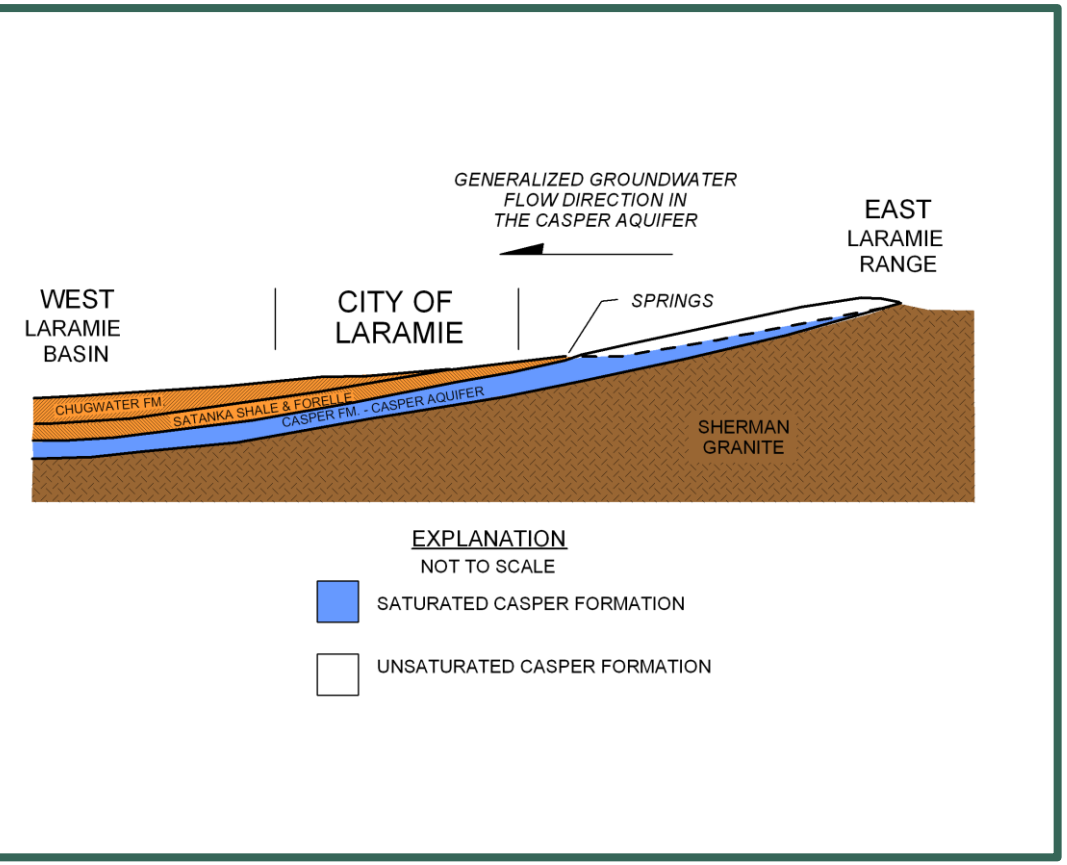
CITY OF LARAMIE CASPER AQUIFER PROTECTION PLAN OVERVIEW

WHAT ARE WE DRINKING? LARAMIE'S WATER: PAST, PRESENT, AND FUTURE

DARREN PARKIN, WATER RESOURCE ADMINISTRATOR & DEREK T. TEINI, AICP PLANNING MANAGER

OCTOBER 24, 2018

GEOLOGIC SETTING



- Casper formation was deposited **~300 Million Years Ago** in the Pennsylvanian; 65-75 Million years ago the Laramie Range was uplifted with erosion exposing the Casper Formation
- Unconformity overlies the 1.4 Billion year old Sherman Granite
- 700 foot thick package of limestone and sandstone layers; **5-members: Alpha, Beta, Gamma, Delta & Epsilon**
- "Extends ~50 Miles to the north-northwest of Laramie before it is interrupted by a thrust fault. To the south it extends past the WY-CO border, a distance of at least 21 miles" – CAPP 2008
- Also extends west into the Laramie basin but with an average dip of 3-4 Degrees it is **~1,500 feet below the surface at the western edge of the City**
- Over time it became saturated with water and became the Casper Aquifer; highly prolific, sandstones store the water and limestones transport the water

LARAMIE'S WATER HISTORY

- Laramie founded by the UPRR – City Springs advertised as the **"Largest and Purest Water Supply in the World"**
- 1868 City Springs – 1.6 MGD
- 1920 Pope Springs – 0.50 MGD (went dry 1934)
- 1924 Soldier Springs – 1.4 MGD
- 1937 (4) Pope Springs Wells Drilled – 1.3 MGD
  - Total Supply – 3.5 MGD (4.3 MGD with Pope Wells)
- 1945 Total Demand Reaches 5 MGD
  - **Laramie is out of Water!**

SETTING THE STAGE: WHY PLAN FOR WATER PROTECTION?

- Cost of **protection** vs. cost of **treatment**
- Supports community longevity & **quality of life**
- **Costly** & difficult (sometimes impossible) to remediate
- Water's importance continues to **grow**
- Emergency **mitigation** (short and long term)
- Promotes **Economic Development**

SETTING THE STAGE: PLAN VS. REGULATION…OR BOTH?

- Water Protection **Plan (Guidance)**
  - **Long term planning**
    - Understanding Conditions
    - Current Management
    - Emergency Management
    - Goals & Implementation
  - **Guidance & Support for future regulations**
  - Water quality & quantity protection
  - Wellhead, aquifer & surface water protection

Versus

- Water Protection **Regulations (Shall Do)**
  - Zoning (overlay zones, prohibited uses, etc.)
  - **Development Standards**
  - Review procedures (SSI)
  - Required monitoring

SETTING THE STAGE: WATER PROTECTION IN LARAMIE

- Why is water protection so important to Laramie?
  - The Aquifer Protection Area encompasses **72 sq/miles** with **97% of the area outside of the City limits**
  - The Casper Aquifer provides about **60% of the City's municipal water supply** (100% in times of drought) and **only controls ~3% of the recharge area**
    - Spur (2), Turner (2), Pope (4) & Soldier Springs Wellfield (1)
  - The Casper Aquifer provides a **majority of the water to rural residents** on domestic wells around Laramie
  - Due to the geology, the Casper Aquifer is **highly vulnerable to contamination** (complex, faults, folds, fractures, etc.)
  - The Casper Aquifer water is of **extremely high quality** (WDEQ – Class 1 Potable Aquifer)
  - City only needs minimal treatment (**chlorinate & fluoridate)** of the Casper Aquifer water before it meets EPA standards and is provided to citizens

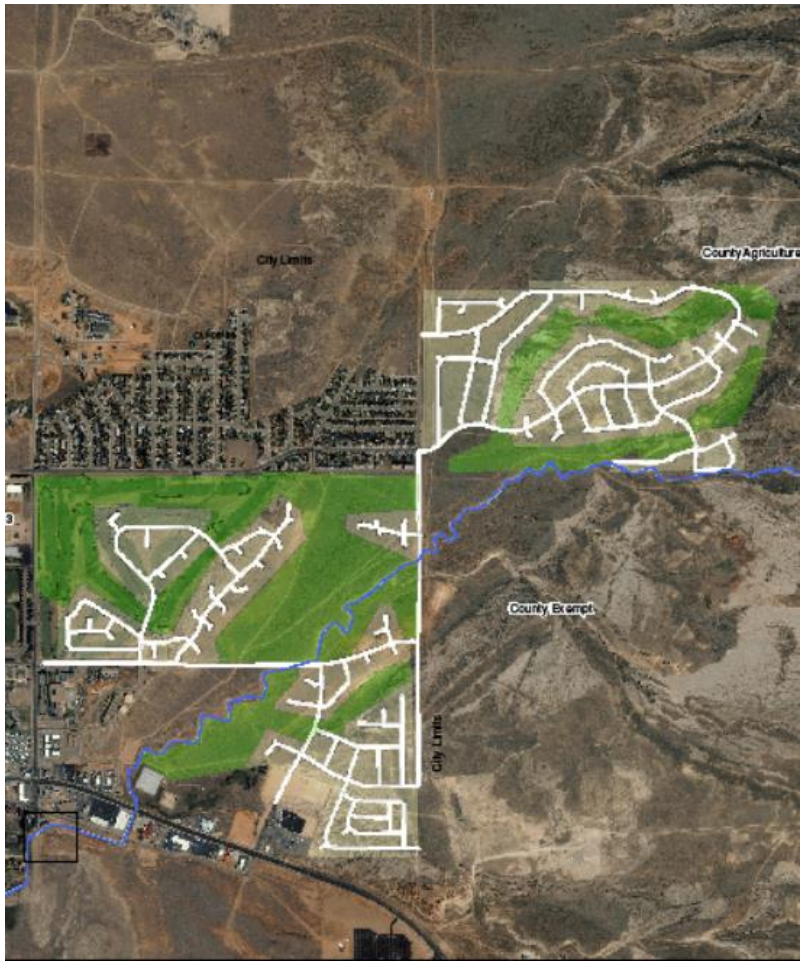
CASPER AQUIFER PROTECTION PLAN (CAPP) HISTORY (PRE – 2002)

- Importance of the Casper Aquifer noted pre-1900's by the railroad
- In the early 90's protection was noted as being important to the community (City, County & Public)
- Late 90's volunteers (Geologist, Hydrologist, Public, etc.) began some of the early research & discussion regarding protection
- Official work on the Plan and Ordinance began in 1998; Completed in 2002; (Cert. by DEQ in 2006)
- Original plan & ordinance adopted by City and County in 2002
- Aquifer Protection Overlay Zone was established (Same for the City and County)
- Water Outreach Coordinator was hired by the City to implement the Plan & Ordinance
- The Plan was to be updated every two years

- 2002 Ordinance (Regulations)
  - Set an Overlay Zone Boundary
  - Established prohibited uses
  - Defined a vulnerable feature
  - Addressed septic systems and proximity to vulnerable features
  - Addressed pre-existing non-conforming uses
  - **No development regulations approved**

CASPER AQUIFER PROTECTION PLAN (CAPP) HISTORY (POST – 2002)

- Two Subdivisions:
  - **Coughlin Pole Mountain 3rd (2005)**
    - Public organizes to protect ridgelines & trail connections
    - Highly organized = effective voice
  - **Jacoby Ridge (2006)**
    - Public organizes to protect ridgelines & trail connections (same group)
    - Developer responds to public comment and protects ridgelines and provides trails
    - Public reorganizes for protection of the aquifer



CASPER AQUIFER PROTECTION PLAN (CAPP) HISTORY (POST – 2002)

- The projects revealed that the existing APO was not **"strong enough"**, supported by Public, PC and Council (2006)
  - Primarily focused on **septic tanks**
  - **No development standards**
  - No criteria for development of specific property assessments
- Citizen petition requesting **prohibition of development** (2006)
- City Council enacts **Building and Subdivision Moratorium** (2006)
  - **Appeal process** set up for the moratorium.
- In-house rewrite attempted; stalled at final reading (2006)
  - Push for a "no degradation" regulation
  - EPA standards "not good enough"
  - Final Straw: Reconciliation of viewpoint too difficult and staff not qualified to complete rewrite
- Council hires consultants for professional review and recommendations (2007)
- **Moratorium extended until new Plan and Ordinance adopted** (2008)

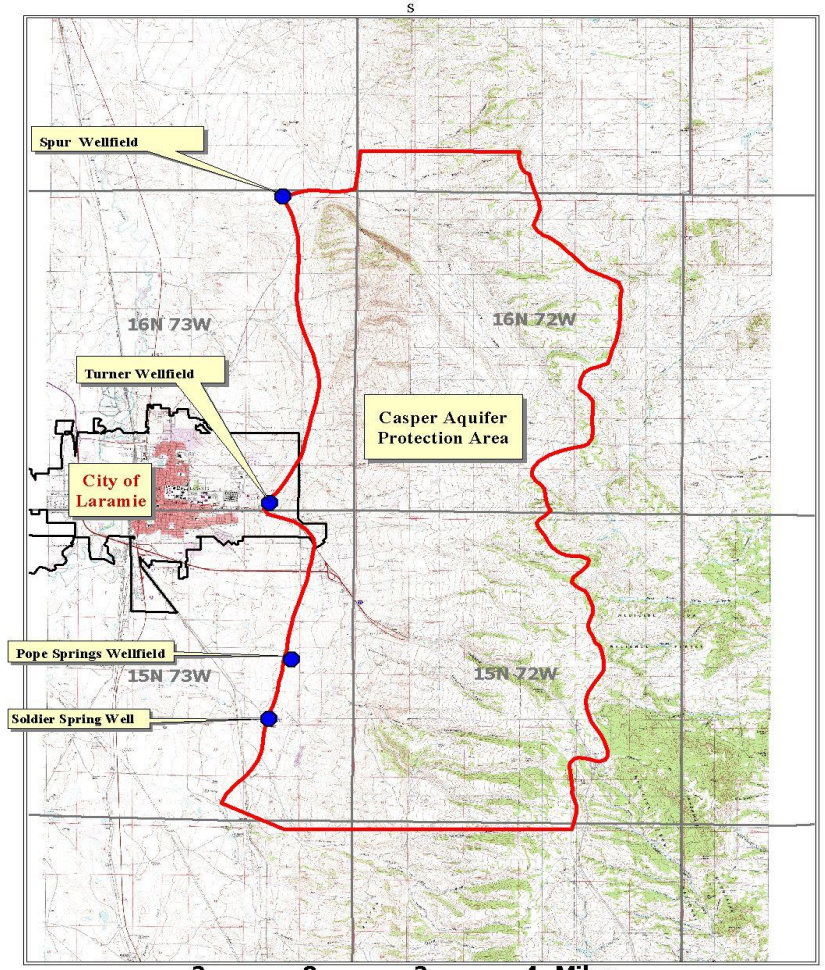
DEVELOPMENT OF THE 2008 CASPER AQUIFER PROTECTION PLAN

- Hired interdisciplinary firm Wittman Hydro Planning to write the Plan and Ordinance
  - **3 Wyoming Geologist's signed off on plan & ordinance**
- Began as a **joint City & County** Project, County later left the process.
- Key Stakeholders Involved: City, County, private landowners, Environmental Advisory Committee
- The plan was dependent upon the information available, current conditions & information that was still needed
- **Science** is a significant component of this planning document
- Environmental Advisory Committee's (EAC) role
- **Different Objectives (public & government)**
- What will the plan & regulations actually provide
- **Compromise**
- Outcome:
  - Casper Aquifer Protection Plan (June 3, 2008)
  - Casper Aquifer Protection Overlay Zone (June 3, 2008)

CITY: CASPER AQUIFER PROTECTION PLAN

- **New western boundary**
- Updated geologic & hydrogeologic data
- Updated list of contamination sources
- Management strategies for potential contaminant sources
- Recommendation for Development Standards **"Site Specific Investigation"** (SSI)
- **Public outreach and education**
- I-80 spill contingency plan (I-80 Plan)
- Septic system alternatives, feasibility study, density reviewed **(East Laramie Study)**
- **Monitoring program**
- **Development** versus **no development**

Figure 1-1
CASPER AQUIFER PROTECTION AREA



Map information provided by Albany County Assessor's Office. Mapping content dated March 2002.

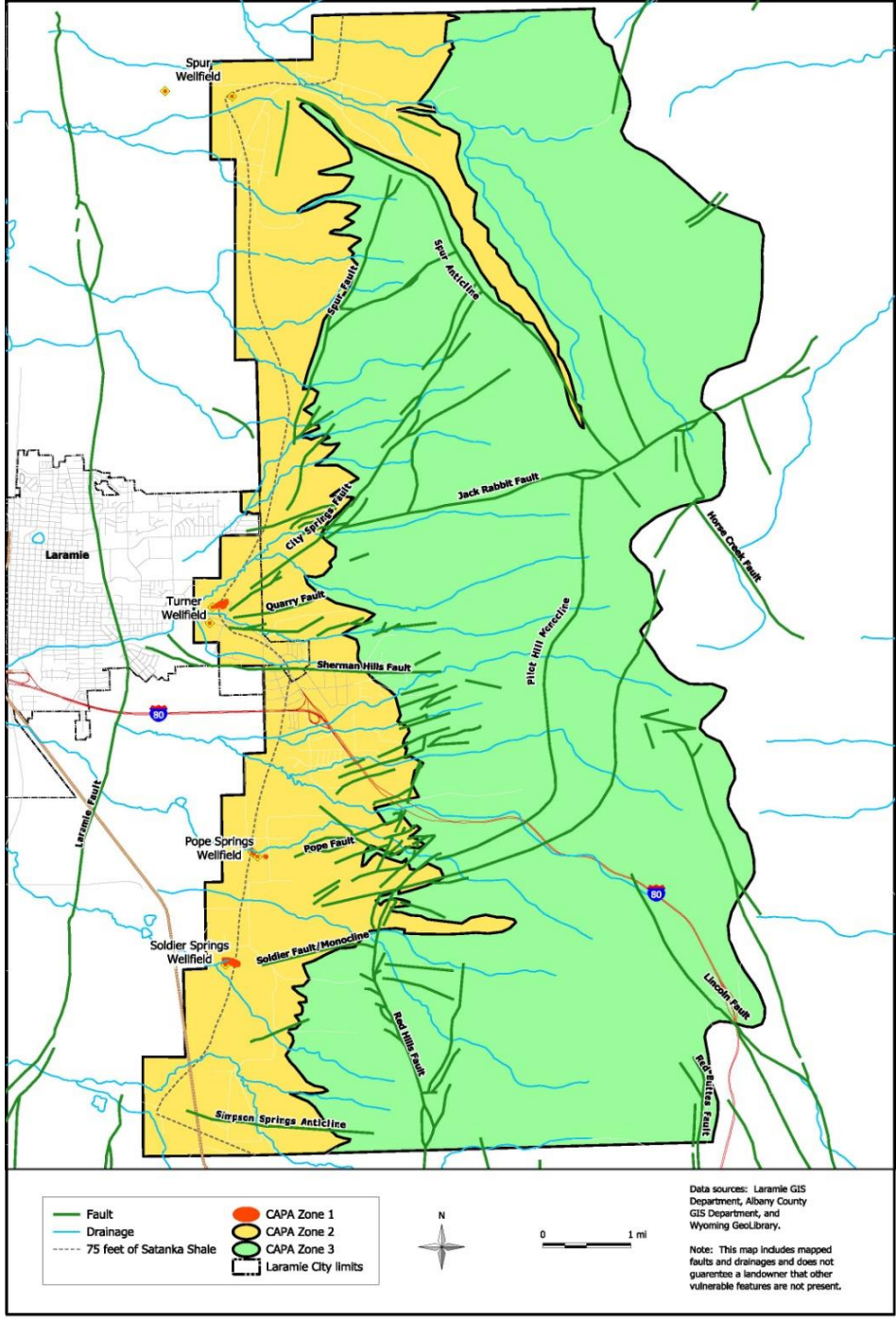


Figure 3-5. Mapped faults and drainages within the Casper Aquifer Protection Area.

CITY: CASPER AQUIFER PROTECTION OVERLAY ZONE (APOZ)

- **New western boundary**
- **Prohibited use** list
- Required **setbacks** from vulnerable features for all development
- **Vulnerable features** defined as fractures, faults, streams, drainages, springs and evidence of hydrogeologic connectivity
- **Site Specific Investigation** & review for new development
- Development defined as **subdivision of land & building permits**, excludes Single Family Residential connecting to city sewer
- Exceptions for utilities
- Pre-existing non-conforming uses addressed

PLAN AND ORDINANCE: KEY POINTS

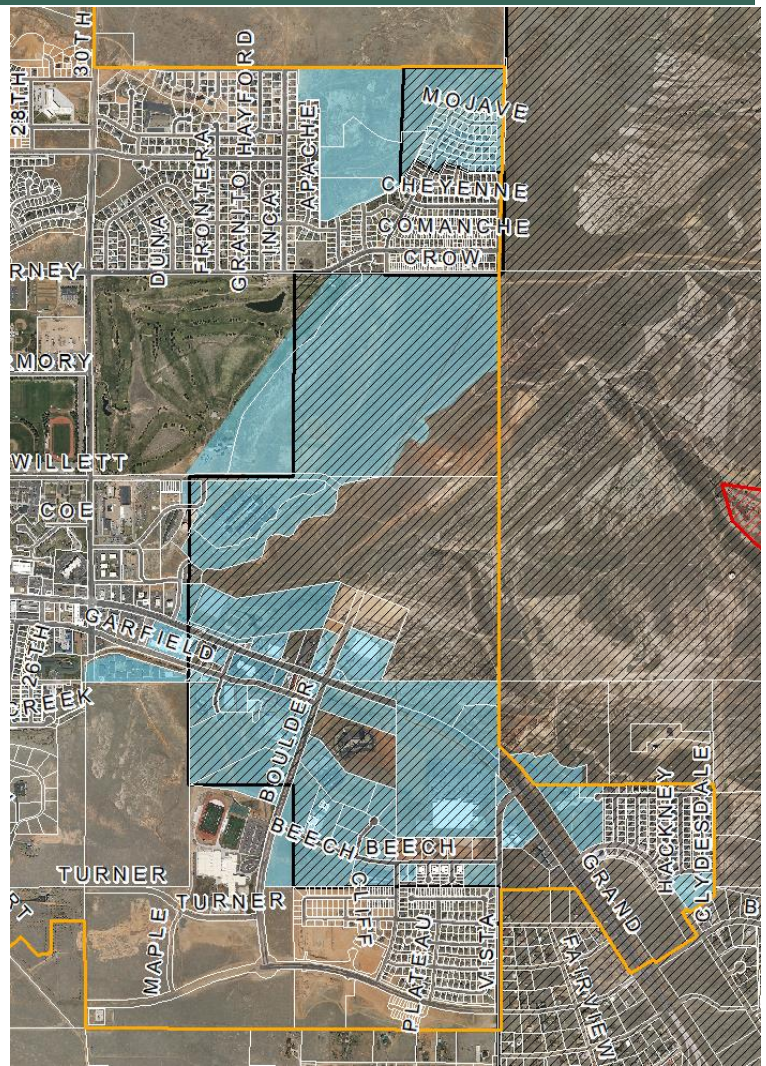
- Protect now or risk contamination later
- Development vs. No Development
- New Western Boundary
- Site Specific Investigation
- Well Monitoring Program Key
- "No Degradation" Standard Not Attainable
- Staffing for implementation a must

SITE SPECIFIC INVESTIGATIONS (SSI)

- Site Specific Investigations
  - What is a Site Specific Investigation (UDC 15.08.040.A)
    - Required by Ordinance for all **"Development"** = Platting, Construction, Reconstruction, Conversation, Structural Alteration and Excavation
    - Preformed by qualified professional **(Geologist, Hydrologist, Engineer)** and reviewed by independent qualified professional hired by the City
    - **Geologic Investigation** (Literature and physical field inspection)
    - Past, Current and Intended use analysis (sources of contamination, amounts stored, what is on site, etc.)
    - Site Plan and Geologic Relationship to **folds, faults, fractures, springs, drainages**, etc.
    - Surface water risk assessment
    - Possible **mitigation** measures identified
    - Project either approved, approved with conditions or denied **(no project has been denied to-date)**

SITE SPECIFIC INVESTIGATIONS (SSI)

- Site Specific Investigations
  - **62 SSI's done since 2008**
    - Project Types: Subdivision to Building Permits
    - ~ SSI Cost to applicant: $2,500 -$5,000; may cost more if complex
    - Qualified Professional City review less than $1,000
  - All 62 have been **approved or approved with required mitigation**
  - Approximately **60% of land** in the City & w/APO has been studied
  - Valuable Information Gained
    - Geologic Information
    - Unknown Wells and Vulnerable Features = Contamination Risk being reduced
    - Best Management Practices
    - Public & Property Owner Education
    - All Studies available to the Public



WHERE ARE WE TODAY?

Current State of the Casper Aquifer

- The City's Municipal Wells **Meet and/or Exceed EPA** Drinking Water Standards
- Aquifer Levels in 2017 Were As High as They Had Been In 33 Years
  - As water levels rise, water quality improves
- Overall Water Municipal Water Demand is Dropping
  - Conservation
  - Infrastructure Improvements
  - Increased Water Rates

City's Concerns with the Casper Aquifer

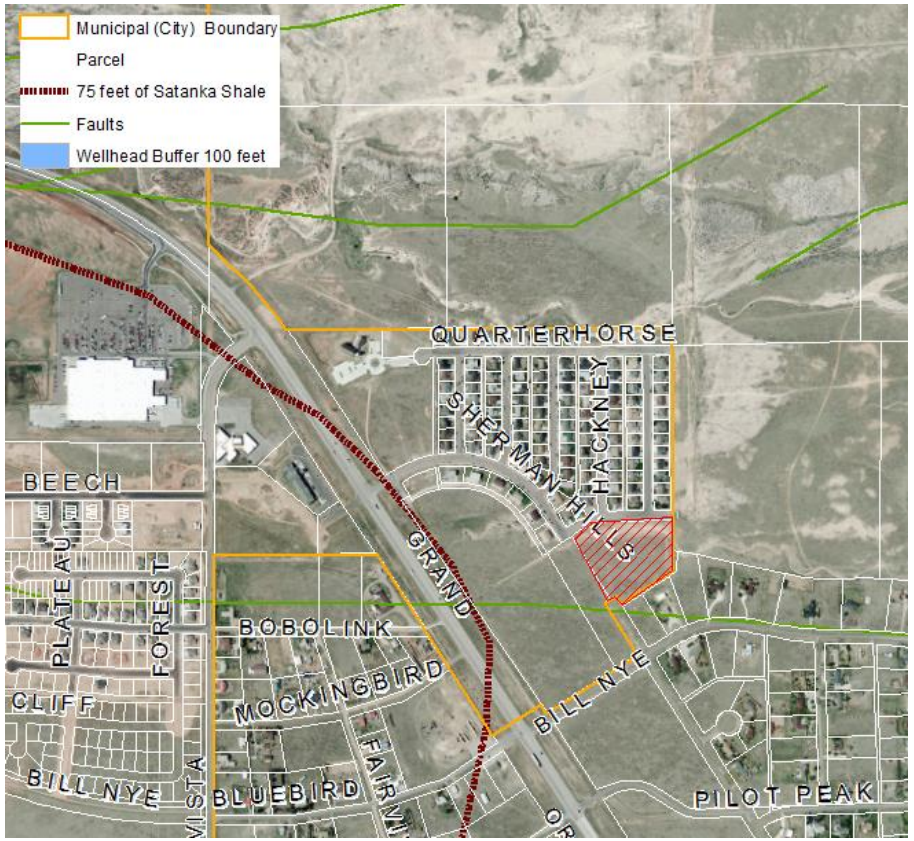
- Continued Development Pressure
  - Quantity and Quality
- Rural Subdivision Densities/Septic System Standards
- **97% of Recharge Area Lies Outside City's Regulatory Control**
- Vulnerability From I-80
- Vandalism/Terrorism
- Continued Viability for 50-Year Municipal Water Planning Horizon

HOW DID WE GET HERE?

- UW Geology Dept. (Huntoon & Lundy) – 1970's
- Municipal Wellhead Protection Plan – 1993
- City/County Casper Aquifer Protection Plan (CAPP) - 2002
- Amended City CAPP and Aquifer Protection Overlay Zone - 2008
- Site Specific Investigations (SSI's) – 2008 - Present
- 2009/2010 Well Monitoring Report – 2009/2010
- Imperial Heights Park Land Purchase - 2009
- County Protection Plan (CAPP) and Regulation - 2011
- The Verge Open Space Acquisition - 2011
- I-80 Telephone Canyon Study – 2011
- East Laramie Water Feasibility Study – 2013
- City Nitrate Monitor Well Network – 2014 - Present
- Santanka Heights Land Purchase - 2015
- Phase II – Well Monitoring Project – 2015
- USGS Sampling - 2016
- Prohibited Use Amendment Process - 2017
- City/County Septic Study – Presently Ongoing

ZONE 2 – IMPERIAL HEIGHTS PARK LAND PURCHASE 2009

- Proposed residential development in a vulnerable area of the aquifer
- Worked with developers to acquire property for a public park
- Cost = $230,000
- Phase II – Well Monitoring Project



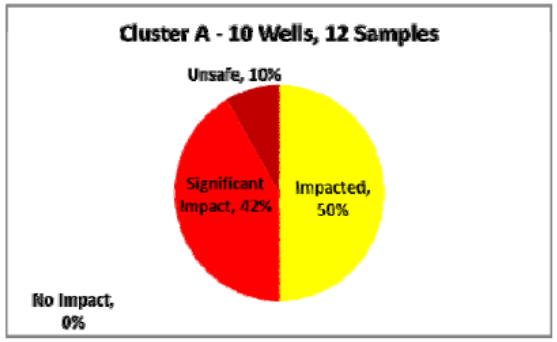
ZONE 2 – THE VERGE OPEN SPACE ACQUISITION 2011

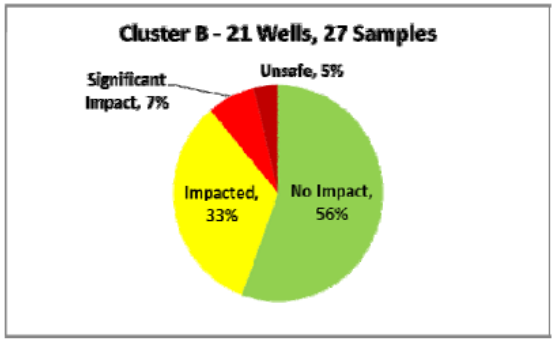
- Acquired as open space as a LMC requirement for multi-family residential development
- 14 acres protected
- Protects a vulnerable feature in the area; intermittent stream
- Now contains a shared use path & protects water going towards the Turner Wellfield

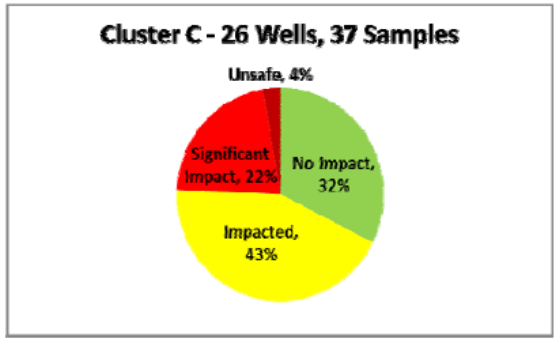
ZONE 2 – SANTANKA HEIGHTS LAND PURCHASE 2015

- Developer purchased land on Ebay
- Determined much of the land was **impossible or difficult** to develop
- Located in an extremely **vulnerable location** within the APO
- **13.6 acres for $58,000**

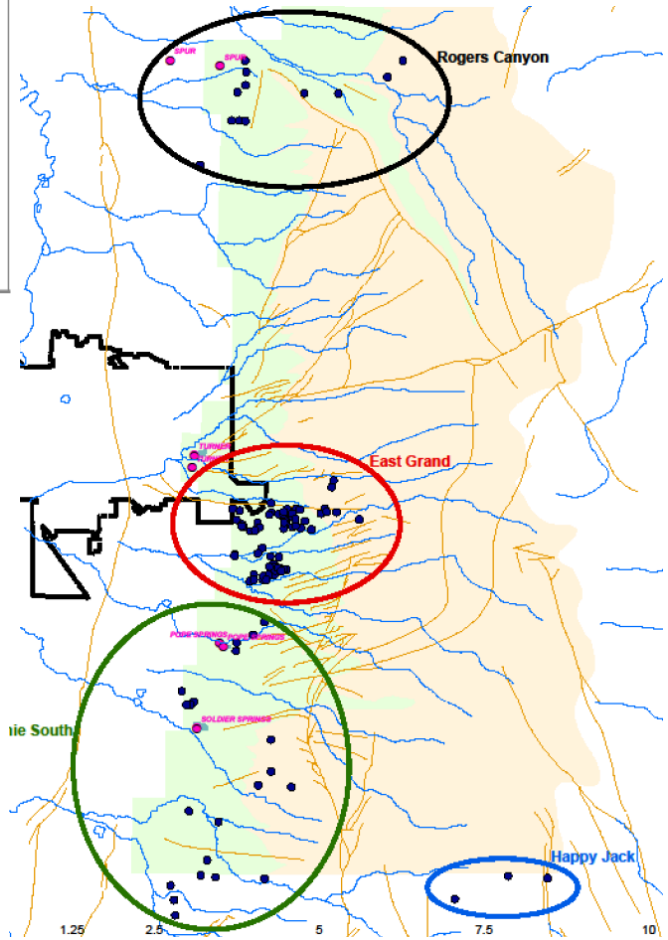
WELL MONITORING REPORT – 2009/2010

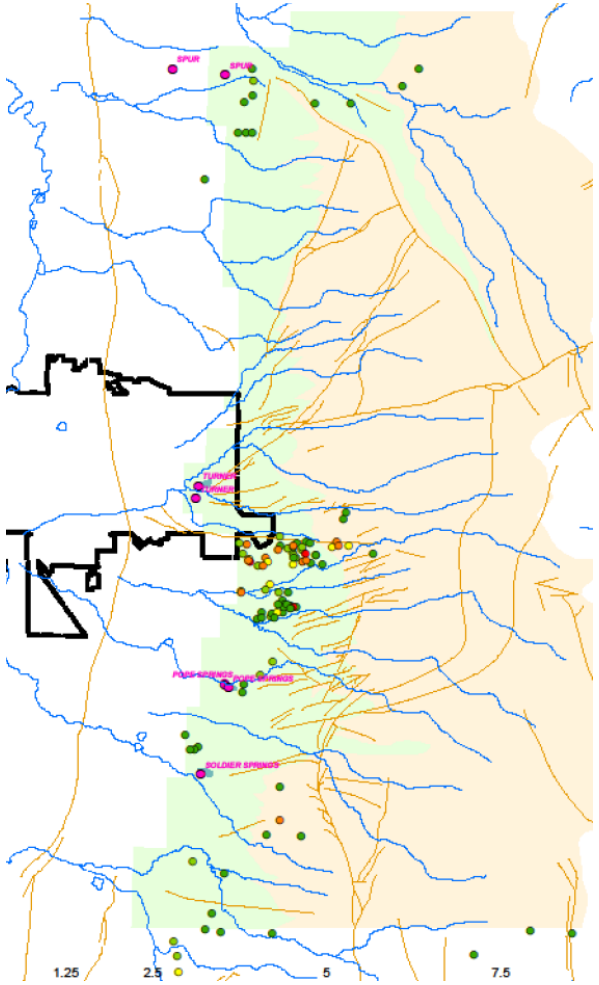




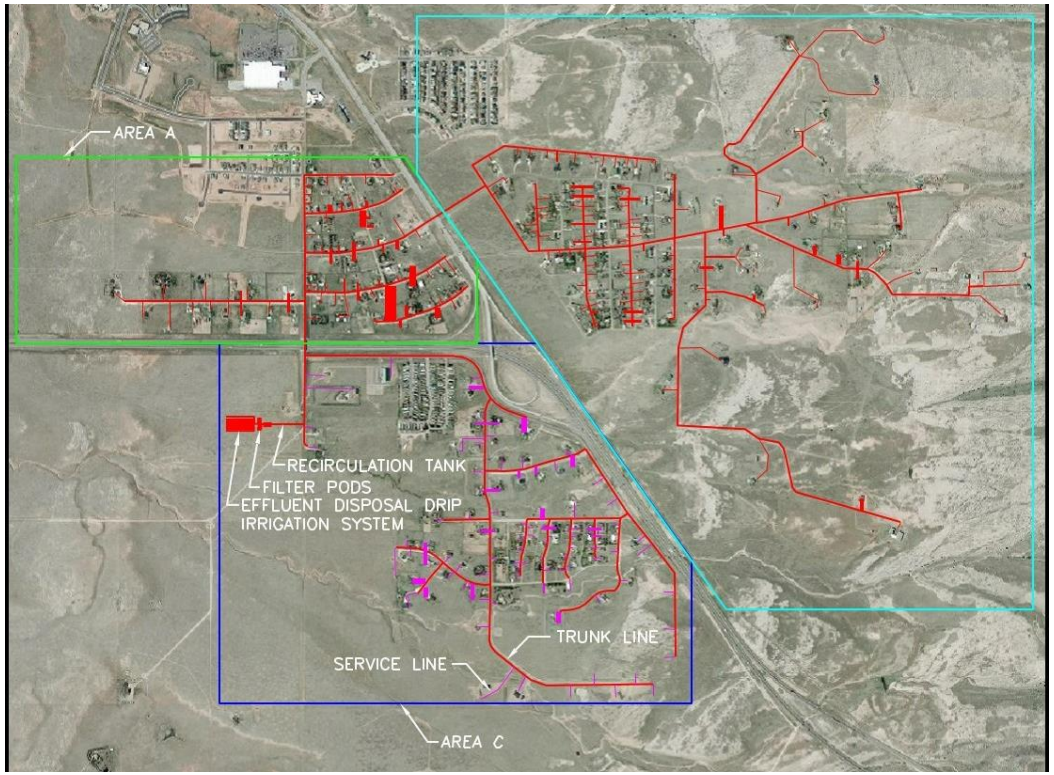


Nitrate Impact Classification	Criteria (Nitrate as N)	Rationale
No Impact	< 2 mg/L	Unable to distinguish between natural and anthropogenic source (Background level)
Impacted	2 to < 5 mg/L	Natural nitrate concentration unlikely at this level, anthropogenic contamination present
Significant Impact	5 to < 10 mg/L	Level triggers increased monitoring by utilities under SDWA due to increased heath risk
Violation of MCL	10 mg/L and greater	Exceeds SDWA MCL, considered unsafe for human consumption



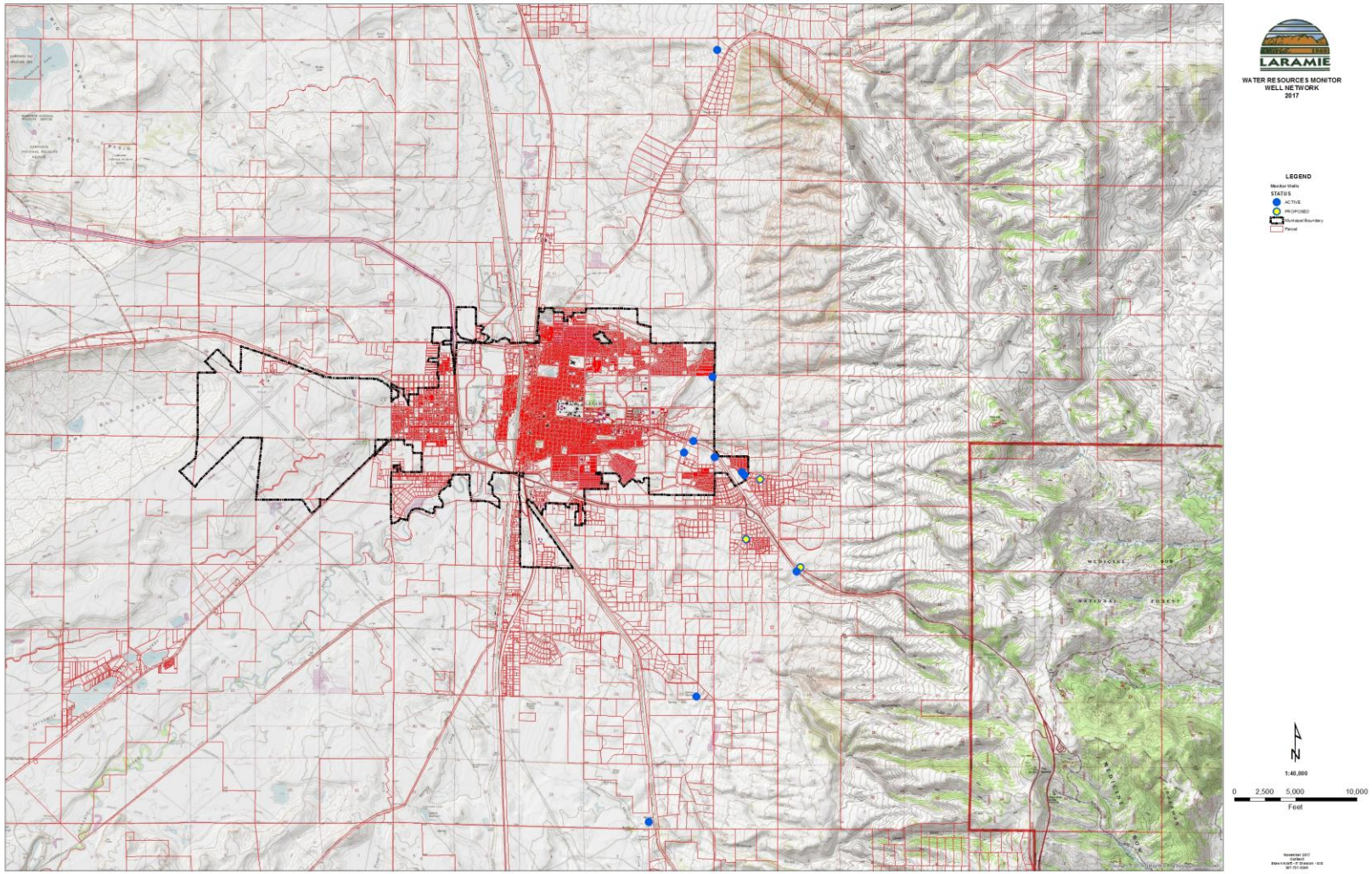


EAST LARAMIE WASTEWATER FEASIBILITY STUDY - 2013



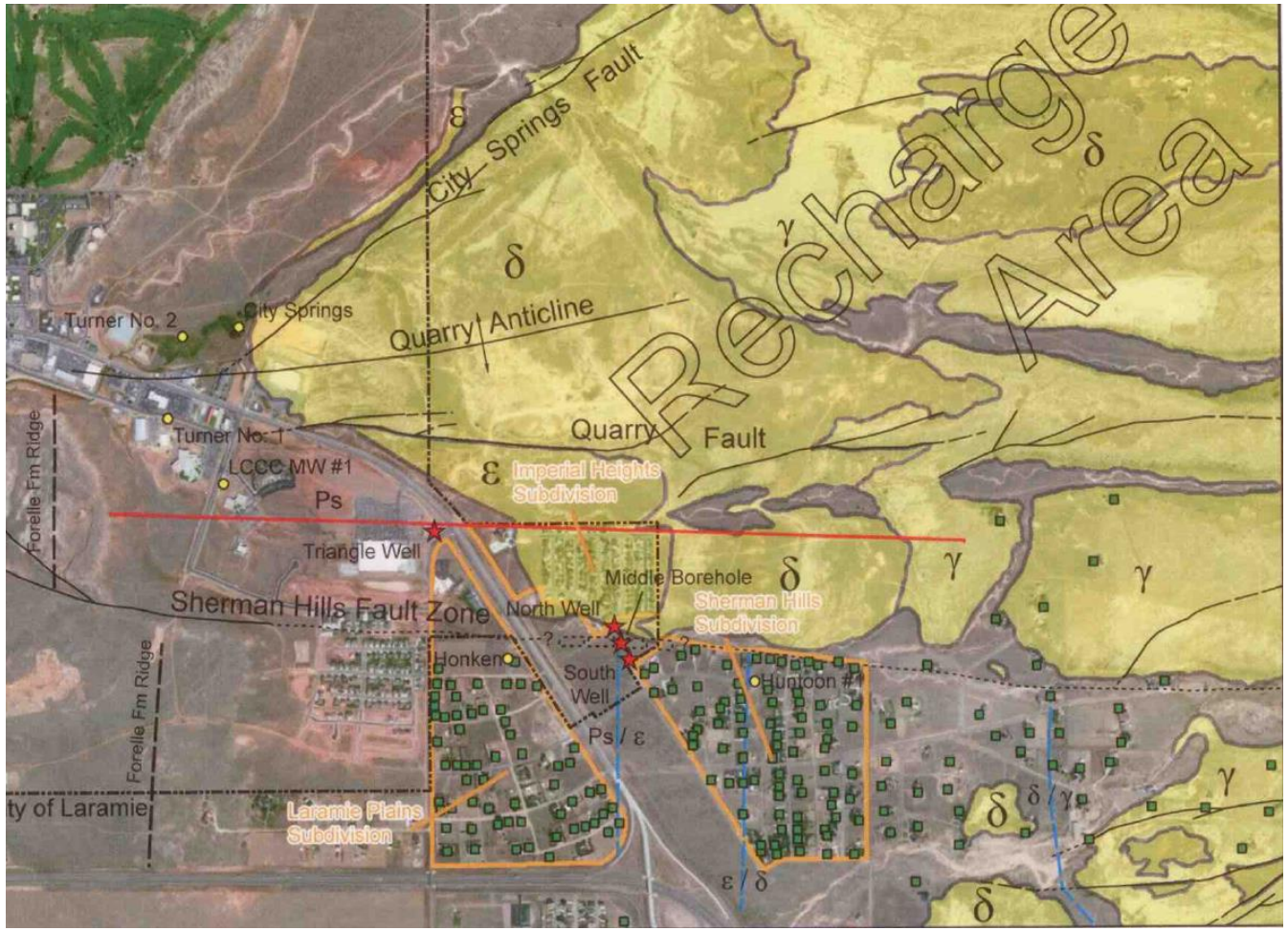
- Premise of the Study: How **feasible** would it be to extend City **Water and Sewer** to County Residents in APO?
- Construction Constraints
- Decentralized System = **$13,000,000**
- City Sewer Connection = **$24,750,000**
- If water contaminated = **$30-40 Million** for a treatment plant.

NITRATE MONITOR WELL NETWORK – 2014 - PRESENT



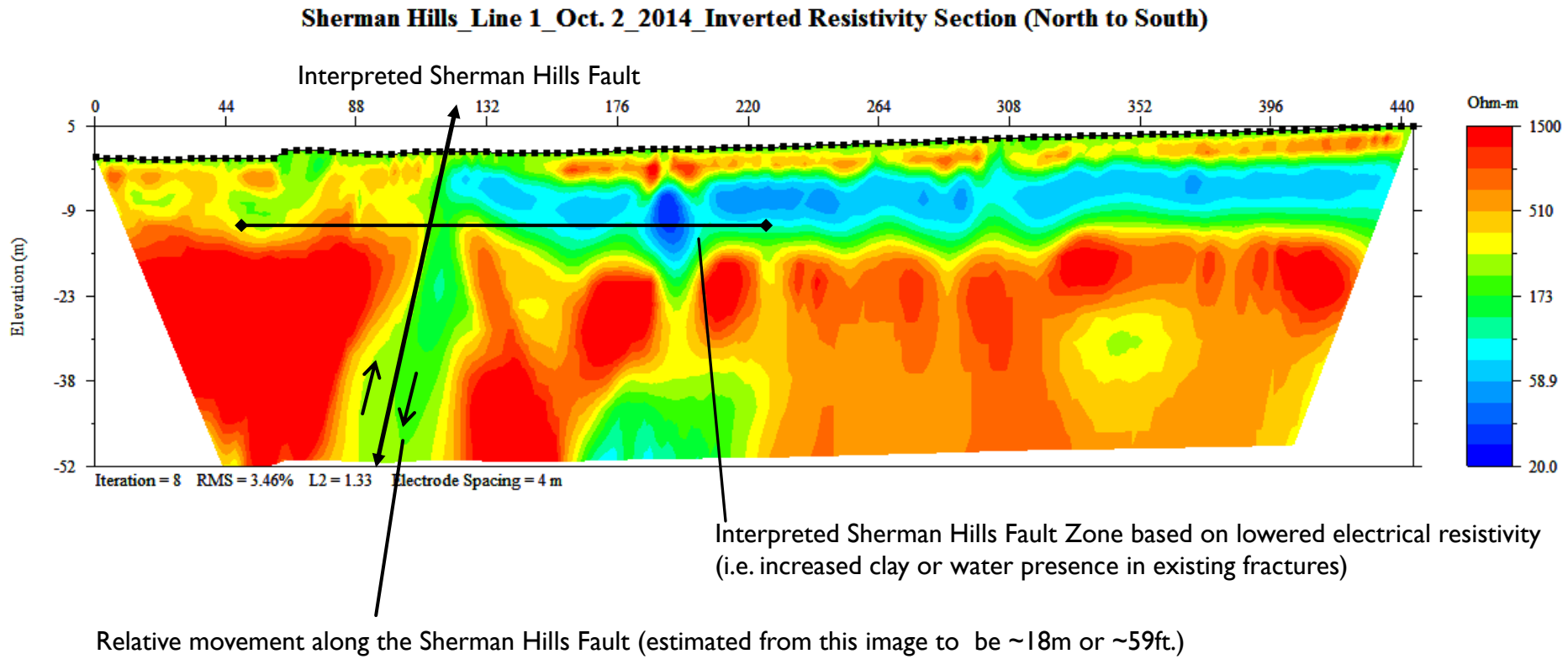
PHASE II MONITOR WELL PROJECT - 2015

- Imperial Heights Park Land Purchase
- **Sherman Hills Fault runs through the property**
- ELWFS suggested that the fault acted as a **"barrier"** to water movement
- Study done to determine **hydrology** and to set up **three monitoring wells**
- Findings:
  - Large amounts of water flow across the fault; it is **not a barrier**
  - Imperial Heights South Well – **6.4 to 8.7 mg/L Nitrates**
  - Imperial Heights North Well – **Non Detect – 1.6 mg/L**
  - Triangle Well – **4.6 to 4.8 mg/L Nitrates**



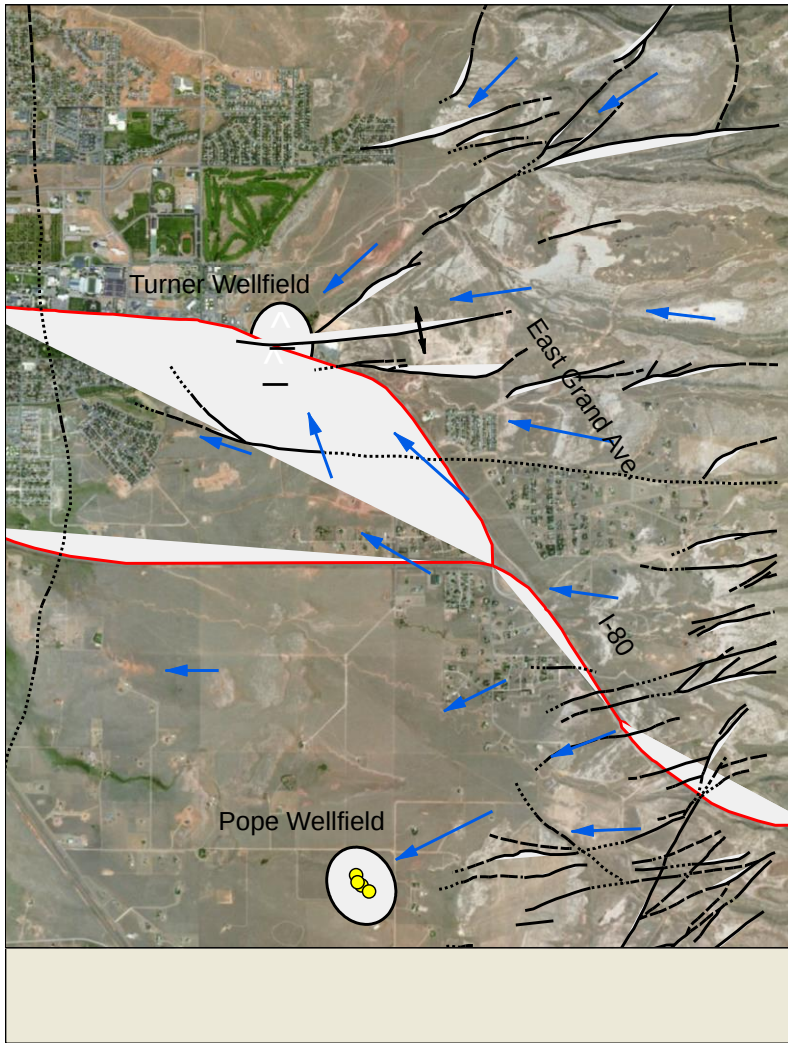
PHASE II MONITOR WELL PROJECT – SHERMAN HILLS FAULT

PHASE II MONITOR WELL PROJECT – SHERMAN HILLS FAULT

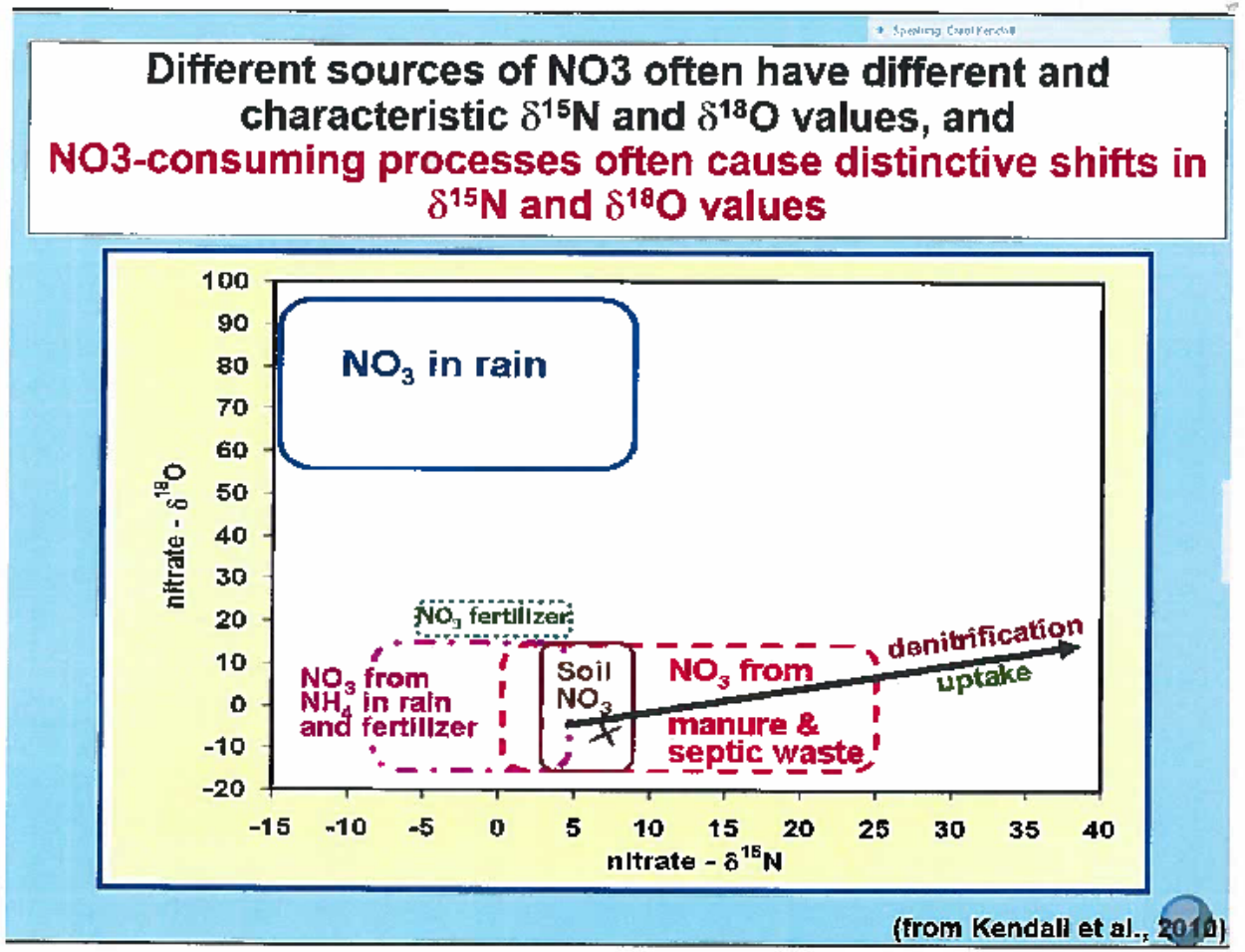


Line 1 Resistivity Data with Sherman Hills Fault Zone Interpretation

PHASE II MONITOR WELL PROJECT – GW FLOW DIRECTION

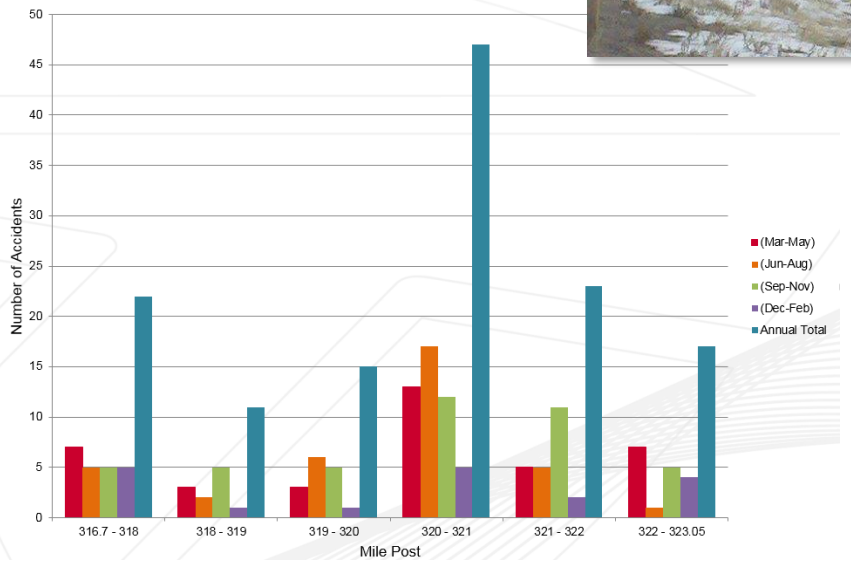


USGS WATER SAMPLING - 2016

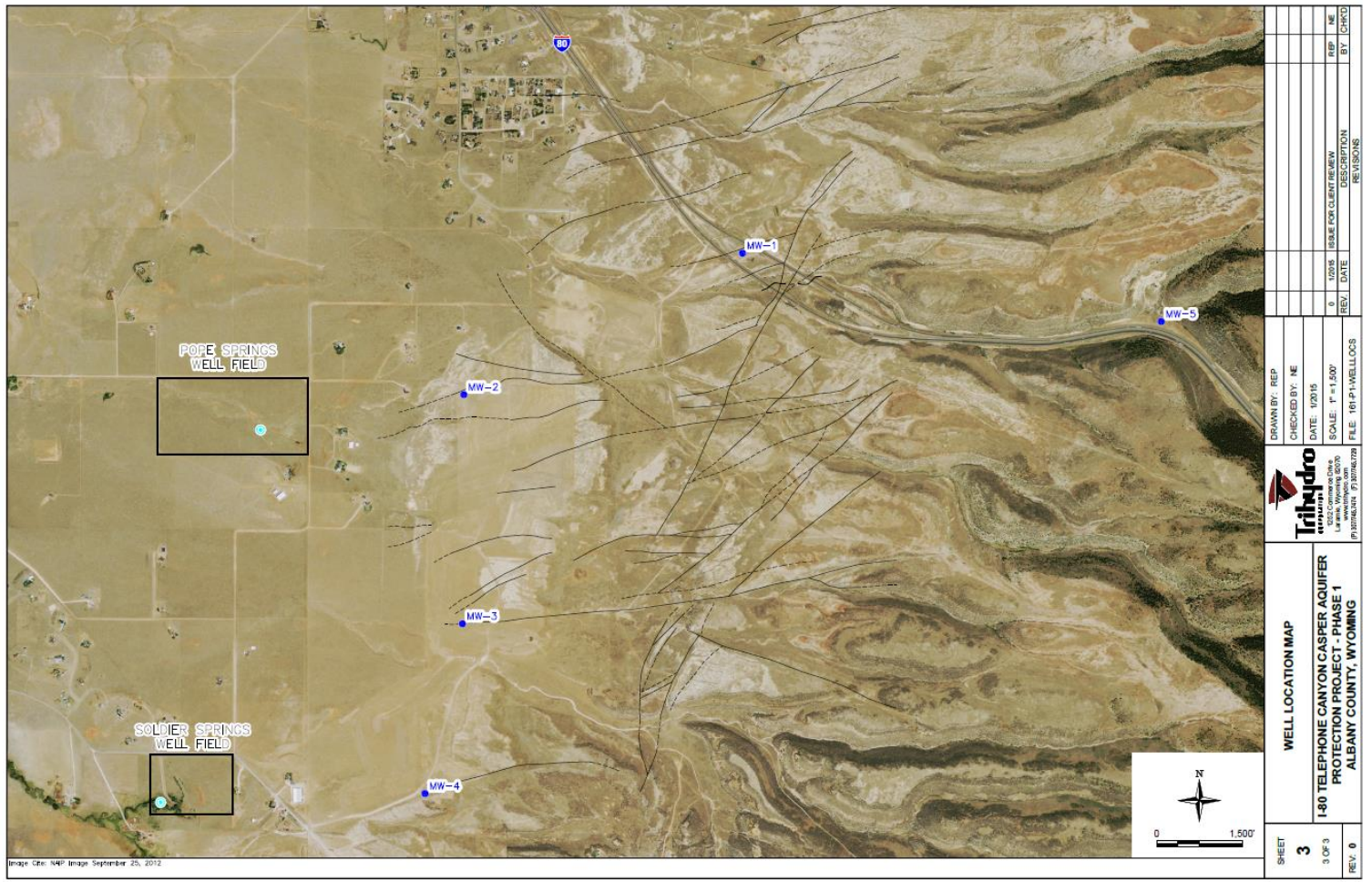


I-80 TELEPHONE CANYON STUDY - 2011

- Consultants: TriHydro (City, County and WYDOT)
- Identify areas of aquifer vulnerability
  - **Geology, Grade & Drainage**
- Determine areas of high **vehicle accident probability**
- Identify the most probable spilled contaminants of concern
  - **Petroleum Products, Household/Industrial Solvents, Ag Products, Radioactive Waste**
- Outline options and associated costs for contamination prevention, response, and mitigation of hazardous materials spills.
  - More Studies
  - **Monitoring Plan (Monitoring Wells) $111,000**
  - Spill Prevention Measures: Seasonal/Variable Speeds & Alternative Road Surfaces
  - Spill Response: Staging, Training & Professional Help
  - Engineering Controls: **Containment and Lining of Channel $1,500,000**



I-80 TELEPHONE CANYON STUDY - 2017



CAPP/CODE PROHIBITED ACTIVITY LIST & ENGINEERING CONTROLS – SPRADLEY-BARR

- Since 2008 all uses in the prohibited use list below have been prohibited.
- For allowed uses, **SSI's have included engineering controls** to mitigate potential risks identified in the SSI.
- **Question:** Could Engineering Controls be used to allow for uses listed as prohibited?

The Following are Prohibited In the APO Zone:

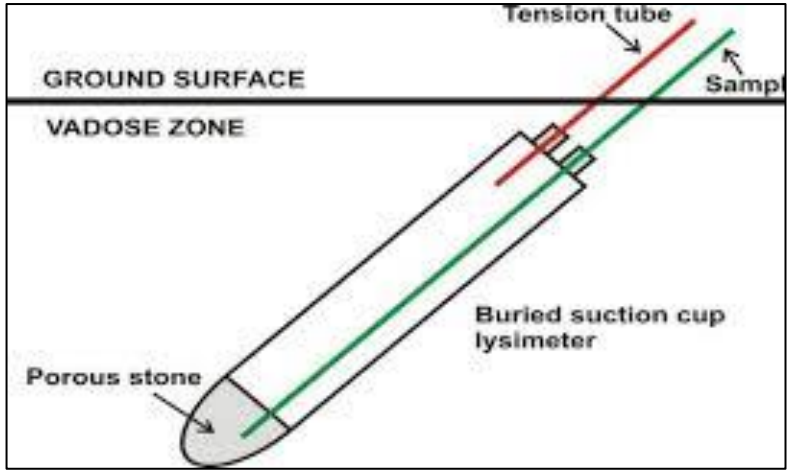
- 26. Commercial and home occupation/home business involving the repair or maintenance of automotive or marine vehicles or internal combustion engines of vehicles, involving the use, storage or disposal of hazardous materials, including solvents, lubricants, paints, brake or transmission fluids or the generation of hazardous wastes. Vehicle service facilities which may include: new or used car dealership, automobile body repair or paint shop, aircraft repair shop, automobile radiator, or transmission repair; small-engine repair; boat dealer; recreational vehicle dealer; motorcycle dealer; truck dealer; truck stop; diesel service station; automotive service station, municipal garage, employee fleet maintenance garage or construction equipment repair or rental.

CAPP/CODE PROHIBITED ACTIVITY LIST & ENGINEERING CONTROLS – SPRADLEY-BARR

- City Staff directed to Develop Amendments to Prohibited Uses List
- Proposed Amendments Reviewed by Wester-Wetstein (Engineering Associates);
  - Recommendations/Conclusions Provided
- Wester-Wetstein Recommendations/Conclusions then Peer Reviewed by WWC Engineering
- EAC Denied Proposed Amendments – February 2, 2017
- Planning Commission Denied Proposed Amendments – March 27, 2017
- City Council – Passed a Resolution Certifying Planning Commission Denial, Along With a Motion to Deny the Proposal – April 28, 2017

WHERE ARE WE TODAY? – CITY/COUNTY SEPTIC STUDY

- **400+ Septic Systems** over the Casper Aquifer Recharge Area
- **Question:** Inadequate Conditions for Denitrification Process to Occur
  - Dry Soils, No Organic Carbon, No Anoxic Zone in the Aquifer, Cold Weather, Septic Effluent is Recharging the Aquifer
- County Lead Agency
- WENCK Associates are the consultants
- 205 (J) DEQ Grant – $60,000 Total Project Cost
  - DEQ - $30,000
  - County - $15,000
  - City - $ 15,000
- 12 Month Data Collection Period



WHERE ARE WE TODAY? - ADDITIONAL PROJECTS

- UW Stable Isotope Lab Study
- Werhmann Nitrate Loading Analysis Models – DEQ
- Additional Monitoring Wells and Testing Parameters
- Wellhead Protection
- Additional Land Acquisition – SPT Funds - $1 Million
- Eventual City and County CAPP Updates
- Collaboration with UW Geophysics/Engineering Depts.
- I-80 / Telephone Canyon
  - Sentinel wells
  - Contaminant Flow Path Study
  - Emergency Response Plan