U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Alternate Concentration Limits
June 13, 2023

Bill von Till, Branch Chief

Division of Decommissioning, Uranium Recovery, and Waste Programs

Alternate Concentration Limits

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- Evolution of ACLs
  - started in RCRA - 1987 EPA Guidance on ACLs
  - EPA moved more to technical impracticability waivers and monitored natural attenuation
  - NRC adopted regulation in appendix A for ACLs near this timeframe
- NRC Regulations: 10 CFR Part 40, Appendix A, Criterion 5B(5) contains ground water protection standards, ACLs allowed under 5B(5)(c)
  - Existing guidance for conventional sites in NUREG-1620
- Collaboration with Agreement States
  - One on one and in person/hybrid workshops
- DOE involvement as a future long-term custodian
  - DOE involved much earlier due to lessons learned

Key Regulatory Criteria
Groundwater Protection Standards
10 CFR Part 40, Appendix A

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- 5B(5)—At the point of compliance, the concentration of a hazardous constituent must not exceed—
  - (a) The Commission approved background concentration of that constituent in the groundwater;
  - (b) The respective value given in the table in paragraph 5C if the constituent is listed in the table and if the background level of the constituent is below the value listed; or
  - (c) An alternate concentration limit established by the Commission.

Key Regulatory Criteria
Groundwater Corrective Action

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- 5D-If the groundwater protection standards established under paragraph 5B(1) of this criterion are exceeded at a licensed site, a corrective action program must be put into operation as soon as is practicable, and in no event later than eighteen (18) months after the Commission finds that the standards have been exceeded. The licensee shall submit the proposed corrective action program and supporting rationale for Commission approval prior to putting the program into operation, unless otherwise agreed to by the Commission. The objective of the program is to return hazardous constituent concentration levels in groundwater to the concentration levels set as standards. The licensee's proposed program must address removing hazardous constituents that have entered the groundwater at the point of compliance or treating them in place. The program must also address removing or treating any hazardous constituents that exceed concentration limits in groundwater between the point of compliance and the downgradient facility property boundary. The licensee shall continue corrective action measures to the extent necessary to achieve and maintain compliance with the groundwater standard. The Commission will determine when the licensee may terminate corrective action measures based on data from the groundwater monitoring program and other information that provide reasonable assurance that the groundwater protection standard will not be exceeded.

Key Regulatory Criteria ACLs

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- 5B(6)—Conceptually, background concentrations pose no incremental hazards and the drinking water limits in paragraph 5C state acceptable hazards but these two options may not be practically achievable at a specific site. Alternate concentration limits that present no significant hazard may be proposed by licensees for Commission consideration. Licensees must provide the basis for any proposed limits including consideration of practicable corrective actions, that limits are as low as reasonably achievable, and information on the factors the Commission must consider. The Commission will establish a site specific alternate concentration limit for a hazardous constituent as provided in paragraph 5B(5) of this criterion if it finds that the proposed limit is as low as reasonably achievable, after considering practicable corrective actions, and that the constituent will not pose a substantial present or potential hazard to human health or the environment as long as the alternate concentration limit is not exceeded.

Key Regulatory Criteria ACLs

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- In making the present and potential hazard finding, the Commission will consider the following factors:
- (a) Potential adverse effects on groundwater quality, considering—
- (i) The physical and chemical characteristics of the waste in the licensed site including its potential for migration;
- (ii) The hydrogeological characteristics of the facility and surrounding land;
- (iii) The quantity of groundwater and the direction of groundwater flow;
- (iv) The proximity and withdrawal rates of groundwater users;
- (v) The current and future uses of groundwater in the area;
- (vi) The existing quality of groundwater, including other sources of contamination and their cumulative impact on the groundwater quality;
- (vii) The potential for health risks caused by human exposure to waste constituents;
- (viii) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents;
- (ix) The persistence and permanence of the potential adverse effects.

Key Regulatory Criteria ACLs

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- (b) Potential adverse effects on hydraulically-connected surface water quality, considering—
- (i) The volume and physical and chemical characteristics of the waste in the licensed site;
- (ii) The hydrogeological characteristics of the facility and surrounding land;
- (iii) The quantity and quality of groundwater, and the direction of groundwater flow;
- (iv) The patterns of rainfall in the region;
- (v) The proximity of the licensed site to surface waters; (vi) The current and future uses of surface waters in the area and any water quality standards established for those surface waters;
- (vii) The existing quality of surface water including other sources of contamination and the cumulative impact on surface water quality;
- (viii) The potential for health risks caused by human exposure to waste constituents;
- (ix) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents; and
- (x) The persistence and permanence of the potential adverse effects.

Examples of Recent ACL Approvals

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

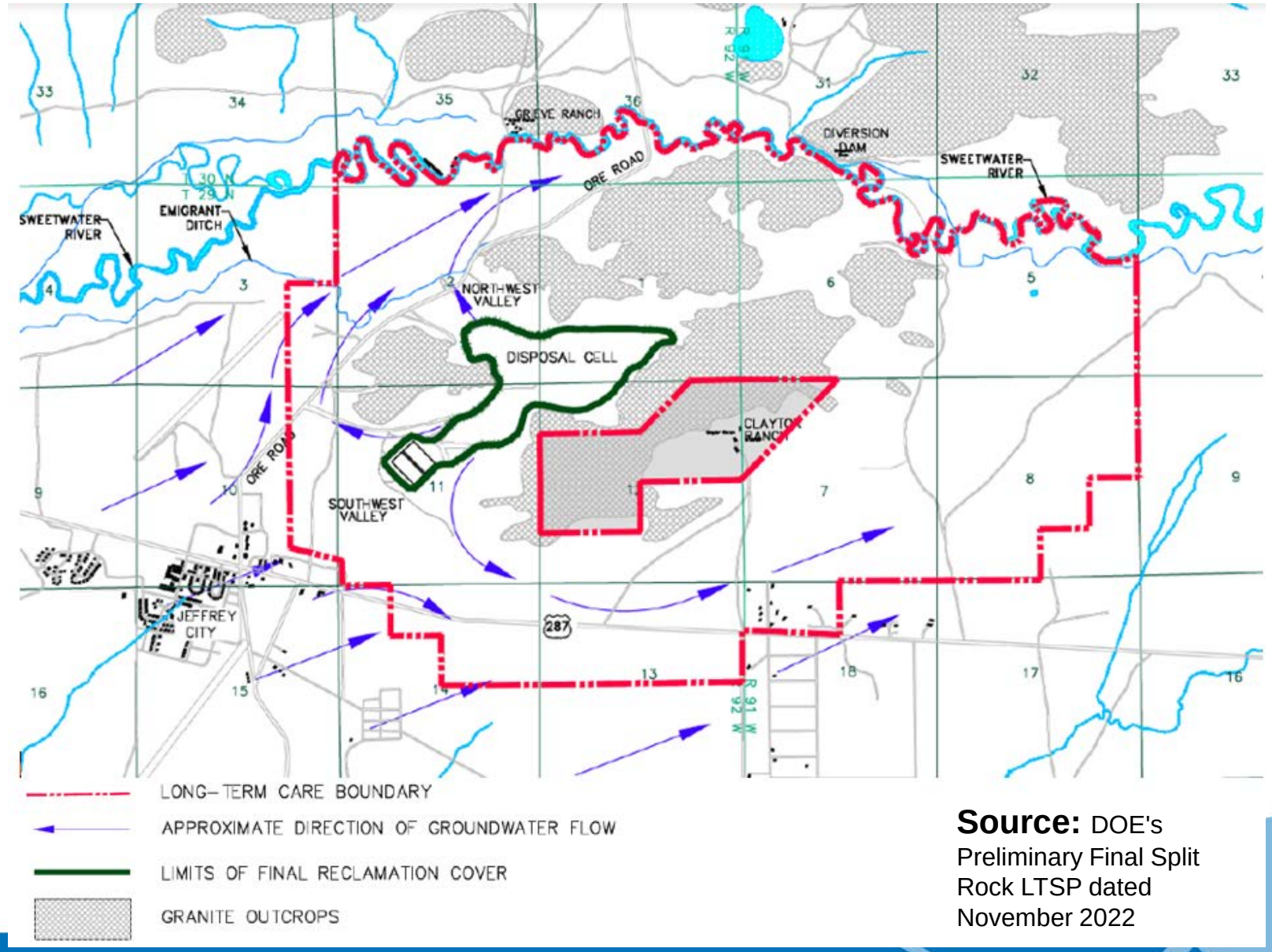
- Atlantic Richfield Company (ARCO), Bluewater: Approved in 1996
- Petrotomics, Shirley Basin South: Approved in 1998
- L-Bar: Approved in 1999
- Umetco, Gas Hills East: Approved in 2002
- Rio Algom Mining, Lisbon Valley: Approved in 2004
- Western Nuclear Inc, Split Rock: Approved in 2006
- Rio Algom Mining, Ambrosia Lake: Approved in 2006 (for Alluvium)
- Homestake Mining Company (applied in 2022) – not accepted
- Sequoyah Fuels (application to be submitted)

Western Nuclear Split Rock ACL Approval

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- Extensive groundwater contamination off-site flowing in two different directions
- Use of institutional controls on off-site residential properties
  - Appendix A alternatives provision
- Collaboration with DOE as they needed to agree in order to take the site for long-term care
- Institutional controls – run with the land, durable, enforceable
- Case of first impression – needed Commission policy decision – 2002, 2005
- WDEQ letter to the NRC, 2006 (ML061950081)
  - *"In our opinion, the majority of groundwater contamination at this site could have, and should have been prevented were more aggressive corrective action measures taken in the 1980's and early 1990's."*
  - *"If the proposed amendment to the License is granted a large (>3,000 ac.) area of relatively high-quality ground water resource will become adversely impacted and unsuitable for roughly 1000 years as contaminants spread uncontrolled throughout ground water underlying the property."*
- NRC approval of the major ACL application, 2006 (ML062910216) after Commission policy decisions in 2002 and 2005
- Later exceedances and need for additional ACL applications
  - Revised Nitrate ACL approved in 2006 and revised Selenium ACL in 2019.
  - **Models often not completely accurate; therefore, continued groundwater monitoring is essential to protect people and the groundwater resource**

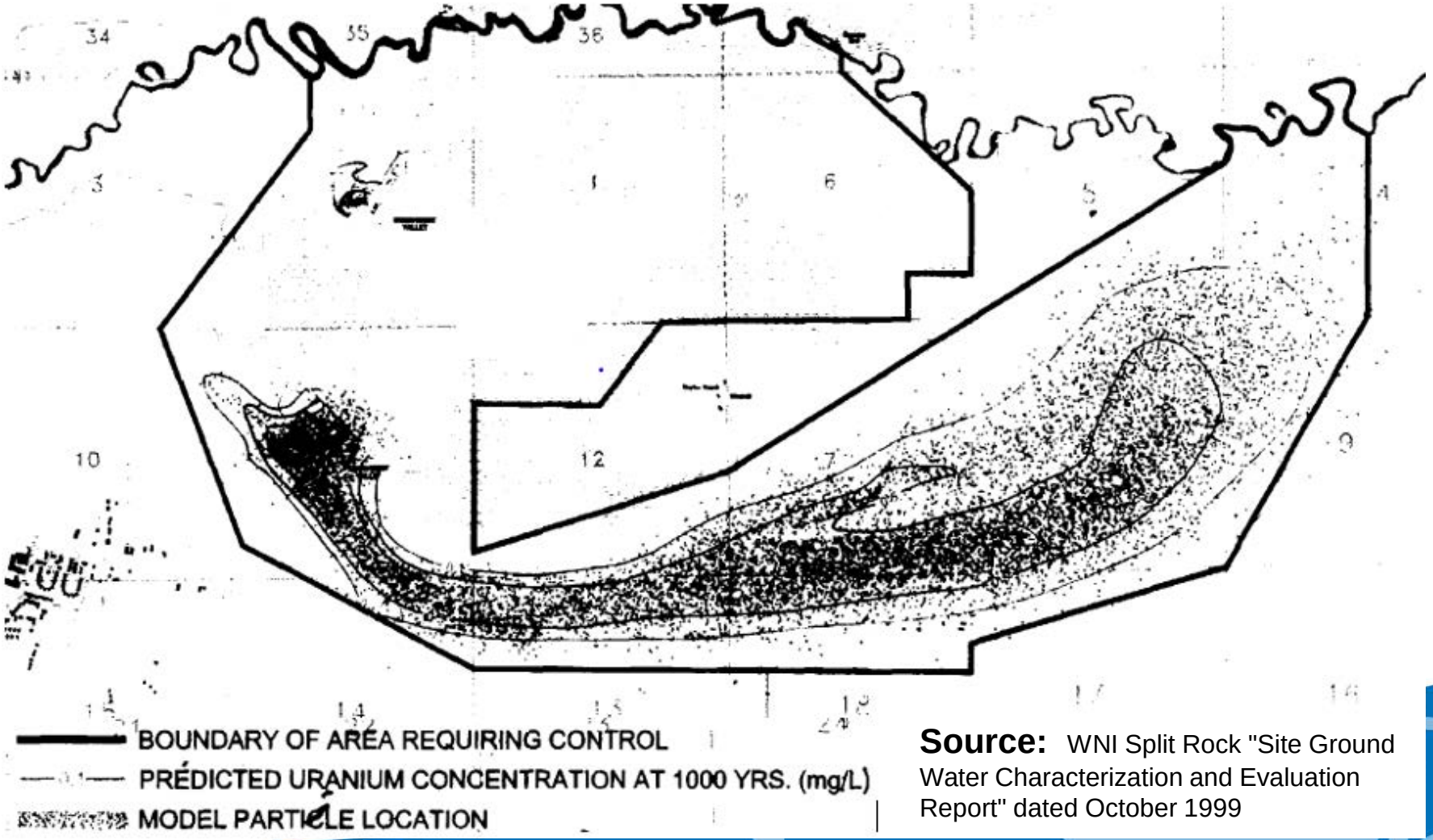
WNI Split Rock Groundwater Flow



Source: DOE's Preliminary Final Split Rock LTSP dated November 2022

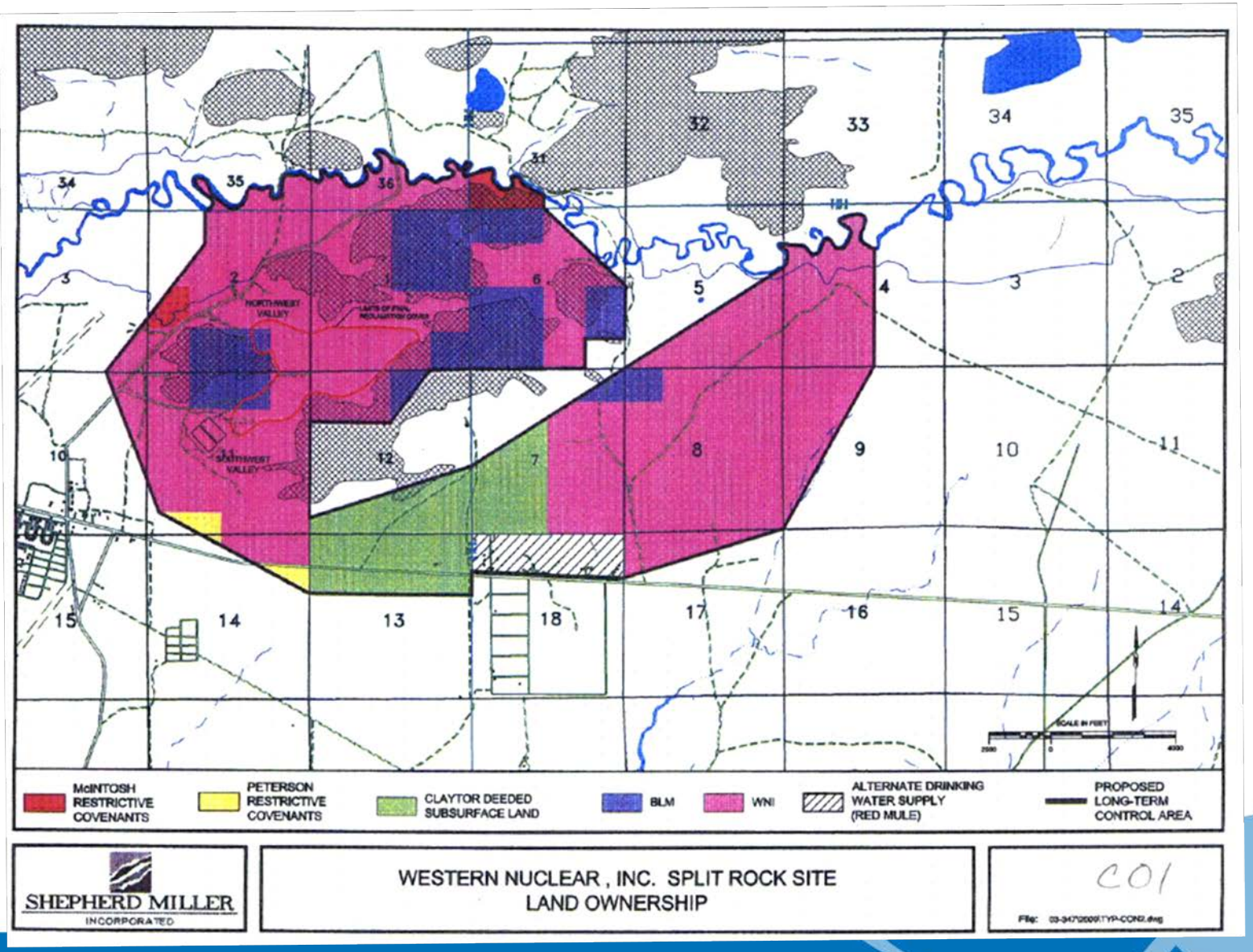
WNI Split Rock Predicted Uranium Groundwater Plume in a 1,000 Years

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment



Source: WNI Split Rock "Site Ground Water Characterization and Evaluation Report" dated October 1999

WNI Split Rock ACL and Land Ownership



Lisbon Valley Lessons Learned – From Utah (April 22, 2022)

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- *Groundwater modeling and actual measurements go hand in hand. Models should be revised and reviewed as additional, empirical data is obtained.*
- *ACL's must be established based on site-specific information. Established limits must be conservative to account for uncertainty in order to protect groundwater.*
- *Wells necessary to continue monitoring and ensure groundwater protection should be maintained. Do not abandon wells that may be useful for future work.*
- *Cover design must be built to prevent continued contamination (turn off the source). A slope is necessary to prevent water infiltration.*
- *Regulators must be present during cover construction to ensure the cover is constructed according to the approved design.*

Source: April 22, 2022, NRC Commission Briefing

Lisbon Valley Uranium Plumes

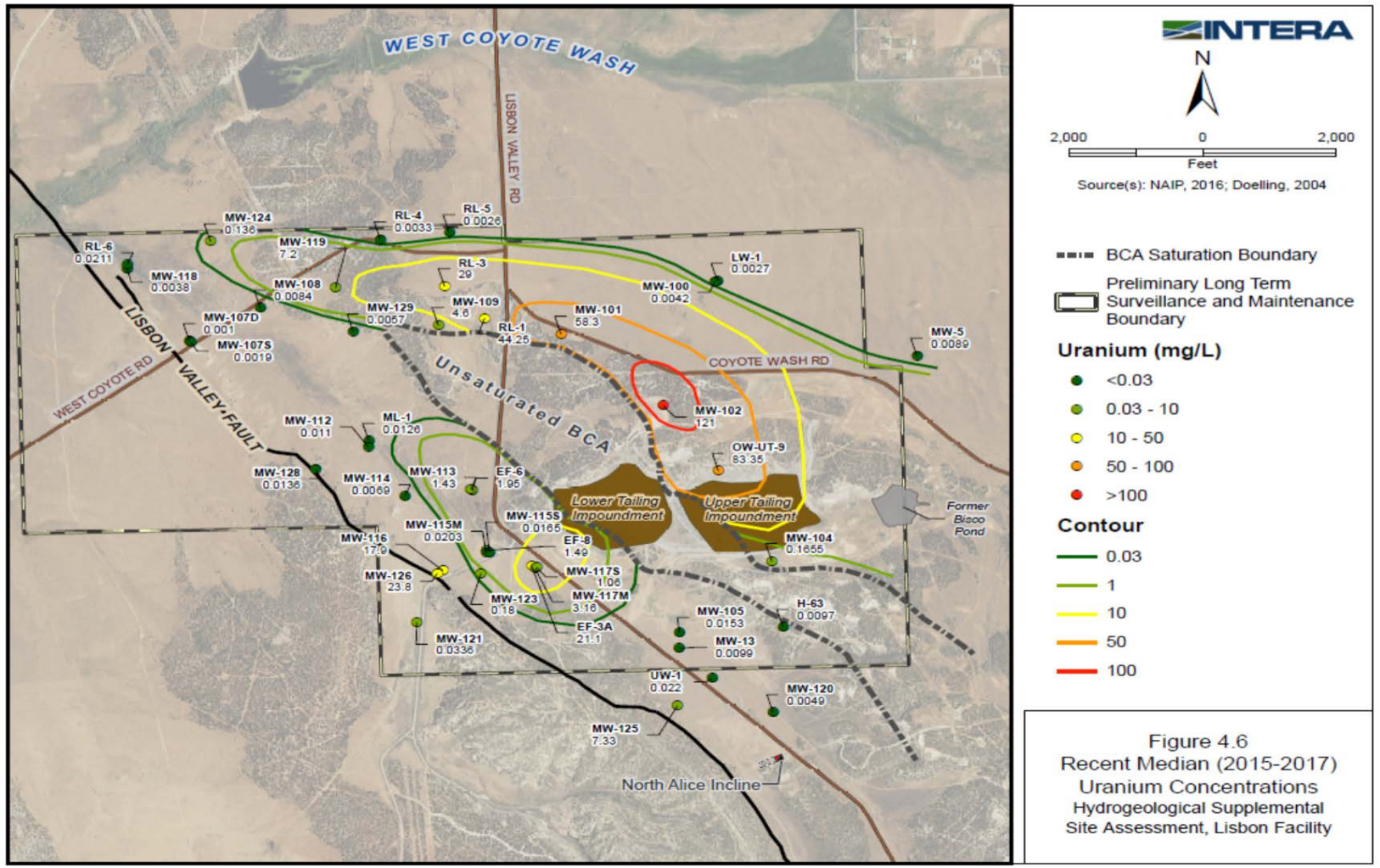
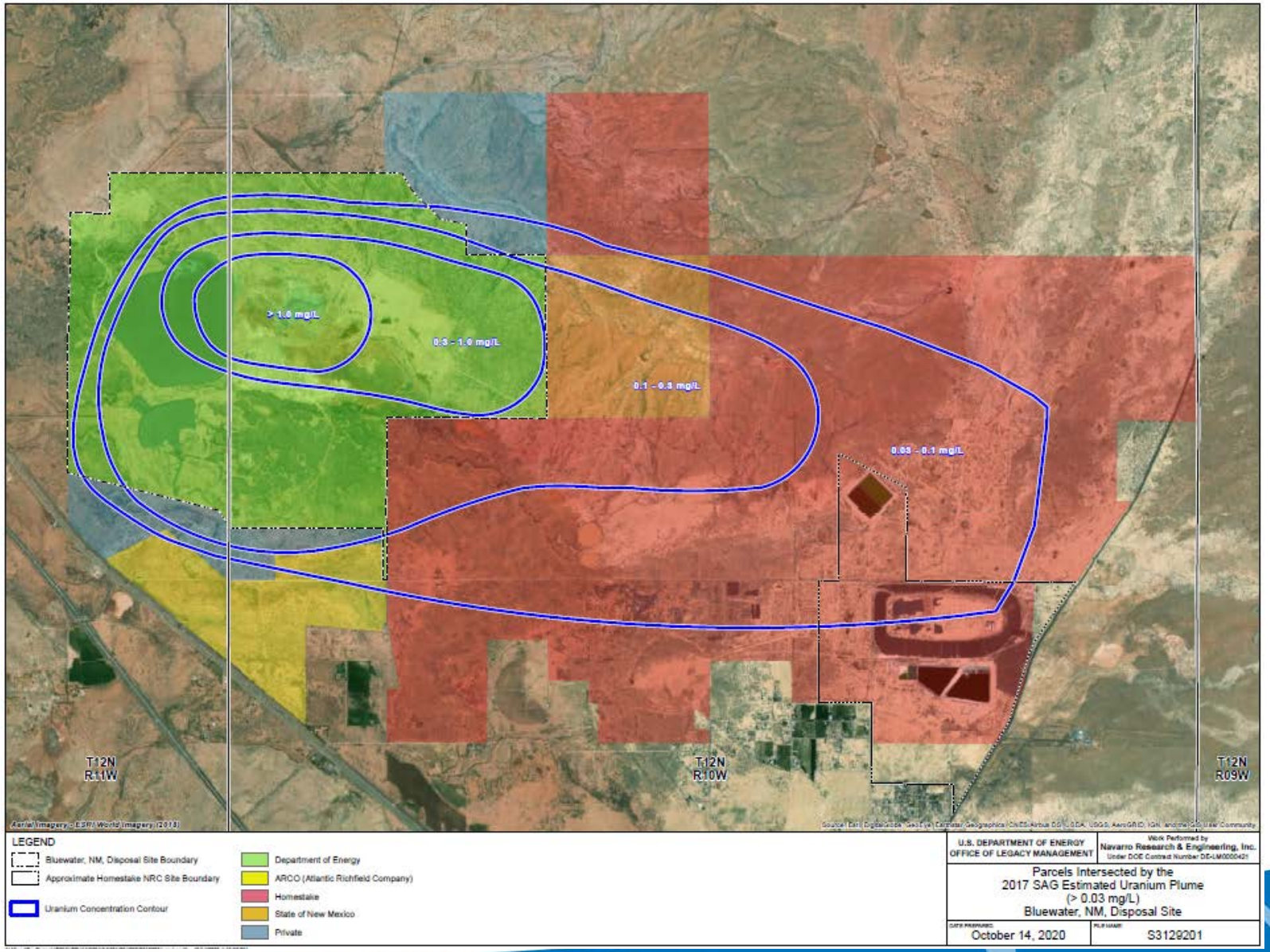


Figure 4.6
Recent Median (2015-2017) Uranium Concentrations
Hydrogeological Supplemental Site Assessment, Lisbon Facility

- Two plumes have been identified.
- The plumes flow west, northwest.
- The plumes have exceeded the long-term surveillance and maintenance (LTSM) boundary.

Source: April 22, 2022, NRC Commission Briefing

Bluewater Plume



- Contamination present in the Alluvial and San Andres Glorieta (SAG) Aquifers
- The SAG plume, shown here, flows to the ESE towards Homestake
- Leading edge of the plume uncertain
- DOE working with NMED and NRC on constructing additional monitoring wells to better define the plume

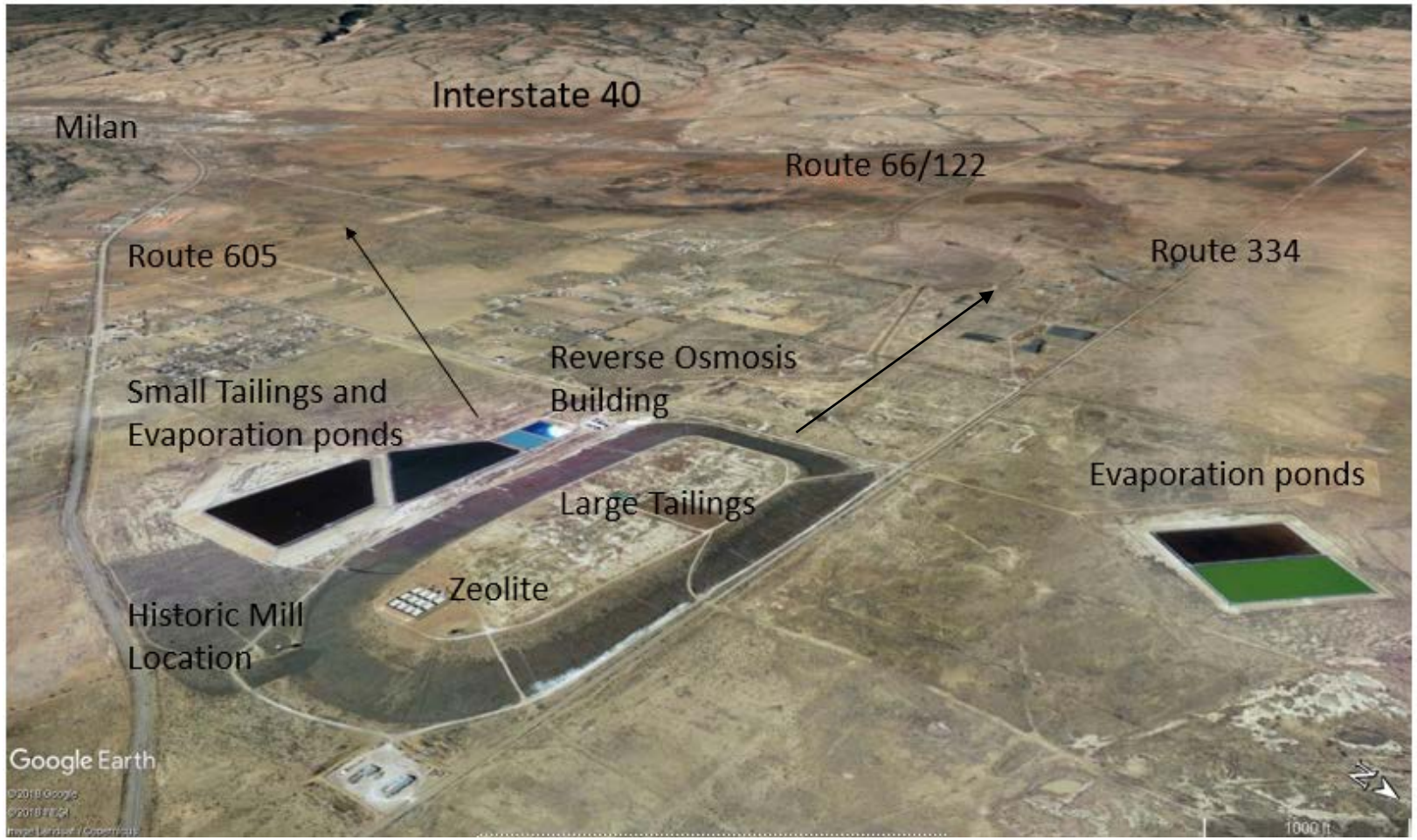
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Homestake Mining Company of California (HMC) Grants Reclamation Project (GRP)

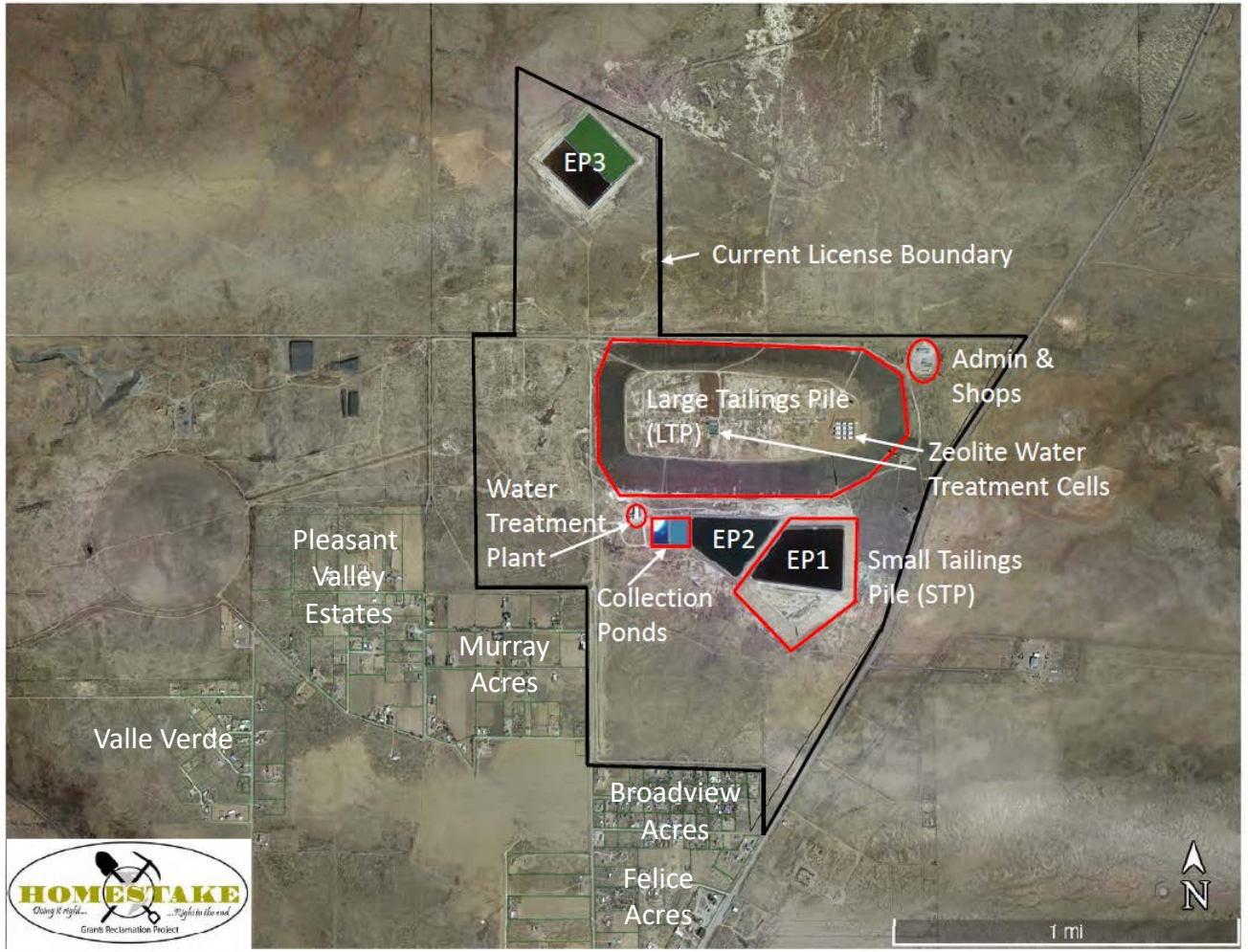
ACL Application

GRP Area and Features

(looking southwest)



GRP Features and Communities



U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

GRP Site and Activities

- Conventional mill tailings site located in Grants/Milan, NM
  - Close to populated areas
  - Groundwater resource is vital to the community and nearby Pueblos.
  - Active groundwater corrective action program from 1977 to present
  - Collection of impacted groundwater from on and off-site wells
  - Remediation of groundwater through Reverse Osmosis, Injection of treated water at edge of plume, 3 evaporation ponds
- Confirmatory Order issued in 2017
- ACL license amendment request (LAR) submitted on August 8, 2022
  - Very complex geology and large plume under many private properties
  - Not acceptable for full review: institutional controls inadequate; ALARA not demonstrated; modeling assumptions not supported.
- Large Tailings Pile (LTP) final radon barrier (Evapotranspiration Cover), revised LAR expected June 2023
- EPA superfund site – coordination with EPA Region 6
- Coordination with the State of NM and DOE
- Community outreach meetings monthly – high interest

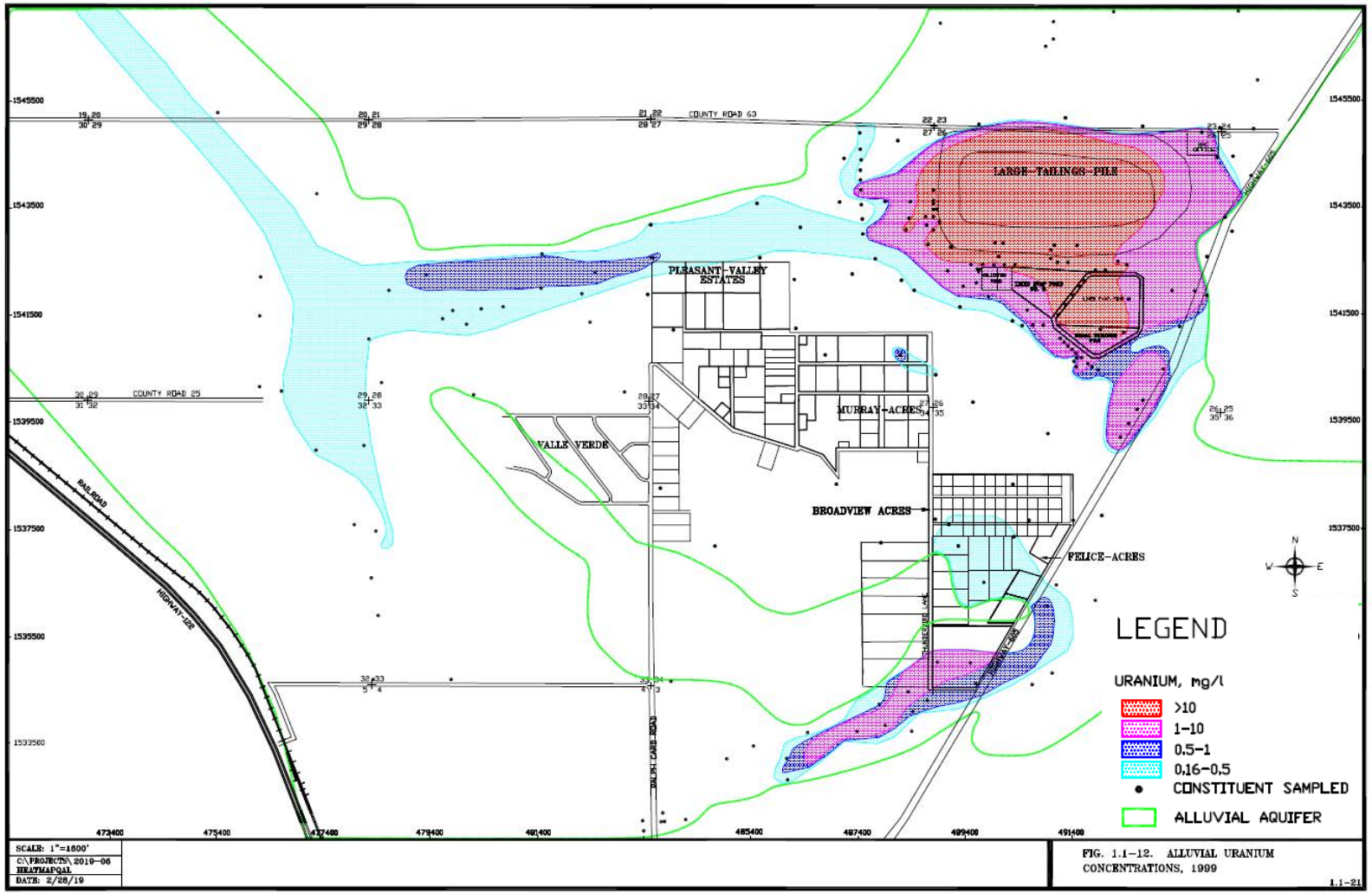
Groundwater Corrective Action Challenges

- Scale of groundwater treatment: approximately 1400 acres of contamination spread across 4 aquifers
- Proximity of contamination to communities and municipal water supply wells
- Estimates for groundwater remediation have consistently been optimistic, which may be due to back diffusion from low permeability zones (see backup slides)
- Alternative treatment technologies (e.g., zeolites, tripolyphosphate) have not been sufficiently successful
- Groundwater modeling efforts have struggled with limited validation data/confidence-building activities

Homestake ACL Application

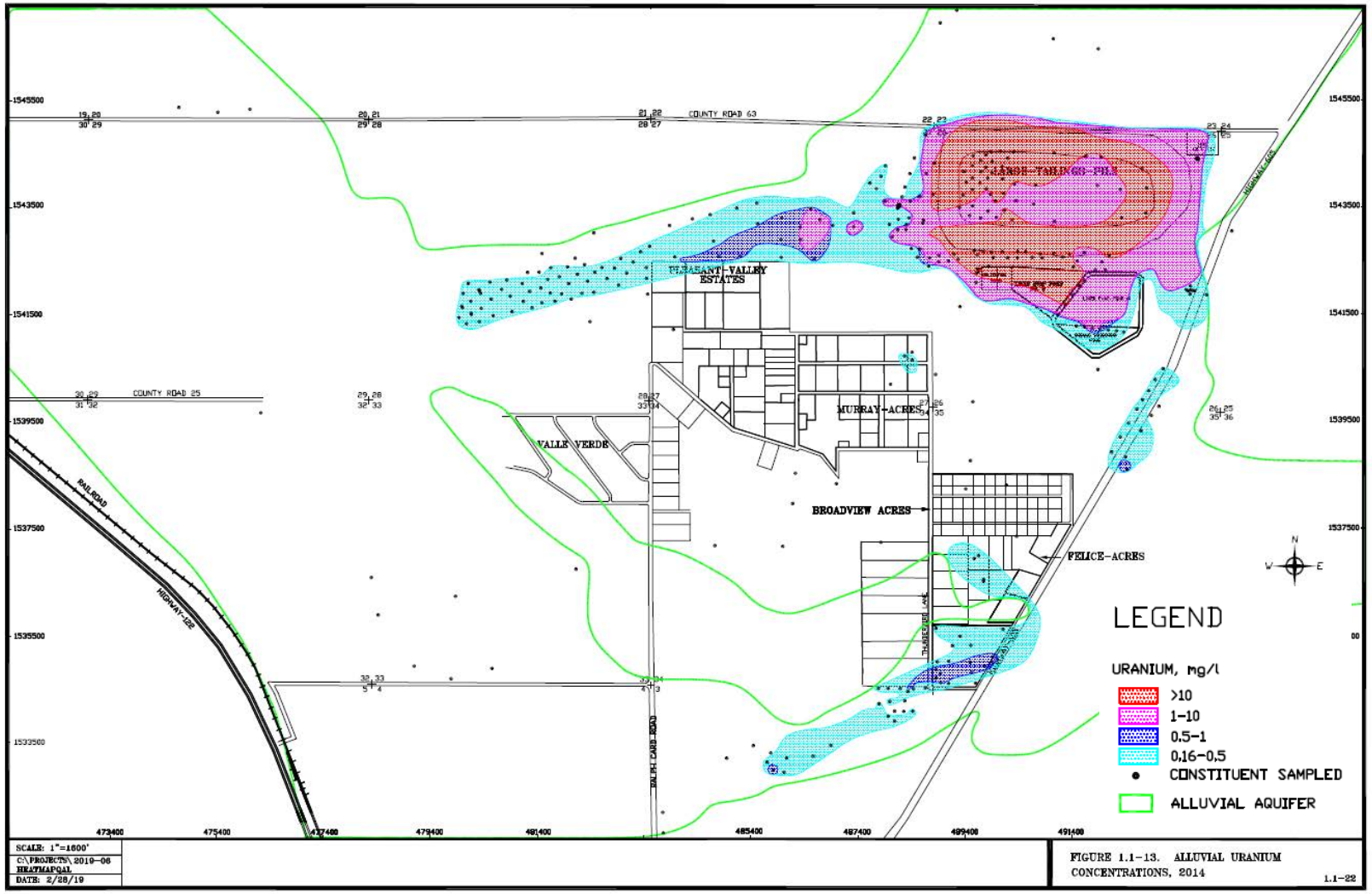
- Principal reasons for non-acceptance of the LAR for review are:
  - The LAR has not detailed whether the pertinent estates within the proposed control boundary have been acquired and does not describe the efforts and timelines for these acquisitions. With these uncertainties, the NRC staff is unable to undertake a detailed review of the LAR.
  - While the application addressed several of the NRC staff comments from the pre-submission audit and summary dated May 17, 2022, several significant comments previously discussed with the applicant were either not fully addressed or the assumptions made were not supported.
  - Information from the ongoing groundwater pumping indicates that the GCAP continues to remove site contaminants from the groundwater notwithstanding claims that contaminants have been removed to a level that is as low as is reasonably achievable. Without explanation of how these data are consistent with HMC's claims, the NRC staff is unable to undertake a detailed review of the LAR.
- Public meeting on June 15 to provide more detail.

Alluvial Groundwater Uranium Concentration 1999



HMC 2022 Annual Monitoring Report (ML23095A168)

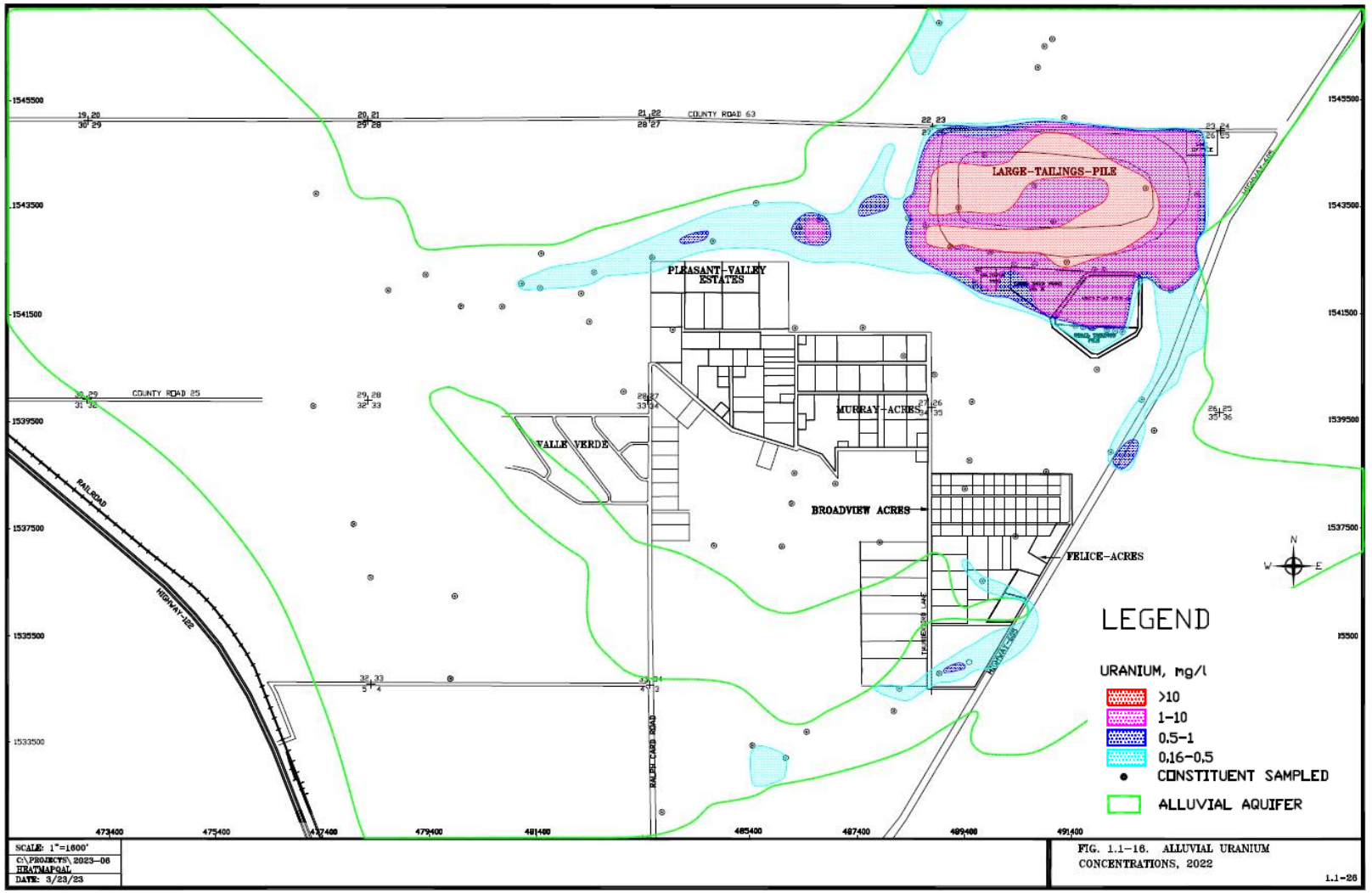
Alluvial Groundwater Uranium Concentration 2014



HMC 2022 Annual Monitoring Report (ML23095A168)

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

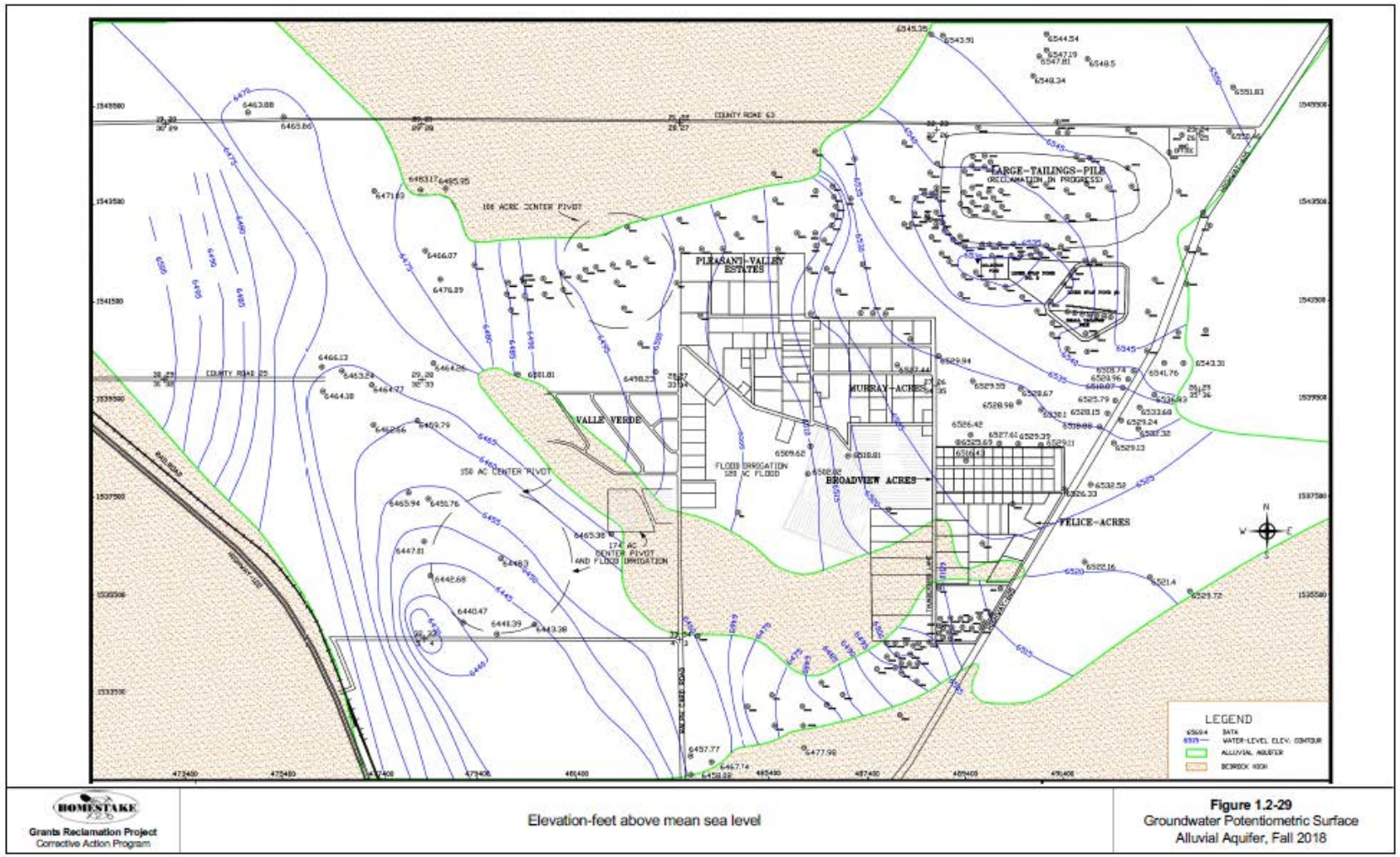
Alluvial Groundwater Uranium Concentration 2022



HMC 2022 Annual Monitoring Report (ML23095A168)

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Potentiometric Surface – Alluvial Aquifer

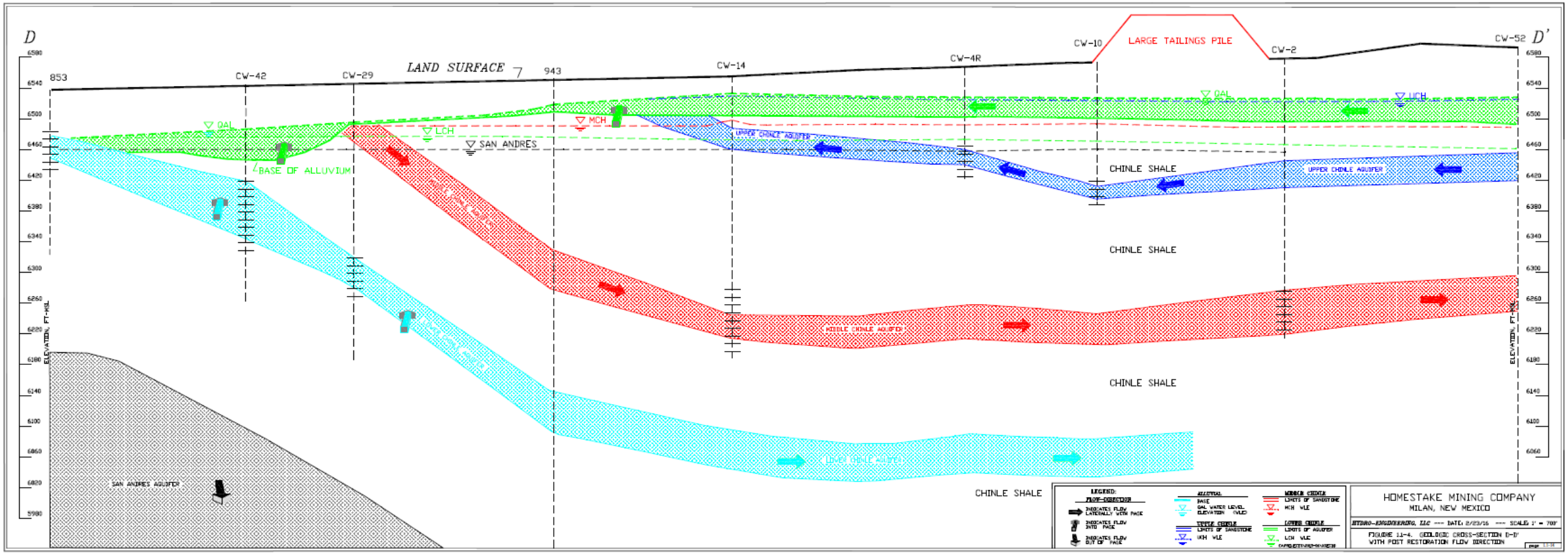


Grants Reclamation Project
Corrective Action Program

Figure 1.2-29
Groundwater Potentiometric Surface
Alluvial Aquifer, Fall 2018

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

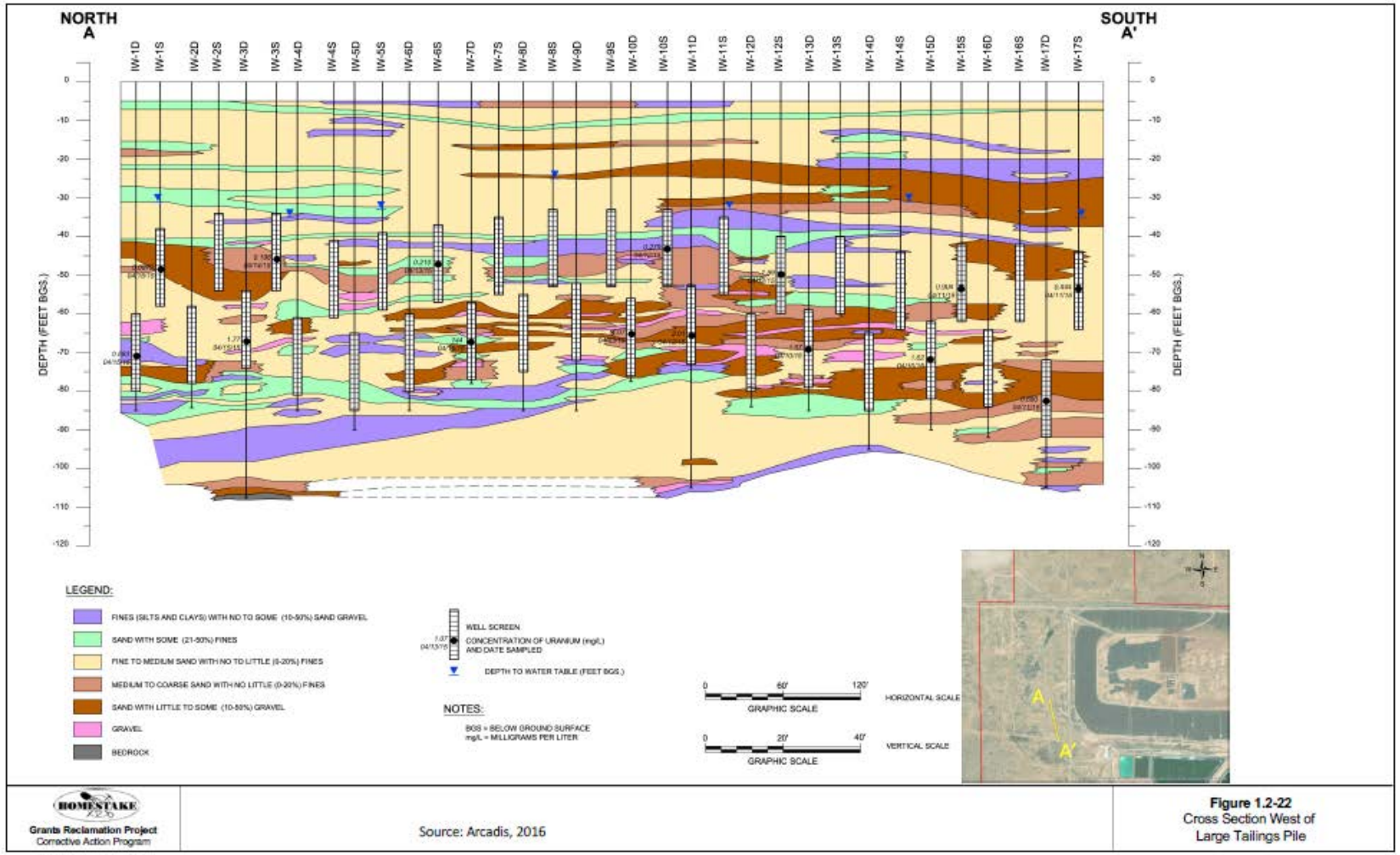
Geologic Cross-Section D to D'



HMC 2022 Annual Monitoring Report (ML23095A168)

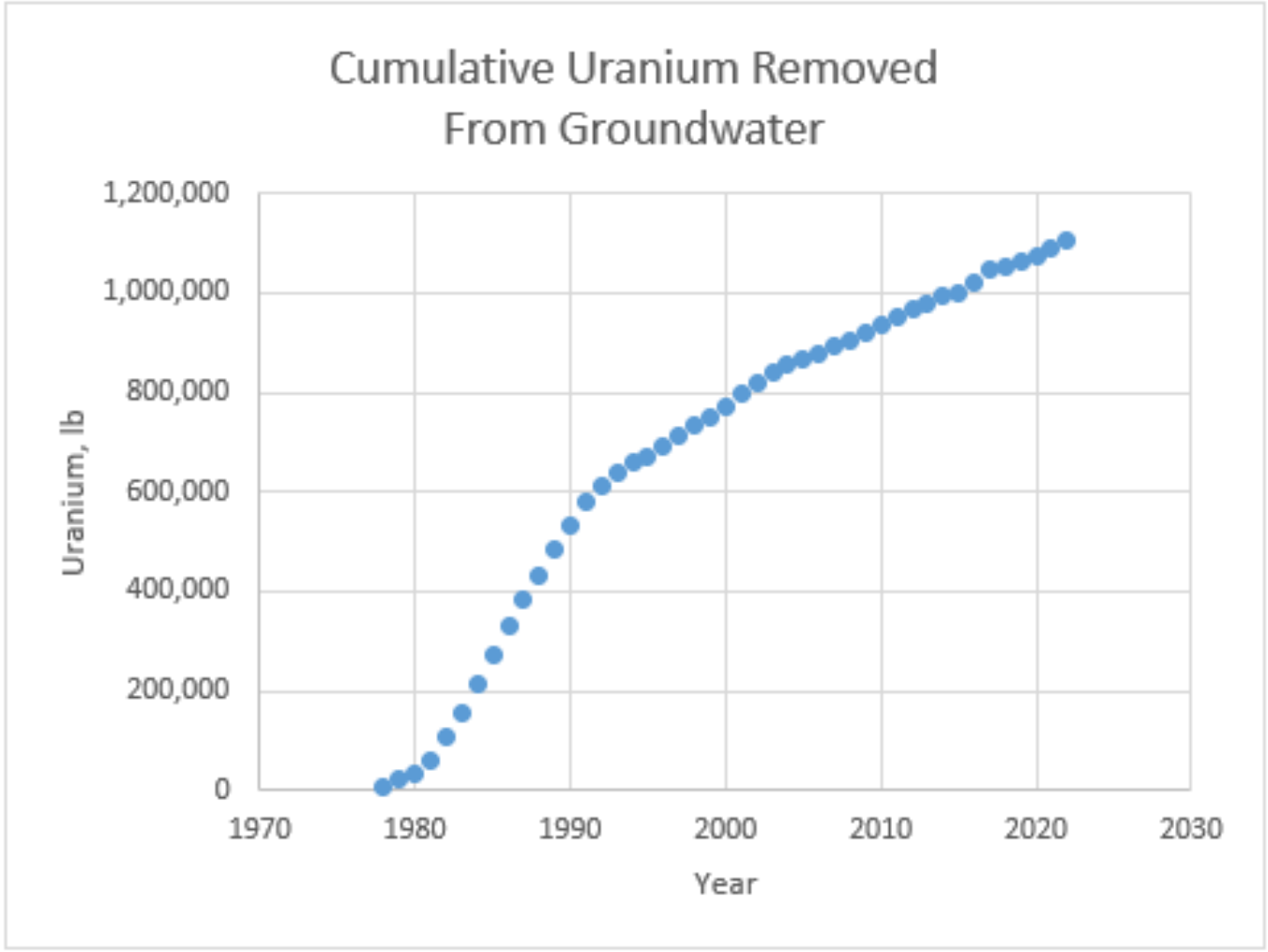
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Cross Section of Alluvial Aquifer



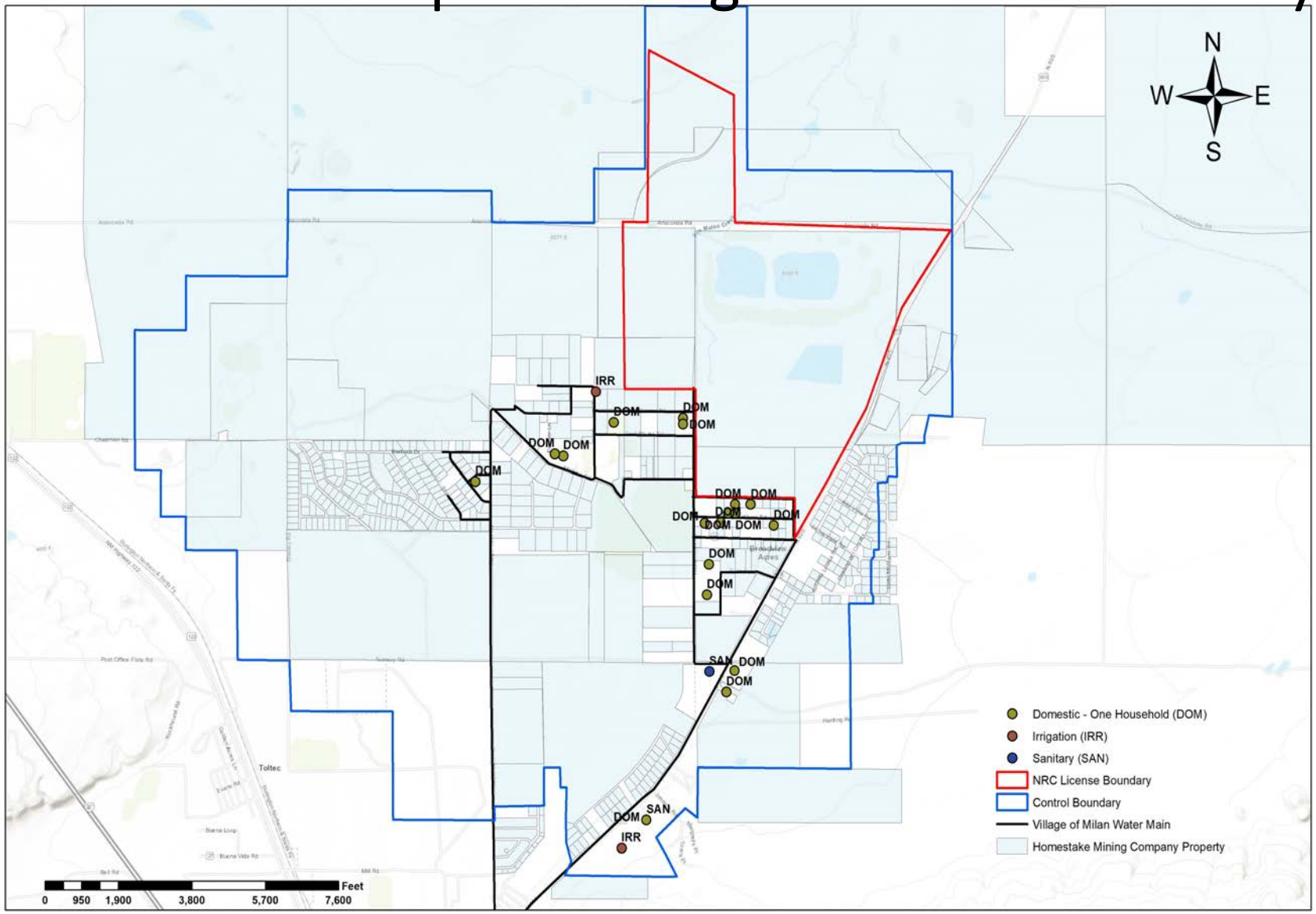
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Groundwater Remediation – Uranium Removal



Data adapted from HMC 2022 Annual Monitoring Report

HMC Proposed Long-Term Care Boundary



Questions?

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Photo: Death Valley, 2023