Caselton Mine Area Project Update
Treasure Hill (OU-1) Feasibility Study
May 21, 2018

Greenfield Environmental Multistate Trust LLC
Trustee of the Multistate Environmental Response Trust

NEVADA DIVISION OF ENVIRONMENTAL PROTECTION

Agenda

- Introductions
- OU-1 Feasibility Study (FS)
  - ✓ Recap of Remedial Investigation (RI) Results
  - ✓ FS Framework
  - ✓ Alternatives Analysis
  - ✓ Recommendations for Implementation

Introductions

- **NDEP**
  - ✓ **Jeryl Gardner, AML Program Manager**
  - ✓ **Jeff Collins, BCA Bureau Chief**
- **Multistate Trust**
  - ✓ **Marc Weinreich, Managing Principal**
  - ✓ **Tasha Lewis, Program/Project Manager**
  - ✓ **David Schnakenberg, Sr. Strategist**
  - ✓ **Bob Rollins, Field Manager**
  - ✓ **Chuck Zimmerman, BC Project Manager**
- **Others**

OU-1 RI Summary for FS

- Evaluation of Stormwater Run-off
- Solids Characterization
- Screening-Leval Human Health Risk Assessment (HHRA)
- Conceptual Model Update

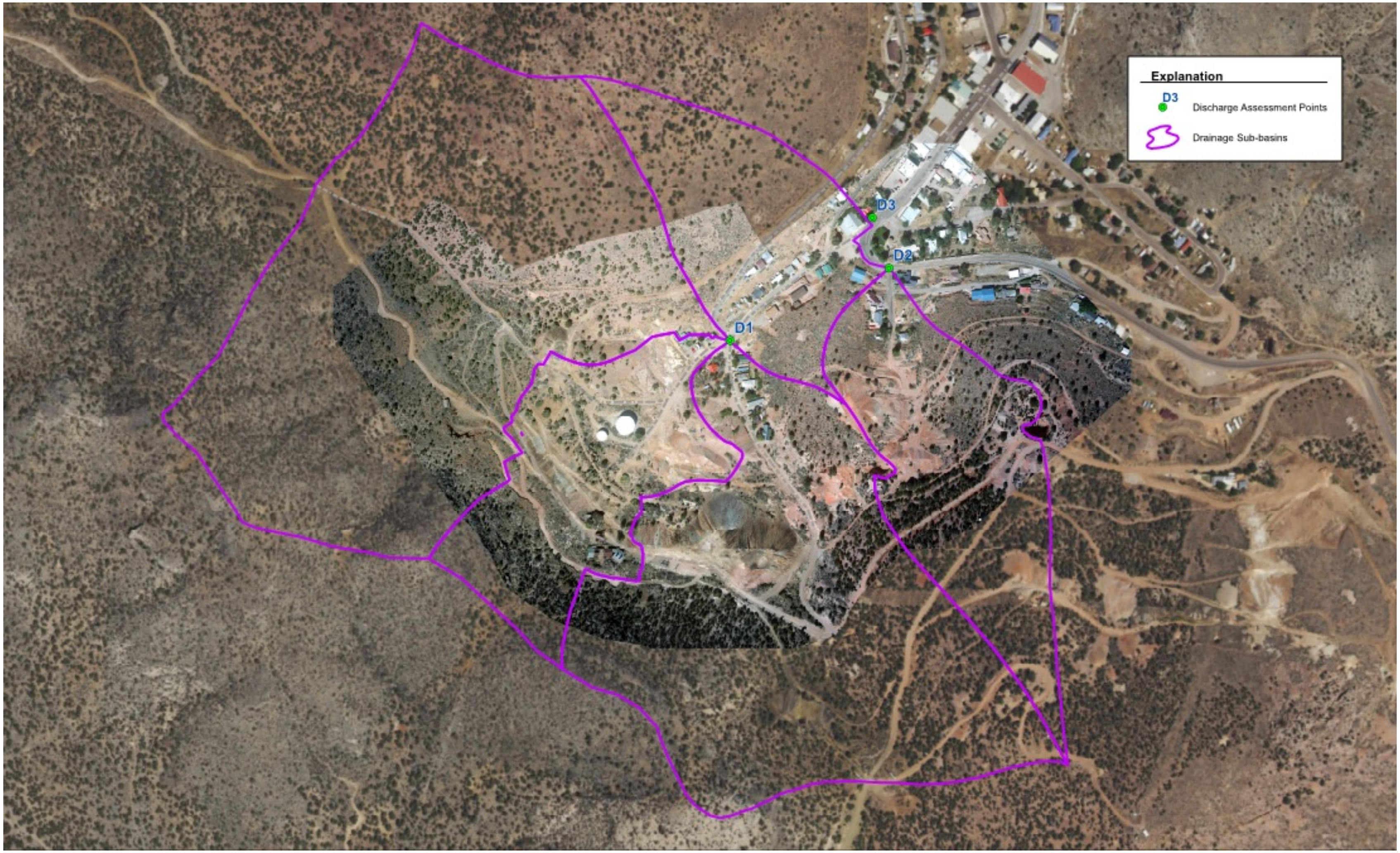
Treasure Hill Stormwater Model Objectives

- Peak run-off and volumes for 5- to 500-year design storm events
- Sediment Transport
- Comparison with Sunrise Engineering Analysis

Precipitation Depths

Precipitation Event (frequency and duration)	Precipitation Depth (inches)
5-year, 24-hour	2.07
10-year, 24-hour	2.43
25-year, 24-hour	2.93
50-year, 24-hour	3.33
100-year, 24-hour	3.74
200-year, 24-hour	4.17
500-year, 24-hour	4.76
Monsoonal Storms from the Southeast	8.3
General Storms from the Northwest	11.2

Treasure Hill Drainage Sub-Basins



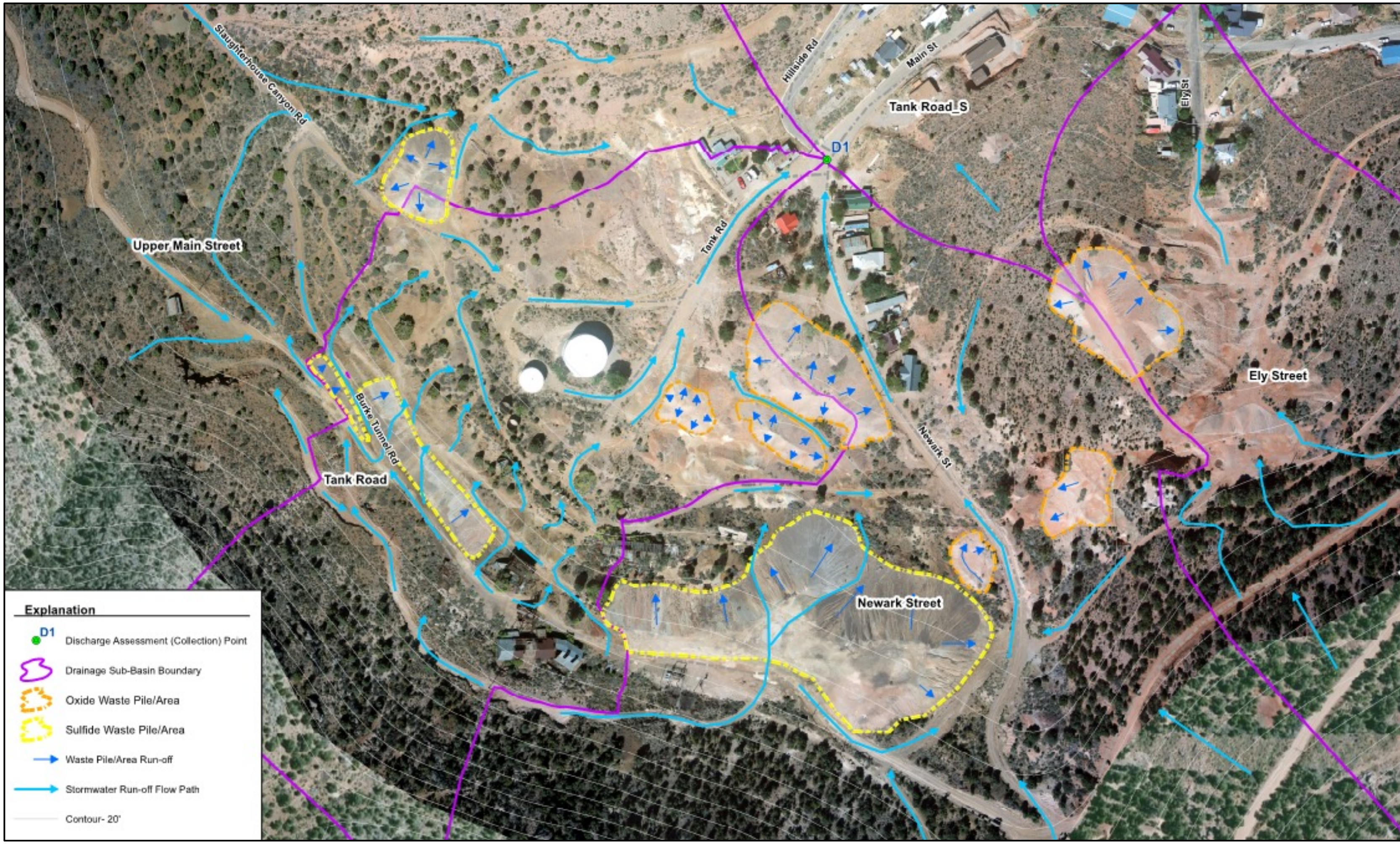
Run-off Peak Discharges and Volumes

Discharge Node	Total Drainage Area		Peak Discharge (cubic feet per second)						
	(acres)	(mi²)	5-YR	10-YR	25-YR	50-YR	100-YR	200-YR	500-YR
D1	110.7	0.173	64	95	144	185	230	278	346
D2	17.9	0.028	15	21	30	37	45	53	65
D3	143	0.224	96	139	205	261	320	384	474
D4	243	0.379	183	255	361	451	546	647	789
Discharge Node	**Total Drainage Area**		**Run-off Volume (acre-feet)**						
	(acres)	(mi²)	5-YR	10-YR	25-YR	50-YR	100-YR	200-YR	500-YR
D1	110.7	0.173	4.5	6.4	9.4	12.0	14.8	17.8	22.2
D2	17.9	0.028	1.0	1.3	1.9	2.3	2.8	3.4	4.1
D3	143	0.224	6.6	9.2	13.2	16.7	20.4	24.5	30.3
D4	243	0.379	14.5	19.5	27.0	33.4	40.2	47.5	57.8

Discharge and Sediment Volumes

Discharge Node	Total Drainage Area		Run-off Volume (acre-feet)						
	(acres)	(mi2)	5-YR	10-YR	25-YR	50-YR	100-YR	200-YR	500-YR
D1	110.7	0.173	4.5	6.4	9.4	12.0	14.8	17.8	22.2
D2	17.9	0.028	1.0	1.3	1.9	2.3	2.8	3.4	4.1
D3	143	0.224	6.6	9.2	13.2	16.7	20.4	24.5	30.3
D4	243	0.379	14.5	19.5	27.0	33.4	40.2	47.5	57.8
Discharge Node	Total Drainage Area		Sediment Volume (acre-feet)						
	(acres)	(mi2)	5-YR	10-YR	25-YR	50-YR	100-YR	200-YR	500-YR
D1	110.7	0.173	2.1	2.3	2.6	2.9	3.1	3.4	3.7
D2	17.9	0.028	0.5	0.5	0.6	0.6	0.7	0.7	0.8
D3	143.4	0.224	2.9	3.3	3.7	4.1	4.4	4.8	5.2
D4	243	0.379	4.7	5.2	6.0	6.6	7.1	7.7	8.4

Treasure Hill Run-Off Flow Pathways



BC and SE Models - Key Differences

Parameter/Assumption	SE Model	BC Model	Differences
Number of sub-basins	1	6	BC model included 6 sub-basins versus the Sunrise model single basin ("88b"; SE model area included a number of basins as part of a larger area of analysis)
Rainfall distribution for 100-year/24-hour event	Linear	SCS Type II	SCS Type II is a widely accepted distribution for runoff modeling used by the Natural Resources Conservation Service (NRCS, 1986)
Maximum Intensity (inches/hour)	0.27	5.13	The SCS Type II distribution has a high intensity at the center of the storm, characteristic of thunderstorms, in contrast to a linear distribution which has the same intensity throughout the storm duration.
Rainfall depth for 100-year/24-hour event (inches)	3.66	3.74	The NOAA Point Precipitation data was selected from different locations. The BC location was selected further up the hillside (6340 ft elevation) from the SE location in the downtown area (6008 ft), because rainfall is expected to be greater at the higher elevation and is more characteristic of the project site.
Rain on snow event adjustment	2.8	none	SE added a depth of 2.8 in of rainfall to the 100-year 24-hour depth (3.66 inches) to simulate a rain-on-snow event, assuming this would be the worst-case scenario. BC did not adjust for snowmelt, assuming that an intense storm event is likely to occur in spring or summer seasons when the chance of a significant snow pack is minimal.
Average Curve Number (CN)	83	82	Slight differences in land use land cover mapping resulted in a difference in the average CN between the model sub-basin(s).
Basin lag time (minutes)	10	6.6	The average lag time presented is based on several flow paths which capture the range of flow path time of concentrations (long and short), versus the SE model which is a lumped model with a less refined time of concentration.

Waste Rock and Soils Characterization

- Waste Rock
  - ✓ Whole Rock Geochemistry
  - ✓ Meteoric Water Mobility Procedure (Leachate Geochemistry)
- Soils
  - ✓ Yard and Roadway Soils Geochemistry
  - ✓ Background Soils Geochemistry

Waste Rock & Soil Values

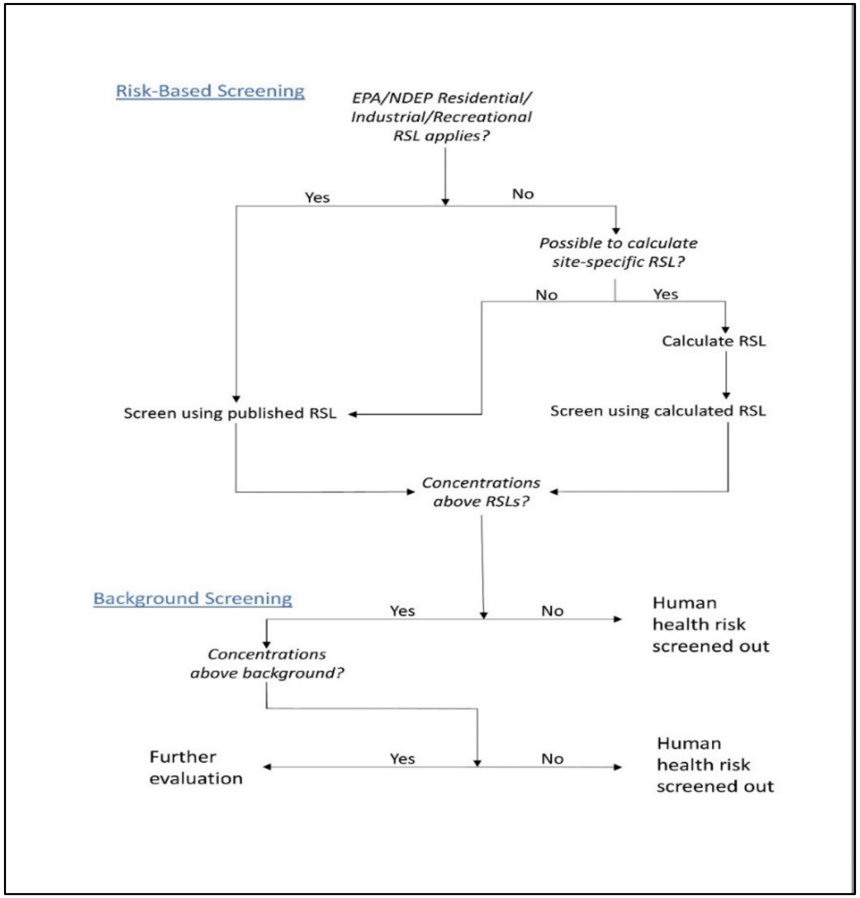
	Arsenic (1)	Copper	Iron	Lead (1)	Manganese	Silver	Zinc
Average Waste Rock Values	246	274	35,615	8,180	1,570	46	6,168
Average Yard Soil Values	39			416			
Average Roadway Soil Values	71			1,308			
Average Background Soil Values	17			207			

(1) Arsenic and lead determined to be only potential human health risk drivers, aka chemicals of potential concern (COPCs); OU-1/OU-2 RI Report (BC, 2015)

OU-1 Screening Level HHRA

- **COPCs = arsenic and lead in waste rock, yards and sediments**
- **Receptors = visitor, resident, construction and cleanup workers**
- **Exposure Pathways = inhalation, ingestion, dermal contact**
- **HHRA Evaluation Methods**
  - ✓ Comparison to regional screening levels (RSLs) residential, industrial, recreational
  - ✓ Comparison to local background soils
  - ✓ Calculate Site-specific RSLs or risk-based concentrations (RBCs)
  - ✓ Comparison to analogous sites in Nevada for cleanup levels

Screening-Level HHRA Approach



HHRA Approach for OU-1 Receptors

- Treasure Hill recreational user/visitor: Site-specific RSL Calculator for recreational user
- Treasure Hill construction worker: not performed
- OU-1 resident (adult and child): use of residential questionnaire, analogous sites and Adult Lead Model (ALM)
- OU-1 street cleanup worker: calculated RBCs with exposure frequency and durations, and ALM

OU-1 Resident Questionnaire Results

- Stormwater run-off transports sediments to street and yard depositional areas
- Dust can be tracked into homes by people/pets, and blown in by wind
- Yards tend to be Dirt without sod; minimal garden produce grown
- Most homes occupied part-time; 5-7 homes occupied full-time (currently no young children)
- Children periodically play in yards, streets and on Treasure Hill
- Treasure Hill used for recreational hiking, off-road vehicles, mineral collection, etc.

Analogous Nevada Mine Site HHRAs

- Eureka, Nevada Smelter
  - ✓ Tiered arsenic cleanup level from 234 to 600 mg/kg
  - ✓ Removal action = 3,000 mg/kg lead and 600 mg/kg arsenic
- McDermitt, Nevada Calcines
  - ✓ Arsenic cleanup level = 60 mg/kg where children are present

HHRA Findings - Recreational User

- Arsenic and lead are the only COPCs with average values in waste rock that exceed all RSLs; retained as risk drivers for HHRA and remedial action
- Frequent recreational users (75 days/year) may be at risk; signage mitigation recommended
- Infrequent visitors/tourists not likely to be exposed at levels of concern due to limited duration and infrequency of exposure

HHRA Findings - Resident

- OU-1 residential soils with arsenic and lead should be removed using 60 and 400 mg/kg cleanup levels, respectively
- Lead cleanup value is conservative relative to RSL in consideration of respect to future young child resident
- Recommended cleanup locations with >400 mg/kg lead correspond to locations with >60mg/kg arsenic

Parcels for Potential Yard Soils Removal

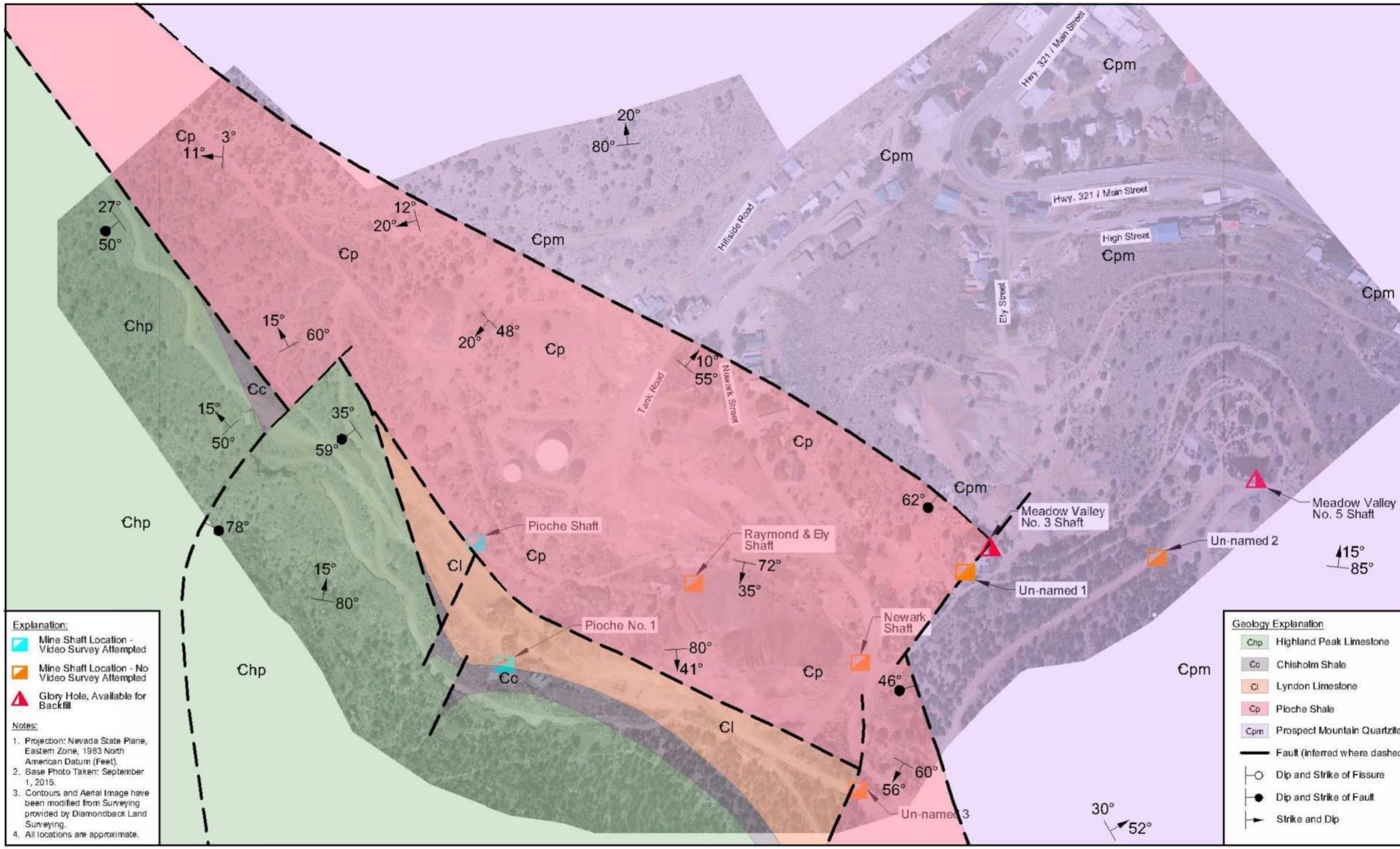
HHRA Findings - Cleanup Worker

- Exposure frequency (EF) range of 4-8 days; 8 hours/day for RBCs based on Lincoln County estimate of worker activity:
  - ✓ major cleanup - 3 days/year; 6 hours/day
  - ✓ minor cleanup - 4 days/year; 2 hours/day
- Lead RBCs (ALM) = 4,400 mg/kg (EF = 4) and 8,700 mg/kg (EF = 8) (average lead value in roadway sediments = 540 mg/kg)
- Arsenic RBCs = 60 mg/kg (EF = 4) and 120 mg/kg (EF = 8) (average arsenic value in roadway sediments = 73 mg/kg)
- No risk to cleanup worker under current conditions

Updated Conceptual Model Elements

- Geology
- Observed Waste Rock Characteristics
- Sediment Transport
- Shaft Conditions

Treasure Hill Geologic Map



Existing Waste Rock Conditions

Existing Waste Rock Conditions

Sediment Transport

Sub-Basin Sediment Volumes

Sub-Basin	Total Drainage Area		Sediment Volume (acre-feet)						
	(acres)	(mi^2)	5-YR	10-YR	25-YR	50-YR	100-YR	200-YR	500-YR
Newark Street	40.3	0.063	0.7	0.8	0.9	1.0	1.1	1.2	1.3
Tank Road	15.4	0.024	0.4	0.4	0.5	0.5	0.6	0.6	0.7
Upper Main Street	55.0	0.086	0.9	1.1	1.2	1.3	1.4	1.5	1.7
Total at D1	110.7	0.173	2.1	2.3	2.6	2.9	3.1	3.4	3.7

Waste Rock Type and Area

Sub-Basin (area)	Waste Pile/Area Type	Waste Pile/Area (acres)	Percentage of Waste Type	Total Waste Pile or Area in Sub-Basin (acres)	Percentage of Total Waste Pile/Area
Newark Street (40,6 acres)	Oxide Waste	1.07	20%	3.83	73%
	Sulfide Waste	2.76	53%		
Tank Road (15.4 acres)	Oxide Waste	0.59	11%	1.16	22%
	Sulfide Waste	0.57	11%		
Upper Main Street (55.1 acres)	Oxide Waste	0.00	0%	0.24	5%
	Sulfide Waste	0.24	5%		
Total Waste Pile/Area		5.23	100%	5.23	100%

Sediment Transport Conclusions - 1

- Large area of erodible sulfide waste rock in Newark Street compared to Tank Road and Upper Main Street Sub-Basins
- Concentration of relatively stable oxide waste rock piles located in Tank Road Sub-Basin
- Physical properties, topography and size of waste rock piles or areas influence erosion and solids transport in run-off
- Using weighted average of waste rock type and area, at least 73% of transported sediment reaches D1 along Newark Street (likely 80% or more due to more erodible sulfide waste)

Sediment Transport Conclusions - 2

- Sediment transport to D1 normalized to 100% (rounded to the nearest 1%):
  - ✓ **Upper Main Street** = 55.1 sub-basin acres x 0.24 waste pile/area acres = 13.22 or **8%**
  - ✓ **Tank Road** = 15.4 sub-basin acres x 1.16 waste pile/area acres = 17.86 or **11%**
  - ✓ **Newark Street** = 40.6 sub-basin acres x 3.25 waste pile/area acres = 131.95 or **81%**

Alternatives Analysis

- EPA (1990) guidance for FS decision-making requires the following be considered in the remedy selection process:
  - ✓ Applicable or relevant and appropriate requirements (ARARs)
  - ✓ Remedial Action Objectives (RAOs)
  - ✓ Threshold, Primary Balancing and Modifying Criteria

ARARs

- Cleanup goals for residential yard soils of 400 and 60 mg/kg, respectively, for lead and arsenic
- NDEP mine closure criteria (NAC 445A.432) requires closure designs to withstand a 500-year storm event (e.g., waste rock repository or stormwater BMP)

RAOs

- RAOs are medium- or area-specific objectives to protect human health and the environment relative to existing conditions:

  - ✓ RAO No. 1 - prevent resident exposure to residential yard soils in parcels with lead and arsenic concentrations above levels that are protective for residential use (yard soil removals).

  - ✓ RAO No. 2 - limit recreational user exposure to waste rock materials on Treasure Hill (institutional controls such as signage)

Additional RAO Considerations

- If the removal and disposal of roadway sediments after storm events posed a human health risk to cleanup workers, O&M procedures and PPE may be needed (the HHRA evaluation indicates no human health risk

- Any remedial action implemented by the Multistate Trust should:

  - ✓ not increase short- or long-term sediment transport relative to existing conditions by de-stabilizing existing waste rock piles or erodible sub-grade materials

  - ✓ optimize annual and life-cycle O&M costs for the removal and disposal of roadway sediments, and limit the adverse environmental effect of dispersal of managed sediments as wind-blown dust

Decision Criteria for Remedy Selection

- Threshold
  - ✓ Overall protection of human health and the environment
  - ✓ Compliance with ARARs
- Primary Balancing
  - ✓ Long-term effectiveness and permanence
  - ✓ Reduction of toxicity, mobility, or volume through treatment
  - ✓ Short-term effectiveness
  - ✓ Implementability
  - ✓ Cost
- Modifying
  - ✓ State Acceptance
  - ✓ Community Acceptance

OU-1 Remedial Alternatives

No. 1 - No Action
No. 2 - Residential Yard Soil Removals (RYSRs) and Curb and Gutter (C&G) Installations

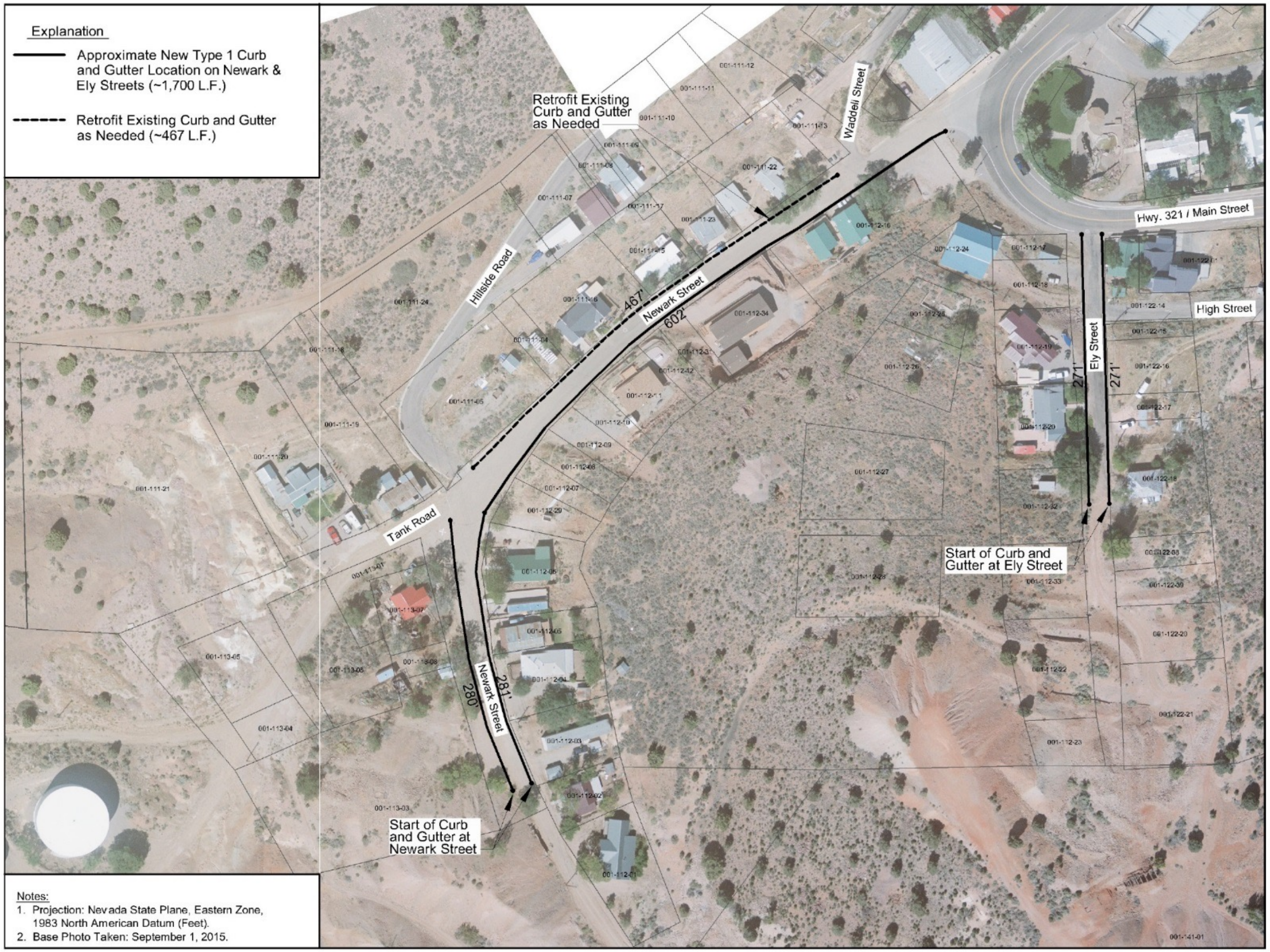
No. 3 - Low-Elevation Stormwater Best Management Practices (BMPs)
No. 4A - On-Site WRR and Low-Elevation BMPs
No. 4B - On-Site WRR with Toe Grout Stabilization and Low-Elevation BMPs
No. 4C - Construction of On-Site WRR with Cover and Low-Elevation BMPs

No. 4D - On-Site WRR with Low- and High-Elevation BMPs
No. 5A - Off-Site WRR with Low-Elevation BMPs
No. 5A - Off-Site WRR with Low- and High-Elevation BMPs
No. 6A - Off-Site WRR and Stormwater Retention Basins (SRBs)
No. 6B - Off-Site WRR and Stormwater Retention Basins (SRBs) and High-Elevation BMPs

No. 6C - Off-Site WRR and SRBs and Storm Sewer Pipeline (SSP)
No. 7 - Sunrise Engineering Capital Improvement Plan (6c is closest approximation)

Parcels for Potential Yard Soils Removal

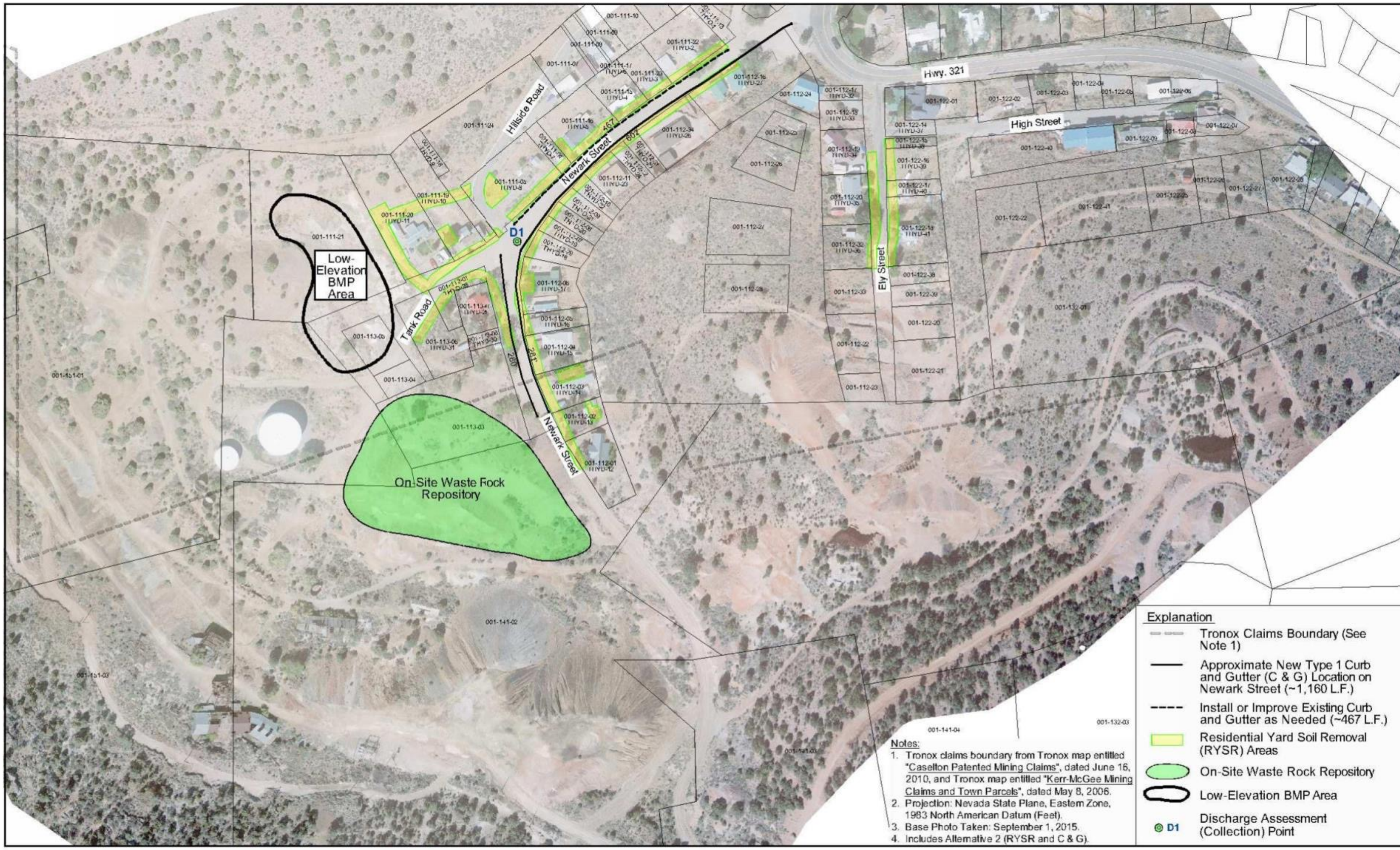
C&G Installations/Repairs



Basis for Implementing Alt. No. 2

- Yard soil removal only remedy that protects human health, is ARAR-compliant and achieves RAOs
- Achieves short- and long-term effectiveness (with C&G maintenance) and permanence (LTEP)
- Readily implemented
- Low cost
- NDEP-accepted

On-Site WRR with BMPs



Sediment Transport and BMPs

- Sediment volumes transported under current or future conditions will be the same for the range of storm events, whether deposited on streets or on streets and within/behind BMPs
- Annual average O&M activities to cleanup sediments from streets and BMPs will require longer hours and longer exposure times
- Longer hours and longer exposure times = greater potential human health risk to workers

Basis for Non-Implemention of Alt. No. 3

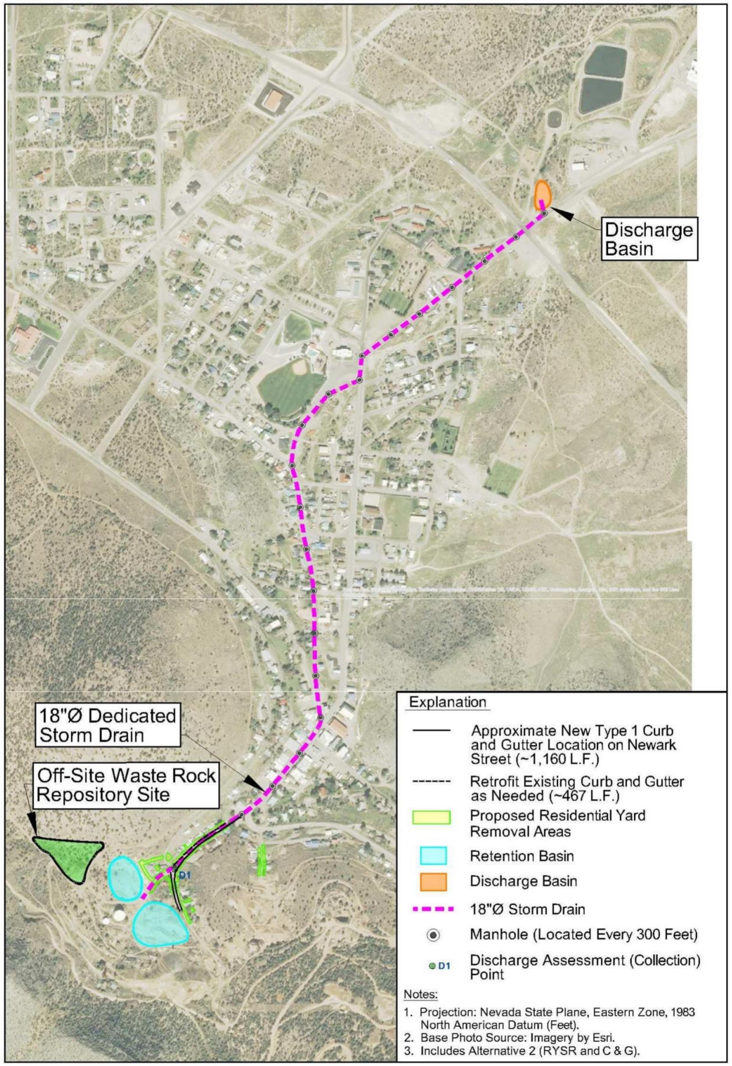
- BMPs do not protect human health, are not ARAR-compliant and do not achieve RAOs
- Short-term effectiveness uncertainty (erosion during and after construction in erodible Pioche shale)
- LTEP uncertainty based on maintaining BMP function and ability to withstand 500-year storm event
- Not readily implemented due to parcel ownership
- Additional capital cost does not improve Site conditions
- Moderately increased O&M costs (about 2x)

Basis for Non-Implemention of Alt. No. 4

- On-Site WRR and BMPs do not protect human health, are not ARAR-compliant and do not achieve RAOs
- Short-term effectiveness uncertainty (erosion during and after construction in erodible Pioche shale)
- LTEP uncertainty based on maintaining WRR and BMP function and ability to withstand 500-year storm event
- Not readily implemented due to parcel ownership
- Additional capital costs eliminate Newark Street hazard
- Moderate increase in O&M costs (much smaller BMP area)

Off-Site WRR with SRBs and BMPs

Off-Site WRR with SRBs and SSP (Alt. 6C)



FS Summary for OU-1 Remedial Action (RA)

- RA must protect human health, comply with ARARs and achieve RAOs
- RA must provide LTEP certainty
- RA must be implementable (no technical or administrative constraints)
- RA must balance capital cost with ARARs/benefits
- RA must meet NDEP requirements

Questions and Discussion