adaptive-management approach to managing a complex fractured bedrock aquifer.

