AIM Monitoring Design Worksheet EXAMPLE

Updated December 2020

Step 1: Develop management objectives (or goals); select ecosystem attributes and indicators to monitor

Step 1a: Develop management objectives or goals related to resource condition and resource trend

Field office management objectives are presented in the State Land Health Standards (LHS), Resource Management Plan (RMP) and the Sage Grouse RMP Amendment. All highlight the importance of healthy ecosystems, including vegetation, soil, water, and wildlife. In addition, RMP goals highlight the importance of monitoring for improving understanding of ecosystem functioning and carrying out adaptive management.

The following represents a synthesis of ecosystem management objectives from the LHS, RMP, and Sage Grouse RMP Amendment:

- *"Upland" soils exhibit infiltration and permeability rates appropriate for the soil type, climate, landform, and geologic processes. Adequate soil infiltration and permeability allows for the accumulation of soil moisture necessary for optimal plant growth and vigor and minimizes surface runoff. (LHS101; RMP)*
- *Riparian systems function properly and have the ability to recover from major disturbance such as fire, severe grazing, or 100-year floods. Riparian vegetation captures sediment and provides forage, habitat, and biodiversity. Water quality is improved or maintained. Stable soils store and release water slowly. (LHS102; RMP; Sage Grouse Plan Amendment)*
- *Healthy, productive plant and animal communities of native and other desirable species are maintained at viable population levels commensurate with the species and the habitat's potential. Plants and animals at both the community and population level are productive, resilient, diverse, vigorous, and able to reproduce and sustain natural fluctuations and ecological processes. (LHS103; RMP). Emphasis on sagebrush biome (RMP; LHS104; Sage Grouse Plan Amendment)*
- *Special status, threatened, and endangered species (federal and State), and other plants and animals officially designated by the Bureau of Land Management (BLM) and their habitats are maintained or enhanced by sustaining healthy, native plant and animal communities. (LHS104). Emphasis on greater sage grouse (RMP; Sage Grouse Plan Amendment)*
- *The water quality of streams and rivers located on or influenced by BLM lands will achieve or exceed state water quality standards. Water quality standards include the designated beneficial uses, numeric criteria, narrative criteria, and anti-degradation requirements set forth under State law as found in Rule 317-2 in the Utah Administrative Law, and as required by Section 303(c) of the Clean Water Act. (LHS105; RMP)*

Step 1b: Select ecosystem attributes and indicators to monitor

Information about populations of threatened and endangered species is also necessary but should be gained through partnership with the state wildlife agency.

*The BLM AIM terrestrial and lotic core indicators (**TN440**; **TR 1735-1**, **TR 1735-2**) are relevant to all of the above objectives (e.g., Terrestrial and Lotic Indicator Tables). At terrestrial plots, we will also monitor sagebrush shape, distance to the nearest sagebrush patch, and the distance to Pinon-Juniper trees or other tall structures to meet the requirements of the Sage Grouse Habitat Assessment Framework (HAF). E. coli samples will also be collected from stream reaches that are heavily impacted by cattle grazing or that are immediately downstream of urban areas.*

Terrestrial Indicators Table. Identify which indicators will be monitored as part of this effort and where the associated data will be collected. For monitoring efforts that seek to evaluate RMP/LUP effectiveness all BLM AIM core terrestrial indicator data should be collected in all locations, but contingent and supplemental indicators may be collected at a sub-set of monitoring locations. Specify which contingent and supplemental indicators you will monitor and describe the types of monitoring locations at which you will collect these data. Record the monitoring locations where contingent indicators should be denoted in the Core and Contingent column. Supplemental indicators should be written into their own row and the locations where these data will be collected should be recorded in the Supplemental column.

Land Health Fundamental or Management Goal	**Indicators**	**Core + Contingent**	**Supplemental**
Watershed Function	Bare ground	*All locations*	
	Vegetation composition (foliar cover)	*All locations*	
	Proportion of plot in large, intercanopy gaps	*All locations*	
	Soil aggregate stability	*All locations*	
	Write in supplemental indicator(s), if needed		*N/A*
Ecological processes	Bare ground	*All locations*	
	Vegetation composition (foliar cover)	*All locations*	
	Non-native noxious species cover	*All locations*	
	Proportion of plot in large, intercanopy gaps	*All locations*	
	Soil aggregate stability	*All locations*	
	Write in supplemental indicator (s), if needed		*N/A*
Habitat Quality	Bare ground	*All locations*	
	Vegetation composition	*All locations*	
	Non-native noxious species	*All locations*	

	Plant species of management concern	*All locations*	
	Vegetation height	*All locations*	
	Proportion of plot in large, intercanopy gaps	*All locations*	
	Supplemental: Sagebrush shape, distance to sagebrush patch, distance to trees and tall structures		*All locations*
Plot characterization or covariates	Topography, Landscape unit and position, Soil profile	*All locations; Soil profile will be verified at revisit points upon first resampling effort*	

Lotic AIM Methods Table. Identify which methods will be utilized as part of this effort and where the associated data will be collected. For monitoring efforts that seek to evaluate RMP/LUP effectiveness, all Lotic AIM core methods should be collected in all locations, but contingent and supplemental indicators may be collected at all or a sub-set of monitoring locations. Specify which contingent and supplemental methods you will monitor and describe the types of monitoring locations at which will you collect these data. Supplemental indicators should be written into their own row and the locations where these data will be collected should be recorded.

Land Health Fundamental or management goal	**Method**	**Method type**	**Collected (Y/N)**	**Collected at all reaches (Y/N)? If no, specify where**
Water quality	pH	Core	*Y*	*Y*
	Specific conductance	Core	*Y*	*Y*
	Temperature (instantaneous)	Core	*Y*	*Y*
	Total nitrogen and phosphorus	Contingent	*Y*	*Y*
	Turbidity	Contingent	*N*	*N*
	Write in supplemental indicator(s), if needed: *E. coli*	*Supplemental*	*Y*	*Locations heavily impacted by grazing*

Watershed function and instream habitat quality	Pool dimensions (frequency, length, depth)	Core	*Y*	*Y*
	Streambed particle sizes	Core	*Y*	*Y*
	Bank stability and cover	Core	*Y*	*Y*
	Floodplain connectivity	Core	*Y*	*Y*
	Large wood	Core	*Y*	*Y*
	Thalweg depth profile	Contingent	*N*	*N*
	Bank angle	Contingent	*Y*	*Locations heavily impacted by grazing*
	Pool tail fines	Contingent	*Y*	*Y*
	Write in supplemental indicator(s), if needed		*N/A*	*N/A*
Biodiversity / riparian habitat quality	Benthic macroinvertebrates	Core	*Y*	*Y*
	Canopy cover	Core	*Y*	*Y*
	Priority noxious vegetation (frequency of occurrence)	Core	*Y*	*Y*
	Priority native woody riparian vegetation (frequency of occurrence)	Contingent	*Y*	*Y*
	Greenline vegetation composition	Contingent	*N*	*N*
	Write in supplemental indicator(s), if needed		*N/A*	*N/A*
Covariate or reach characterization	Bankfull width, wetted width, flood-prone width, human influence, photos, and slope		*Y*	*Y*

Step 2: Set the study area and reporting units; develop monitoring objectives

Step 2a: Set the study area, reporting units, define the target population, document the geospatial layers used to describe these areas, and select the existing sample designs to be used for revisits.

The study area for both lotic and terrestrial monitoring efforts is all BLM lands and perennial streams and rivers within the West Desert District boundary (Figure 1). The target population for terrestrial monitoring includes accessible BLM terrestrial ecosystems as defined by the national Surface Management Agency layer and verified in the field. The target population for lotic ecosystems includes streams and rivers defined as perennial by the medium resolution NHD that are verified in the field to have water at a minimum of 5 transects. Reporting units for this monitoring effort tie back to the monitoring objectives and include: the Field Office areas and sage grouse habitat areas (PHMA and GHMA). If designs stratified simply by field office do not produce enough sample points to report on sage grouse habitat, we may intensify monitoring efforts in those areas.
The geospatial data layers used to define the study area and reporting units were derived from the ***BLM's AIM Master Sample*** *for terrestrial and lotic systems and included:*

- *BLM field office boundaries*
- *BLM land ownership: Surface Management Agency (SMA) layer published July 2015*
- *Sage Grouse Habitat Info: PHMA, GHMA, Focal Areas and Population Areas*
- *National Hydrography Dataset (NHD): medium resolution version 2.0*

Several previously sampled terrestrial design will be incorporated into this design for revisits. These include the 2016-2020 Land Use Plan design in the field office, a 2017 sage-grouse habitat intensification design and 12 targeted plots within the Field office. The geospatial layers used to create these designs are documented below. This includes point locations, stratification polygons and sample frames. Additional non-revisit plots and new revisit plots will be spatially balanced around existing sampled plot locations. There are no previously sampled lotic points and the new design will start to revisit points in the second monitoring cycle.

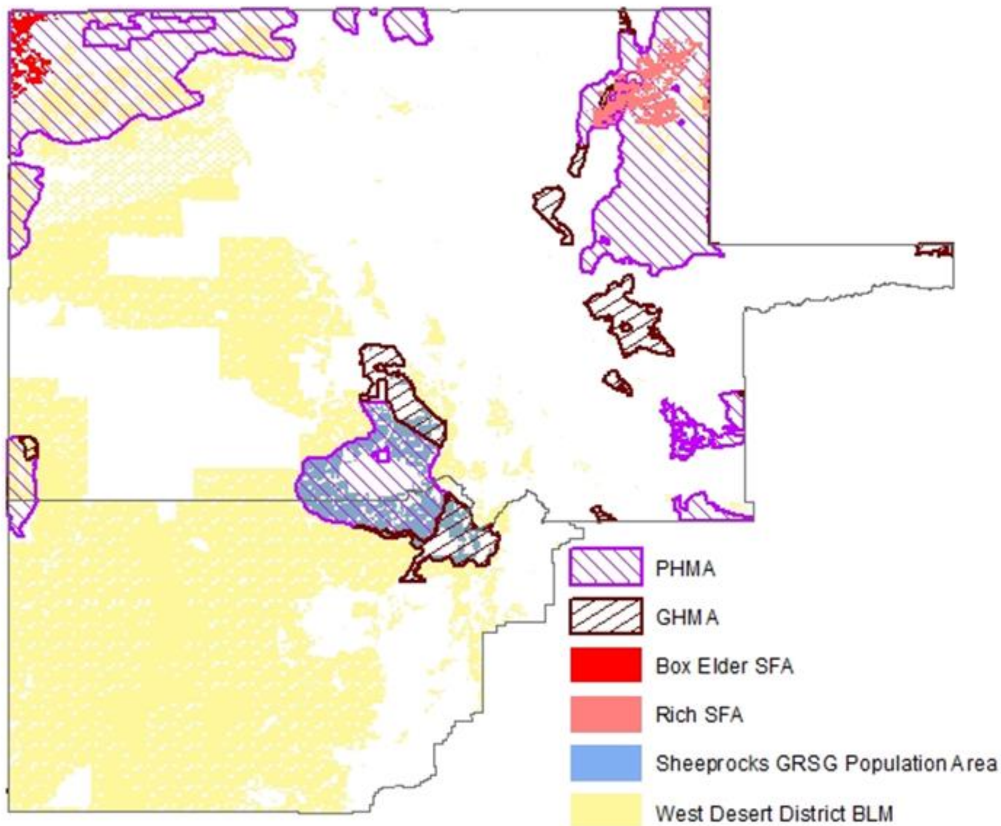

Figure 1. Terrestrial study area and reporting units for the AIM monitoring design in the West Desert District, Utah.

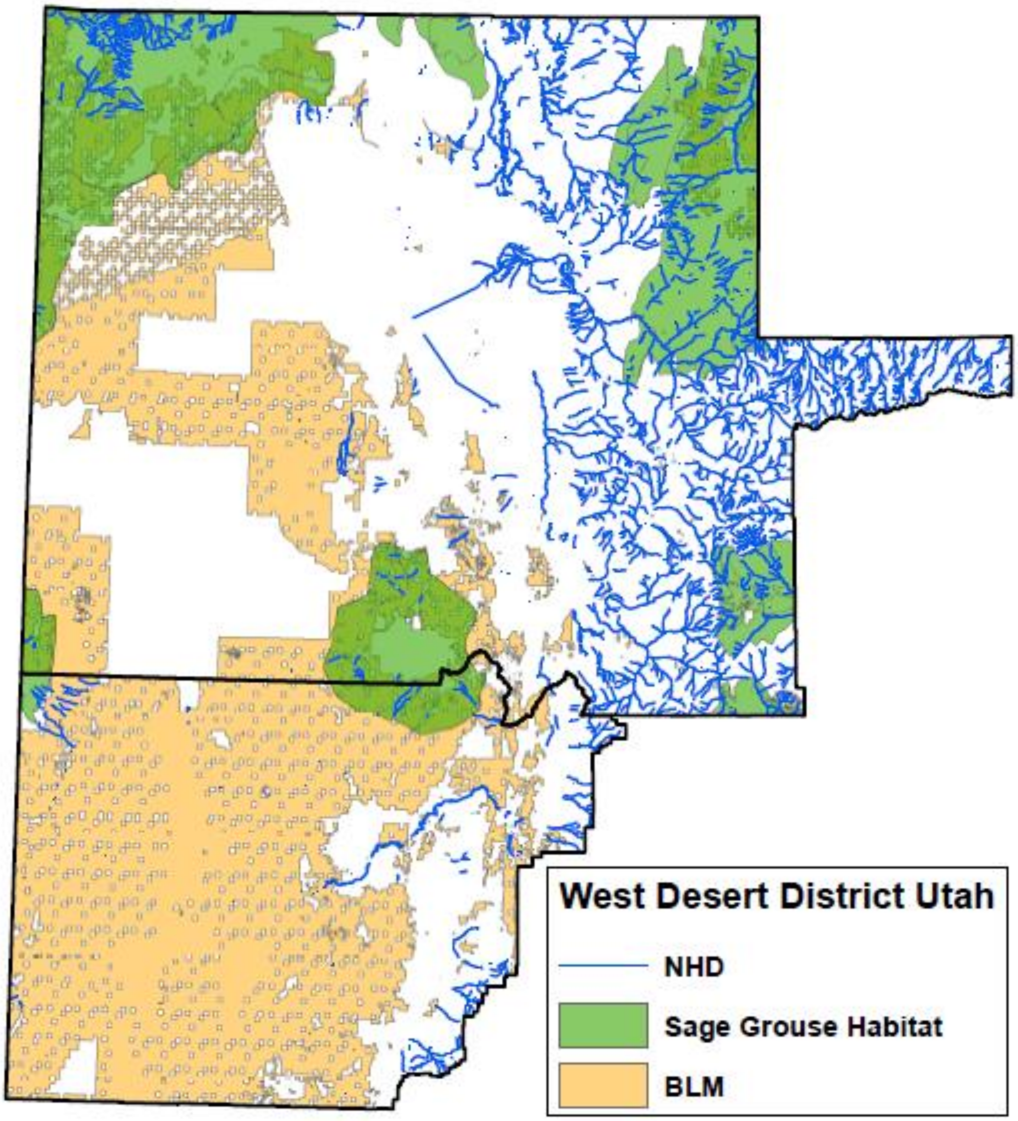

Fig 2. Lotic study area and reporting units for the AIM monitoring design in the West Desert District, Utah.

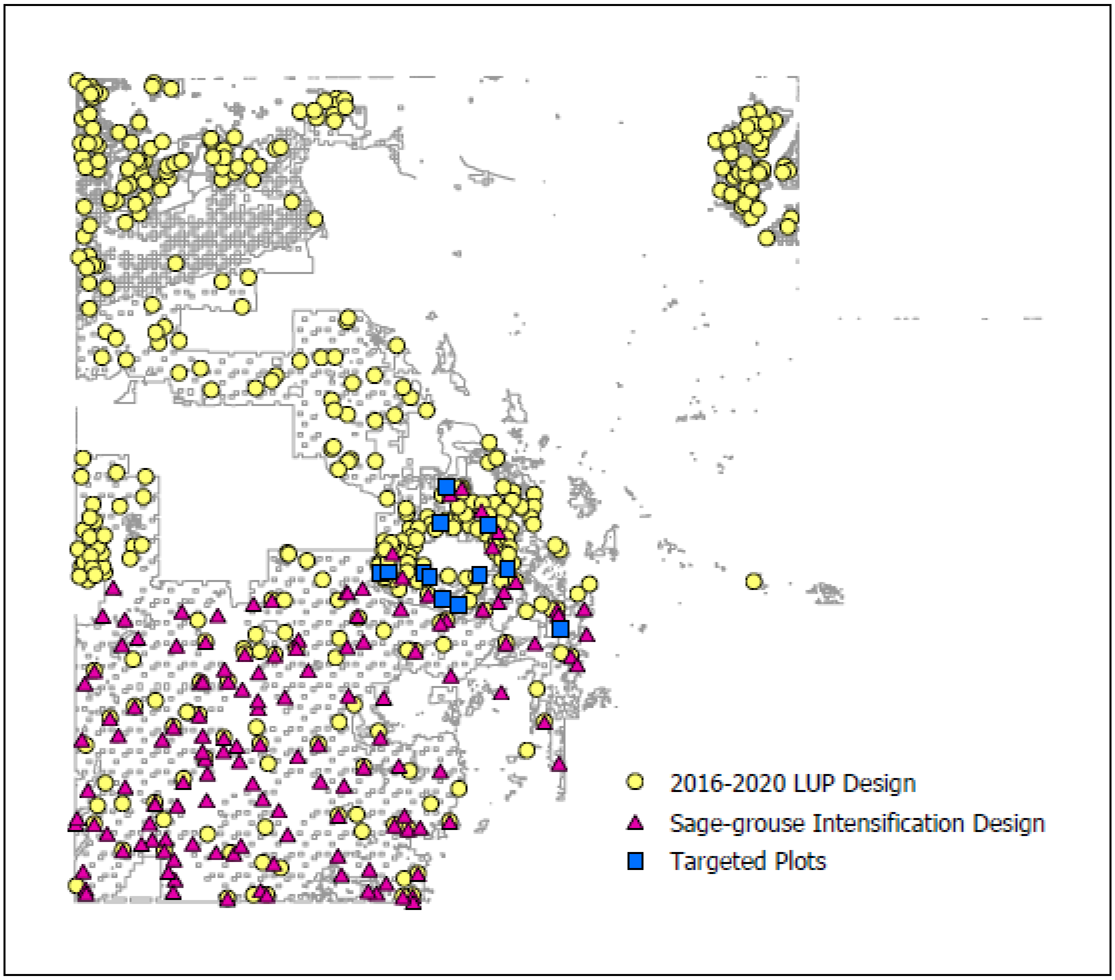

Fig 3. Terrestrial designs to be used for revisits in the West Desert District, Utah.

Step 2b: Develop monitoring objectives related to resource condition and resource trend

Monitoring objectives were identified by adding quantitative benchmarks associated with the terrestrial and lotic indicators that are related to each management goal (i.e. Terrestrial and Lotic Indicator Tables). These benchmarks communicate the indicator values that must be achieved across a specific percentage of the landscape/resource to show that conditions are acceptable (meeting objectives) vs. unacceptable (not meeting objectives). For example, the first monitoring objective in table shows that soil aggregate stability should be greater than 4 across 70% of the landscape in order for the management goal to be achieved. Unacceptable conditions could trigger a change in management. Indicators were chosen for each Land Health Standard using Appendix 1 in Tech note 453. Benchmark values were gleaned from policy, research, and professional judgment.

Resource Condition Objectives Table

Management Goal	Monitoring Indicator	Condition determination method and source	Benchmark	Percentage achieving desired conditions (% of acres or stream km)	Time Frame
LHS 101 – Upland Soils	*Soil Aggregate Stability*	*Research (Smith et al. 1990)*	*>=4*	*>70%*	*2020-2024*
	Bare ground	*Professional Judgement (T Henderson)*	*Loamy soil >= 30% Clayey Soils >= 40%*	*>80%*	*2020-2024*
LHS 103 – Healthy productive plant and animal communities	*Plant Cover*	*Ecological Site Descriptions*	*Loamy soil >= 40% Clayey Soils >= 50%*	*>90%*	*2020-2024*
	Plant Species Richness	*Professional Judgement (T Henderson)*	*> 15 species per plot*	*>90%*	*2020-2024*
	Macroinvertebrate biological integrity	*Multi-Metric Index (MMI)*	*Mountains: <42 Transitions: <32 Plains and Xeric: <22*	*>80%*	*2020-2024*
LHS 103, Sage-grouse plan amendment – Special status, threatened and endangered species	*Perennial grass + forb cover*	*Research (see citations in Sage-grouse plan amendment, Table 2.3 p.2-29)*	*15%* [1]	*>80% of each habitat type should be meeting objectives specific to that type*	*2020-2024*
	Sagebrush height		*12 - 32 in (30 -71 cm)* [1]		*2020-2024*
	Proximity of sagebrush to sage-grouse leks[3]		*Protective sagebrush cover occurs 328 feet from leks*		*2020-2024*
	Proximity of trees/ tall structures to sage-grouse leks[3]		*Trees and tall structures are absent/uncommon 1.86 miles around leks*		*2020-2024*
	Predominant sagebrush shape[3]		*> 50% spreading*		*2020-2024*
LHS 102 – Riparian areas and stream channel morphology	*Riparian vegetative complexity*	*Percentiles of regional reference condition, USEPA*	*Minimal: >30th percentile Moderate: 30t-10th percentile*	*>80% in non-sage-grouse areas >90% in sage-grouse areas*	*2020-2024*
	Canopy cover	*Professional Judgement, (F Lee)*	*Minimal: >30th percentile Moderate: 30th-10th percentile*	*>80%*	*2020-2024*
	Bank stability	*Percentiles of regional reference condition, USEPA*	*Minimal: >80th percentile Moderate: 80th-70th percentile*	*>80%*	*2020-2024*
	Percent Fine sediment	*Percentiles of regional reference condition, USEPA*	*Minimal: <70th percentile Moderate: 70th-90th percentile*	*>80%*	*2020-2029*
	Floodplain Connectivity	*Percentiles of regional reference condition, USEPA*	*Minimal: <70th percentile Moderate: 70th-90th percentile*	*>80%*	*2020-2024*
LHS 105 – Water quality	*pH*	*UTDWQ numeric criteria*[2]	*6.5-9*	*>90%*	*2020-2024*
	Specific Conductance	*Predicted Natural Conditions (Hawkins and Olson)*	*Predicted natural values +/- 53.7s*	*>80%*	*2020-2024*
	E.coli[3]	*UTDWQ numeric criteria*[2]	*1C: 668/100ml 2A: 409/100ml 2B: 668/100ml*	*>90% of points surveyed*	*2020-2024*

[1] *Different management areas (e.g. grazing allotment, PHMA, wilderness study area) are likely to have different benchmarks and percentage achieving desired conditions*

[2]*Utah Department of Water Quality beneficial use categories: 1C = drinking water, 2A = frequent primary contact recreation, 2B = infrequent primary recreation* [3]*Supplemental Indicator*

Resource Trend Objectives Table

Management Goal	Monitoring Indicator	Units (e.g., percent, absolute value, or condition category)	Direction of change (positive or negative, or no change)	Magnitude of desired change	Time period for assessing change
LHS 103 – Healthy productive plant and animal communities	*Non-native noxious species cover*	% cover	Decrease	*10% reduction across 80% of field office*	*Comparison of 2015-2019 to 2020-2024*
LHS 103 – Healthy productive plant and animal communities	*Sagebrush cover*	*% cover*	*Increase*	*Increase sagebrush cover by 10% within vegetation treatment area*	*5 years following vegetation treatment*
LHS 105 – Water Quality	Specific Conductance	µS/cm	Decrease	50 µS/cm	2011 to 2024

Step 3: Select criteria for stratifying the study area (as appropriate)

Terrestrial

In order to reduce complexity of the terrestrial design, stratification will be reduced to 2 strata: priority areas for sage-grouse management and non-habitat areas. Points will be allocated disproportionately so that twice the number of points per acre will be focused on sage-grouse habitat areas.

The geospatial data layers used to define these strata were derived from GHMA and PHMA layers described in the Sage-grouse RMP amendment as well as modelled habitat based on vegetation cover types (See Fig 4).

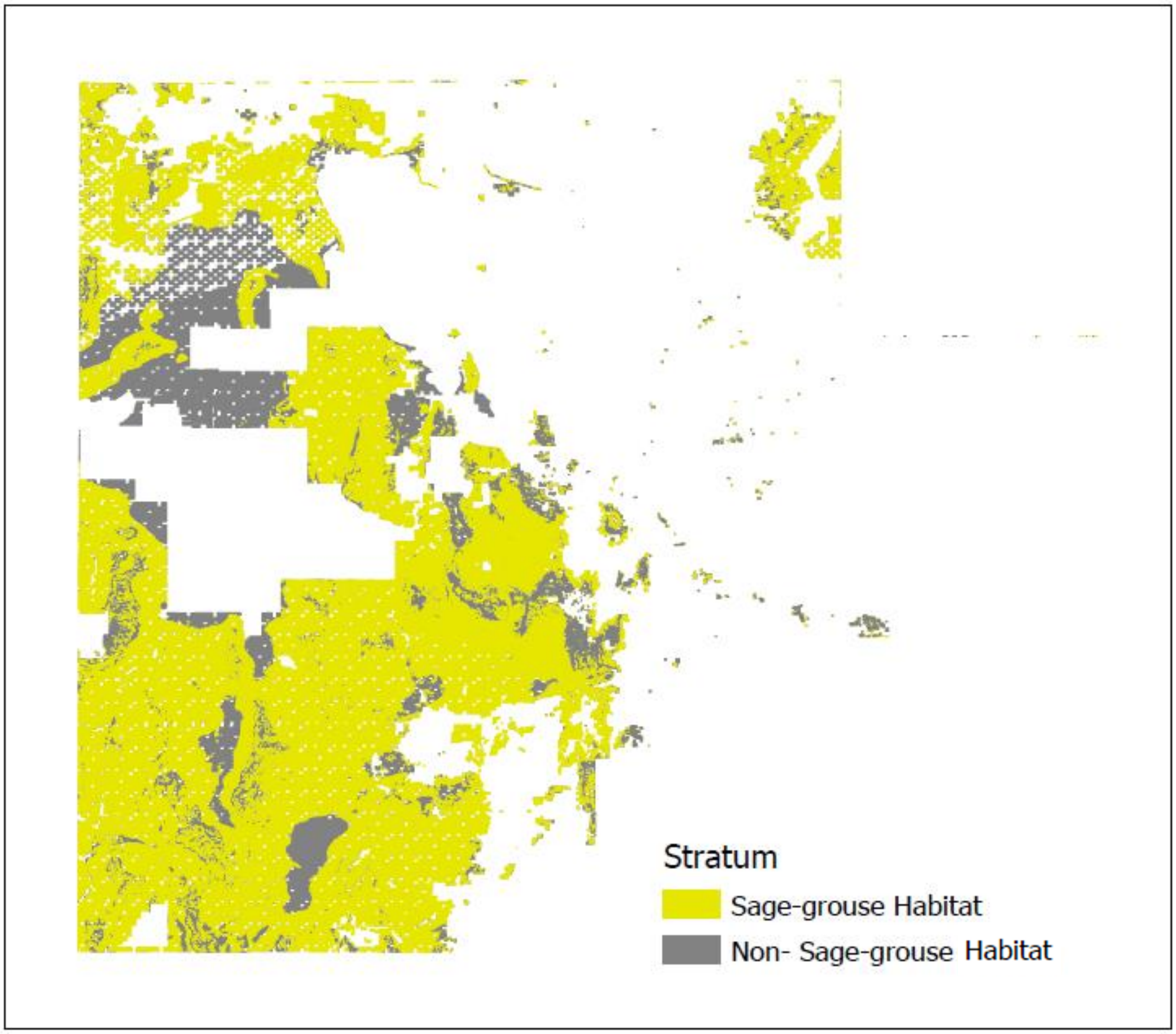

Fig 4. Strata (Sage-grouse and Non-Sage-grouse habitat) for the West Desert District terrestrial monitoring design.

Terrestrial Sample Design Table.

Stratum Name	Approx. stratum hectares	Proportional area or length	Proportional points per stratum	Final Points per stratum per cycle	Approx. point weight
Sage-grouse habitat	*800,000*	*80%*	*90%*	*225*	*3,555,6 hectares*
Non-Sage-grouse habitat	*200,000*	*20%*	*10%*	*25*	*8,000 hectares*
Total	***1,000,000***	***100%***	***100%***	***250 points***	***NA***

Lotic

The streams and rivers within the study area will be stratified by three Strahler Stream Order categories (Figure 4): small streams (1st and 2nd order), large streams (3rd and 4th order), and rivers (5th order and above).

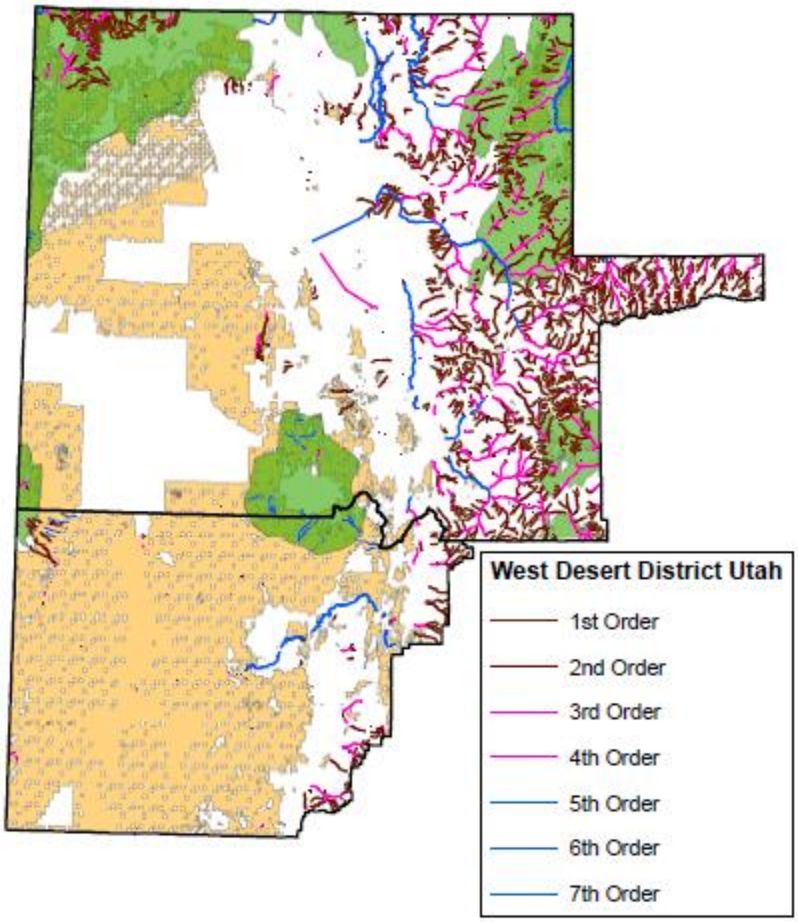

Fig 5. Strahler stream order categories for the West Desert District lotic AIM monitoring design. First and second order streams are grouped into the "small stream" category, third and fourth order streams are grouped into the "large stream" category, and fifth order streams and above are grouped into the "river" category.

Lotic Sample Design Table.

Summary of Strahler stream order categories (strata) and associated sample sized used in the lotic design. The number of points per strata is proportionate to the available stream kilometer, with a minimum sample size of three per strata; individual sample points represent between 19 and 23 stream kilometers

Stratum Name (Strahler Stream order category)	Approx. stratum stream km	Proportional area or length	Proportional points per stratum	Final Points per stratum	Approx. point weight
Small stream (1st and 2nd order)	*212.2*	*82%*	*41*	*37*	*5.7 km*
Large streams (3rd and 4th order)	*45.2*	*18%*	*8*	*11*	*4.1 km*
Rivers (5th order +)	*0*	*0%*	*0*	*0*	*0 km*
Total	***257.4***	***100%***	***49***	***50***	***NA***

Step 4: Select and document supplemental monitoring methods; estimate sample sizes; set sampling frequency; develop implementation rules

Step 4a: Review and document supplemental monitoring methods (if required)

Terrestrial – *Supplemental methods –Terrestrial monitoring indicators and methods can be found in BLM Tech Note 440 and the Monitoring Manual for Grassland, Shrubland and Savanna Ecosystems (MacKinnon et al. 2011; Herrick et al. 2015). The core terrestrial indicators are sufficient for evaluating most of the terrestrial management and monitoring objectives, as discussed in Steps 1 and 2. However, several supplemental indicators were identified that were not addressed by the core indicators: sagebrush shape, distance to nearest sagebrush patch and distance to nearest juniper/tall structure. These supplemental indicators inform sage grouse habitat questions as part of the Sage Grouse Habitat Assessment Framework (Stiver et al. 2015). Distances to nearest sagebrush patch and distance to nearest juniper/tall structure can be measured using GIS with minimal additional field time, especially with the help of good notes taken by the field crew (Stiver et al. 2015). The Field Office GIS staff will capture this information in an Excel spreadsheet following the field season. A standard method for describing sagebrush shape, consistent with the HAF is available in the National Resource Inventory (NRI) protocol (National Resources Inventory 2016). This information will be recorded every time a sagebrush plant is hit while doing Line Point Intercept, and electronically captured using DIMA. Supplemental training for field crews and field office staff will be made available to ensure that these methods are implemented successfully.*

Lotic – *The lotic core indicators will be sufficient for evaluating most of the lotic management goals and monitoring objectives. However, the Utah Standards of Rangeland Health require that the BLM assess whether streams are meeting State water quality standards for e. coli. Since e. coli exceedances are only likely to occur in streams that are impacted by grazing, e. coli samples will only be collected at streams that are heavily used by cattle. E. coli samples will be submitted to the Utah Department of Environmental Quality, Division of Water Resources for analysis. The Aquatic Ecologist in the West Desert District will train the field crew on e. coli sample collection methods.*

Step 4b: Estimate sample sizes (Completed by National AIM Team)

Terrestrial – *Sample sizes were determined for each stratum based on field crew capacity and the final proportion of acres represented by each stratum (Sample Design Table).*
Within the broader District, a decision was made to intensify monitoring within sagebrush-dominated strata (mountain big sagebrush and Wyoming big sagebrush) to address sage grouse habitat management objectives. Sampling intensity was reduced in non-sage-grouse habitat areas.

One field crew can collect approximately 50 points in a monitoring season, so we intend to sample 100 plots per field season, for 5 years. Thus, we are planning to hire and run two three-person field crews to collect terrestrial monitoring data for each of the 5 years. We plan to revisit 80% of terrestrial points on a five-year rotating basis in order to estimate trend.

Lotic – *To balance personnel capacity, statistical power, budget etc., we worked with NAMC/NOC to select a sample size of 50 stream reaches for the district. We anticipate that a sample size of 50 will allow us to estimate the proportion of stream km in a given condition category with 80% confidence. Supplemental points can be added to increase the precision and accuracy of estimates as needed. There were no river km on BLM managed lands in the West Desert District, therefore we will only monitor small and large streams. Proportional allocation of points to small and large streams would have resulted in fewer than 10 points on large streams which seemed like an insufficient sample size, so we increased the point allocations in the large stream category to obtain a larger sample size and decreased the number of points allocated to small streams to keep the total number of sample points to the desired number of 50 points for the district.*

In our area, one lotic field crew can collect data at approximately 25-30 reaches in a year. Thus to accomplish the desired sample size of 50 points, we plan to hire one, 2-person crew for the next two years.

The objectives for trend monitoring will be determined after baseline conditions are established. Specifically, follow up monitoring will be focused on any indicators that raise red flags. The temporal scale that we will use to implement subsequent monitoring will depend on which indicators need to be monitored and the temporal scale that we expect them to change in response to natural environmental variability and/or management actions. For example, recommendations might be to assess water quality indicators on a monthly basis if exceedances are observed. In contrast, bank stability would be assessed on an annual or semi-annual time-scale.

Step 4c: Define revisit parameters

i) Set the revisit frequency and the number of years sampled per cycle

Terrestrial – We plan on sampling each year for every 5-year sampling cycle and will revisit points every 5 years.

Lotic ***– Due to resource and budget imitation only he first two years of each cycle will be sampled, and revisits points will be visited every 5 years.***

ii) Set number of cycles and the total duration of your design

Terrestrial – *This design will have 4 sampling cycles, each lasting 5 years for a total design duration of 20 years.*

Lotic – *This design will have 2 sampling cycles, each lasting 5 years for a total design duration of 10 years.*

iii) Set the ratio of revisit points to non-revisit points in your design

In order to balance the power to detect both trend over time with the ability to capture spatial variation in terrestrial and lotic resources both terrestrial and lotic designs will plan to revisit 80% of their design points and use the remaining 20% of points for non-revisit points.

Terrestrial Revisit Frequency Table

Revisit Frequency	Number of Years Sampled per cycle	Number of Cycles	Design Duration	Total number of points/cycle	Ratio of revisit to non-revisit points/cycle	Total number of revisit points/cycle	Total number of non-revisit points/cycle
5 years	5	4	20 years	250	80% revisits to 20% non-revisits	200	50

Terrestrial Survey and Revisit Design Table (completed by the NOC). Over 20 years 400 unique plots are sampled for a total of 1000 observations. The 40 points in panels 1 through 5 are repeated every five years (i.e., sample efforts), while the 10 points in panels 6 through 25 are never repeated.

		Cycle 1					Cycle 2					Cycle 3					Cycle 4					
		Year					Year					Year					Year					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Revisit Panels (80%)	1	40					40					40					40					
	2		40					40					40					40				Total Revisit Points:
	3			40					40					40					40			40 per year
	4				40					40					40					40		200 per cycle
	5					40					40					40					40	200 per 20 years
Non-Revisit Panels (20%)	6	10																				
	7		10																			Total Non-Revisit Points:
	8			10																		
	9				10																	10 per year
	10					10																50 per cycle
	11						10															200 per 20 years
	12							10														
	13								10													
	14									10												
	15										10											
	16											10										
	17												10									
	18													10								
	19														10							
	20															10						
	21																10					
	22																	10				
	23																		10			
	24																			10		
	25																				10	

Lotic Revisit Frequency Table

Revisit Frequency	Number of Years Sampled per cycle	Number of Cycles	Design Duration	Total number of points/cycle	Ratio of revisit to non-revisit points/cycle	Total number of revisit points/cycle	Total number of non-revisit points/cycle
5 years	2 out of 5	2	10 years	50	80% revisits to 20% non-revisits	40	10

Lotic Survey and Revisit Design Table (completed by the NOC). Over 10 years 50 unique reaches are sampled for a total of 100 observations. The 20 points in panels 1 and 2 are repeated every five years (i.e., sample efforts), while the 5 points in panels 3 through 6 are never repeated.

		Cycle 1					Cycle 2				
		Year					Year				
		1	2	3	4	5	6	7	8	9	10
Revisit Panels (80%)	1	*20*					*20*				
	2		*20*					*20*			
Non-Revisit Panels (20%)	3	*5*									
	4		*5*								
	5						*5*				
	6							*5*			

Step 4d: Develop implementation rules

Terrestrial and Lotic – *We will use the standard AIM implementation rules, the Terrestrial Plot Tracking map in ArcGIS Collector, and the Lotic Design Management Spreadsheet to implement the designs and to document the fate of all design points (see aim.landscapetoolbox.org).*

Additional implementation rules are that the supplemental indicators will be collected at each terrestrial plot (see step 7).

Step 5: Collect and evaluate available data to determine sampling sufficiency and the validity of the strata (if available)

Terrestrial *– Terrestrial sample sufficiency analysis focused on the proportion of the area meeting a benchmark based on pre-existing data. Pilot data were available from an adjacent field office that has similar ecosystems and environmental characteristics. We looked at five different indicators: bare soil, total foliar cover, shrub cover, perennial grass cover, and perennial forb cover. In general, at most 27 samples were sufficient to estimate the proportion of the area meeting objectives for all indicators with 80% confidence and 10% margin of error. In cases where the observed proportion of the landscape meeting objectives was far away from the required proportion, fewer samples were* *required. Thus, the current design is sufficient to report out in any given year at the District or Field Office scale and over 5 years in the Sheeprocks Sage Grouse Population Area at these error levels. Reporting in the Rich and Box Elder SFA's, which have smaller sample sizes in this design, will result in a higher margin of error (e.g., 15% or 20%).*

Lotic *– No pilot data were available so we were not able to incorporate any previously collected data into our sample sufficiency analysis and strata validity.*
With the help of the NOC, we determined that our initial approach should be to collect data at 25 points and then do a sample sufficiency analysis to determine if our target sample size of 50 stream reaches will be enough to characterize conditions with enough confidence. We based this number on the worst case scenario of observing the maximum allowable variance for estimating a proportion (50%), with a 90% confidence level. This scenario will only allow one to detect degraded stream conditions when 50% (± 15%) of streams are in most degraded condition – an unacceptable amount from a management perspective. The actual variance observed at these initial 30 sample points will be used to determine the final sample size of this monitoring effort.

Step 6: Apply stratification and select statistically valid monitoring locations
Terrestrial – *Monitoring locations were selected by the Jornada using the terrestrial master sample tool (Figure 4). This tool relies on the GRTS method which produces random, spatially balanced points across the landscape of interest (Stevens and Olsen 2004). The ID team reviewed the points to make sure that they met the design criteria described in steps 1-3. During that review, the interdisciplinary team noted that in Year 1, more points were needed to report on sage grouse habitat conditions in the Box Elder SFA and the Sheeprocks GRSG Population areas in order to satisfy immediate reporting needs. Points were "borrowed" from later years of the design (Years 2-5) in order to provide additional points to be sampled the first year (Figure 5). The design was finalized on March 22, 2016 and is stored on the local field office share point drive.*

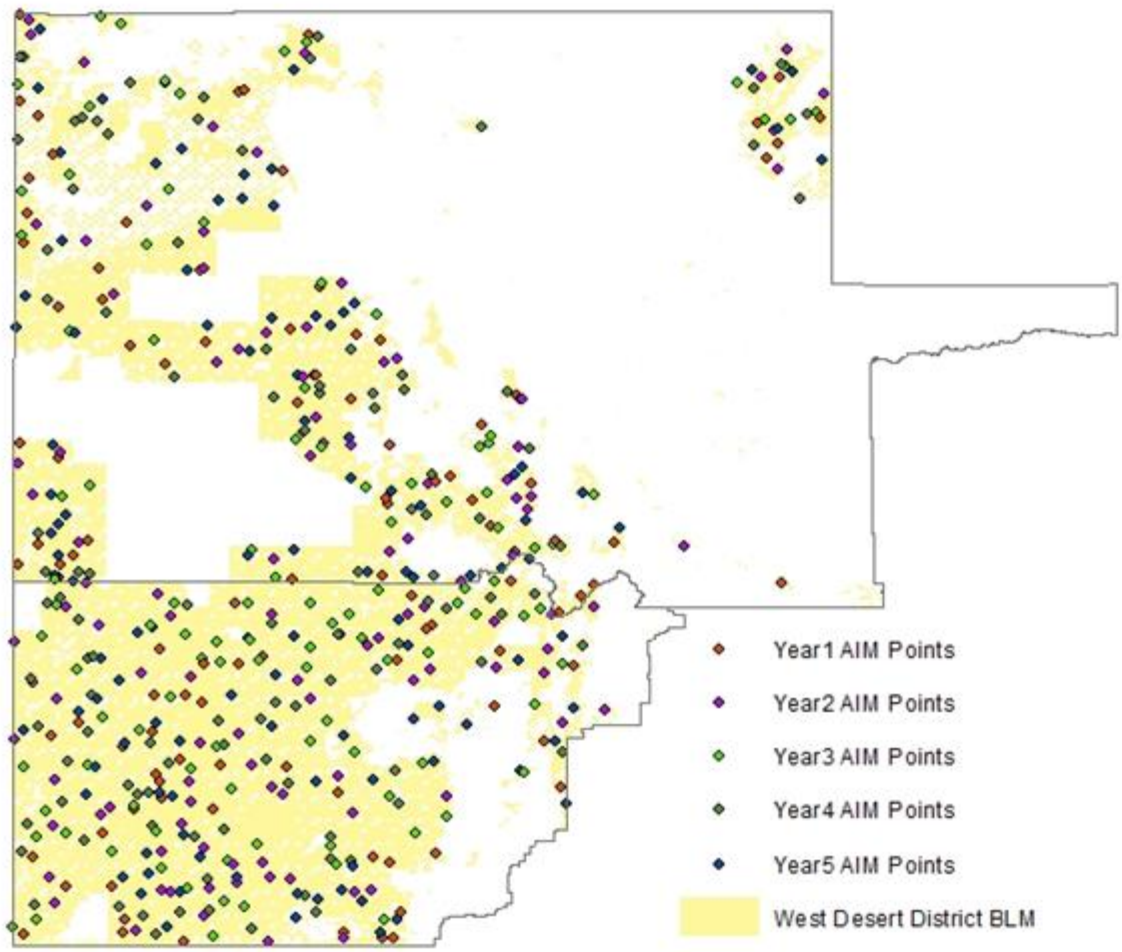

Fig 6. Final terrestrial monitoring design for the BLM district to address management and monitoring objectives.

Lotic – *In total 50 sample reaches were selected for potential sampling (i.e., base reaches) and over double that number as were selected as replacement reaches for failed reaches (i.e., oversample reaches = 100). All 50 sample reaches were selected for the RMP effectiveness monitoring design by the NOC using the lotic master sample tool. However, due to errors in the NHD layer the draft design revealed that no points had been generated in the Sheeprock Sage Grouse area. Therefore, 10 additional reaches (and 30 oversample or replacement reaches) were selected to intensify the sample design in the Sheeprock Sage Grouse Habitat Area using an R script.*

The design was finalized on April 17, 2020. More information can be found in the lotic design metadata file that is stored with the other design files on the BLM AIM office share point drive.

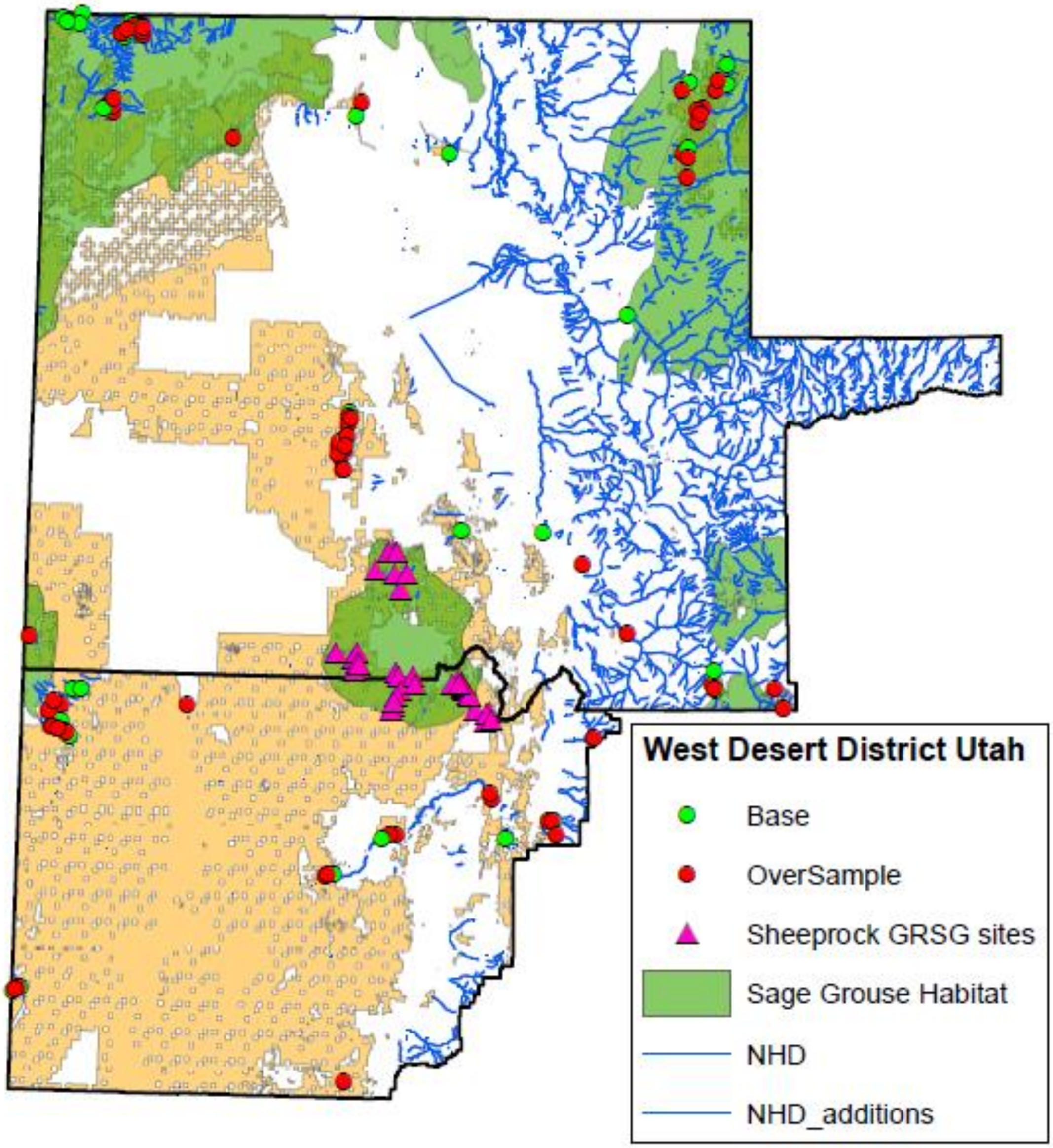

Fig 7. Locations of final lotic AIM design points in the West Desert District, UT.

Step 7: Develop quality assurance and quality control (QA and QC) procedures and data management plans

Terrestrial – Data management, quality assurance, and quality control for the terrestrial core indicators will follow the standard procedures in the Terrestrial AIM Data Management Protocol 2020 available on the AIM Landscape Toolbox.

Supplemental indicators require additional data management and quality considerations. Distance to nearest sagebrush patch and distance to nearest juniper/tall structure will be captured in an Excel spreadsheet following the field season. Sagebrush shape will be electronically captured using Survey123 and Collector along with the Line Point Intercept method. Supplemental training for field crews and field office staff will be made available after the AIM terrestrial core methods training to ensure that these methods are implemented successfully.

Lotic – Standard procedures for lotic core indicators may be found in the **Lotic Data Management and QAQC Protocol**.

E. coli indicator data will be managed by the district aquatic ecologist.