

**CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD  
LAHONTAN REGION**

**MEETING OF JUNE 12, 2019  
BARSTOW**

**ITEM 9**

**STATUS REPORT ON CLEANUP ACTIVITIES CONCERNING CHROMIUM  
CONTAMINATION FROM PACIFIC GAS AND ELECTRIC COMPANY'S (PG&E'S)  
HINKLEY COMPRESSOR STATION**

**CHRONOLOGY**

Nov. 4, 2015	Cleanup and Abatement Order (CAO) No. R6V-2015-0068 directed PG&E, among other things, to continue remedial actions and to achieve cleanup of chromium in groundwater to 50 parts per billion (ppb) by Dec. 31, 2025 and to 10 ppb by Dec. 31, 2032. Annual remediation effectiveness reports are required to be submitted every February 28.
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**BACKGROUND**

This agenda item is the third annual summary of PG&E's remediation effectiveness and cleanup status since adoption of the 2015 CAO.

**ISSUES**

The Water Board will be given a report of remedial actions conducted for chromium contamination cleanup in Hinkley during 2018. PG&E will present proposed actions for 2019. PG&E asserts they are on track for meeting cleanup requirements of the CAO.

**DISCUSSION**

PG&E staff and the Hinkley Community independent consultant, Project Navigator will make presentations (Enclosures 1 and 2) updating the Board on these topics:

- Chromium plume status
- Remedial actions in 2018 and planned in 2019
- Domestic wells
- Technical Working Group meetings/Background Study actions
- Public outreach

Enclosure 3 is the executive summary from PG&E's 2018 Annual Report on cleanup status and remediation effectiveness, required by the CAO.

Water Board staff will provide an update on the following topics (Enclosure 4):

- Review of projects to continue progress for chromium actions
- Status of hexavalent chromium drinking water standard
- U.S. Geological Survey (USGS) Chromium Background Study update and mid-term report

Enclosure 5 is the April 2019 Status of Actions sheet created by Water Board staff which was distributed to the Hinkley community at the second quarterly community meeting on April 26, 2019.

#### **PUBLIC OUTREACH/INPUT**

The Water Board's quarterly Status of Action sheets are provided and discussed during quarterly Hinkley Community meetings. Water Board orders, letters, and requests for comments are uploaded to Geotracker and posted on the PG&E Hinkley Chromium Cleanup webpage on the Water Board's website. This item was distributed to the Hinkley interested persons email subscription list and posted to the Water Board's website.

#### **PRESENTERS**

Kevin Sullivan/Betsy Brunswick, PG&E  
Dr. Ian Webster, Project Navigator  
Lisa Dernbach and Anne Holden, Water Board

#### **RECOMMENDATION**

This is an information item only. The Water Board may provide direction to staff as appropriate.

<b>ENCLOSURE</b>	<b>ITEM</b>	<b>BATES NUMBER</b>
<b>1</b>	PG&E presentation	9 - 3
<b>2</b>	Community Advisory Committee presentation by Project Navigator	9 - 19
<b>3</b>	Executive Summary of PG&E's 2018 Cleanup Status and Effectiveness Report	9 - 35
<b>4</b>	Water Board staff presentation	9 - 43
<b>5</b>	April 2019 Status of Actions sheet	9 - 53

# **ENCLOSURE 1**



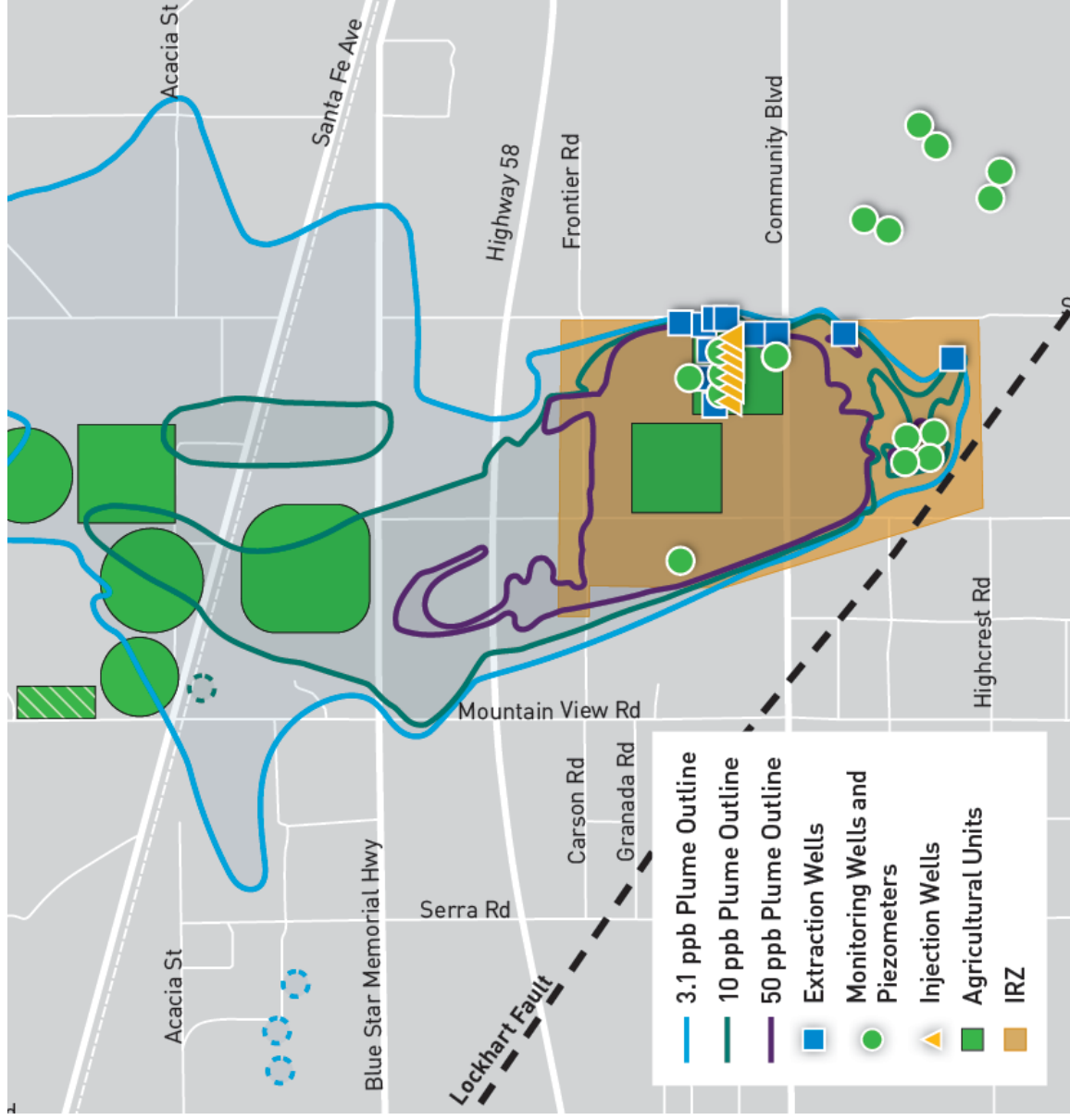


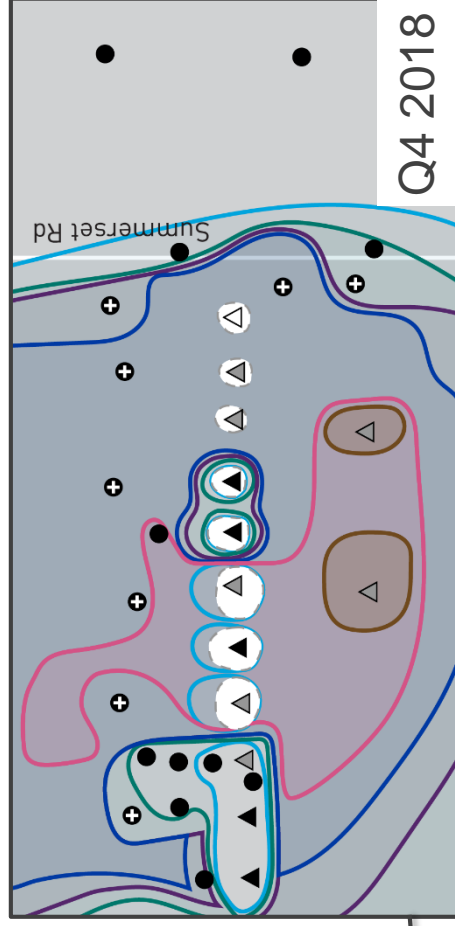
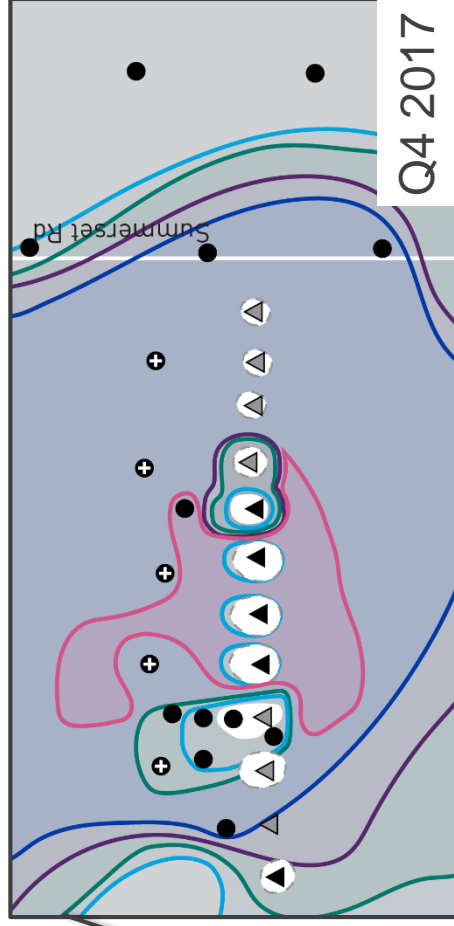
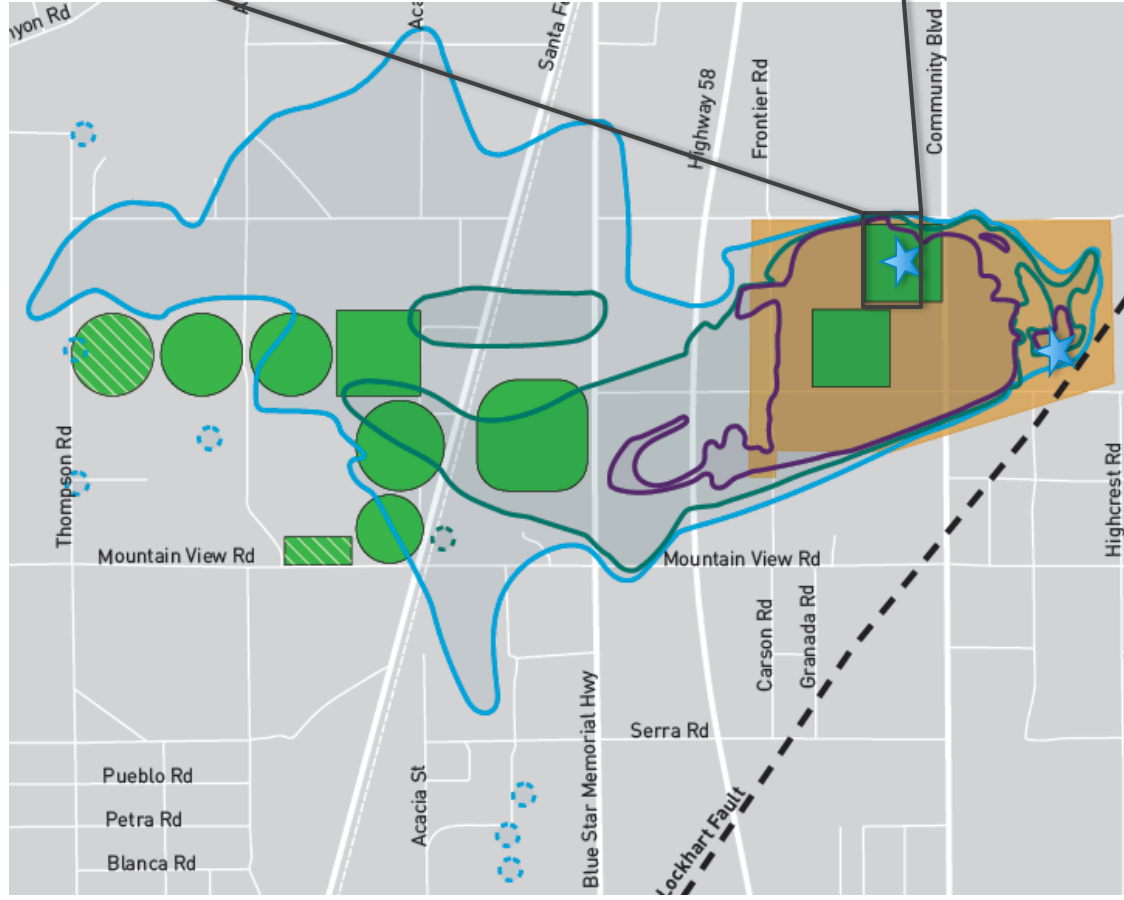
- 2018 Remedy Progress
- Impacts of Long Term Drought
- Progress on Chromium Treatment
- Look Ahead

**PG&E is committed to doing what's right for the Hinkley community, and we will be here until we finish the job.**

## Installed

12 extraction wells  
7 injection wells  
13 monitoring wells  
9 piezometers

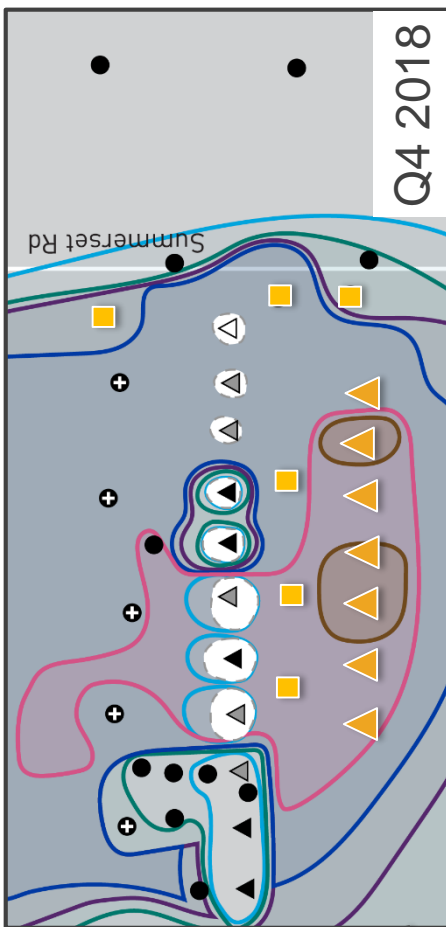
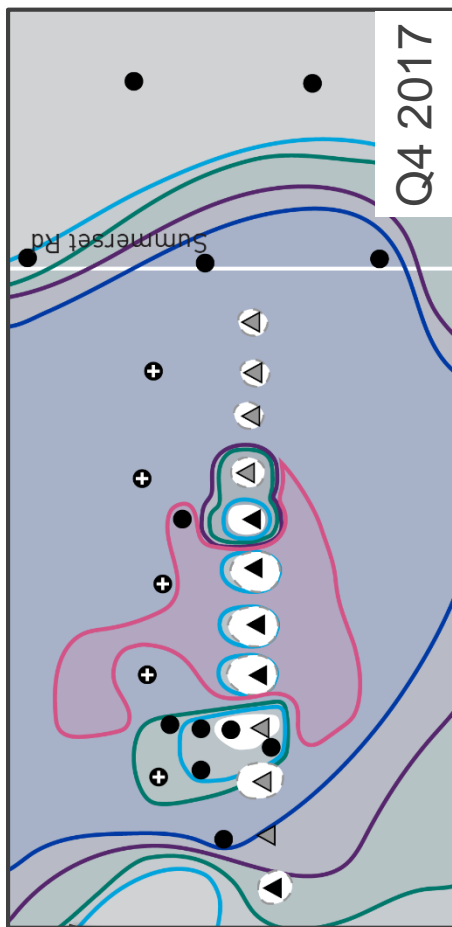
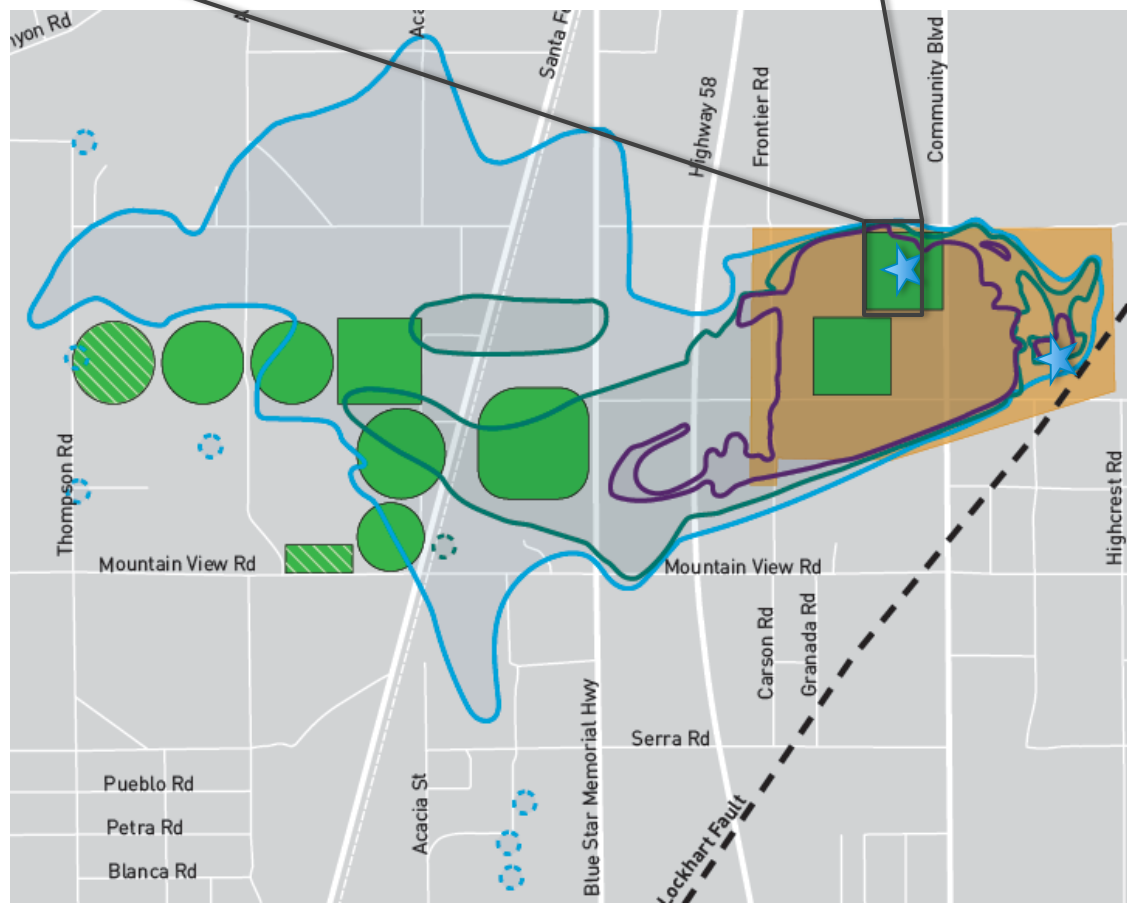




- 3.1 ppb Plume Outline
- 10 ppb Plume Outline
- 50 ppb Plume Outline
- 100 ppb Plume Outline
- 500 ppb Plume Outline
- 1000 ppb Plume Outline
- Agricultural Units
- IRZ

Identified areas of elevated Cr(VI) that are relatively difficult to treat

# 2018 Remedy Enhancements Target High Cr6 Areas



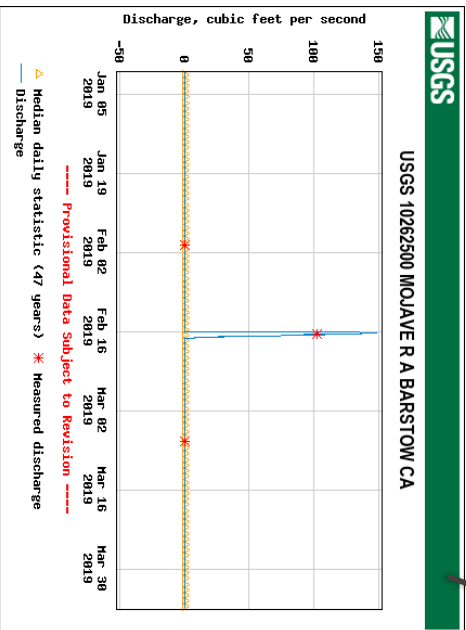
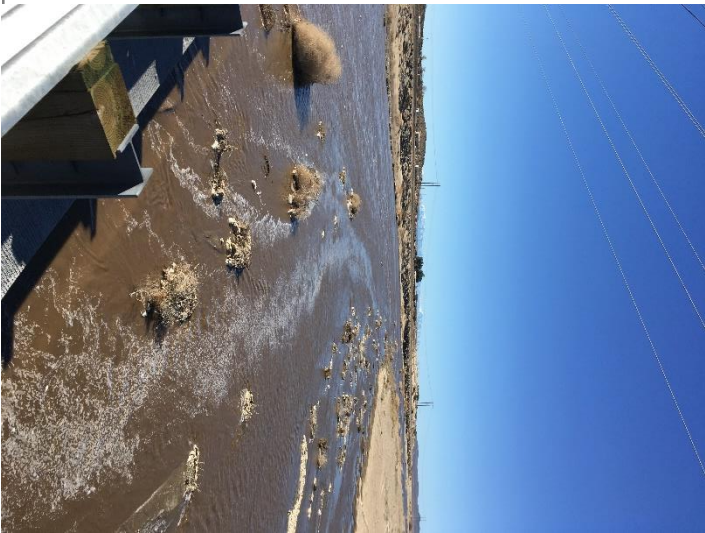
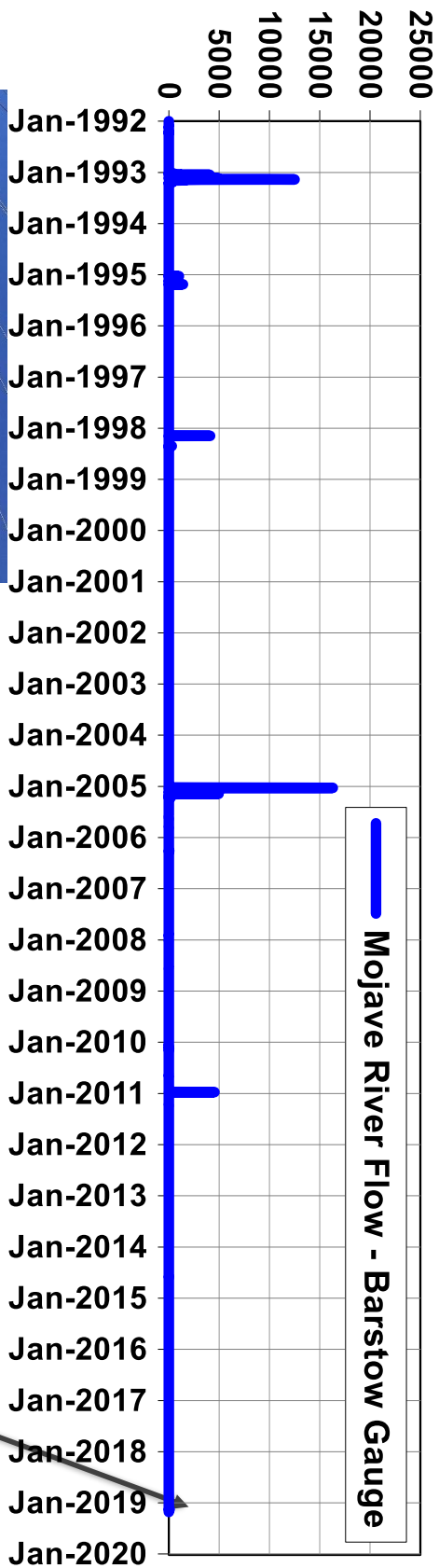
- New Extraction Well
- New Injection Well
- 500 ppb Plume Outline
- 1000 ppb Plume Outline
- Agricultural Units
- IRZ
- 3.1 ppb Plume Outline
- 10 ppb Plume Outline
- 50 ppb Plume Outline
- 100 ppb Plume Outline



# Aquifer is Recharged by Flow of Mojave



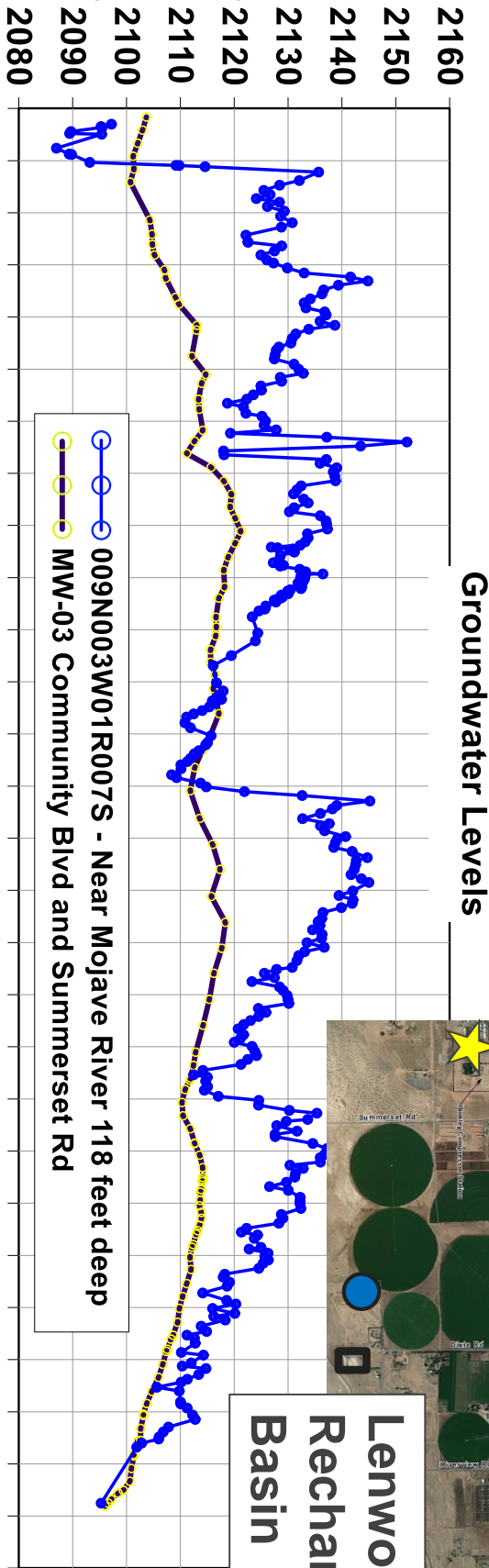
Mojave River Discharge  
(cubic feet per second)



River flowed in February,  
but was not a significant event

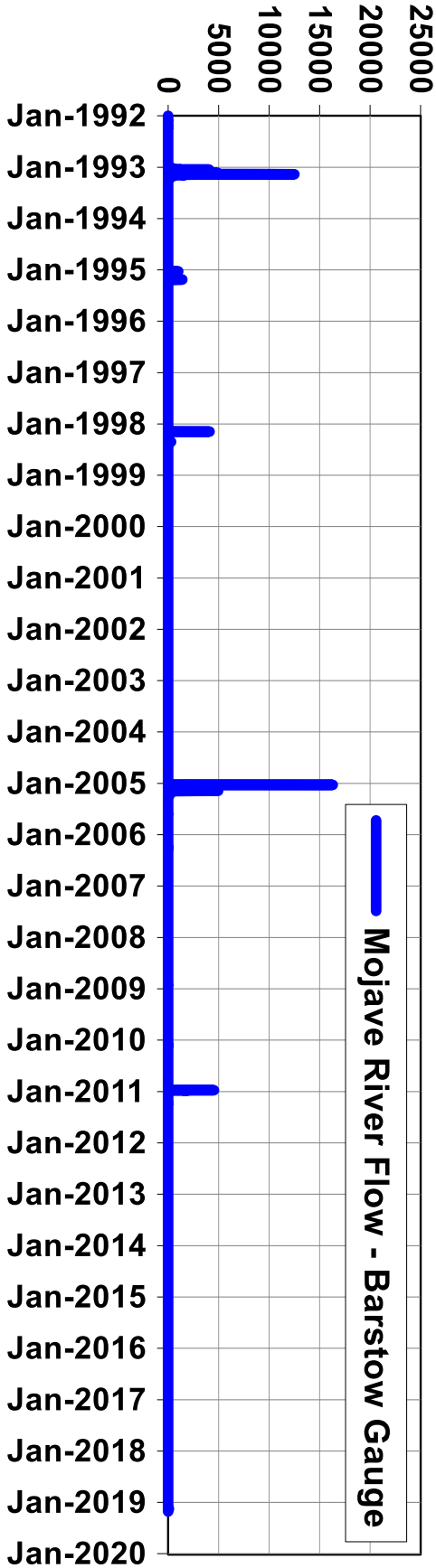
# Groundwater Levels Are Reaching Historical Lows

Groundwater Elevation  
(ft AMSL)



Lenwood  
Recharge  
Basin

Mojave River Discharge  
(cubic feet per second)









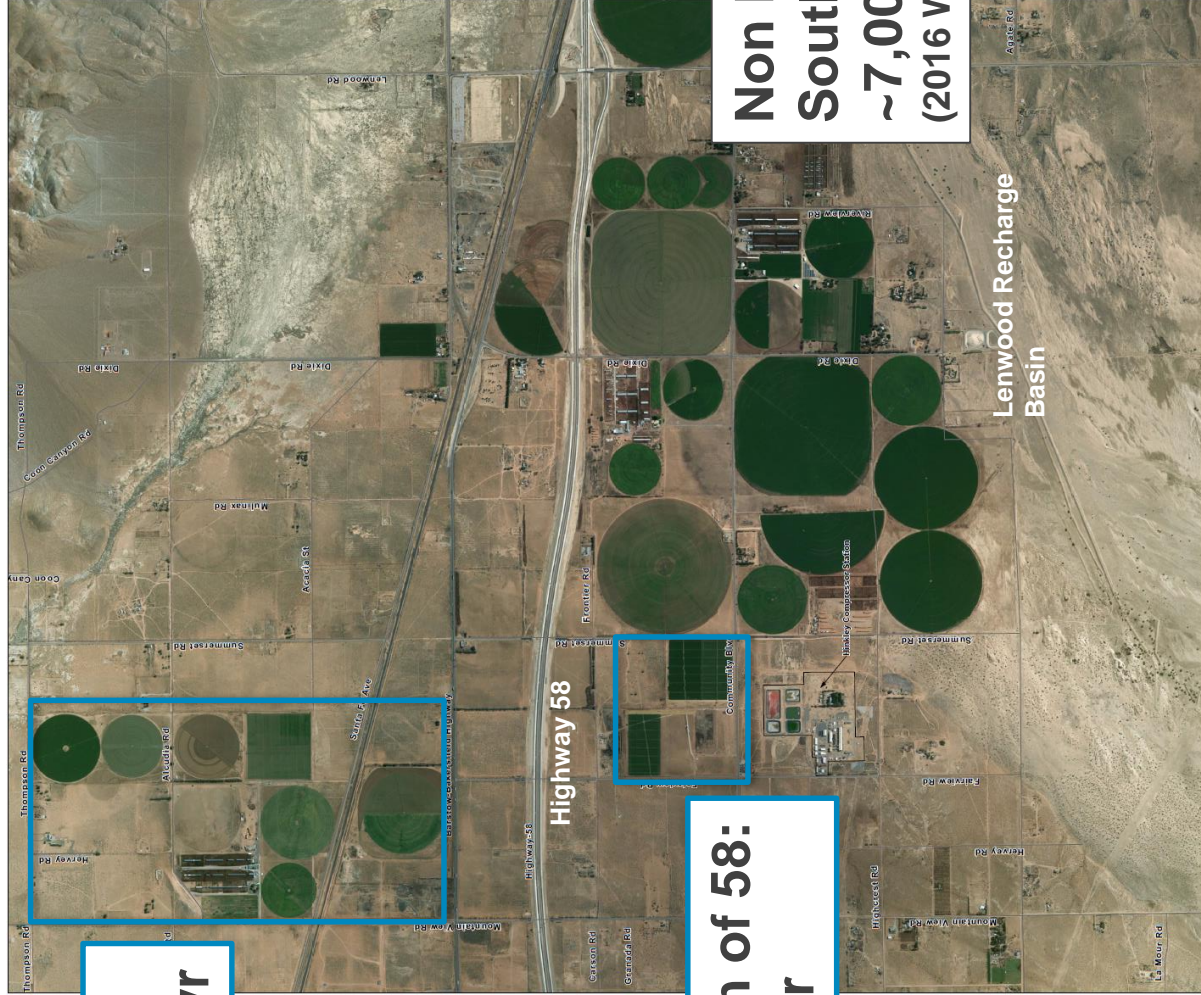
- Regional drought and declining water levels having multiple effects
- Water table has dropped more than 10 feet across plume area
- Reduced saturated thickness has required adjustments to remediation

## Dry Monitoring Wells



# Relative Water Use

**PGE North of  
58: 1420 ac-ft/yr**



**PGE South of 58:  
410 ac-ft/yr**

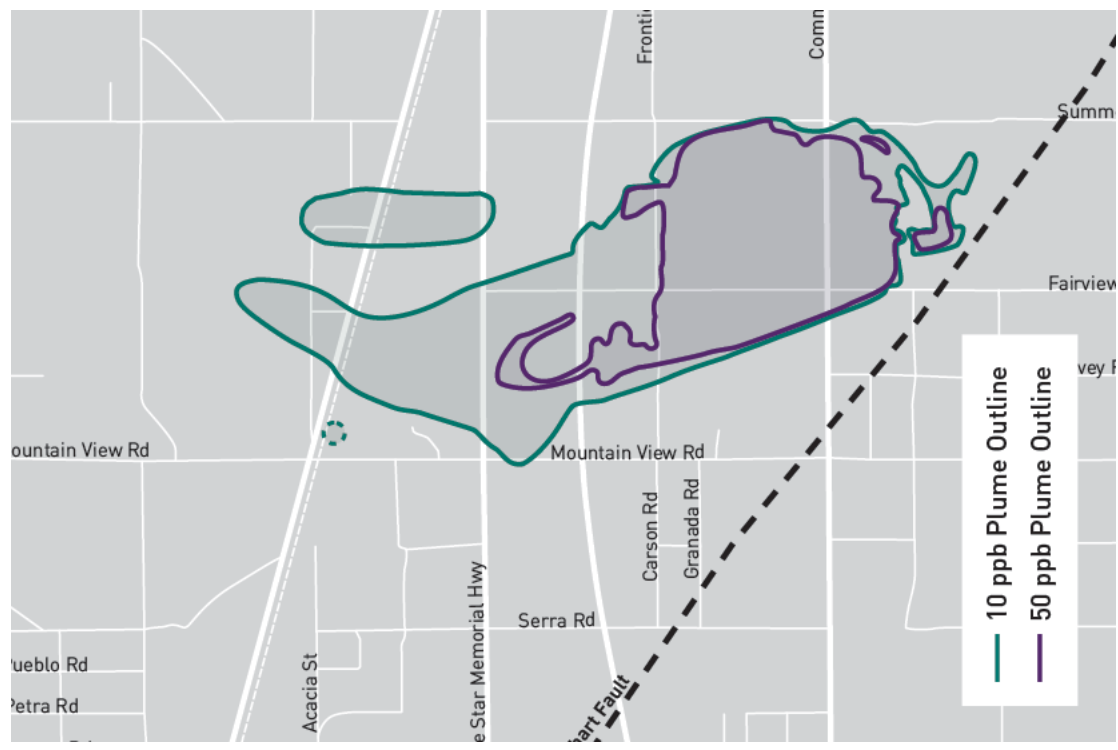
**Non PGE pumping  
South of 58:  
~7,000 ac-ft/yr  
(2016 Water Master Records)**

**Lenwood Recharge  
Basin**

## August 2014

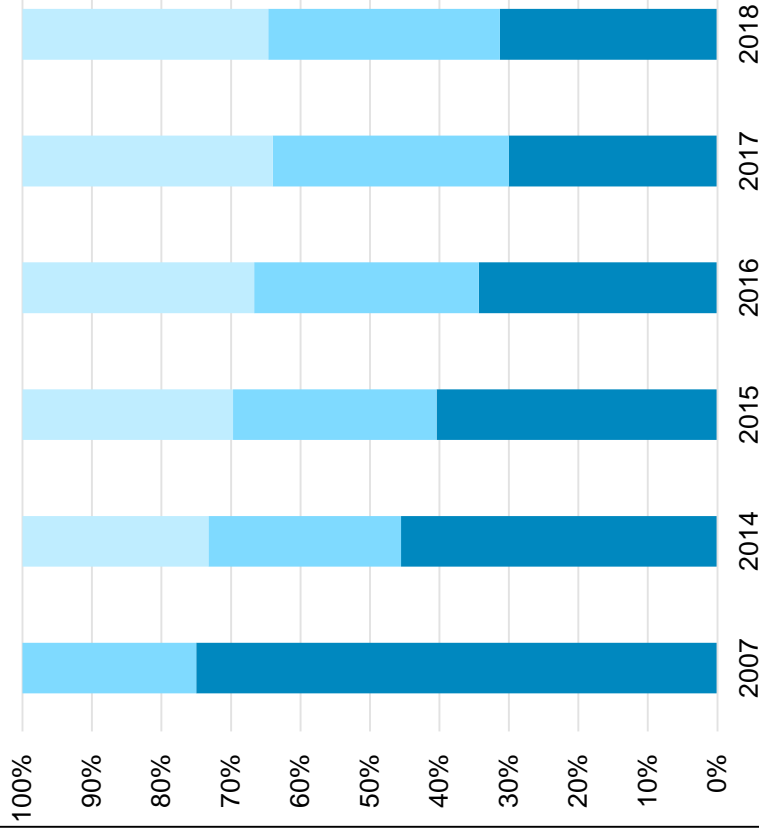


## Fourth Quarter 2018



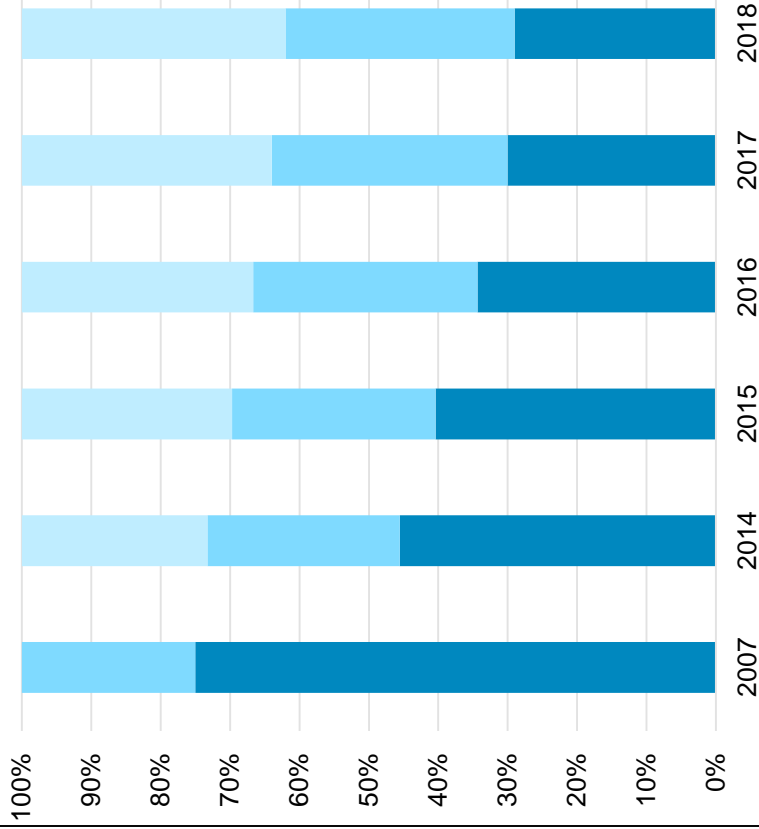
# Mass Removal from Groundwater Overtime

**Estimated Mass Removal from Groundwater**



- Estimated Cr(VI) Mass Removal from Groundwater by IRZs
- Estimated Cr(VI) Mass Removal from Groundwater by ATUs, Northwest Extraction, and Former Ranch & East LTUs
- Estimated Cr(VI) Mass Remaining in Groundwater

**Estimated Cr(VI) Mass Removal from Groundwater Adjusted Saturated Thickness Due to Drought**



- Estimated Cr(VI) Mass Removal from Groundwater by IRZs
- Estimated Cr(VI) Mass Removal from Groundwater by ATUs, Northwest Extraction, and Former Ranch & East LTUs
- Estimated Cr(VI) Mass Remaining in Groundwater

- PG&E continues its strong commitment to the community through local hiring, sustainable practices and community partnerships.
- Continued Implementation of the remedy in accordance with the CAO and EIR is protective of the community
- 2018 Updated model predictions regarding domestic well changes due to remediation:
  - No increase of chromium concentrations
  - No remedy byproducts
  - No drawdown of water levels
- All domestic well chromium results to remain below safe drinking water standards



## **ENCLOSURE 2**





# IRP Manager's Board Update

## Hinkley Community Outreach Program Regarding PG&E's Cr(VI) Groundwater Remediation Program

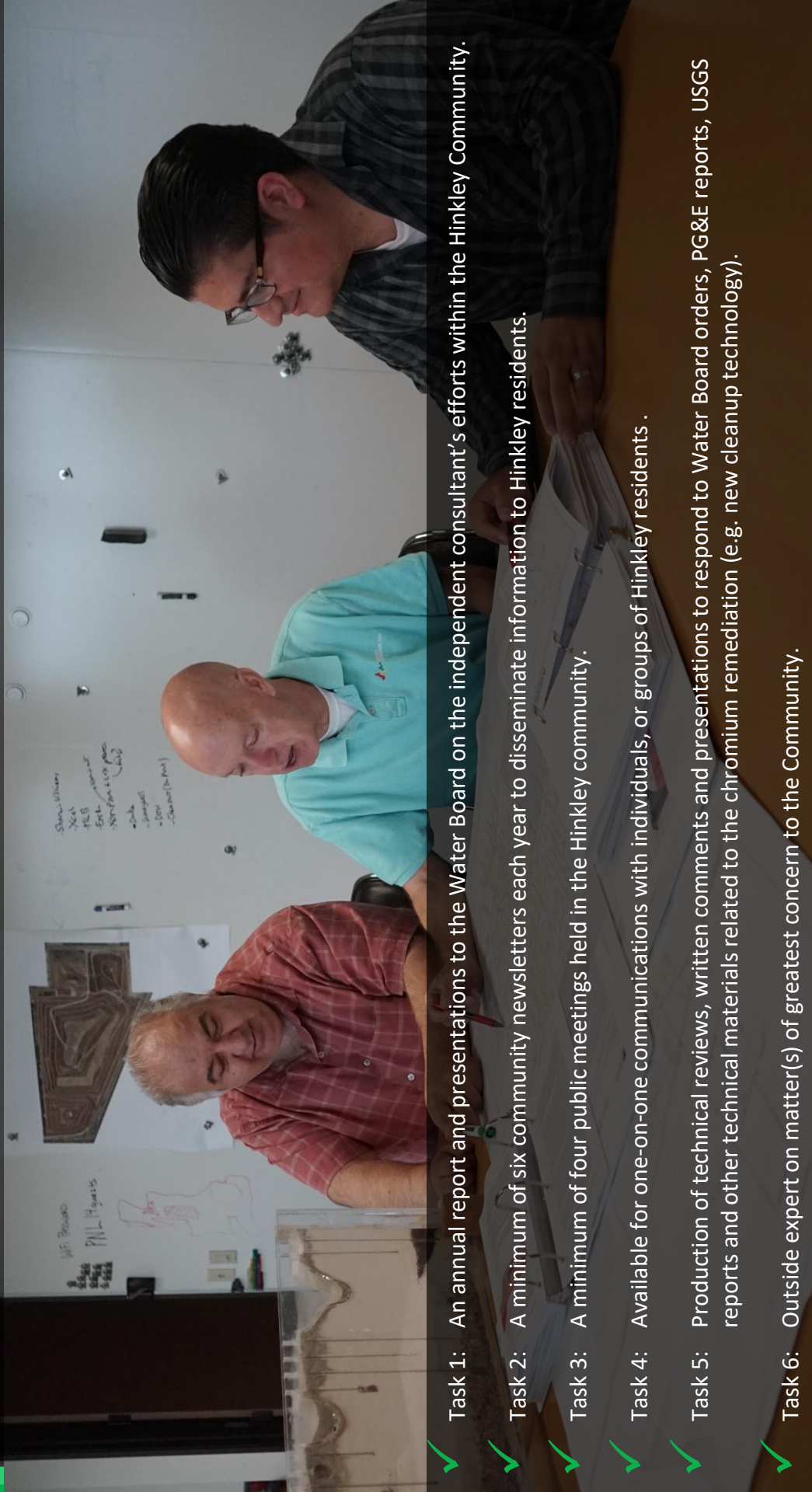
June 12, 2019  
Barstow, California

*Prepared for*  
Lahontan Regional Water Quality Control Board  
Board Members' Meeting

*Prepared by*  
Dr. Ian A. Webster, as IRP Manager  
Dr. Raudel Sanchez,  
Dr. Halil I. Kavak  
Mr. Anthony L. Vu  
Mrs. Annie M. Cwieka  
Margaret DeAngelis



# What?: The IRP Manager is Tasked to Provide Independent Technical Advisory Services to the Hinkley Community per CAO No.R6V-2015-0068, Section VIII.B. (November 4, 2015).



- ✓ Task 1: An annual report and presentations to the Water Board on the independent consultant's efforts within the Hinkley Community.
- ✓ Task 2: A minimum of six community newsletters each year to disseminate information to Hinkley residents.
- ✓ Task 3: A minimum of four public meetings held in the Hinkley community.
- ✓ Task 4: Available for one-on-one communications with individuals, or groups of Hinkley residents .
- ✓ Task 5: Production of technical reviews, written comments and presentations to respond to Water Board orders, PG&E reports, USGS reports and other technical materials related to the chromium remediation (e.g. new cleanup technology).
- ✓ Task 6: Outside expert on matter(s) of greatest concern to the Community.

# How: As IRP, We Perform Outreach in Three Ways.

## 1. Relationships

- Reputation for delivering fact-based information
- One on Ones with timely follow-up
- Relationships built over our tenure
- Accurate media reporting and outreach
- Persistence and Attitude

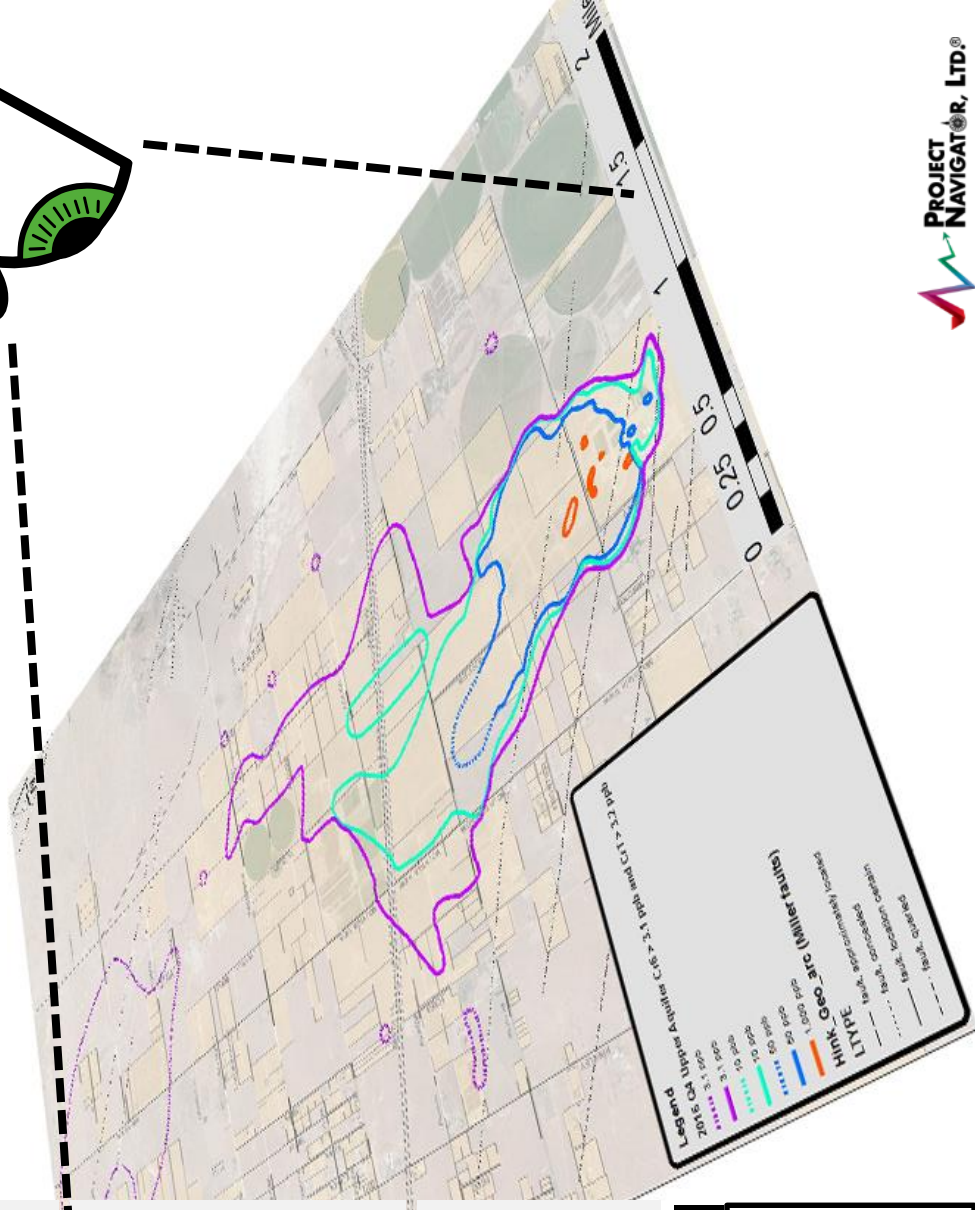
## 2. Technical

- Third party data review, analysis and feedback
- Translating complex science and data into understandable visuals
- Photo reports, visual descriptions
- Newsletters
- Website
- Project Knowledge
- TWG Participation (re BGGs)

## 3. Physical

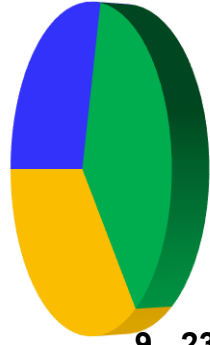
- Meetings –Be Visible
- Community Sponsored Events
- IRP Office – Backroom/Models
- Use of a Local, Community PM
- Field Trips

The IRP Manager's Team  
interfaces with Community  
Stakeholders in 3 Ways

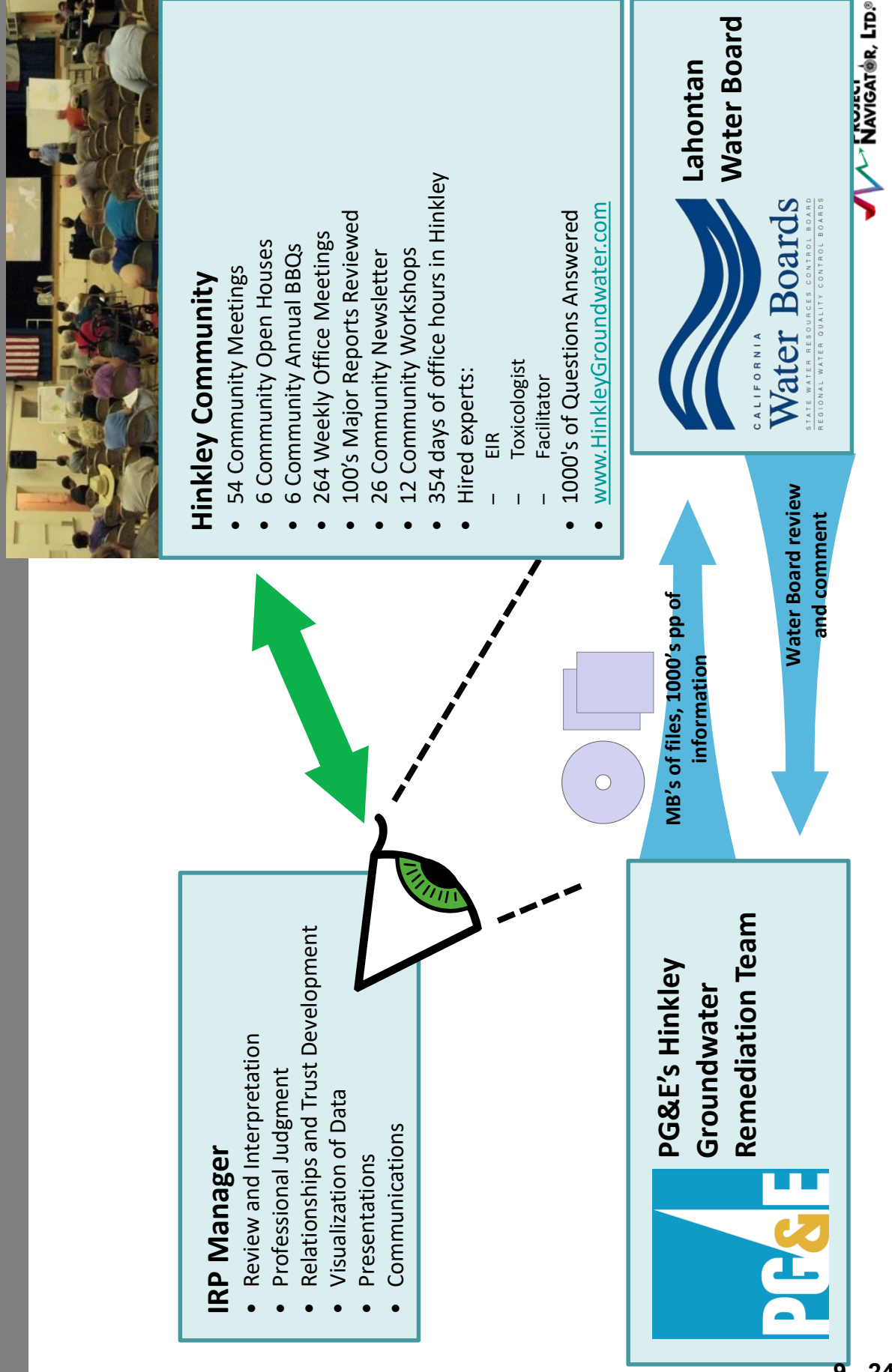


Our Efforts are Equally Distributed

Relationships  
Technical  
Physical



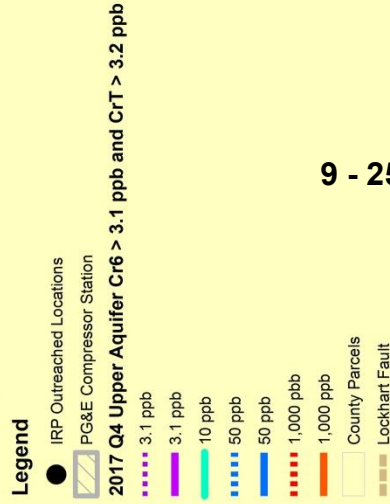
# How: Our Efforts to Date: Some Metrics.





# Where: The IRP Manager Team Has Provided Technical Outreach to the Hinkley Community for the Over Seven Years.

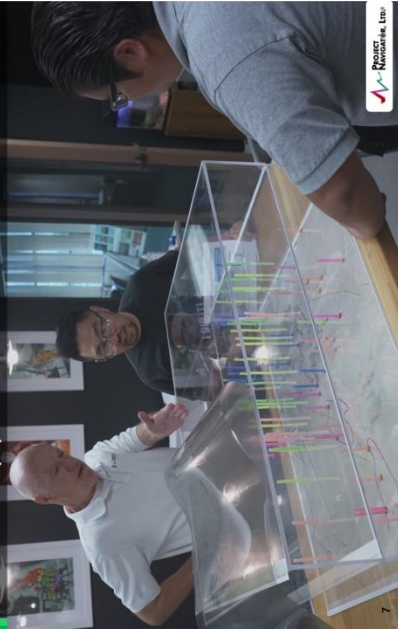
IRP Manager Team has  
Provided Technical  
Outreach at over 100  
Hinkley Residences





# Here are 6 Ways We're Performing Technical Outreach, Building Understanding...and Thereby Trust.

**1. The Use of Hardtop Models.**  
The IRP Manager Team Created an Easy-To-Understand Model of the Cr(VI) Plume



**2. High Touch Interactions with Interested Community Members.**  
Depicted: Informal Q&A About the USGS Background Study Before the July 26, 2018 Community Meeting.



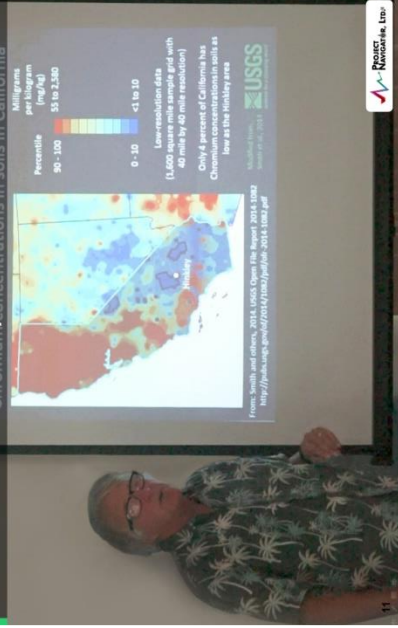
**3. Mid-Year Workshop on USGS Background Study and PG&E's Remediation Program at the IRP Manager's Office on June 22, 2018.**



**4. Community Newsletters Are Issued 6 Times a Year.**



**5. The IRP Manager Filmed USGS's Dr. John Izbicki Presenting an Update on the Cr(VI) USGS Background Study. His Presentation is Available online at [www.HinkleyGroundwater.com](http://www.HinkleyGroundwater.com)**

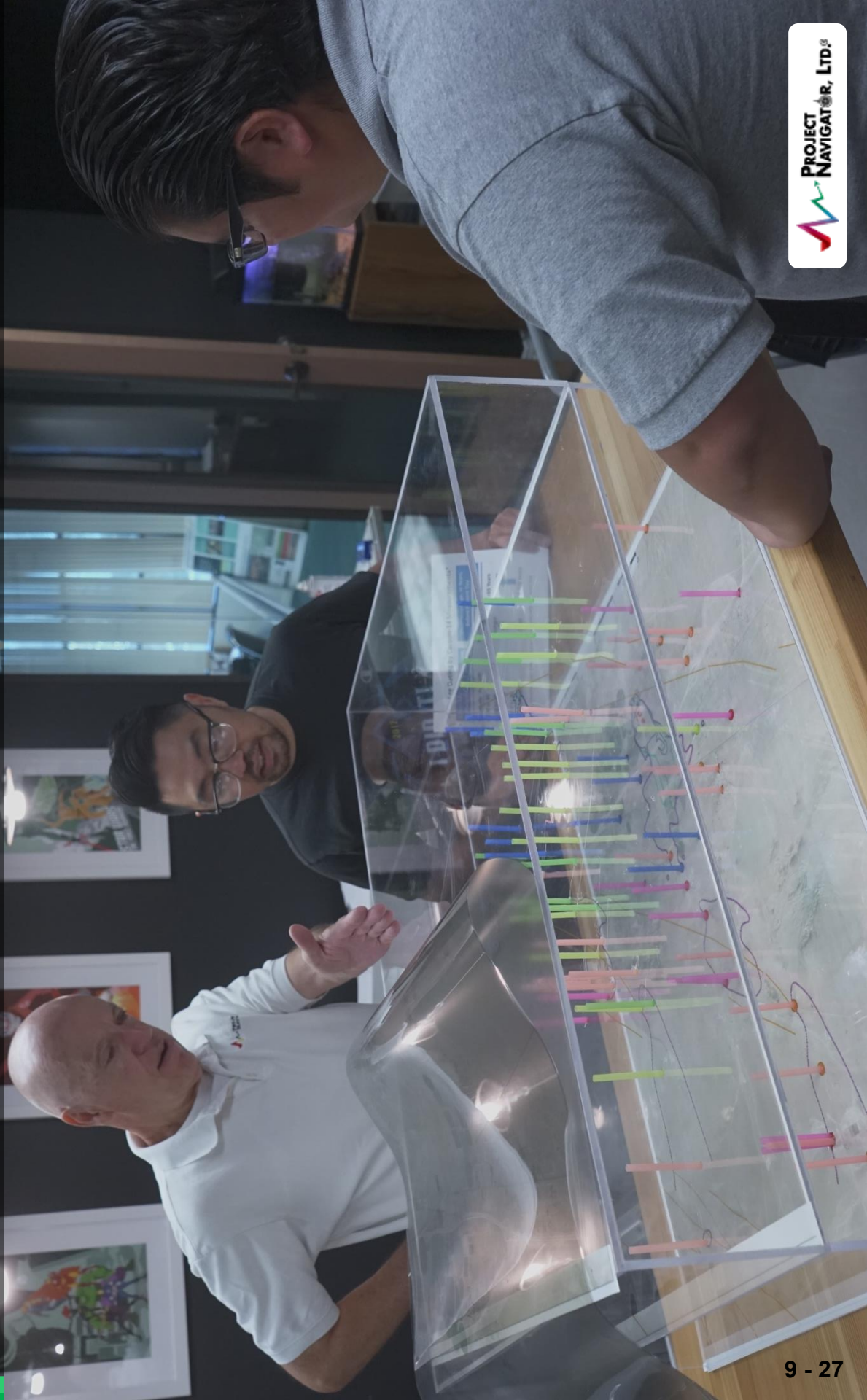


**6. Vivid Illustrations are used to Explain Complex Technical Topics in the FAQs Section of the Newsletter.**





# 1. The Use of Hardtop Models. The IRP Manager Team Created an Easy-To-Understand Model of the Cr(VI) Plume.





## 2. High Touch Interactions with Interested Community Members. Depicted: Informal Q&A About the USGS Background Study Before the July 26, 2018 Community Meeting.



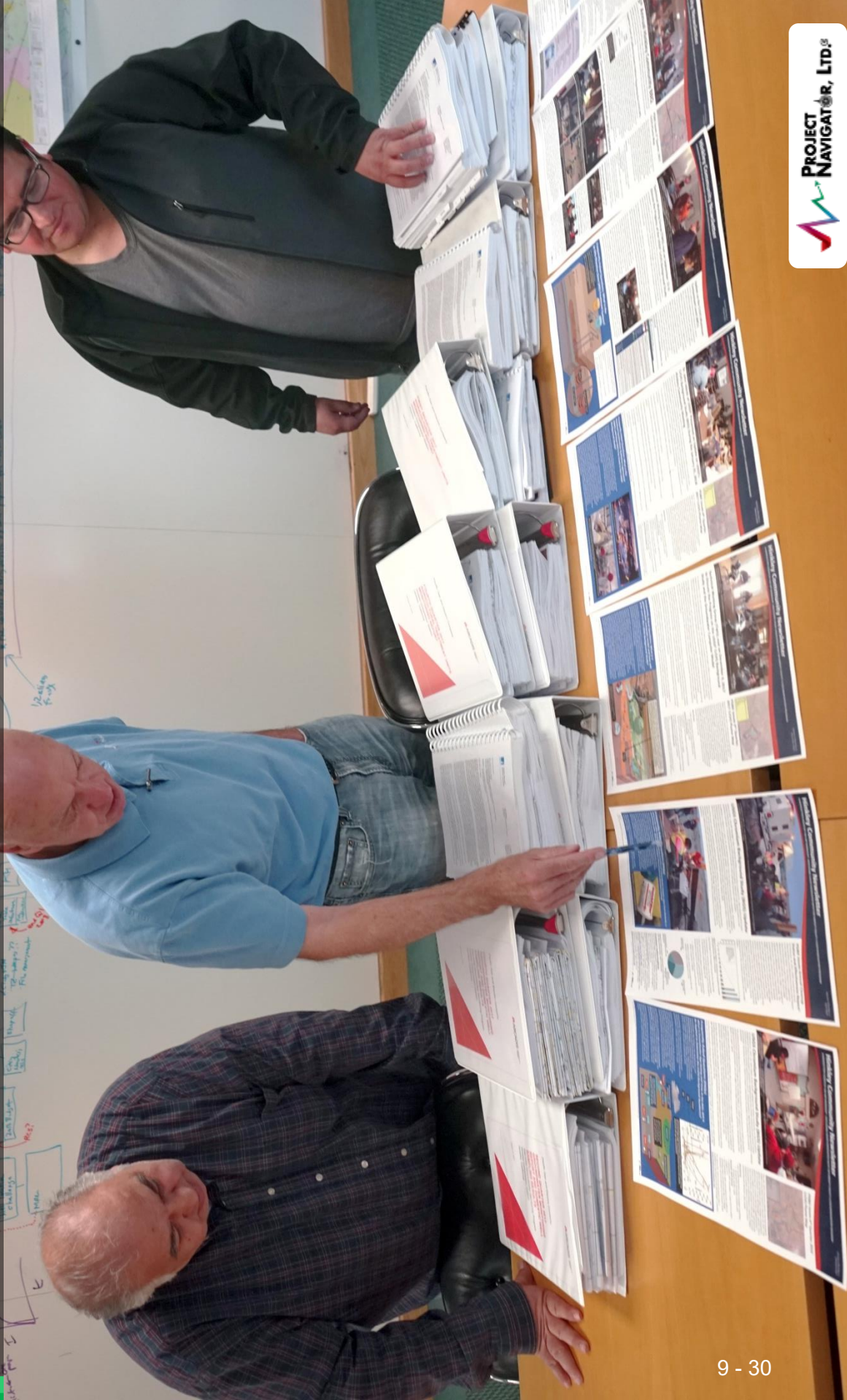


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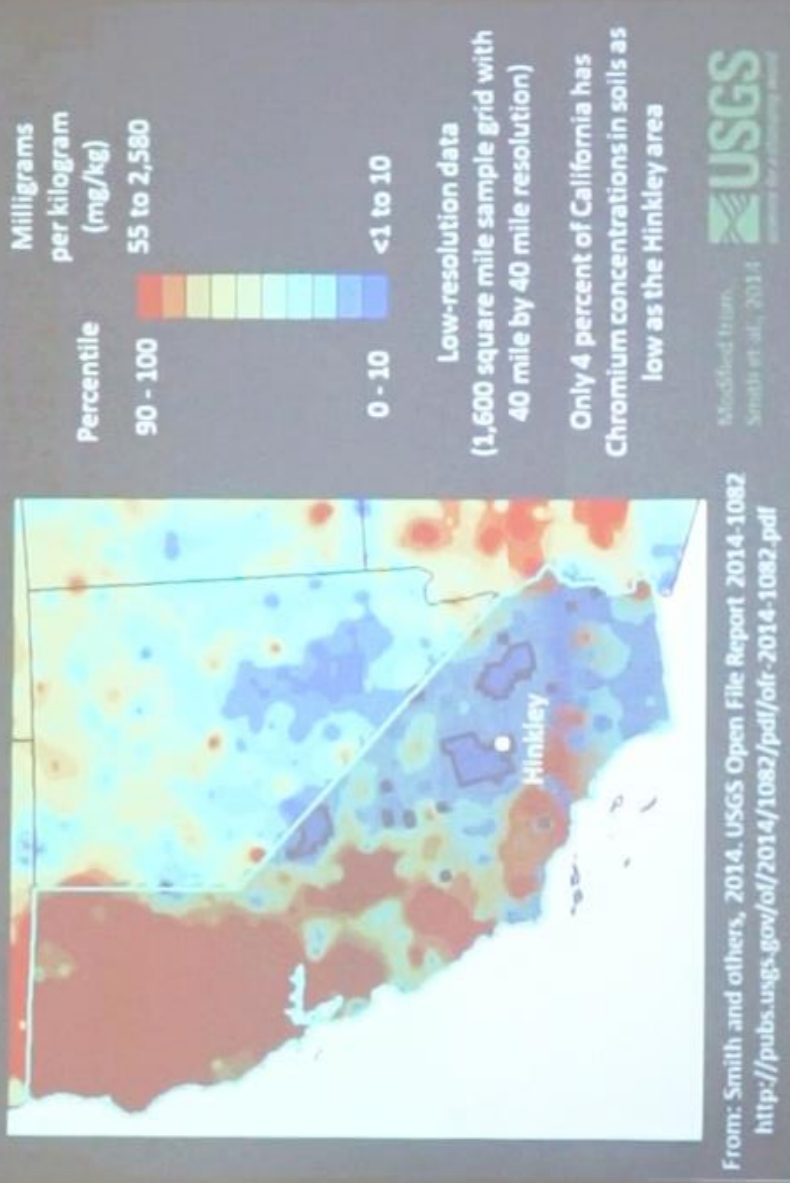


## 4. Community Newsletters Are Issued 6 Times a Year to all Hinkley Residents.



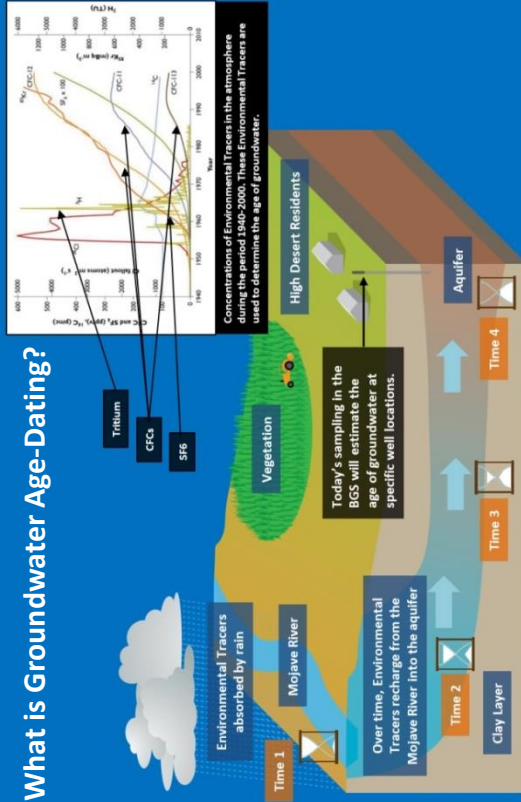


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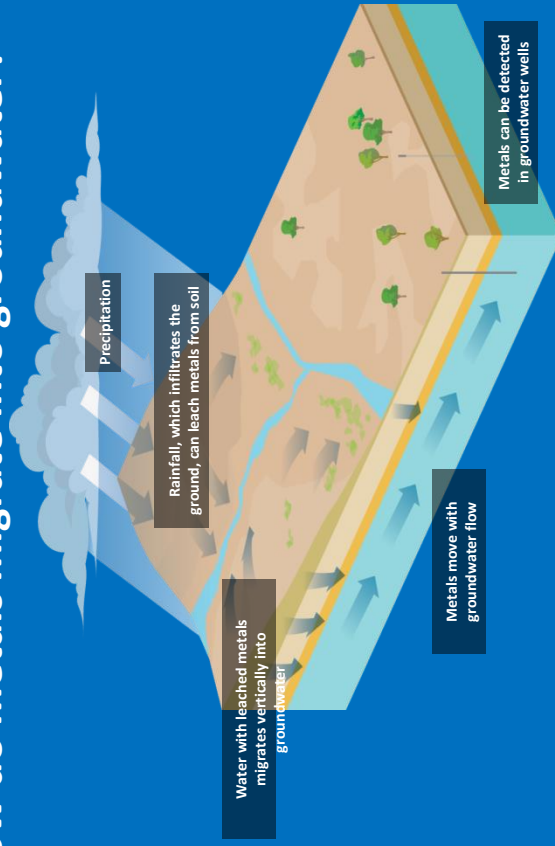


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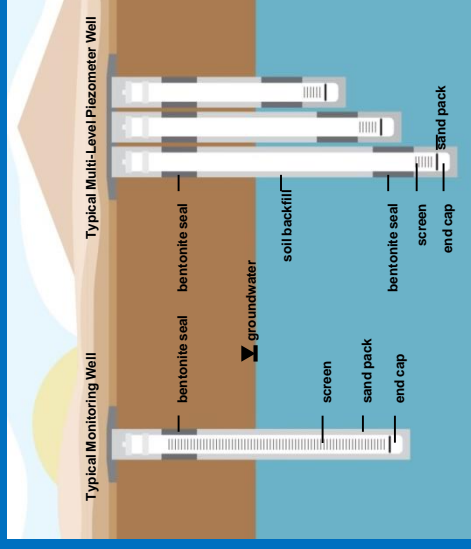
# What is Groundwater Age-Dating?



## How do metals migrate into groundwater?



## “What is a Piezometer? How does a Piezometer differ from a Monitoring Well?”



## What is the Summative Scale Analysis and How Will this Method be Used in the USGS Background Study?

1. Collect groundwater samples at specific locations



2. Samples taken for complete analysis



3. Interpretation of all background data by the USGS



4. Use Summative Scale questionnaire to score each well

Questions	+1	-1
Note: make "Neutral" available		
1. Are geologic materials at the well even the ground?	✓	
2. Do geologic materials at the well appear abundant?	✓	
3. Do geologic materials at the well appear moderate?		
4. Do geologic materials at the well appear scarce?		
5. Has water from the well been used for irrigation?		
6. Has water from the well been used for other purposes?		
7. Has water from the well been used for drinking?		

5. Sum up the score for each well and identify the source of Cr(VI)

	SSA Final Score
Well 1	✓
Well 2	✓
Well 3	✓
Well 4	✓
Well 5	✓
Well 6	✓

6. Compare Summative Scale Analysis (SSA) to Computer Groundwater Model (CGM)



7. Update plume boundaries based on results from SSA



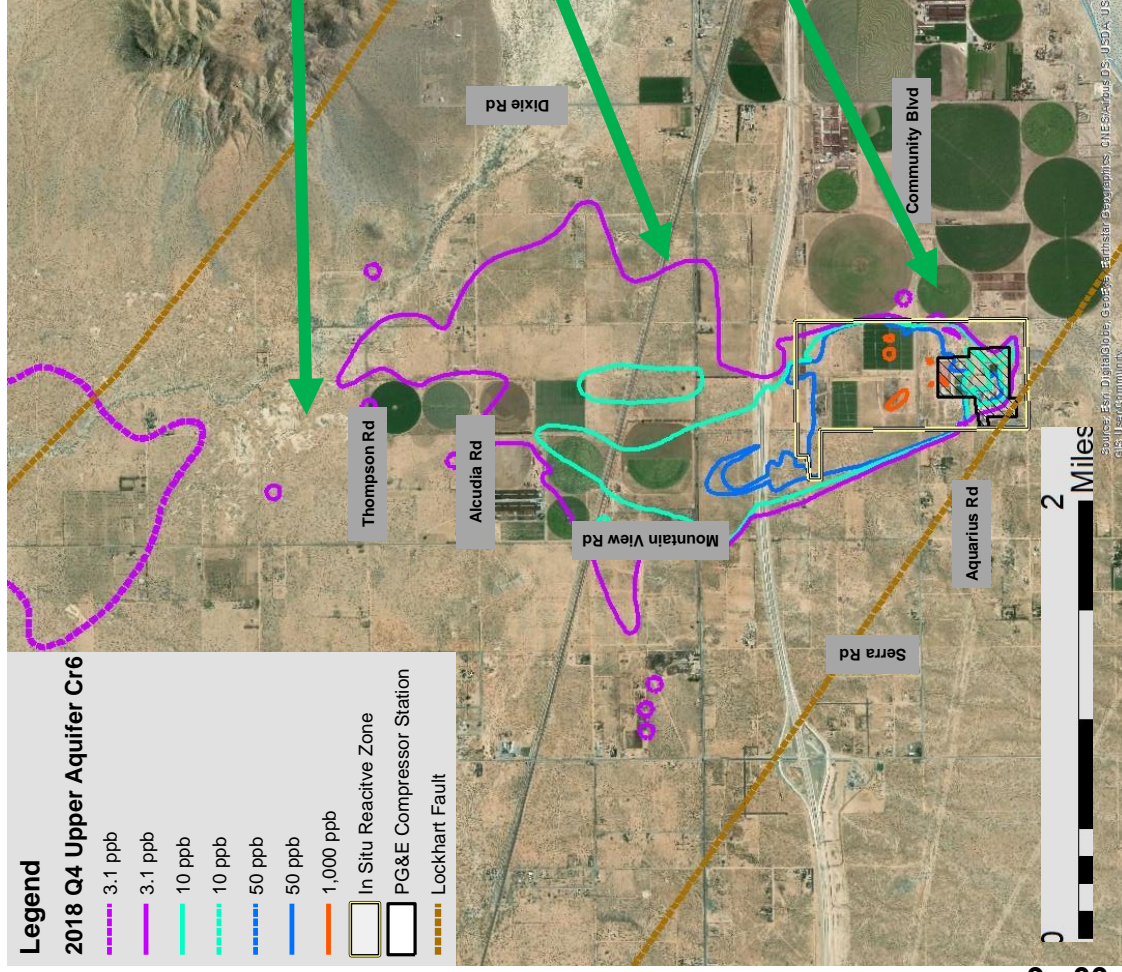
8. Use wells identified as naturally occurring Cr(VI) from the SSA to update Cr(VI) background number





# Current Messaging...

## ...4<sup>th</sup> Quarter 2018 Plume Map.



### Key Take-Aways

- All domestic wells are below 10ppb
- Hydraulic Capture continues at Thompson Rd
- Plume is *generally* stable and continues to *shrink in most areas*
- Continuing assessment in southwest area to understand increasing Cr(VI) trends

# Grand Conclusions:

- IRP activities are in compliance with Water Board Order.
- Community Members are actively interested in the technical understanding of the Cr(VI) Remediation Process, and USGS's Background Study.
- The Background Study (BGS) Technical Working Group (including Community Members) meets and provides input to USGS... helps ensure a ***transparent, and trustworthy*** study process.

■ [www.HinkleyGroundwater.com](http://www.HinkleyGroundwater.com)

## **ENCLOSURE 3**





Pacific Gas and Electric Company

# **ANNUAL CLEANUP STATUS AND EFFECTIVENESS REPORT (JANUARY TO DECEMBER 2018)**

Hinkley Compressor Station  
Hinkley California

Cleanup and Abatement Order  
No. R6V-2015-0068

February 28, 2019

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## Executive Summary

This Annual Cleanup Status and Effectiveness Report (January to December 2018) (report) evaluates the effectiveness of remedy components (including hydraulic containment, agricultural operations, and in situ treatment) that have been implemented at the Pacific Gas and Electric Company (PG&E) Hinkley Compressor Station (the site) to date towards reaching remedial targets specified in the Cleanup and Abatement Order No. R6V-2015-0068, issued on November 4, 2015 (2015 CAO; California Regional Water Quality Control Board, Lahontan Region [Water Board] 2015). The report also recommends improvements for remedy performance and includes the operational plan for 2019. Exhibit ES-1, below, summarizes key construction activities, effectiveness evaluations, and recommendations for improvements from observations made between January and December 2018.

The 2015 CAO established cleanup requirements for the site, including the following cleanup timeframes for the southern plume:

- Reach and maintain 50 parts per billion (ppb) hexavalent chromium (Cr[VI]) and total chromium (Cr[T]) in 90% of the 50 ppb Cr(VI) plume as of the date of the 2015 CAO by December 31, 2025, as determined by a specified set of monitoring wells.
- Reach and maintain 10 ppb Cr(VI) and Cr(T) in 80% of the 10 ppb Cr(VI) plume as of the date of the 2015 CAO by December 31, 2032, as determined by a specified set of monitoring wells.

In 2014, a Remedial Timeframe Assessment (RTA; Arcadis U.S., Inc. [Arcadis] 2014) was conducted that estimated remedial timeframes based on a preliminary design of remedial infrastructure and a preliminary plan of construction sequencing and operations. The estimated timeframes from the RTA informed the cleanup timelines adopted in the 2015 CAO, although the exact deadlines in the 2015 CAO are sooner than the range of estimates from the RTA. Since the RTA was conducted, PG&E has implemented investigation in areas of planned remedial infrastructure to design remedial actions, constructed additional remedial system wells, and continued to operate and optimize the existing remedial systems, including the Agricultural Treatment Units (ATUs) and In Situ Reactive Zone (IRZ) systems. The information gathered through implementation of these activities is used to inform and refine plans for future remedy infrastructure and operations, employing an adaptive management approach.

In 2018, significant progress was made towards remedy implementation, with a focus on remediation of higher Cr(VI) concentration areas across the plume. The 2018 remedy enhancements included 12 extraction wells, seven injection wells, 13 monitoring wells, and nine piezometers across the site. The RTA did not account for expansions or construction in 2018; however, the remedy expansion plans recommended in the 2017 Annual Cleanup Status and Effectiveness Report (Arcadis 2018) were implemented in 2018 with a few modifications and several additions. As part of the adaptive management approach, proactive investigations were completed across the plume. Results from these investigations identified areas with concentrations of Cr(VI) greater than originally estimated or considered in the RTA, including areas of elevated Cr(VI) concentrations that appear relatively difficult to treat in the deep zone of the Upper Aquifer (e.g., the Deep South Central Reinjection Area [SCRIA] East). Remedy enhancements were implemented in 2018 and additional infrastructure is planned in 2019 to further target areas containing high chromium concentrations.

The possibility of the existence of additional areas of high Cr(VI) concentrations was recognized to affect the validity of the model predictions in the RTA, as stated in Section 5 of the RTA on modeling uncertainty, “the influences of aquifer heterogeneities on plume behavior, mass removal, reagent delivery and IRZ performance cannot be described or predicted prior to remedy implementation, and cannot be fully

## ANNUAL CLEANUP STATUS AND EFFECTIVENESS REPORT (JANUARY TO DECEMBER 2018)

predicted with the solute transport model. In addition, the model cannot fully describe the heterogeneity in the Cr(VI) distribution and areas where there may be more mass loaded into tighter lithologies or the immobile pore space or areas which may not be in communication with the rest of the aquifer. Such areas may be more difficult to treat or may show rebound after treatment and require additional remediation" (Arcadis 2014). PG&E is making a concerted effort to address these difficult-to-treat areas with the installation of additional infrastructure, but the potential that some of these areas will lag the modeling predictions is not surprising and was recognized at the time of the RTA.

Throughout 2018, hydraulic control was maintained through adaptive management. In the northern portion of the southern plume (northern ATUs), hydraulic control was maintained and capture was further enhanced with the construction of an additional extraction well. In the southern plume area (southern ATUs), hydraulic control was maintained and capture was enhanced by bringing six extraction wells online along the eastern plume boundary, although declining groundwater levels due to drought conditions presented challenges that required adaptive management actions to improve hydraulic control.

Prevalent drought conditions continue to be present in the Mojave Desert where groundwater is the primary source of water for domestic, municipal, and agricultural use. The Hinkley Valley aquifer is almost entirely replenished by intermittent Mojave River flows, which require very large storm events for the river to flow sufficiently to result in groundwater recharge. Recharge to the Hinkley Valley aquifer from intermittent Mojave River flows is supplemented with imported water sourced from northern California that is applied to the Lenwood recharge basin. However, due to the lack of Mojave River flows (last flow events occurred in 2005 and 2011) and limited Lenwood recharge basin imports in recent years, groundwater levels in the Hinkley Valley and greater area have generally shown a steady decline since 2011. Currently, groundwater levels are approaching historic low levels.

These continued declining water levels in the region resulted in unplanned remedial infrastructure design and construction to monitor groundwater levels and improve concentration trends in the east and southeast southern plume core. Increasing Cr(VI) concentration trends at the plume edge in the southeast were observed related to changing conditions associated with the drought. PG&E responded rapidly to the observed trends by installing eight new (six operational in 2018; two more will be operational in the first half of 2019) extraction wells, adding an estimated 350 gallons per minute of additional extraction capacity along the east side of the southern plume boundary in 2018. PG&E also installed eight piezometers to better understand the changing groundwater gradients. Monitoring results for wells in areas where new extraction wells became operational during 2018 show improvements in chromium concentrations.

Estimates of mass removed from groundwater continue to be updated. In 2018, the estimates for mass removal from groundwater by in situ remediation and mass remaining in groundwater were complicated by the decreasing water levels due to the drought, resulting in less certainty in the estimates. Despite uncertainty, estimates of mass removed from groundwater demonstrate continued, steady mass removal is occurring. Since 1992, groundwater extraction and ATU operations have removed an estimated 2,392 pounds of Cr(VI) from groundwater in the Upper Aquifer. During that time, approximately 262 tons of nitrate also present in groundwater from pre-existing land use activities were also removed from groundwater. A significant amount of Cr(VI) has also been removed from groundwater (an estimated 2,533 to 2,737 pounds) by IRZ operation to date. However, given the uncertainty in mass removal estimates as saturated thickness declines due to the drought and the incorporation of high-concentration data delineated by new wells, the estimated portion of mass remaining in groundwater is roughly equivalent to 2017. Regardless, the mass removal evaluation continues to indicate that twice as much chromium has been removed from groundwater than remains to be treated. The majority of the mass



## ANNUAL CLEANUP STATUS AND EFFECTIVENESS REPORT (JANUARY TO DECEMBER 2018)

removed by the agricultural treatment systems to date was achieved by operation of the historical Land Treatment Units in the plume core. Since 2007, the IRZs have accounted for most of the mass removed.

The changes to sampling frequencies under 2015 CAO requirements I.C and I.D in 2019 included reduced sampling frequency in 29 wells and increased sampling frequency in 21 wells. During 2018, remedial systems were generally operated according to the 84 monthly goals set forth in the 2018 operational plan (Arcadis 2018), with two very minor exceptions, one that was 1 gallon per minute below plan in the freshwater injection system in April 2018, and one month due to construction within the Community East ATU. These minor exceptions did not impact system performance. Data collected to date indicate improved treatment from optimized operations of remedial systems, with positive trends toward remedial goals exhibited in many areas. In some cases, data evaluations indicated areas where treatment is not performing as anticipated. These areas were identified for remedy enhancements and investigations were conducted to inform remediation infrastructure enhancements to improve treatment. Initial results indicate improvements have been observed following the remedy enhancements. Plans for continuing these improvements in 2019 are presented in this report.

# ANNUAL CLEANUP STATUS AND EFFECTIVENESS REPORT (JANUARY TO DECEMBER 2018)

## Exhibit ES-1 2018 Remedy Summary

Remedial System/ Area	Were Plans for 2018 Construction Implemented? <sup>1</sup>	Additional Construction Activities <sup>2</sup>	System Effectiveness	Changes Recommended for 2019
Hydraulic Containment North	Yes	Yes <ul style="list-style-type: none"> <li>• 1 additional extraction well</li> </ul>	Effective <ul style="list-style-type: none"> <li>• Successful containment</li> <li>• Significant plume contraction continued</li> <li>• Western operations optimized</li> </ul>	No
Hydraulic Containment South	Yes	Yes <ul style="list-style-type: none"> <li>• 2 extraction wells south of Community Boulevard in the Southeastern Source Area</li> <li>• 6 extraction wells East of Community East ATU</li> </ul>	Effective <ul style="list-style-type: none"> <li>• Hydraulic control of plume was maintained under changing drought conditions with the addition of 6 new extraction wells.</li> <li>• Supplemental infrastructure to ensure hydraulic control as drought continues</li> </ul>	Yes <ul style="list-style-type: none"> <li>• Operation of new extraction wells</li> </ul>
Lower Aquifer	Not applicable	Not applicable	Effective <ul style="list-style-type: none"> <li>• Remedy will take time due to complexity of geologic conditions</li> </ul>	No
Central Area IRZ	Not applicable	Not Applicable	Effective, with recommendations <ul style="list-style-type: none"> <li>• Eastern and central portions progressing</li> <li>• Existing infrastructure does not effectively target the far western extent of the IRZ</li> </ul>	Yes <ul style="list-style-type: none"> <li>• Expand the remedial system to the west following Habitat Conservation Plan (HCP) approval and Incidental Take Permit (ITP) issuance</li> </ul>
SCRIA IRZ	Yes	Yes <ul style="list-style-type: none"> <li>• 7 injection wells and 3 extraction wells were installed in the Deep SCRIA East</li> <li>• 1 monitoring well to evaluate the western extent of Cr(VI)</li> </ul>	Effective, with recommendations <ul style="list-style-type: none"> <li>• Improvement in areas of new operations</li> <li>• Investigations identified area with elevated Cr(VI) in the Deep SCRIA East and further west than previously estimated</li> </ul>	Yes <ul style="list-style-type: none"> <li>• Operate the newly installed Deep SCRIA East IRZ remedial wells</li> <li>• Expand to the west after approval of the HCP and receipt of ITP</li> </ul>
Source Area IRZ	Yes	Not applicable	Effective, with recommendations <ul style="list-style-type: none"> <li>• Continued Cr(VI) concentration declines in highest concentration areas</li> <li>• Investigation defined one area in southwest for remedy improvement</li> </ul>	Yes <ul style="list-style-type: none"> <li>• Develop strategy to address elevated Cr(VI) concentrations in southwestern Compressor Station Area</li> </ul>

### Notes:

<sup>1</sup> 2018 construction plan as presented in Arcadis 2018.

<sup>2</sup> Construction activities in addition to those in Arcadis 2014 Remedial Timeframe Assessment (Arcadis 2014).



## **ENCLOSURE 4**





**ITEM 9**

**Status Report on  
Activities Concerning Chromium  
Contamination,  
PG&E Hinkley Compressor Station**

Lahontan Water Board Meeting  
June 12, 2019  
Barstow, CA

**Lisa Dernbach, PG, CEG, CHG**  
Senior Engineering Geologist (Specialist)

**Anne Holden, PG**  
Engineering Geologist



## Outline

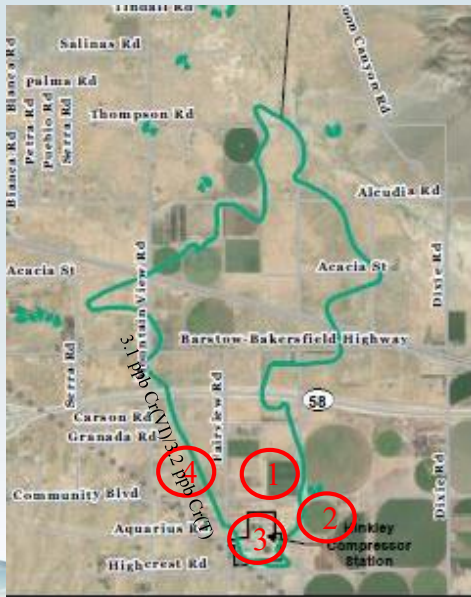
During 2018:

1. Review of projects to continue chromium corrective actions
2. Status of Cr(VI) drinking water standard development
3. USGS Background Study update



## Additional Investigations

- 1) North of Compressor Station (SCRIA)
- 2) East of Compressor Station
- 3) Source Area
- 4) Western In-situ Remedial Zone (IRZ)



## Additional Remediations

Extraction and/or injection wells

- 1) Northernmost ATU
- 2) North of Compressor Station (SCRIA)
- 3) Source Area

## Reduced Extraction in Western Area

- 4) Ceased actions west of freshwater injection wells



## Review Sampling Frequency of Monitoring Programs

1. January 2018: Annual Sampling Frequency Evaluation (2015 CAO). Change in 64 (14%) of 450 wells
2. 2017 Bioreactor Pilot Study Post-Test Sampling program (implemented in 2018). Continue monitoring where orthophosphate is >0.1 per million



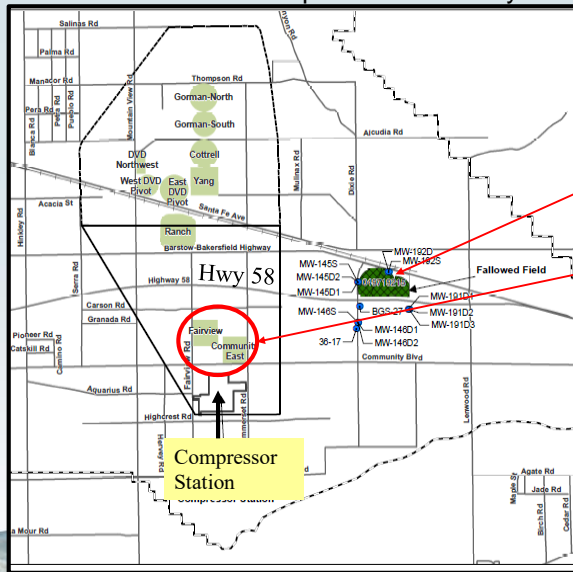
## Establish Baselines in ATU Areas and Evaluate Potential Impacts from the Project

**Board Order No. R6V-2014-0023 requires that "the Discharger shall propose a statistical method to determine if uranium (U) concentrations are increasing in a statistically significant manner due to remedial irrigation."**

- February 2018: Accepted proposal to define background U concentrations and a statistical method to evaluate U trends in soil (Mann-Kendall test)
- November 2018: Conditional acceptance to continue monitoring to define U background and request for additional information



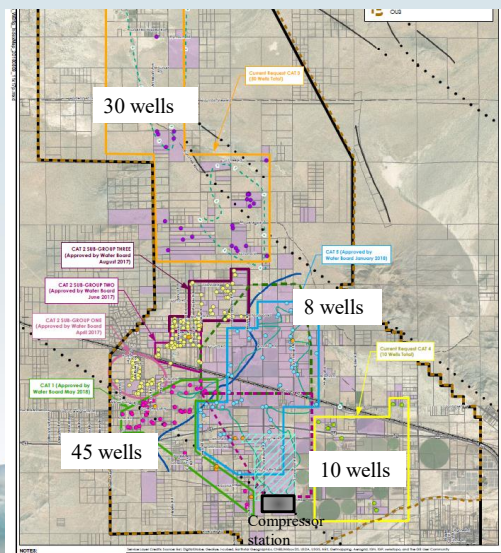
### Location of Farm Swap Fields in Hinkley



### Proposals for Mitigation of Potential Nitrate/TDS Byproducts from ATU Operations:

- 1) "Farm Swap"— follow a field used to discharge dairy waste water for credit towards managing potential byproducts from PG&E's Community and Fairview ATUs. Includes a monitoring program
- 2) LEPA Proposal — reimburse farmers for converting to more efficient irrigation systems that reduce water use and potential byproducts creation by 10 percent

### Management of Inactive Supply Wells on PG&E Properties



Accepted two PG&E proposals in 2018 for well destruction:

Destroyed 93 single aquifer wells (mostly domestic and some agricultural) that are sited across Hinkley



## Status of Cr(VI) Drinking Water Standard

**July 2014**  
California Cr(VI)  
MCL of 10 ppb

**May 31, 2017**  
Judge invalidates  
California's Cr(VI)  
MCL of 10 ppb

**2018-20**  
New California  
Cr(VI) MCL in  
development (Div.  
of Drinking Water)



## Status Update

### U.S. Geological Survey Chromium Background Study

**Anne Holden, PG**  
Engineering Geologist, Lahontan Water Board  
Background Study Contract Manager  
[anne.holden@waterboards.ca.gov](mailto:anne.holden@waterboards.ca.gov)



# Purpose of Background Study

- Evaluate extent of anthropogenic hexavalent chromium (Cr[VI]) released from the PG&E compressor station
- Estimate background Cr(VI) concentrations in the upper aquifer of study area (Hinkley and Water Valleys)
- Investigate potential for trivalent chromium (Cr[III]) to re-convert back to Cr(VI) after in-situ treatment is completed

Prepared in cooperation with the Lathrop Regional Water Quality Control Board

### A Plan for Study of Natural and Man-Made Hexavalent Chromium, Cr(VI), in Groundwater near a Mapped Plume, Hinkley, California

By John A. Ibbicki and Krishnangi Groover

The Pacific Northwest Corridor (PNC) is the Western Division's only facility east of Los Angeles, in which a continuous stream of gas as it is transported through a pipeline from Texas to California. Between 1972 and 1984, cooling water used at the compressor station was treated with a compound containing chromium to prevent corrosion. After cooling, the wastewater was discharged to adjacent ponds, resulting in contamination of soil and groundwater in the vicinity of the facility by the United States Geological Survey (USGS).

Since 1986, cooling water treatment practices have been used that do not contribute chromium to groundwater.

In 2007, a PNC study of the natural background concentrations of hexavalent chromium (Cr(VI)), in groundwater near the facility, with 1:2 correspondence per line (e.g., with 95 percent upper confidence limit of 1:1 and 95 percent lower confidence limit of 1:1 and 95 percent lower confidence limit of 1:1) was adopted by the Lathrop Regional Water Quality Control Board (LRWQCB) as the maximum background concentration used to map the plume extent. In response to criticism of the study's methodology,

and an increase in the mapped extent of the plume between 2008 and 2011, the Lathrop RWQCB, Lathrop Regional Water Quality Control Board, 2012) agreed that the 2007 PNC background concentrations study be repeated.

The purpose of this updated background study is to evaluate the presence of natural and man-made Cr(VI) near Hinkley, Calif. The study compares natural and man-made Cr(VI) concentrations in the aquifer upgradient and downgradient from the compressor station and near the mapped plume. The study was developed by the U.S. Geological Survey (USGS) in collaboration with a technical working group (TWG) composed of community

members, the Independent Review Panel (IRP) Manager (Project Manager), and consultants for PNC.

The scope of the study includes eight tasks and publication of four reports (Table 1, shown on page 12). The project is available at <http://water.usgs.gov/projects/hinkley/> as well as the study describing the study is available at <http://water.usgs.gov/projects/hinkley/background-study/>.

The study was approved by the Lathrop Regional Water Quality Control Board in January 2015. Field data collection began in March 2015; the study is scheduled to be completed in December 2018.

USGS  
12100 Rockwell Avenue  
Golden, CO 80601  
703.648.7200  
703.648.7200  
703.648.7200

Page 10 of 10  
January 2016  
USGS

USGS Study Fact Sheet, Jan 2016

- USGS Study Fact Sheet, Jan 2016



# History of Revised Background Study

**Jan. 2013:**  
Technical Working Group (TWG) formed. Meetings are open to public.

**June 2013:**  
Develop and execute contract to retain USGS's Dr. Izbicki to develop formal study proposal.

**Oct. 2013 and Jan. 2014:**  
Dr. Izbicki presents study proposal to Hinkley community and Water Board at public meetings. Strong support for proposal is expressed.

**Jan. 2014 to Jan. 2015:**  
Water Board and USGS staff develop contract to implement proposal; contract processing through State Water Board.



## Draft Final Report Status

### Good Progress...

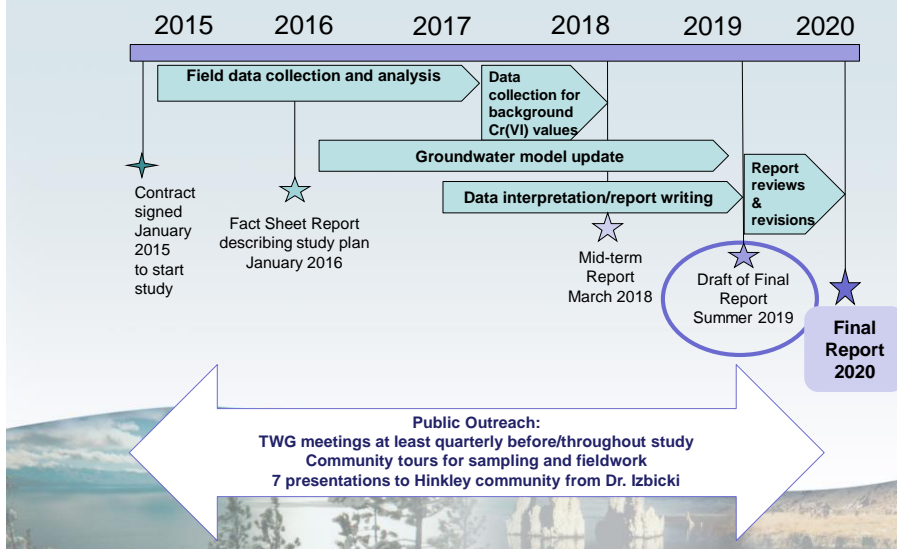
- Majority of report chapters drafted, and many are complete
- Graphics and figures drafted and under review

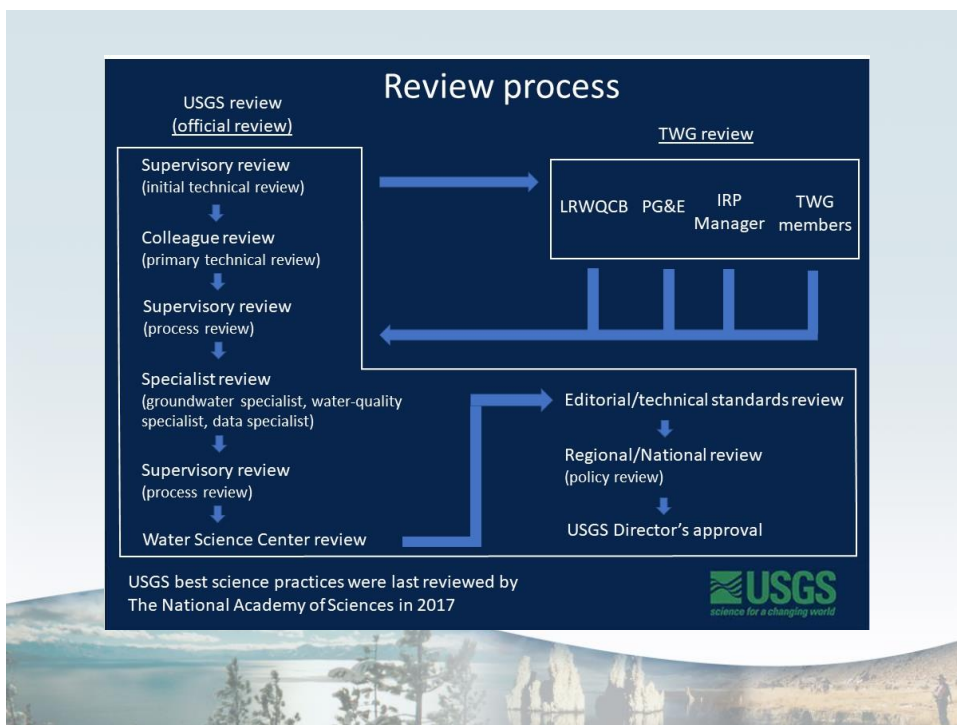
### ...Some Challenges

- Groundwater model evaluation (Task 5) was more time intensive than predicted
- Federal government shutdown in late 2018/early 2019 caused run-on backups in schedule

Status: Draft Final Report release delayed

## Background Study (revised) Timeline





## Online Information

Lahontan Water Board Hinkley Project webpage

- [https://www.waterboards.ca.gov/lahontan/water\\_issues/projects/pge/](https://www.waterboards.ca.gov/lahontan/water_issues/projects/pge/)

USGS Hinkley Project webpage

- <https://ca.water.usgs.gov/projects/hinkley/>

YouTube videos

- <https://www.youtube.com/>

*Search USGS chromium background study*

State Board's Geotracker webpage - USGS/Water Board contract documents

- [http://geotracker.waterboards.ca.gov/profile\\_report?global\\_id=T10000010367](http://geotracker.waterboards.ca.gov/profile_report?global_id=T10000010367)

Project Navigator's webpage

- <http://www.hinkleygroundwater.com/>

## **ENCLOSURE 5**





**Status of Actions  
PG&E Hinkley Chromium Contamination  
April 2019**

**Chromium Plume Boundary**

The 4th quarter 2018 chromium plume map is posted on the Water Board's Hinkley website at: [http://www.waterboards.ca.gov/lahtan/water\\_issues/projects/pge/index.shtml](http://www.waterboards.ca.gov/lahtan/water_issues/projects/pge/index.shtml), at the bottom of the page under the section titled "Other Documents and Information." The first quarter 2019 plume map is due on May 10, 2019, consistent with the reporting due dates contained in the CAO.

**Mitigation of Potential Groundwater Impacts**

The 2013 Environmental Impact Report (EIR) listed different strategies available to PG&E to implement for mitigating potential impacts to groundwater from its remedial actions. On November 21, 2018, PG&E submitted the document, "Water Conservation Program: Basin Wide Approach to Mitigation of Potential Groundwater Impacts Associated with Operation of Agricultural Treatment Units (ATUs) Managing Potential ATU Byproducts (Mitigation Measure WTR-MM-4)." The document presents a proposal for a new irrigation water conservation program to mitigate potential impacts of groundwater quality that could occur as a result of operations of the Agricultural Treatment Units (ATUs) used for remediation of hexavalent chromium in groundwater. The program would financially reimburse Hinkley Valley farmers to convert from less water efficient broadcast sprinklers or spray heads to Low Energy Precision Application (LEPA) irrigation methods. LEPA systems reduce water loss from the aquifer, reduce total dissolved solids (TDS) in the water not taken up by the plant and thus reduce the potential TDS accumulation in irrigation return water. This reduction in TDS to the Hinkley aquifer is expected to offset potential TDS impacts to groundwater generated at any of the ATU fields. PG&E's proposal is still being reviewed by Water Board staff.

**Annual Evaluation of Groundwater Monitoring Program**

Consistent with Cleanup and Abatement Order (CAO) R6V-2015-0068, in January PG&E submitted its annual evaluation of the groundwater monitoring program. Attachments B and C of the CAO's monitoring and reporting program are decision trees that specify criteria to evaluate the sampling frequencies of each monitoring well in the CAO program to determine if those frequencies should be changed. PG&E's evaluation has proposed reducing the sampling frequency for some wells, increasing the sampling frequency at other wells, and keeping the sampling frequency the same at most wells. PG&E's proposal is still being reviewed by Water Board staff.

## **Other Remedial Actions**

PG&E has been aware of increasing chromium concentrations in certain monitoring wells located in the southern and southeastern portion of the chromium plume. PG&E installed off-site piezometers and on-site extraction wells to better understand groundwater flow and improve hydraulic containment. Data from the new wells will be used to evaluate if the groundwater flow direction is changing on a regional scale due to drought conditions or from pumping at agricultural wells for the two fields located north of the compressor station. Results of this investigation, as reported in a fourth quarter 2018 monitoring report, are so far promising as chromium concentrations are reducing. PG&E has proposed to continue groundwater extraction and monitoring chromium changes for the first three quarters of 2019. The fourth quarter 2019 monitoring report will evaluate remedial results and state whether additional monitoring wells are needed to define the southern and southeastern chromium boundary. PG&E's proposal is being reviewed by Water Board staff.

## **Chromium Background Study**

Data interpretation, groundwater flow model evaluation and report writing continue to be the focus of Dr. Izbicki's current efforts. Dr. Izbicki is scheduled to discuss the background study at the April 25, 2019 Hinkley community meeting.