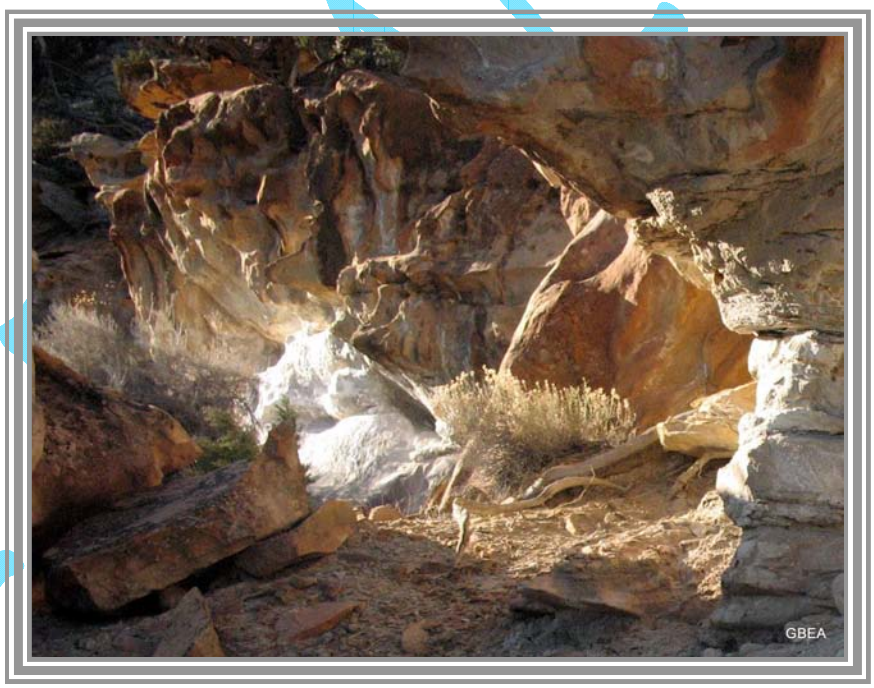
Argali Exploration Co
Well 24-2

Restoration Design
And
Implementation



Prepared By:
Great Basin Environmental and Aquatics

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Acknowledgements

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Introduction

Argali Exploration Co. is in the process of a restoration of well pad 24-2. The restoration includes the well pad and access road that are on Federal lands administered by the Bureau of Land Management (BLM).

Argali's objective is to restore well pad 24-2 with drainage, and the access road in a manner that should provide a stable channel design initially, yet remain dynamic long-term, reduce the potential for erosion, have a successful re-vegetation of the approved mix of native species, construct a landform that is in keeping with the surrounding topography and will not distract visually from the surrounding area. Further, the project and resulting construction should be cost effective for Argali Exploration and meet the stated objectives and management goals of the BLM.

The design and restoration plan is presented in four sections:

- Channel design and construction of a restored emphleral channel that crosses the well pad.
- The well pad 24-2
- The access road and drainages that cross the road.
- Re-vegetation, seeding and erosion control

Argali and Great Basin Environmental and Aquatics have made several field trips to the site and collected basic on-site information to assist in the design and implementation of the project. Figure 1 gives an overview of the site with a delineation of features to be restored. Table 1 is the geographical coordinates of the well pad centroid.

Throughout the document, a consultation with the BLM will be included in italics and any changes will be noted. The complete text of the consultation is in Appendix E in a continuous format.

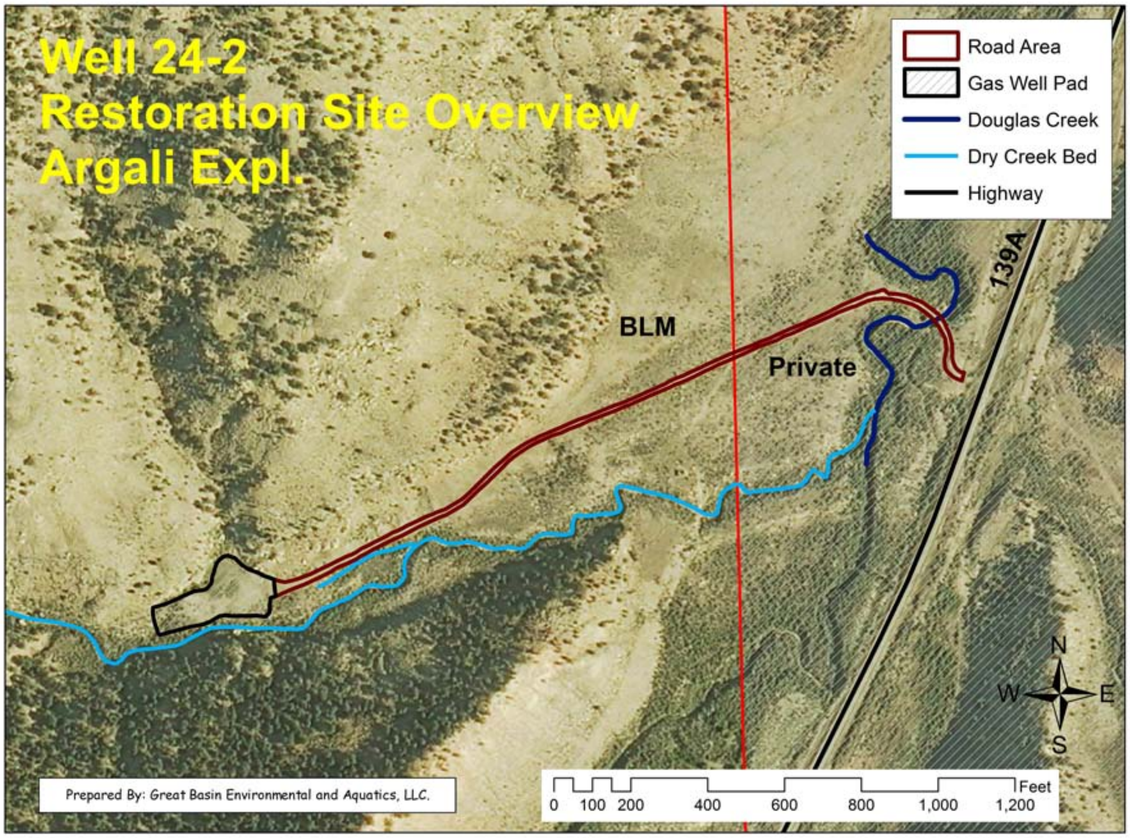

Figure 1. Well pad 24-2 and road overview.

Table 1. Well pad centroid coordinates.

Well Pad 24-2 Location NAD 1983, UTM, Zone 12N	
Northing	Easting
4404395	689524

The approximate size of the restoration is 2.25 acres with a perimeter of 3604 feet.

Ephemeral Channel Design

Reference Drainage Selection and Channel Attributes

A reference drainage has been selected to validate the design of the drainage that will cross the well pad. Upstream of the well pad, 1200 ft, is a drainage that has similar attributes to the well pad drainage. The approximate drainage area, slope, aspect orientation, and channel size for both drainages are in Table 2. Figure 2 is a map of the two drainages.

Table 2. Comparison of reference and well pad drainages.

Reference and Well Pad Drainage

Drainage	% Slope	Acres	Drainage orientation in degrees	Bed Width (ft)	Bankfull Width (ft)	Depth (ft)
Reference	27.1	31.9	158.4	4.0 - 4.5	6.0 - 7.5	1 - 2.3
Well Pad	24.1	30.7	157.4	4.0 - 4.5	6.0 - 6.0	0.75 - 1.1
Average	25.6	31.3	157.9	4.3	6.4	1.3

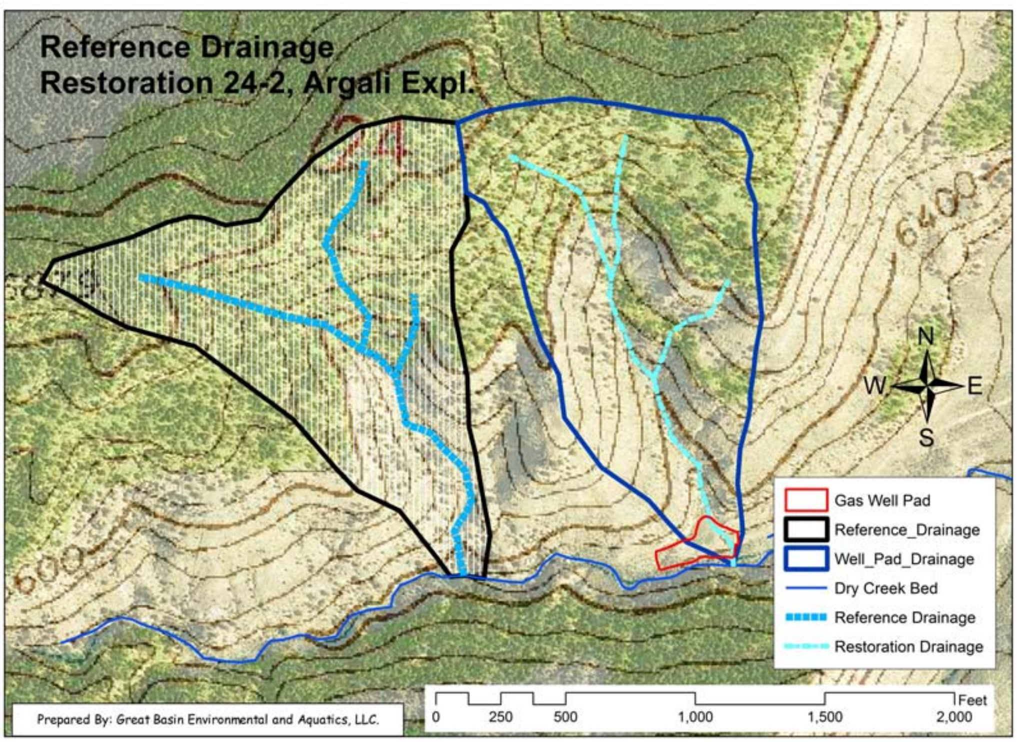

Figure 2. Reference and well pad drainages.

It should be noted that it was difficult to define bankfull by using a typical bankfull indicator in the reference channel. The well pad channel is more typical, with a well defined "bench" on both the right and left bank

The reference drainage has a single dry stream that forms a confluence with the main creek bed (Appendix F, Photo B4). Photos of the reference and the existing well pad cross-sections are located in Appendix F.

Channel Design

To assist in designing the channel, a topographic survey was taken. A Nikon NPL352 (5 sec) total station was used to collect 700 points (XYZ). The initial survey used an arbitrary datum of 5000.00, 5000.00, 100.00 to establish a control network and collect topography. Post collection data processing, utilized ESRI ArcMap and supporting software. The initial datum coordinates were rotated and adjusted to overlay the Texas Mountain, USGS, 1:24000, topographical map. The accuracy of this overlay is approximately one meter (+ or -) without any use of rubber sheeting or warping to maintain the surveys spatial relationship in both the horizontal and vertical, for use during construction. The new coordinates are in NAD1983, UTM Zone 12N, GEOGCS. Imagery from the National Agriculture Imagery Program (NAIP) and Google Earth was also utilized during post processing.

Coordinates from the initial survey control points are in Appendix G and the post processed data is available upon request.

Using the survey, topographical maps with contours at one foot intervals, were produced for both the current and design topography. Figure 3 is a map of the current topography (See Appendix G for more maps).

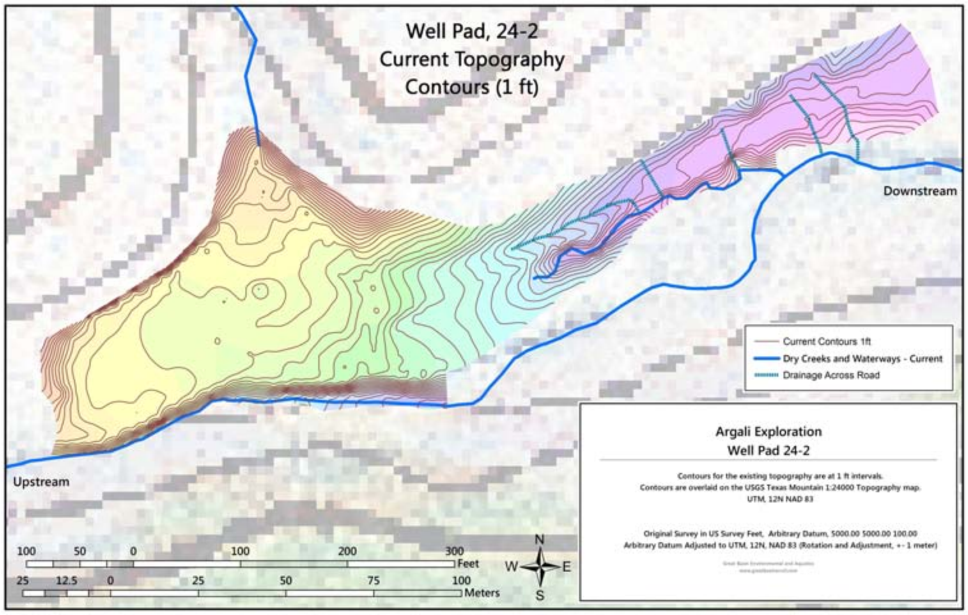

Figure 3. Existing topography contours.

Based upon the dendritic form of the selected reference channel and the surrounding drainages, a one channel design has been selected ("*One or two constructed shallow drainage swells will be built along the pad from north to south*", BLM consultation Appendix E, bullet 6). The objective is to have a channel that is similar in form to the surrounding area, is stable through the reclamation period allowing vegetative growth on upslope areas, yet will become dynamic over time with an active regime of appropriate channel change. The following will step through each major component of the design.

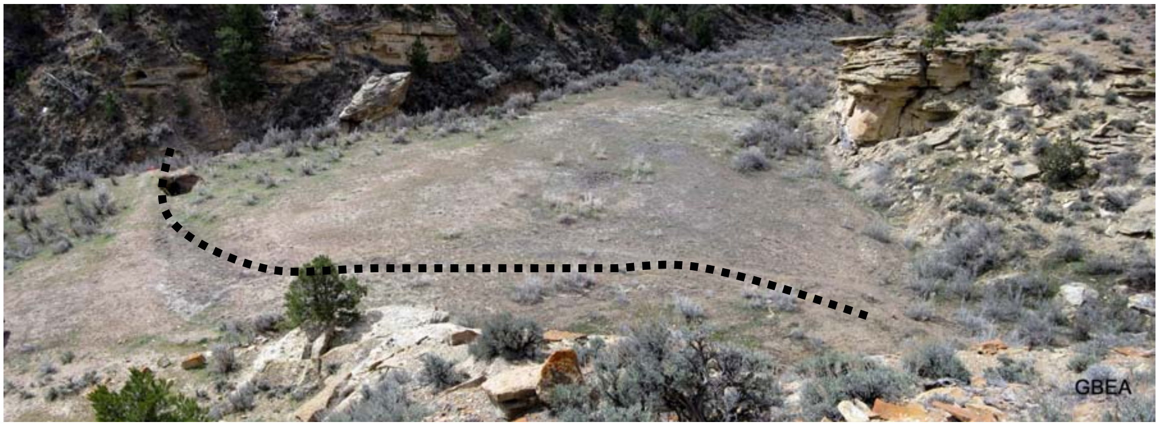

Photo 1. Overview of well pad and approximate location of the design channel center line.

1. The channel will be constructed on the eastern portion of the well pad in a north to south orientation (Figure 4 and Photos 1 - 2). A topographical map with the design channel is shown in Figure 4.

2. Channel design will follow the existing well pad drainage in cross-sectional form and dimensions as in Figure 5. This sizing should be to accommodate the current hydrologic conditions. The cross-section of the bed will have an approximate width of 4 feet with a bankfull width of 6 feet. Depth at bankfull will average 1 foot. A small shelf at bankfull is on both river left and right (Figure 4 and 5). Note that the BLM consultation is different: "*The swell will have a 3 foot flat bottom*" (Appendix E, bullet 6). This difference is due to the design approximating the existing channel size of the reference and the well pad drainages.

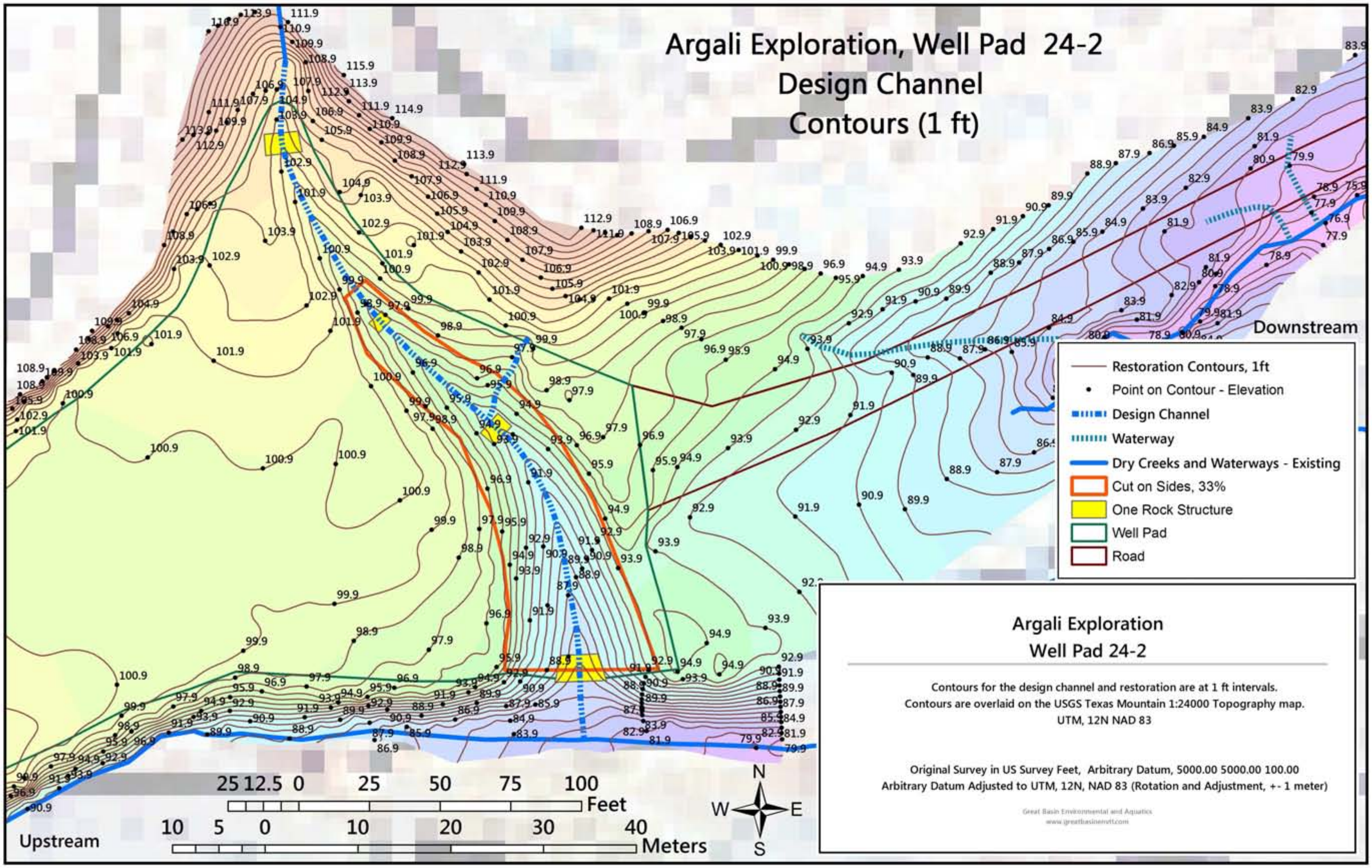

Figure 4. Generalized well pad, design channel plan view. Compare contours to original topography.

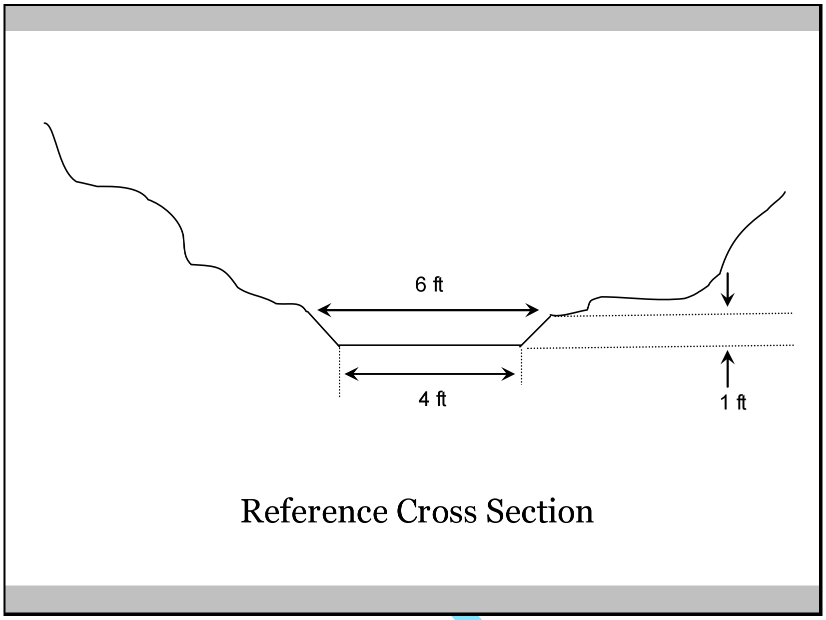

Figure 5. Well pad design channel cross-section dimensions (not to scale).

3. From the existing channel and alluvial fan on the north side of the well pad, there is an 21.6 foot elevation difference with the confluence elevation. The slope of the design channel is 8.0%. Figure 6 is a representation of the existing well pad and design channel beds, slope and elevation in longitudinal profile. The data used to establish this relationship was collected during the topography survey. The BLM consultation states: "*The outlet elevation of the swell will be the bottom of the sink hole next to the ephemeral channel and the top will daylight at the beginning of the sediment delta or fan. The grade of the drainage swell will be gradual between these two points allowing for a non-erosive path for flood waters to the channel"* (Appendix E, bullet 6).

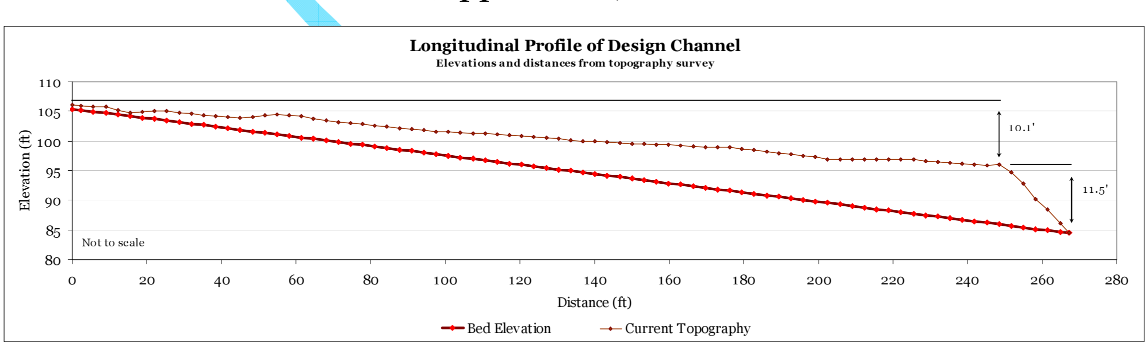

Figure 6. Well pad slope.

4. The BLM has suggested a 33.3%% (1/3) slope to the side of the design channel (Appendix E, bullet 6). Starting at the design channel confluence and working towards the existing alluvial fan, following the 33.3% bank slope, produces a land form similar to the

tapered stylized diagram in Figure 7 (see Photo 2 and Figure 4 and 6). Appendix D has cross-sections through the design channel with current and design topography. On river left near the top of the design channel, the slope will deviate from 33.3% due to the drainage from a hill and contouring the design channel bed up toward the toe of the hill (Figure 4). In general the design channel cut, in plan view, tapers from the widest portion (64 ft) at the confluence to just the channel bed near the top (Figure 4 and see Appendix D). The BLM consultation states: *"3:1 sloping sides up to the current undisturbed elevation."* (Appendix E, bullet 6).

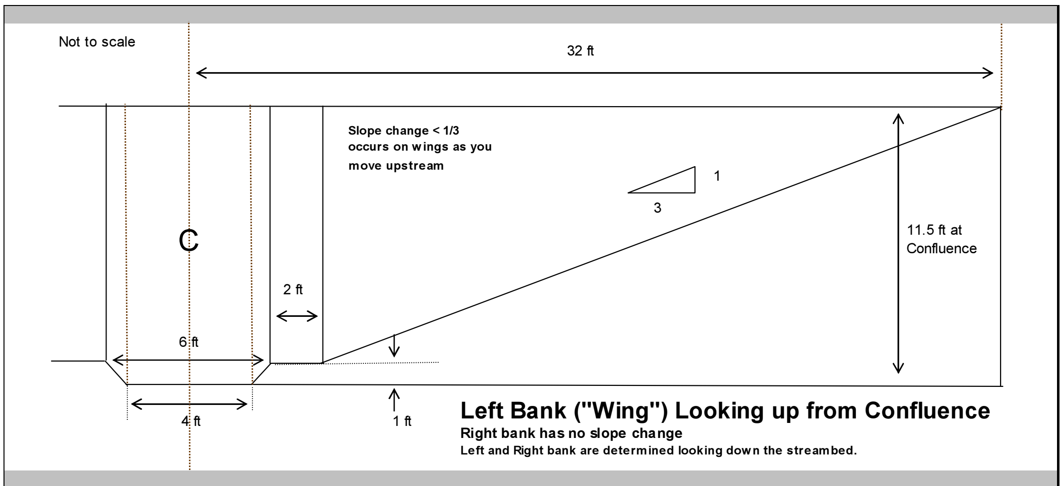

Figure 7. Channel cross-section design and bank slope. Compare to figure4.

5. The hill on the east side of the well pad (river left) has a small drainage that is currently flowing directly south and leaving the pad. This small drainage will be relocated and connected to the design channel in a small swell. See Figure 4 for the approximate location. The slope of this swell will be less then 33.3%. No mention of this drainage or swell is in the BLM consultation.

6. To stabilize the channel, rock structures will be built in several locations in the design channel. At least three single layered (one) rock "dams" (ORD) will be built. The ORD elevation above the channel bed is to be less then 1/3 of the design bankfull depth, thus 4 inches in the highest for this design (Zeedyk, 1999). ORD's will be located to bracket the gradual lateral bends as in Figure 8 (Sponholtz, 2010). A single ORD will be placed near the toe to reduce the potential for headcuttng. See Figure 4 for anticipated lateral bend and ORD placement. This placement is to reduce energy entering the lateral bend (lower water velocities). Rock sizing for ORD's will be no smaller then 8 inches on the B axis. Larger rocks will be on the downstream side of the ORD. The rocks will continue up over the bankfull elevation to reduce bank erosion and increase stability (Sponholtz, 2010). All ORD structures will have no less then 4 rows of rocks (BLM consultation Appendix E, bullet 6-7).

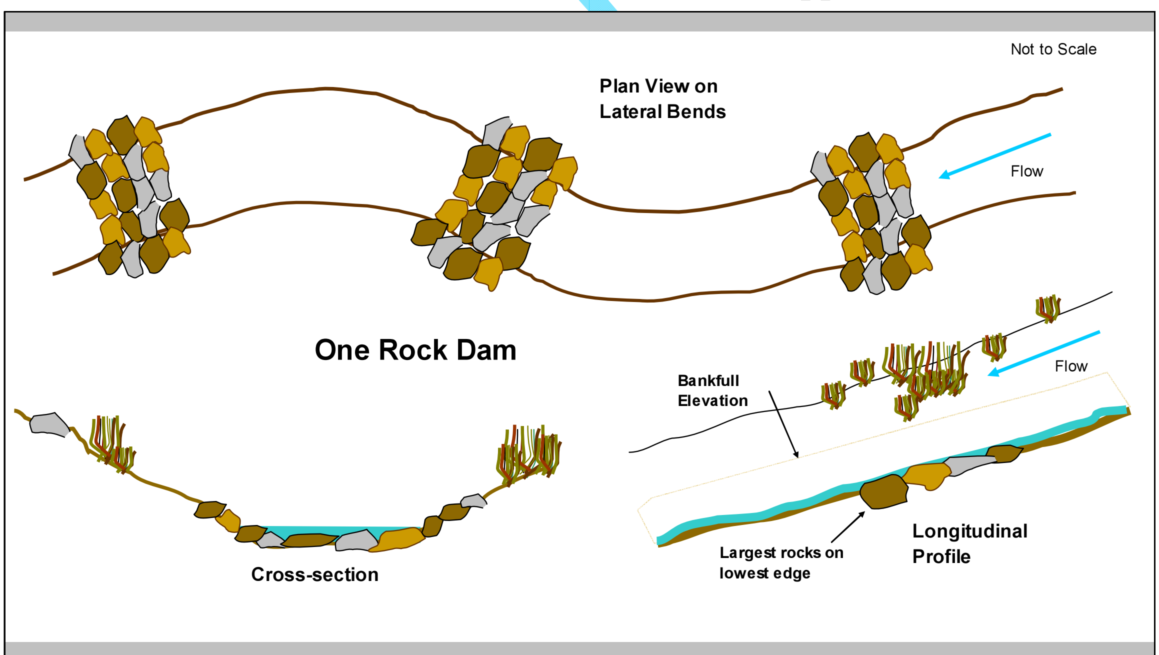

Figure 8. Single layered – one rock dam design.

7. Rock excavated from the site will be salvaged and used to build ORD's. Rock may also be obtained from a local source (native rock). The BLM consultation states: "*Excavated rock from the excavated sites on the pad and access road and potentially rock quarried and purchased from a private vendor will be used to construct one rock structures…*" (BLM consultation, Appendix E, bullet 7).

8. Excavated material from the design channel will be used to return portions of the road and pad to a topography that is closer to a natural state. See Figure 4, and the sections on the well pad and road restoration, for fill usage. The BLM consultation states: *"Excavated material will be spread between drainage swells and rounded to allow for drill seeding'* (BLM consultation, Appendix A, bullet 7). An attempt will be made to salvage any alluvium as the channel is excavated. The alluvium will then be used for the bed of the design channel.

A generalized plan and longitudinal view is shown in Figure 4 and 7 (Also see Appendix D and G).

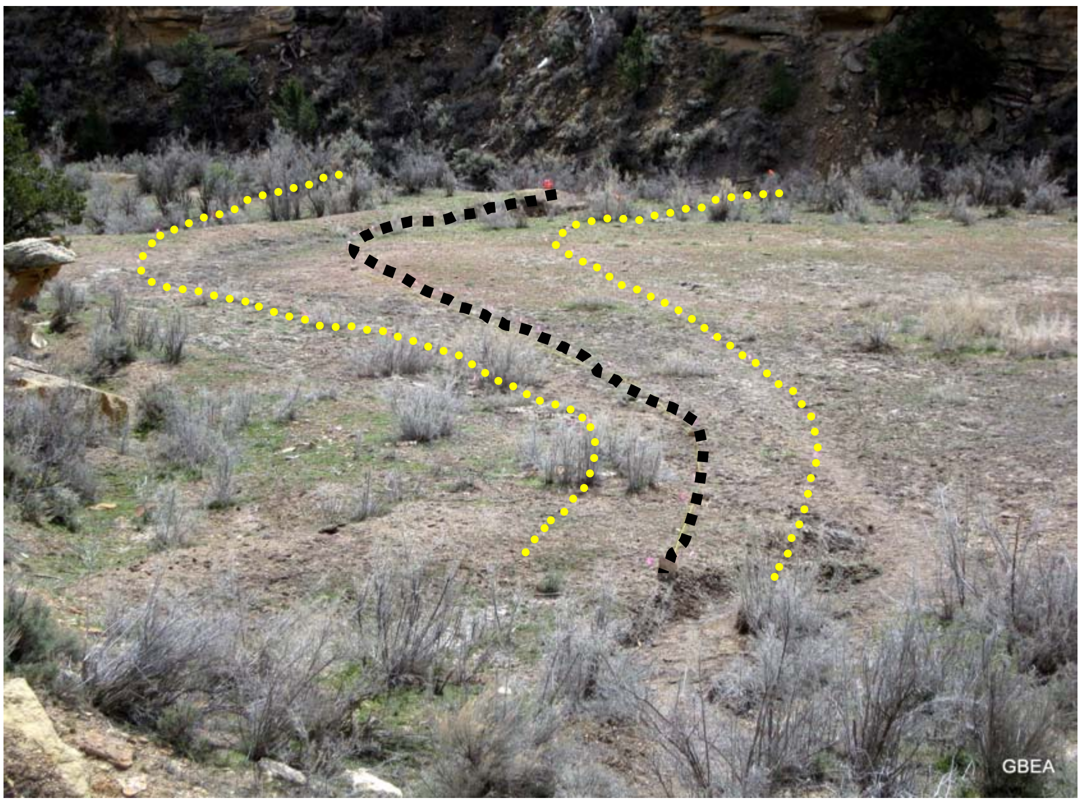

Photo 2. The approximate location of the design channels center line and top edge of the 33.3% slope cut.

Well Pad

The well pad currently has a mature stand of sagebrush (*Artemisia tridentata* ssp. not known) and other vegetation, covering the western portion of the pad (polygon Undisturbed if Possible - Existing Veg, Figure 9). It is anticipated that the existing grade and the vegetation will remain undisturbed.

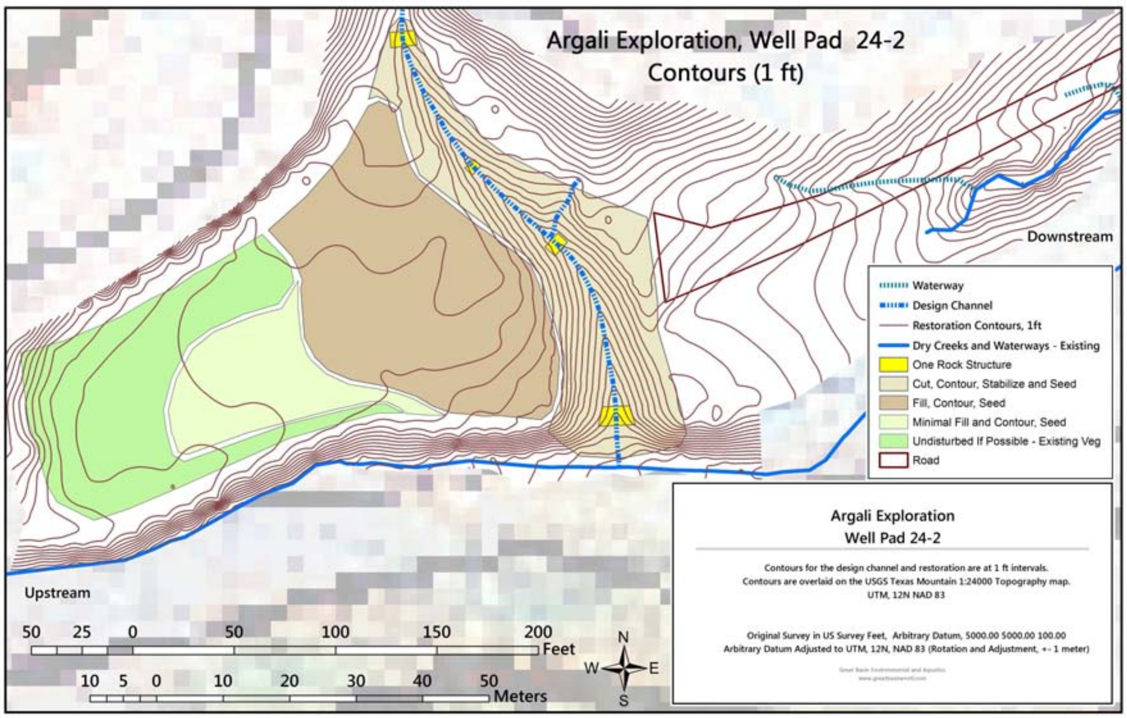

Figure 9. Plan view of the well pad restoration.

In the central portion of the pad, the surface has several depressions allowing water to pond (polygons Minimal Fill and Contour, Seed - Fill, Contour, Seed, Figure 9). The low areas will be filled and graded to a contour that gradually rises in elevation to the east (minimal slope) smoothly transitioning to the edge of the design channel form. Fill will come from the design channel cut and from top soil stockpiled during the excavation of the design channel. Fill from the design channel cut will be placed as shown in the polygon, Fill, Contour, Seed, Figure 9.

Access Road Restoration

The access road has been divided into four sections, three of these are on land managed by the BLM. Sections 2-4 are BLM managed and section 1 is on private property; figures 11 and 12 show the road sections 2 through 4 respectively. The delineations of sections is roughly based upon slope of the road, the quantity of fill and cutting needed to re-contour, and the number of drainages crossing the road. Section 2 has the least amount of slope, minimal fill, and limited drainages. Section 4 will require the largest amount of reconstruction and contouring to match the undulating topography of the adjacent hill on the north side. The BLM consultation states: "*The natural undulating landform with ridge and swell will be returned on section 4*" (Appendix E, Bullet 5). Small drainages .that currently cross the road will be realigned and reconnected to a dry channel that is just south of the road (Figure 12). See Appendix D for longitudinal profiles of the current and design topography on the road

Cut and Fill

The current generalized cross-sectional form of the road is shown in figure 10. Section 4 has the most radical cross-section form while sections 2 and 3 are less so, thus lower quantities of material will need to be moved in those sections. Photo 3 has a diagram of a cut (original road cut) and fill superimposed on section 4. The fill material will be supplemented with excavated soil from the design channel as needed.

The section 1 portion of the access road is on private property and the restoration of that section is beyond the scope of this plan.

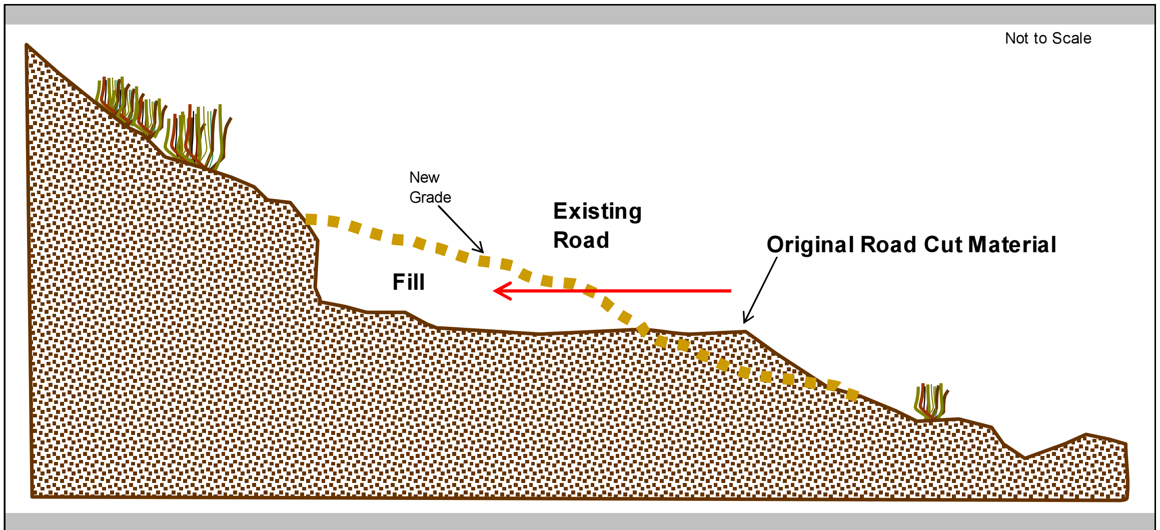

Figure 10. Generalized cross sectional view of access road.

Photo 3. Original road cut material and fill diagram, superimposed upon access road section 4.

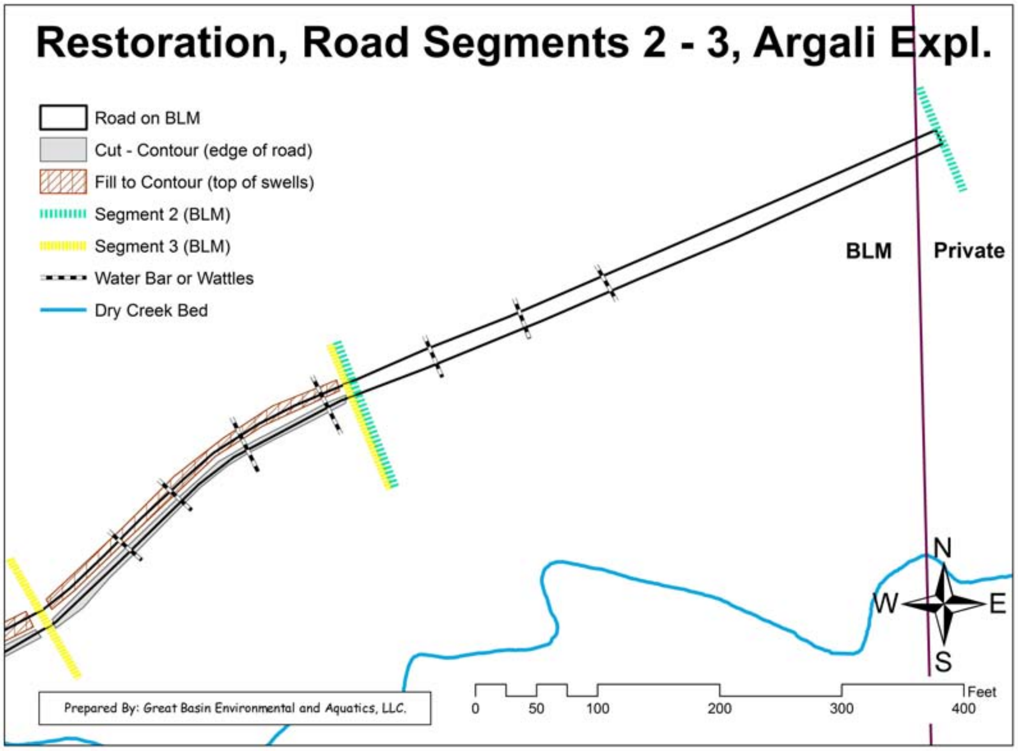

Figure 11. Access road sections 2 and 3.

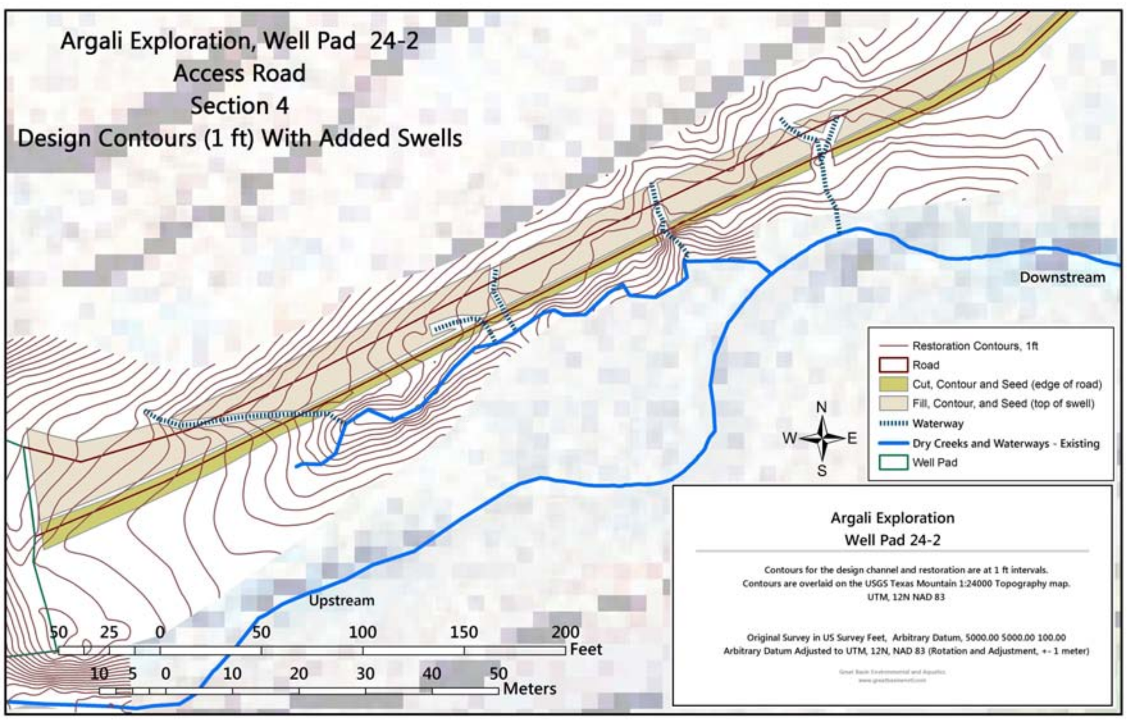

Figure 12. Access road section 4.

Soil Salvage and Reuse

An horizon of top soil does exist on the well pad (Photo 4) plus silt has been deposited on the northern portion. The top soil and silt, will be salvaged and reused to facilitate and enhance the recover of the seeded vegetation. The quantity of topsoil salvaged is not sufficient to cover the total reclamation area. Soil samples will be taken and fertilizer used to augment the supply of topsoil. This may enhance weed growth, thus rates and timing of the fertilizer application will be designed to minimize potential weed growth and runoff of nutrients.

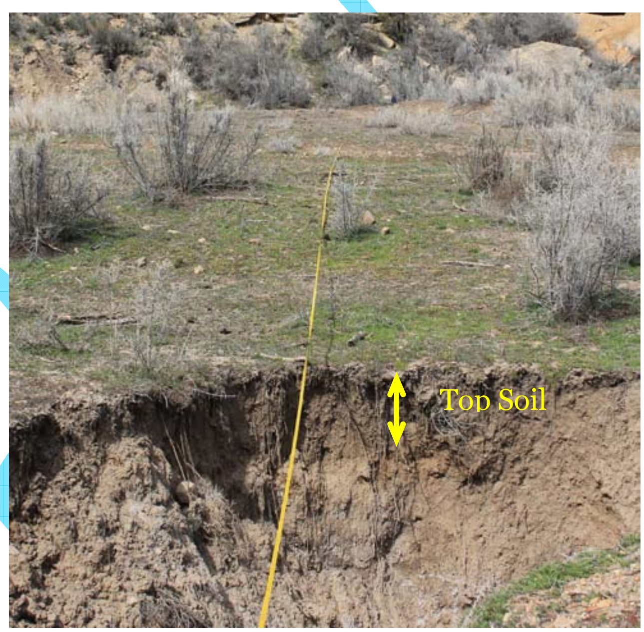

Photo 4. Top soil horizon in sink hole.

Erosion Control

Erosion control will be designed for the specific location where it is to be implemented. The control of erosion in the design channel has been addressed previously. The design channel bullets 6 and 7 discuss the use of ORD's for channel stability.

On sections 2-4 of the re-contoured access road, straw wattles and/or water bars will be used to reduce and control erosion. The BLM consultation states: "*Minimal water bars will be installed as necessary to divert water from the old roadway on segment ... 2...... Water bars will be less than 9 inches from the ditch to the crest of the borrow material and shall discharge into stable well vegetated terrain*" (Appendix E, bullet 3). Straw wattles may be used in combination with the water bars. Installation of straw wattles will follow the manufactures' recommendations. Figure 13 and 14 are general schematics of wattle and water bar implementation. Spacing between wattles will also follow manufactures' recommendations. Figure 11 gives a suggested, approximate, configuration on spacing.

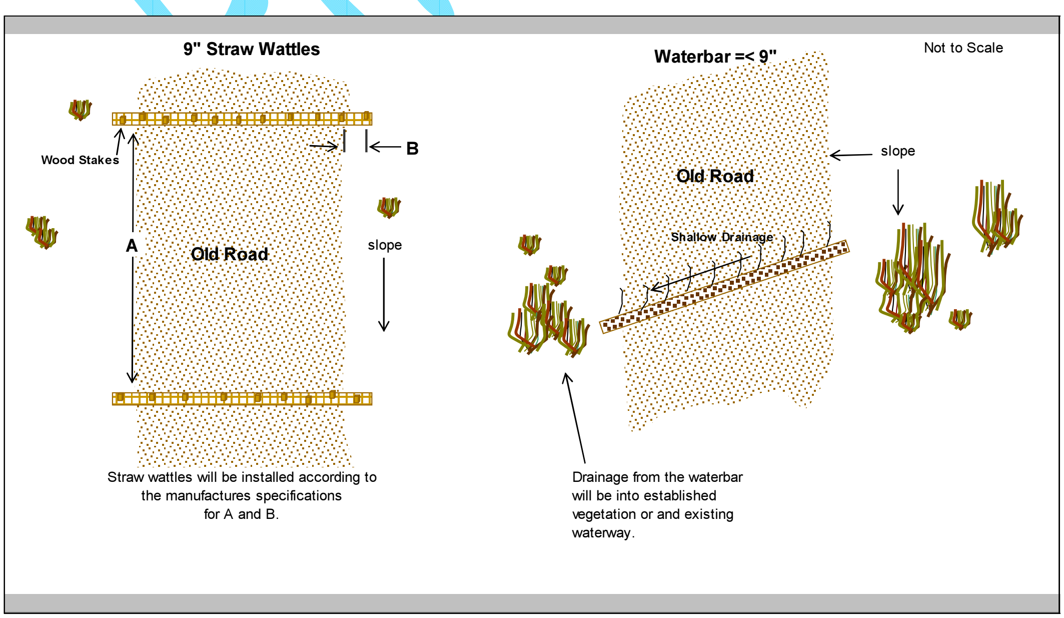

Figure 13. Straw wattles and water bar, plan view schematic.

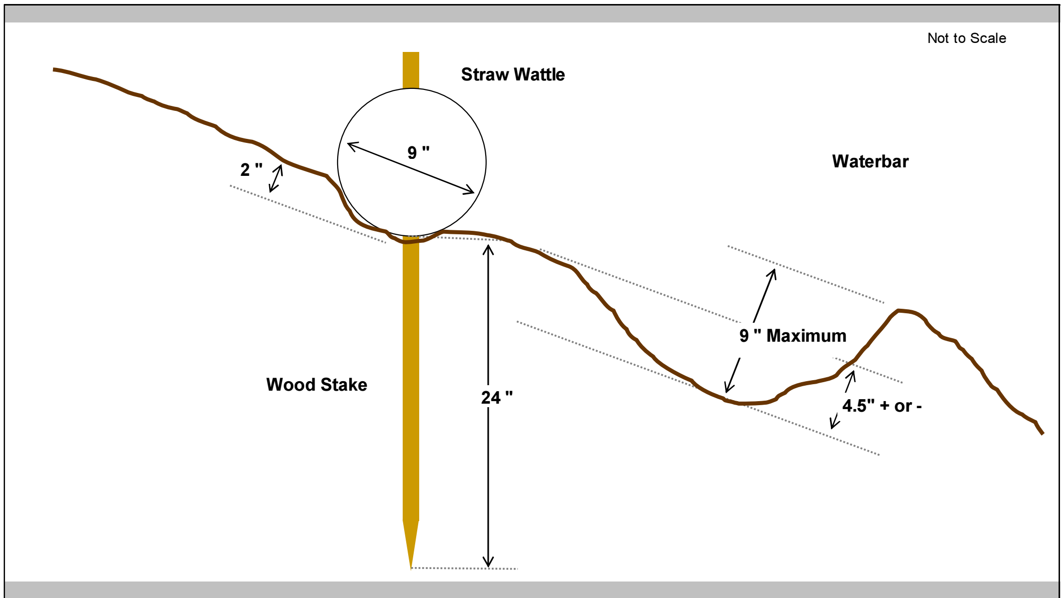

Figure 14. Straw wattles and water bar, longitudinal profile schematic.

Straw wattles are to be weed free and certified as such by the manufacturer.

Straw erosion control blankets may be used after seeding on an as need basis. Again, they shall be certified weed free by the manufacturer and installed according to the manufactures' specifications for slope and usage.

If erosion occurs that compromises the integrity and viability of the reclamation process, the BLM will be notified verbally and by Sundry Notice. Remediation will begin within a reasonable time frame after approval is received.

When the restoration site has become stable with minimal erosion the residue of the wattles and water bar structures will be removed and spread; wattle residue that is not biodegradable will be disposed of off site. The BLM consultation states: "*All unnatural berms and terraces on the access* *road on section 3 and 4 (see Figure 1) will be removed and spread*" (Appendix E, bullet 4).

If a robust, repeatable monitoring of erosion becomes warranted, a proposed method is suggested and outlined in Appendix C.

Re-vegetation, Seeding, and "Weeds"

Seeding

All areas that are disturbed to bare soil by construction or restoration are to be seeded with BLM mix number 1 (Table 3). Areas with compacted soils shall be ripped to a minimum depth of 18"and a seed bed prepared by disking or harrow to achieve the desired roughness of the seed bed. Ripping increases the infiltration of water, reduces erosion potential, may increase soil moisture, and enhances the potential for success in the establishment of the desired vegetation. The BLM consultation has suggested a minimally rough seed bed on road section 2. It states: "*This section of the old access road will be minimally roughened and seeded using a drill seeder and the BLM approved seed mix. If a drill seeder is unavailable the location should be raked and seeded at double the drill-seed rate.*" (Appendix E, bullet 3).

Table 3. BLM seed mix number 1 and application rates.

BLM Seed Mix #1			
Common Name	Scientific Name	Cultivar	Application Rate (lbsPLS/acre)*
Western Wheatgrass	*Pascopyrum smithii*	Rosana	4.5
Thickspike Wheatgrass	*Elymus lanceolatus* ssp. *lanceolatus*	Critana	3.5
Bottlebrush Squirreltail	*Elymus elymoides*	Toe Jam Creek	3.0
Scarlet Globemallow	*Sphaeralcea coccinea*		0.5
Sulphur-flower buckwheat	*Eriogonum umbellatum*		1.5
Winterfat	*Krascheninnikovia lanata*		1.0

* Seed rates are drill rates; double the rate for broadcast seeding. Broadcast seeding should incorporate harrowing or raking to cover the seed.

Note 1. It is recommended that seeding occurs between September and March 15th.
Note 2. All seed is to be Certified as weed free.

If broadcasting is the seeding method used, the application rate will be doubled from the drill rate listed in Table 3.

Seed tags will be submitted to the BLM along with a description of the type of seeding process, description of the area seeded, size of area, date of seeding, and applicator's name.

Sagebrush Transplanting

Young sagebrush (*Artemisia tridentata* ssp. unknown), specimens under a foot in height, are re-colonizing portions of the well pad and road. Many of theses young plants will be destroyed during the project. Some success has been shown in other projects around the west in transplanting sagebrush (McAdoo, 2013). McAdoo (2013) also states, that transplanting may potentially “speed” the progression of a plant community’s seral stages, provide soil stability, nutrients, and enhance soil moisture, plus providing wildlife habitat. McAdoo indicates that success rates are as low as single digits to over 60% depending on range conditions and source of transplant. Sagebrush transplanting may visually enhance the landscape by “camouflaging” the area from recognition as a reclaimed area sooner then a seeding of a grass and forb mixture. Some of the young sagebrush will be potted and stored until the sites construction is completed and then replanted. The sagebrush will be planted in “islands”.

Invasive and Noxious Weed Control

The site will be monitored for invasive and noxious weeds. Weeds will be mechanically removed if densities are low and distributions are limited. If mechanical removal is ineffective due to conditions, then spraying of herbicides will occur. Herbicide use will follow the labeling guidelines for application rates, plant species usage, and certification of the applicator. To help prevent a possible infestation of a "weed", equipment or tools that are potential vectors for the transportation of weed seed will be cleaned, as needed.

Weeds shall be defined using the Colorado States weed list, with list A and B species the targeted species (Appendix B).

Evaluation of Re-Vegetation Success

MacKinnon et.al. (2011), suggest six core indicators for quantitative evaluation of vegetation. They are as follows:

- Bare ground expressed as a percentage.
- Vegetation composition as a percentage of a plant community and a proportion of foliar cover, by species.
- Non-native invasive plant species as a percentage of a plant community and a proportion of foliar cover, by species. Note that this is a subset of the overall plant community composition.
- Plant species of management concern as a percentage of a plant community and a proportion of foliar cover, by species. Note that again this is a subset of the overall plant community composition.

- Vegetation height helps model suitability in three-dimensional space for wildlife habitat.
- Proportion of soil surface in large inter-canopy gaps. This is related to the percentage of bare ground, plant community composition, and vegetative height with impacts of erosion potential and suitability in three-dimensional space for wildlife habitat.

These core indicators are incorporated into the AIM Strategy (Herrick 2010).

Herrick, (2009 and 2005), details a simple line-point intercept, vegetative transect method to quantitatively measure the plant community. This methodology will be used to determine the progress and final state, of the reclamations success. In general the desired plant communities' indicators species should comprise 80 percent similarity of the desired foliar cover, bare ground, and shrub and/or forb density (Draft RMPA/EIS, 2012). No single species should comprise over 70 percent of relative density as measured using foliar cover (Draft RMPA/EIS, 2012). At a minimum five species should constitute the desirable plant community and may include native species from the surrounding area as well as those seeded during the reclamation(Draft RMPA/EIS, 2012).

At least two transect placed on the well pad and perpendicular across the design channel should facilitate sampling. Figure 15 shows an approximate location and length. The final location and length will be marked with 1/2" "re-bar" at both ends. The access road will have several transects perpendicular to the road (Figure 16).

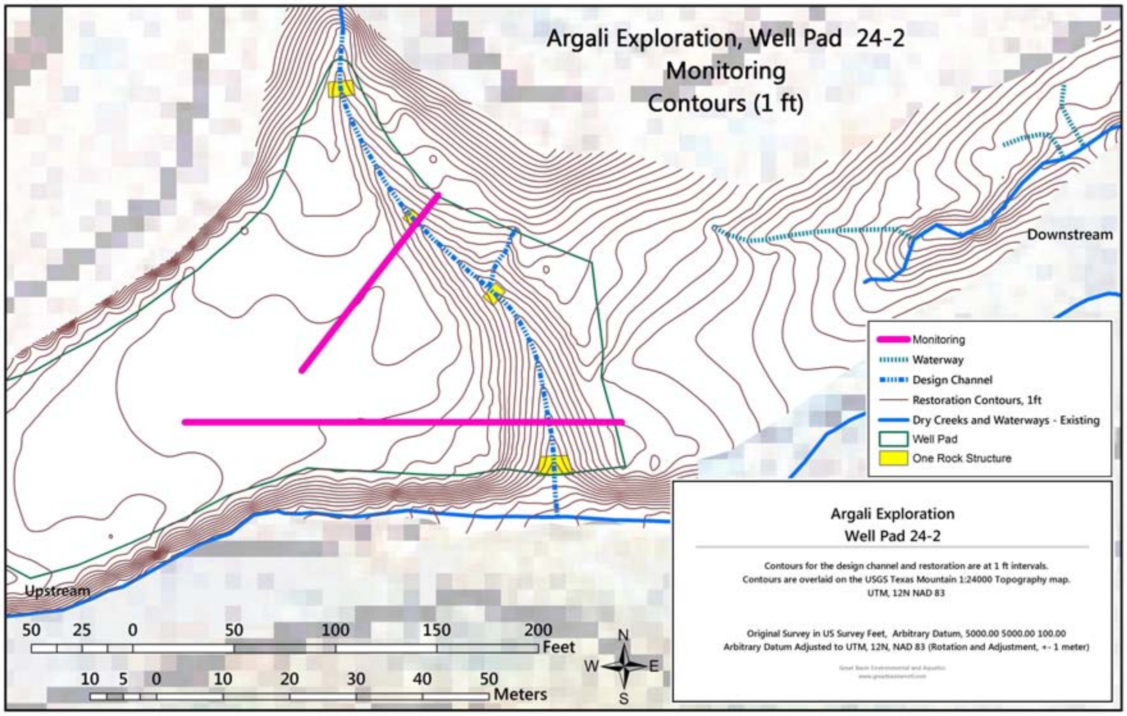

Figure 15. Proposed well pad monitoring transect locations.

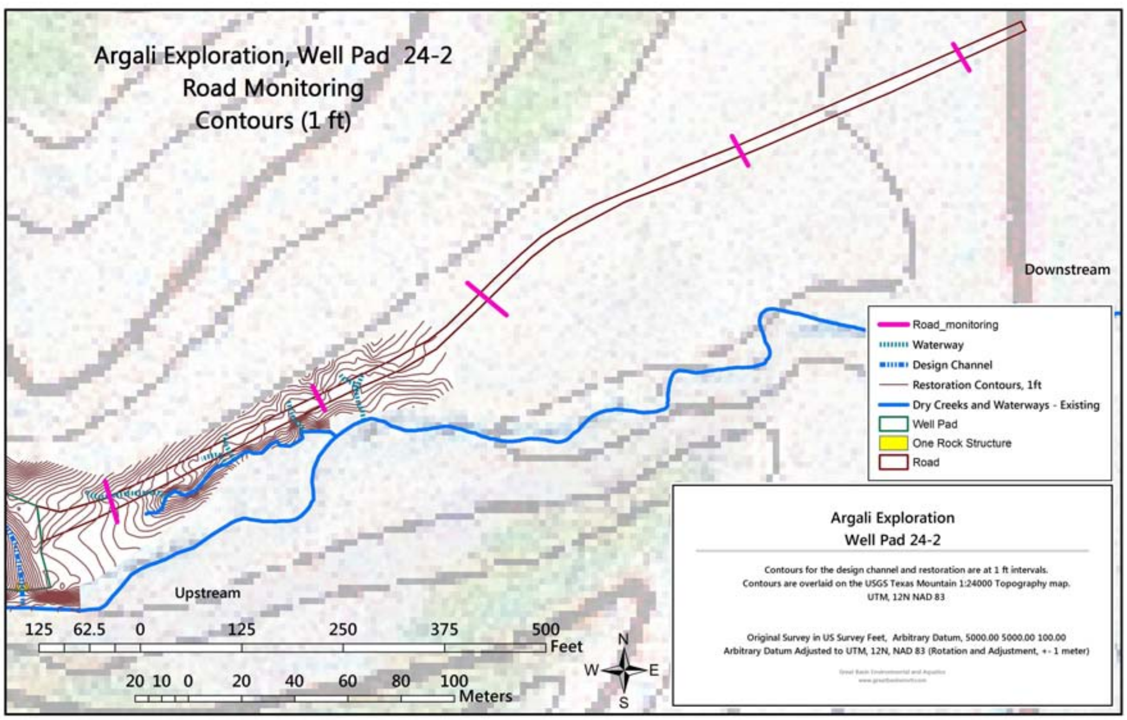

Figure 16. Proposed road monitoring transect locations.

The following can be derived from the information collected at each vegetative transect:

- Foliar cover as percent and by species, if desired.
- Basal cover as percent and by species, if desired.
- Bare ground as percent.
- Canopy gaps as percent.
- Basal gaps as percent.
- Vegetative height to be used as an indicator of erosion or wildlife habitat potential (MacKinnon et. al. 2011).

Appendix A has example field forms that generally follow Herricks (2009) suggested methods and show the field information collected.

Fencing

Cattle, wild horses, and wildlife use the restoration area. Grazing of the restoration site may damage the seeding and vegetative growth. Fencing following the BLM guidelines of either a standard barb/smooth-wire configuration, or an electrified, high tensile steel wire fence will be installed as needed. Livestock "pass-through" will be constructed as needed. Fencing will be maintained during the life of the project.

Fencing will be removed at the finalization of the project.

Abandon Gas Pipeline

There is an abandoned pipeline that parallels the access road and goes into the well pad. The construction of the design channel and road reconstruction has the potential to expose the pipeline. The pipe is to be cut, capped, and buried as per the BLM recommendations. The BLM consultation states: "*Any portion of the pipeline that is exposed while restoring the original topography and matching the natural land form will be removed by excavating into the bank about two feet, cutting the pipeline and attaching a breathable cap or plate on the portion of the pipe to be left in place and seeding the subsequent disturbance.*" (Appendix E, bullet 1).

Visual

In keeping with the intent of reclamation, the project when finalized should appear to be comparable with the relatively undisturbed adjacent terrain. For example, rock exposed on the surface should resemble the size, relative shape, and color of the adjacent. The exception would be rock used for an approved erosion control structure (e.g. the design channel). Contouring of soils over the well pad and access road before seeding also falls into this category.

Construction Debris

Construction equipment, materials, and debris, will be removed from the site after construction of the design channel, road contouring, fencing and planting, within a reasonable period of time. Through out the life of the project, the objective will be to maintain a visually pleasing view and to not allow the area to become "trashy".

The intent of a restoration is to return the location to a facsimile of the original. In keeping with that intent, material used during construction and reclamation will be removed. This will include fencing and posts, remaining non-biodegradable material from erosion control wattles and blankets, plus other items that are not in keeping with the concept of restoration.

References

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Appendix A

Vegetative Transect
Line-Point Intercept
Canopy and Basal Gap
Field Forms

List of Figures

Vegetative Transect Form

Line-Point Intercept

Site: **Date:** **Time:** **Page:** **of**

UTM[1] Zone: **Easting:** **Northing:** **Compass Bearing:**

Crew:

Transect #: **Length:** **Spacing:** **Units:**

Photos

Point	Top Layer	Lower Layers 1	2	3	Soil Surface	Point	Top Layer	Lower Layers 1	2	3	Soil Surface
1						31					
2						32					
3						33					
4						34					
5						35					
6						36					
7						37					
8						38					
9						39					
10						40					
11						41					
12						42					
13						43					
14						44					
15						45					
16						46					
17						47					
18						48					
19						49					
20						50					
21						51					
22						52					
23						53					
24						54					
25						55					
26						56					
27						57					
28						58					
29						59					
30						60					

[1] Coordinates are for the starting point of the transect (zero).

See back of form for more info and codes

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Figure A1. Vegetative transect, line-point intercept field form.

Vegetative Transect Form

Line-Point Intercept

Site:	Date:	Time:	Page:	of

Crew:

Transect #:

Photo Notes:

General Notes:

Rough Calculations:

Foliar Cover

(# of top layer points/total points)*100=% Foliar cover

Bareground

(# of points with no layers having veg /total points)*100=% Bare ground

Basal Cover

(# of points at plant base /total points)*100=% Basal cover

Code for, Genus not known	**Soil surface codes**	**Rock and Gravel Codes - B axis**
AF# = Annual forb (also includes biennials)	R = Rock	R2 = sand 0.1 - 0.25"
PF# = Perennial forb	BR = Bedrock	R3 = fine gravel 0.25 - 1.0"
AG# = Annual graminoid	EL = Embedded litter	R4 = coarse gravel 1.0-3.0"
PG# = Perennial graminoid	D = Duff	R5 = small cobble 3.0 - 6.0"
SH# = Shrub	M = Moss	R6 = large cobble 6.0 - 12.0"
TR# = Tree	LC = Visible biotic crust on soil	R7 = boulder >12.0"
	S = Soil that is visibly unprotected by any of the above	

Top Layer Codes: Species code, common name, or NONE (no cover).

Lower Layers Codes: Species code, common name, L (herbaceous litter), WL (woody litter, >5 mm (~1/4 in) diameter).

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Figure A2. Back of vegetative transect sheet, line-point intercept field form.

Vegetative Transect Form

Canopy Gap

Site:	Date:	Time:	Page: of
UTM[1] Zone:	Easting:	Northing:	Compass Bearing:
Crew:			
Transect #:	Length:	Units:	

Circle One: Perennial Veg Only OR Annual and Perennial Veg

Canopy Gaps: Min Size = _______________							Basal Gaps: Min Size = _______________						
Start	End	Gap Size	Gap Length Bins				Start	End	Gap Size	Gap Length Bins			
Sum							**Sum**						
Line Length							**Line Length**						
(Sum / Line Length) x 100=%							**(Sum / Line Length) x 100=%**						
		Gap Size	**Gap Length Bins**						**Gap Size**	**Gap Length Bins**			
		ft	**1 - 2**	**2.1 - 3**	**3.1 - 6**	**>6**			**ft**	**1 - 2**	**2.1 - 3**	**3.1 - 6**	**>6**
		cm	**25 - 50**	**51 - 100**	**101 - 200**	**>200**			**cm**	**25 - 50**	**51 - 100**	**101 - 200**	**>200**

[1] Coordinates are for the starting point of the transect (zero).

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Figure A3. Vegetative transect, canopy and basal gap field form

Vegetative Transect Form

Vegatative Height

Site: **Date:** **Time:** **Page:** **of**

UTM[1] Zone: **Easting:** **Northing:** **Compass Bearing:**

Crew:

Transect #: **Length:** **Spacing:** **Diameter of Point:** **Units:**

Point	Distance on Tran	Top Layer	Height	Point	Distance on Tran	Top Layer	Height	Point	Distance on Tran	Top Layer	Height
1				21				41			
2				22				42			
3				23				43			
4				24				44			
5				25				45			
6				26				46			
7				27				47			
8				28				48			
9				29				49			
10				30				50			
11				31				51			
12				32				52			
13				33				53			
14				34				54			
15				35				55			
16				36				56			
17				37				57			
18				38				58			
19				39				59			
20				40				60			

Notes:

[1] Coordinates are for the starting point of the transect (zero).

See back of form for more info and codes

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Figure A4. Vegetative height field form

Appendix B
Colorado State Noxious Weed List

List of Tables

Table B1. Colorado noxious weed list, for A and B species

Colorado Noxious Weeds			
List A Species		**List B Species**	
Common Name	Scientific	Common Name	Scientific
African rue	*Peganum harmala*	Absinth wormwood	*Artemisia absinthium*
Camelthorn	*Alhagi pseudalhagi*	Black henbane	*Hyoscyamus niger*
Common crupina	*Crupina vulgaris*	Bouncingbet	*Saponaria officinalis*
Cypress spurge	*Euphorbia cyparissias*	Bull thistle	*Cirsium vulgare*
Dyer's woad	*Isatis tinctoria*	Canada thistle	*Cirsium arvense*
Elongated mustard	*Brassica elongata*	Chinese clematis	*Clematis orientalis*
Giant reed	*Arundo donax*	Common tansy	*Tanacetum vulgare*
Giant salvinia	*Salvinia molesta*	Common teasel	*Dipsacus fullonum*
Hydrilla	*Hydrilla verticillata*	Corn chamomile	*Anthemis arvensis*
Japanese knotweed	*Polygonum cuspidatum*	Cutleaf teasel	*Dipsacus laciniatus*
Giant knotweed	*Polygonum sachalinense*	Dalmatian toadflax, broa	*Linaria dalmatica*
Bohemian knotweed	*Polygonum x bohemicum*	Dalmatian toadflax, narr	*Linaria genistifolia*
Meadow knapweed	*Centaurea pratensis*	Dame's rocket	*Hesperis matronalis*
Mediterranean sage	*Salvia aethiopis*	Diffuse knapweed	*Centaurea diffusa*
Medusahead	*Taeniatherum caput]medusae*	Eurasian watermilfoil	*Myriophyllum spicatum*
Myrtle spurge	*Euphorbia myrsinites*	Hoary cress	*Cardaria draba*
Orange hawkweed	*Hieracium aurantiacum*	Houndstongue	*Cynoglossum officinale*
Purple loosestrife	*Lythrum salicaria*	Jointed goatgrass	*Aegilops cylindrica*
Rush skeletonweed	*Chondrilla juncea*	Leafy spurge	*Euphorbia esula*
Squarrose knapweed	*Centaurea virgata*	Mayweed chamomile	*Anthemis cotula)*
Tansy ragwort	*Senecio jacobaea*	Moth mullein	*Verbascum blattaria)*
Yellow starthistle	*Centaurea solstitialis*	Musk thistle	*Carduus nutans)*
		Oxeye daisy	*Chrysanthemum leucanthemum)*
		Perennial pepperweed	*Lepidium latifolium)*
		Plumeless thistle	*Carduus acanthoides)*
		Quackgrass	*Elytrigia repens)*
		Russian knapweed	*Acroptilon repens)*
		Russian-olive	*Elaeagnus angustifolia)*
		Salt cedar	*Tamarix chinensis, T. parviflora and T. ramosissima*
		Scentless chamomile	*Matricaria perforata)*
		Scotch thistle	*Onopordum tauricum)*
		Spotted knapweed	*Centaurea maculosa)*
		Spurred anoda	*Anoda cristata)*
		Sulfur cinquefoil	*Potentilla recta)*
		Venice mallow	*Hibiscus trionum)*
		Wild caraway	*Carum carvi)*
		Yellow nutsedge	*Cyperus esculentus)*
		Yellow toadflax	*Linaria vulgaris)*

Table B2. Colorado noxious weed list for C and watch list species.

Colorado Noxious Weeds			
List C Species		Watch List	
Common Name	Scientific	Common Name	Scientific
Bulbous bluegrass	*Poa bulbosa*	Asian mustard	*Brassica tournefortii*
Chicory	*Cichorium intybus*	Baby's breath	*Gypsophila paniculata*
Common burdock	*Arctium minus*	Bathurst burr, Spiney cocklebur	*Xanthium spinosum*
Common mullein	*Verbascum thapsus*	Brazilian elodea	*Egeria densa*
Common St. Johnswort	*Hypericum perforatum*	Common bugloss	*Anchusa officinalis*
Downy brome	*Bromus tectorum*	Common reed	*Phragmites australis*
Field bindweed	*Convolvulus arvensis*	Flowering rush	*Butomus umbellatus*
Halogeton	*Halogeton glomeratus*	Garlic mustard	*Alliaria petiolata*
Johnsongrass	*Sorghum halepense*	Hairy willow-herb	*Epilobium hirsutum*
Perennial sowthistle	*Sonchus arvensis*	Himalayan blackberry	*Rubus armeniacus*
Poison hemlock	*Conium maculatum*	Japanese blood grass/cogongrass	*Imperata cylindrica*
Puncturevine	*Tribulus terrestris*	Meadow hawkweed	*Hieracium caespitosum*
Redstem filaree	*Erodium cicutarium*	Onionweed	*Asphodelus fistulosus*
Velvetleaf	*Abutilon theophrasti*	Pampas grass	*Cortideria jubata*
Wild proso millet	*Panicum miliaceum*	Parrotfeather	*Myriophyllum aquaticum*
		Scotch broom	*Cytisus scoparius*
		Sericea lespedeza	*Lespedeza cuneata*
		Swainsonpea	*Sphaerophysa salsula*
		Syrian beancaper	*Zygophyllum fabago*
		Water hyacinth	*Eichhornia crassipes*
		Water lettuce	*Pistia stratiotes*
		White bryony	*Bryonia alba*
		Woolly distaff thistle	*Carthamus lanatus*
		Yellow flag iris	*Iris pseudacorus*
		Yellow floatingheart	*Nymphoides peltata*
		Yellow tuft	*Alyssum murale, A. corsicum*

The weed list is current as of June, 2014.

Appendix C

Possible Erosion Evaluation Method

Use if Needed

List of Figures

Evaluation of Erosion

The design channel will be subject to erosion and depositional processes during the period of reclamation and afterwards. During reclamation, the transect locations that are used for vegetative analysis, could also be used to evaluate and quantitatively sample the change in channel form and elevation. Sutton (2008) described a method to evaluate changes in bed elevation caused by high flow events on the Klamath River. Bed elevations were measured on a cross-section (transect) with a total station, using an arbitrary datum reference for the elevation standard. A scour chain system was also used in conjunction with the cross-section. Figure C1 and C2 diagram the proposed potential methods.

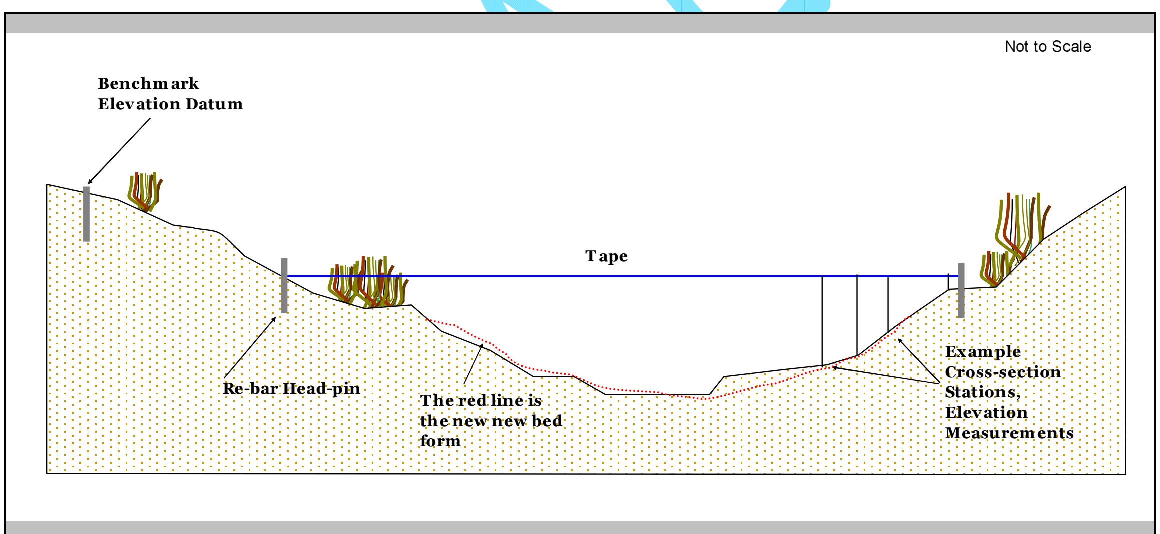

Figure C1. Cross-section (transect) showing bed change over time.

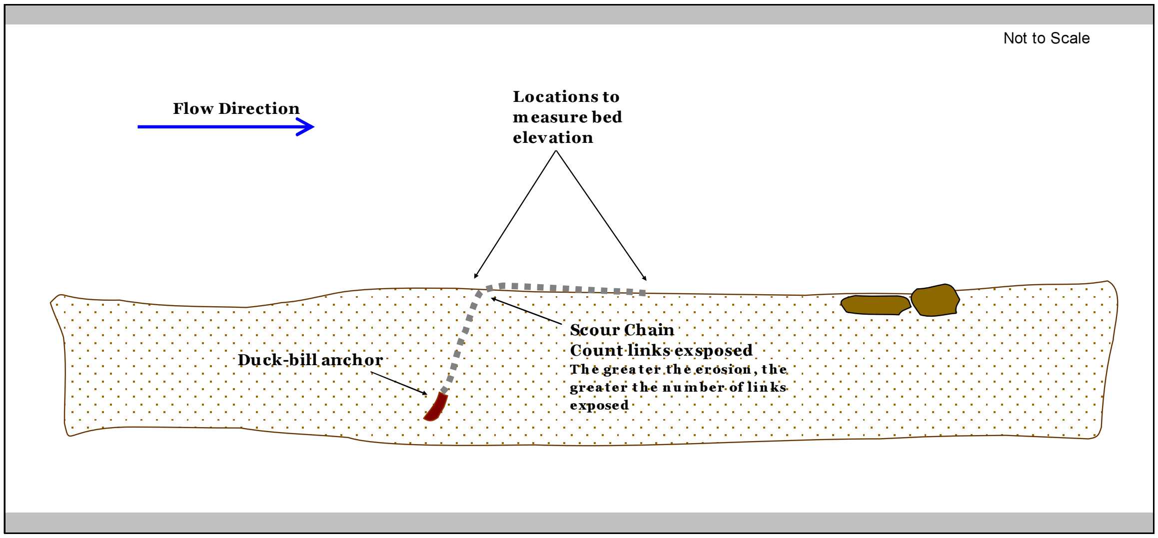

Figure C2. Scour chain shown after flood event and erosion.

Cross-sections could be evaluated after the construction is completed (a base-line values) and at the same time that the vegetation transect is being sampled. The scour chain could be measured yearly along with photos taken at the scour chain location.

General Erosion

Erosion will occur throughout the project area until the soil becomes stabilized by vegetation. The site will be monitored on a regular basis, both visually and documenting with photos, for erosion that may need remediation. If erosion occurs that compromises the integrity and viability of the reclamation process, the BLM will be notified verbally and by Sundry Notice. Remediation will begin within a reasonably time frame after approval is received.

Appendix D

Cross - Section and Longitudinal Profiles

Design Channel and Road

List of Figure

Road, Longitudinal Profile
Not to Scale

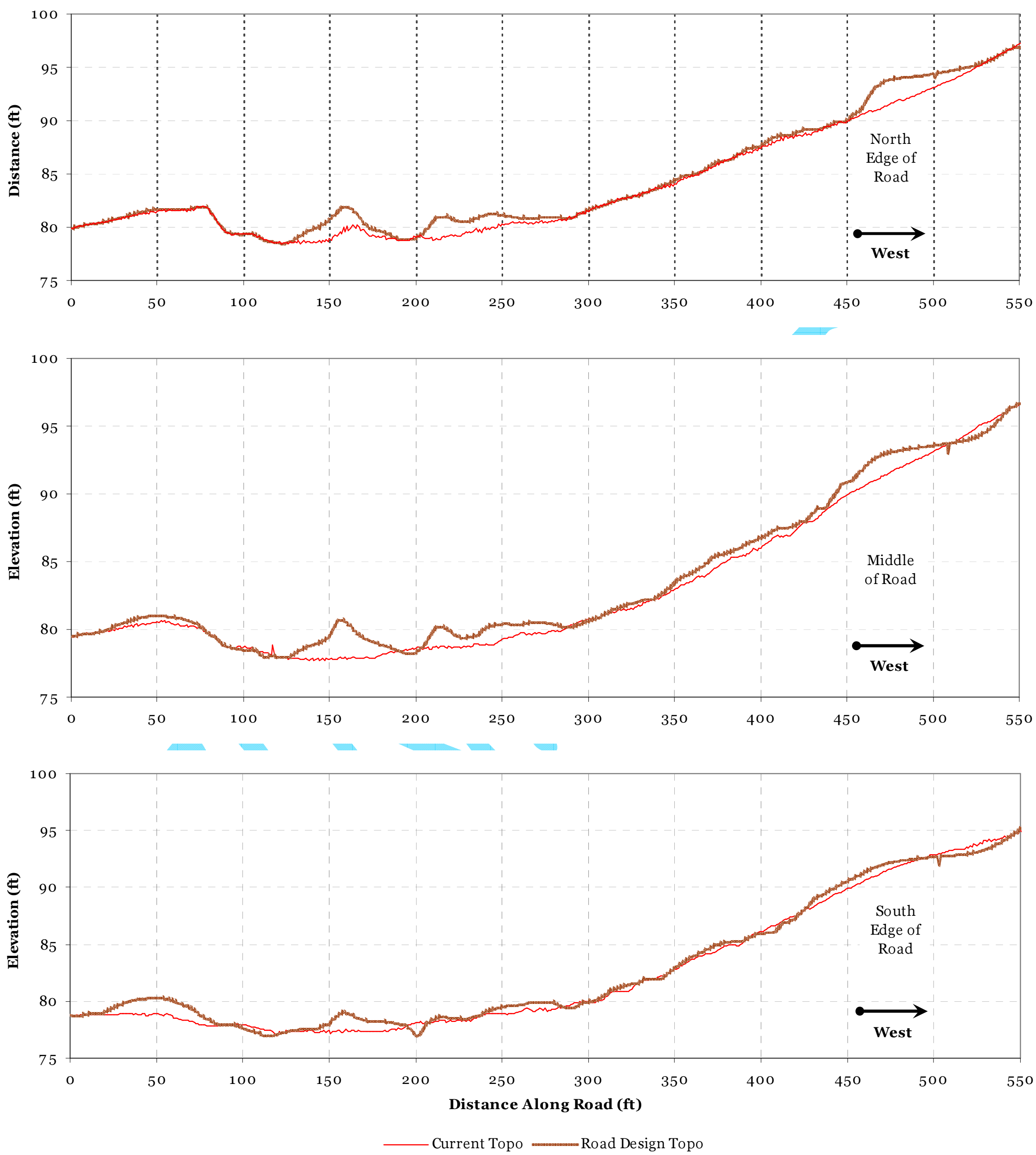

Figure D1. Longitudinal profile of road with before and after topography.

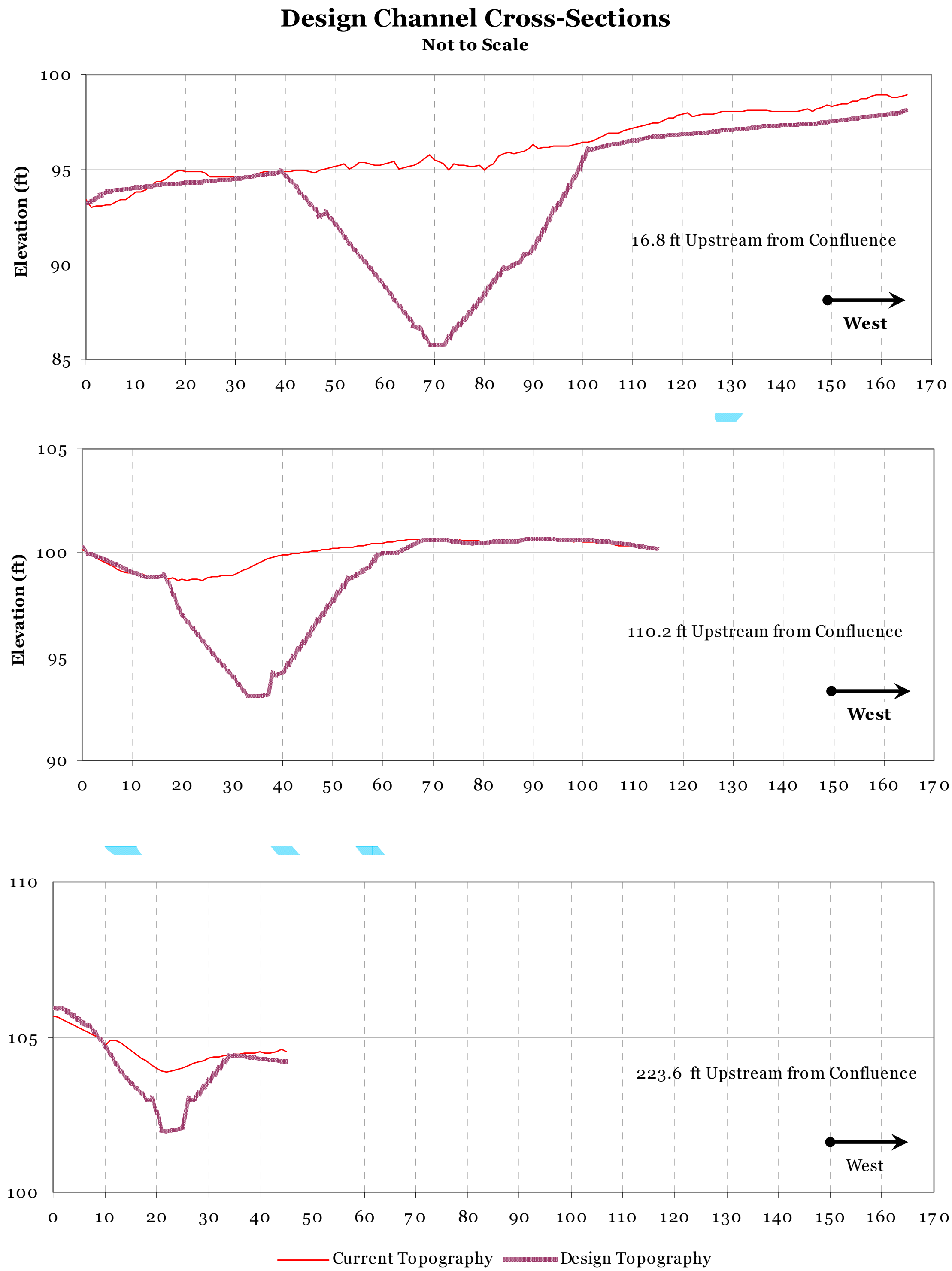

Figure D2. Cross-section profile of design channel with before and after topography. More cross-section profiles are available on request.

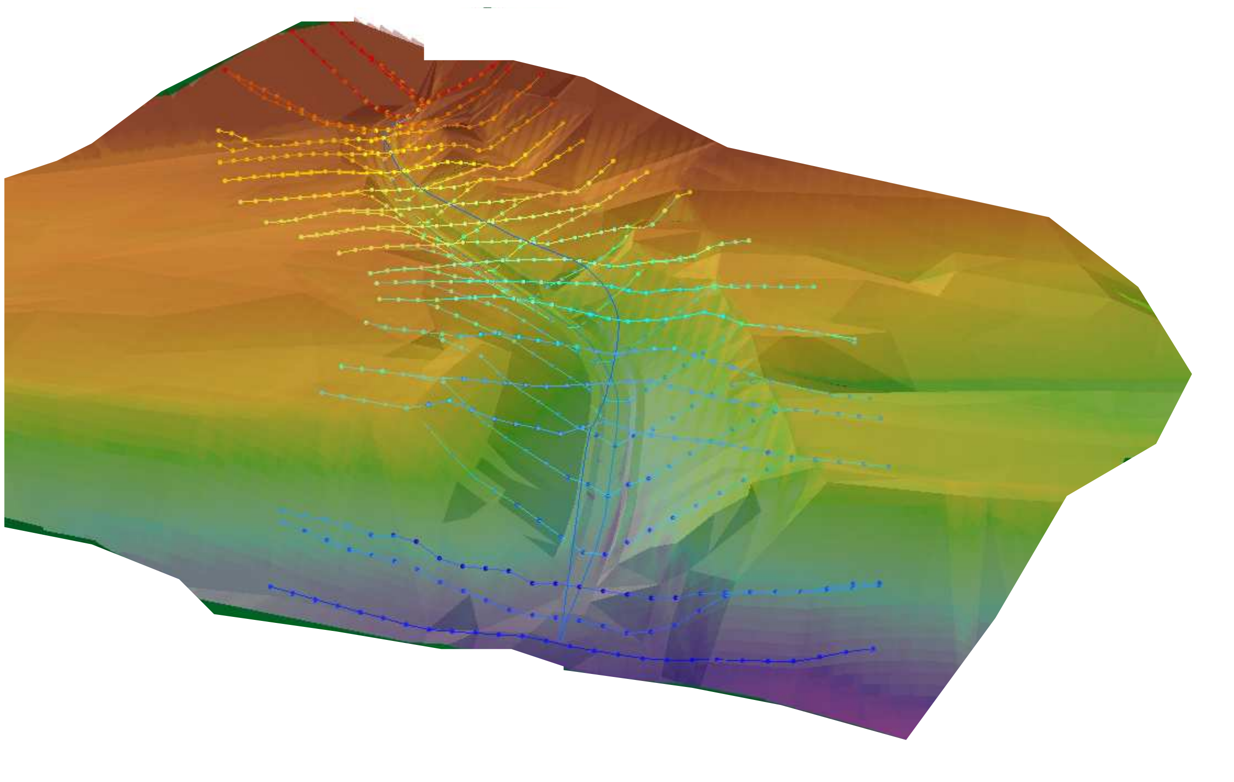

Figure D3. Cross-section profile of design channel with before and after topography. superimposed on a three dimensional model of the design terrian.

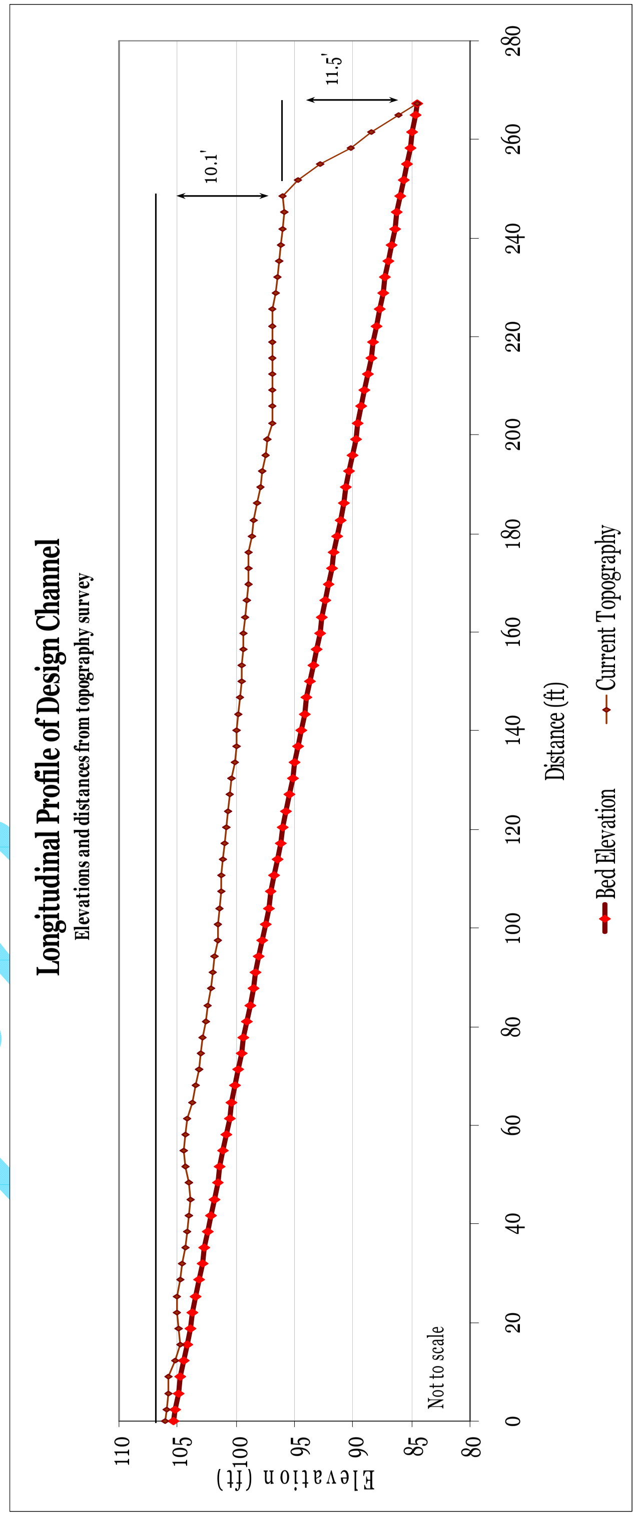

Figure D4. Longitudinal profile of design channel bed with before and after topography.

Appendix E
BLM Consultation

FOR: Jay Johnson, Natural Resource Specialist DATE: 03/17/2014
FROM: Bob Lange, Hydrologist
SUBJECT: Argali Well 24-2 Final Abandonment Reclamation Plan

A field visit occurred on 3/6/2014 to evaluate a pipeline and reclamation for Argali Well 24-2. This was the second visit to the site and had the advantage of no snow cover. There was some question about the reclamation of this site since the pad site is located on a sediment delta at the mouth of a steep drainage, next to a downcut ephemeral drainage and there has been some erosion and deposition on both the pad and the access road during rain events including some large sink holes. Due to the unique conditions the current owner of the well Gary Hinaman has asked for input in developing his reclamation plan that will be submitted with the notice for final abandonment. An additional field visit was conducted on 12/17/2013.

The pad is accessed off of highway 139 and has a cattle guard with a gate and a culvert crossing on Douglas Creek both located on private lands. The pad is located on the terrace next to an ephemeral drainage that is significantly downcut and shows evidence of past high water events. There has been up to two feet of sediment deposition on the pad surface, the well has been plugged and all the equipment removed from the site. There is an abandoned pipeline that parallels that access road and may be exposed during recountouring.

The following items were discussed and agreed to at the March field visit (see figure 1 and 2):

1. Any portion of the pipeline that is exposed while restoring the original topography and matching the natural land form will be removed by excavating into the bank about two feet, cutting the pipeline and attaching a breathable cap or plate on the portion of the pipe to be left in place and seeding the subsequent disturbance.

2. Depending on landowner wishes the culvert will be left in place or removed. If the culvert is removed the fill in Douglas Creek will be excavated and used to fill the west entry into the culvert.

3. Minimal water bars will be installed as necessary to divert water from the old roadway on segment 1 and 2 (see figure 1). Water bars will be less than 9 inches from the ditch to the crest of the borrow material and shall discharge into stable well vegetated terrain. This section of the old access road will be minimally roughened and seeded using a drill seeder and the BLM approved seed mix. If a drill seeder is unavailable the location should be raked and seeded at double the drill-seed rate.

4. All unnatural berms and terraces on the access road on section 3 and 4 (see Figure 1) will be removed and spread.

5. The natural inundating landform with ridge and swell will be returned on section 4. Swells will be excavated to the bottom of piped or sinks and material will be spread on adjacent ridges (Figure 2). All disturbance drill seeded or raked and seeded at double the drill seed rate with the BLM approved seed mix during a time of the year that will likely receive enough regular moisture for seed to germinate. If pipeline is encountered during excavation it will be handled as per item 1.

6. Two constructed shallow drainage swells will be built along the pad from north to south (Figure 2). The outlet elevation of the swell will be the bottom of the sink hole next to the ephemeral channel and the top will daylight at the beginning of the sediment delta or fan. The grade of the drainage swell will be gradual between these two points allowing for a non-erosive path for flood waters to the channel. The swell will have a 3 foot flat bottom and 3:1 sloping sides up to the current undisturbed elevation. Excavated material will be spread between drainage swells and rounded to allow for drill seeding. There should be no abrupt edges in the recountouring allowing for a natural land form as much as possible.

7. Excavated rock from the excavated sites on the pad and access road and potentially rock quarried and purchased from a private vendor will be used to construct one rock structures along the bottom of the drainage swell to increase surface friction and structure, reduce flow velocities and increase infiltration of surface runoff during a storm event. No material will be gathered beyond the disturbed areas. One rock structures with 8 inch or greater angular rock, at least 4 rows of rocks wide (only one rock high) and hand placed to reduce surface runoff would work for this application (Figure 3).

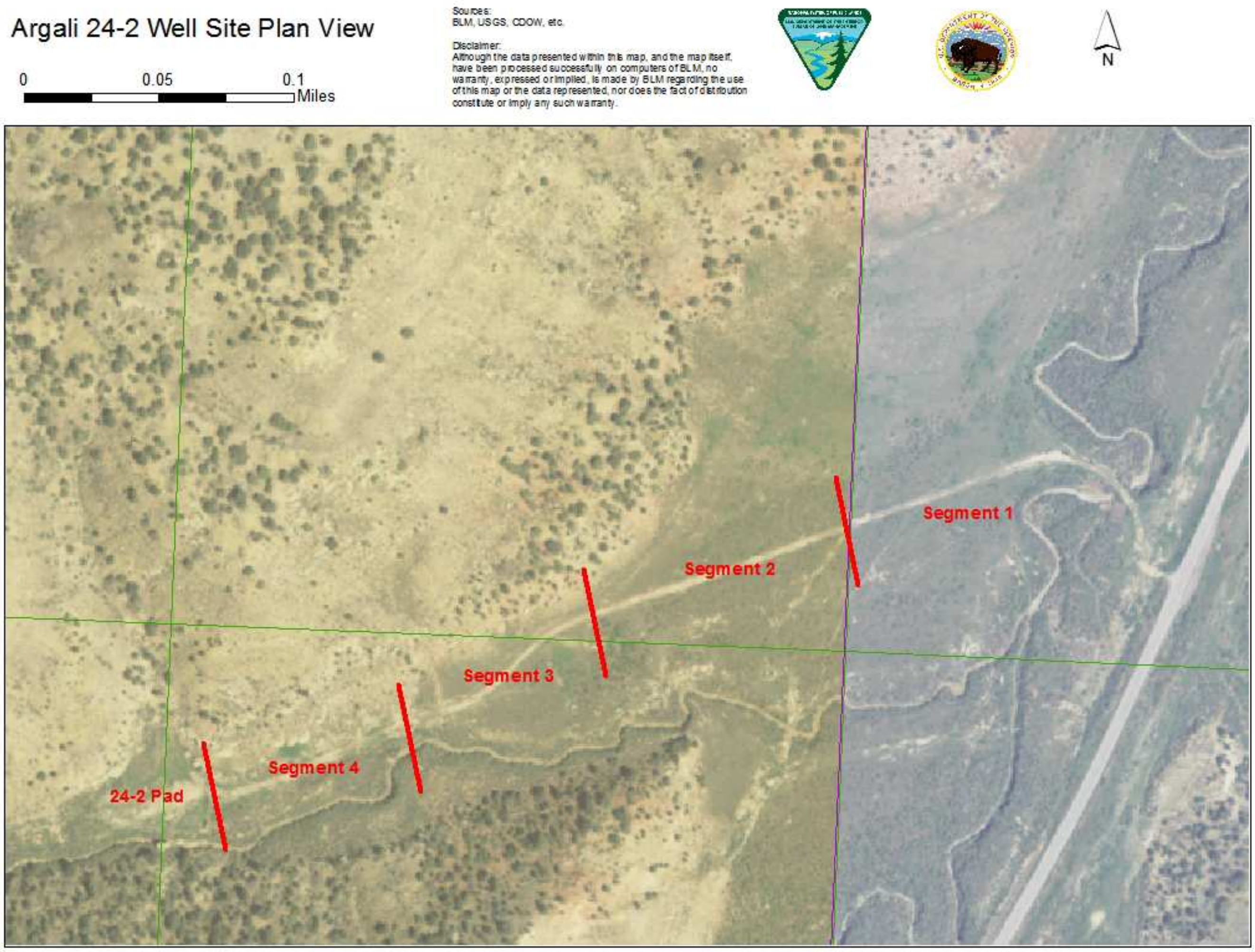

Figure 1: Plan View

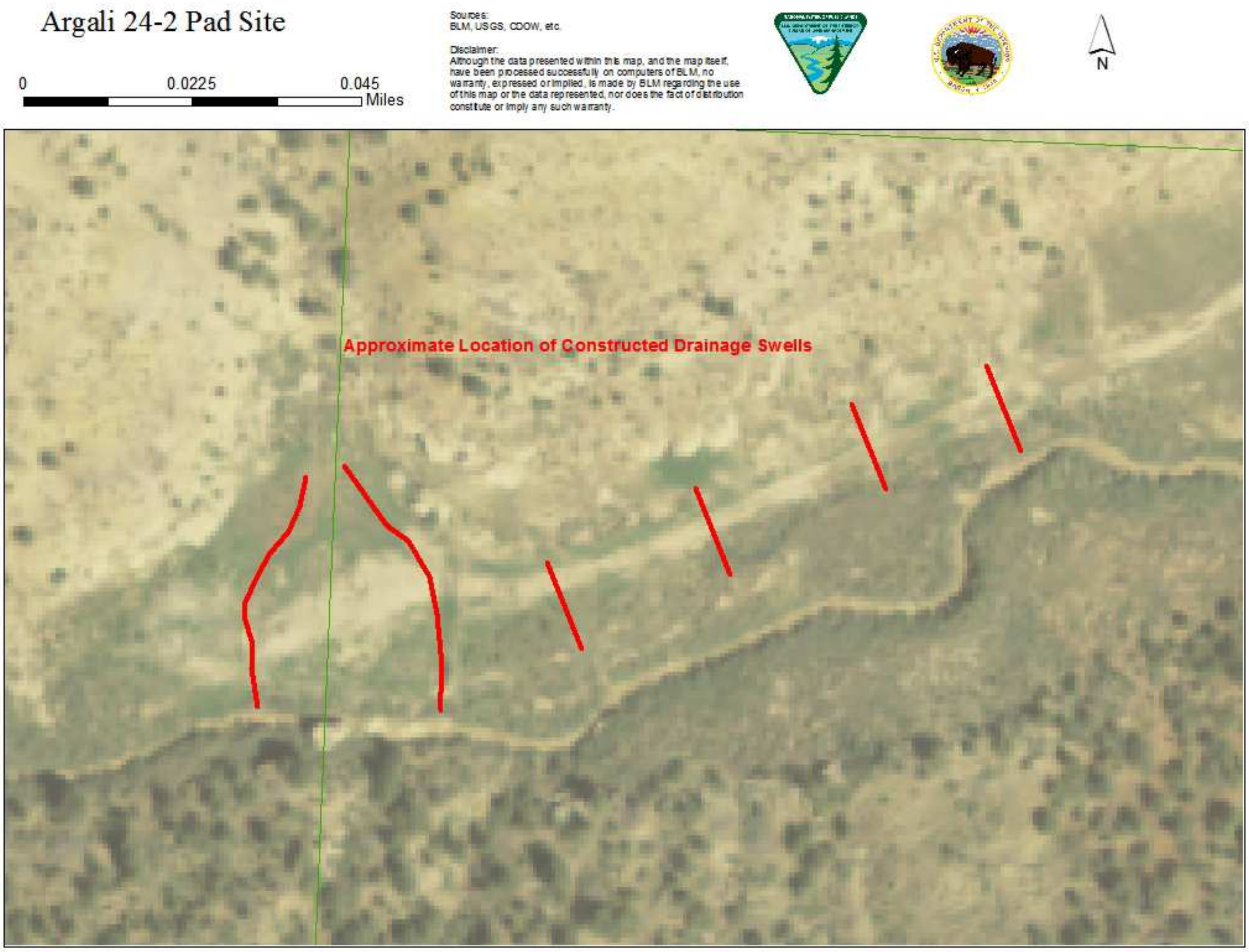

Figure 2: Pad site and the last section of the access road.

Appendix F
Photos

Photo F1. Photos and schematic, of well pad drainage reference cross-section.

Photo F2. Reference and well pad drainages (Google Earth).

Photo F3. Photo of reference drainage cross-section slightly above the confluence of the main dry drainage (bed is 4' across).

Photo F4. Photo of reference drainage cross-section slightly above the confluence with the main dry drainage; also see Photo B3.

Photo F5. Photo of reference drainage above the confluence with the main dry drainage; looking downstream.

Appendix G

Control Points and Maps

List of Figures

List of Tables

Table G1. Control points.

Control Point Coordinates

#	Point	UTM, 12N, NAD 83				Original Survey (Survey Feet)		
	Name	X (Easting)	Y (Northing)	Z (m)	Z (ft)	X	Y	Z
1	BM	689546.575	4404391.754	1929.997	6332	5000.000	5000.000	100.000
2	CP1	689549.756	4404417.657	1930.383	6333	5000.000	5085.623	101.264
3	CP2	689600.603	4404392.258	1926.829	6322	5175.733	5023.244	89.606
4	CP3	689470.845	4404371.552	1932.758	6341	4761.474	4903.934	109.059
5	CP4	689548.912	4404425.652	1931.854	6338	4994.055	5111.317	106.093
6	CP5	689528.510	4404445.303	1932.770	6341	4919.763	5167.152	109.098
7	CP6	689575.773	4404418.863	1930.008	6332	5084.241	5099.950	100.036
8	CP7	689594.430	4404424.194	1928.923	6328	5142.863	5124.770	96.475
9	CP8	689629.940	4404441.461	1927.170	6323	5251.595	5195.198	90.723
10	CP9	689694.780	4404472.319	1925.291	6317	5450.398	5321.606	84.560
11	CP10	689724.950	4404455.474	1923.254	6310	5555.380	5278.817	77.876
12	CP11	689630.492	4404411.618	1926.152	6319	5265.325	5098.238	87.383

Original Survey in US Survey Feet, Arbitrary Datum, 5000.00 5000.00 100.00
Arbitrary Datum Adjusted to UTM, 12N, NAD 83 (Rotation and Adjustment, +- 1 meter)

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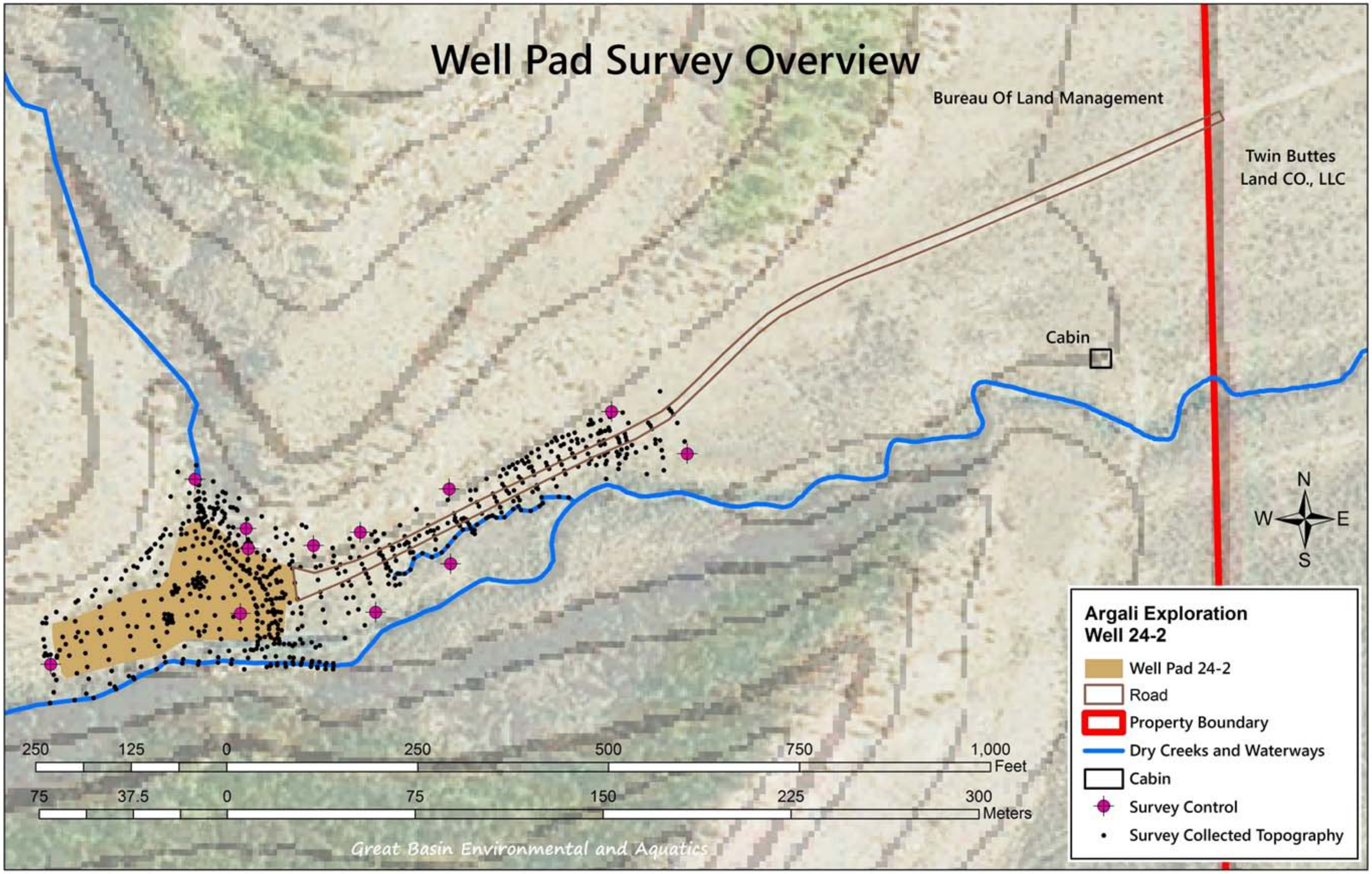

Figure G1. Overview of control points, surveyed topography points, drainages, and property lines.

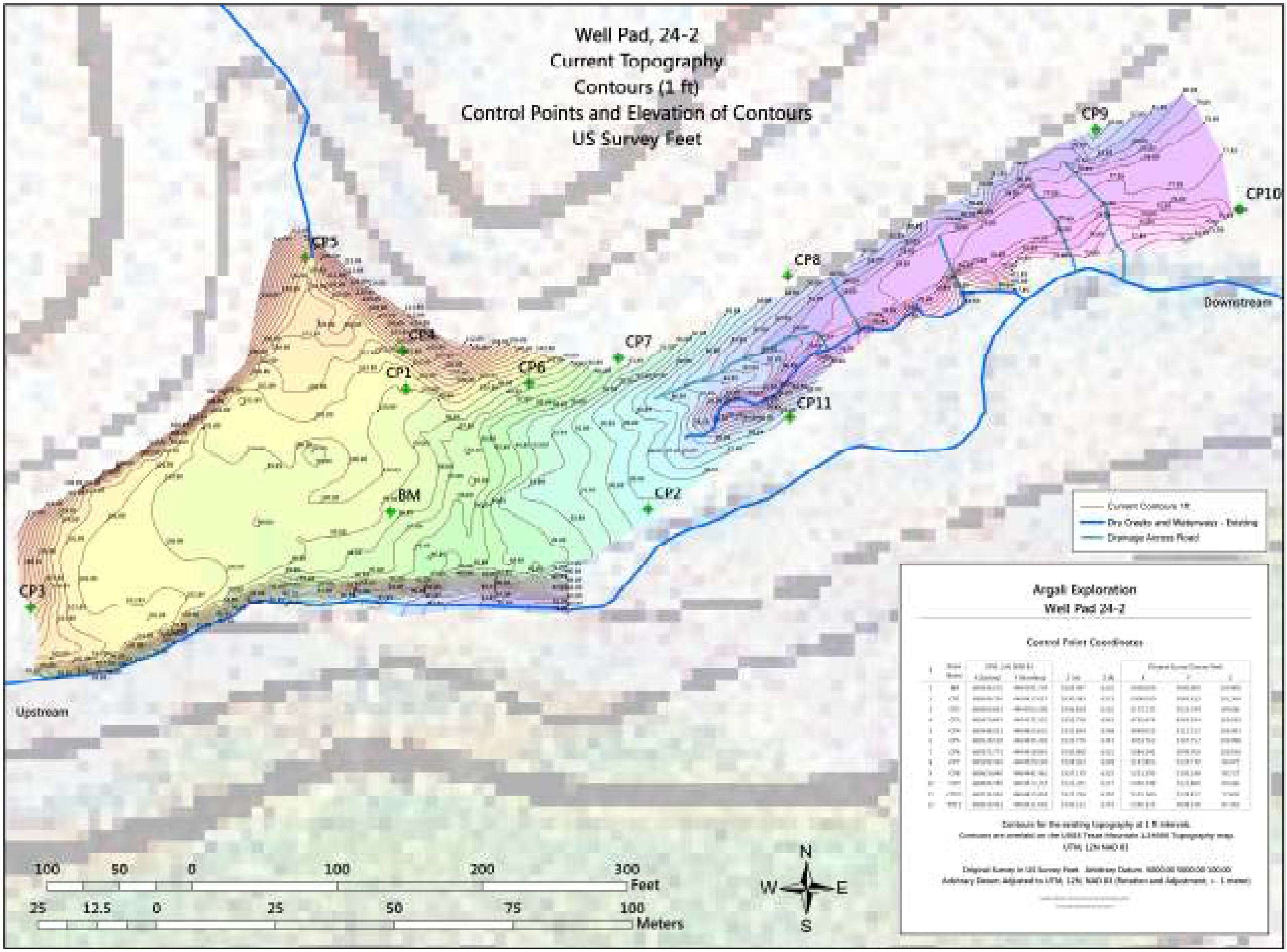

Figure G2. Overview of control points, current topography with elevations in feet, and drainages.

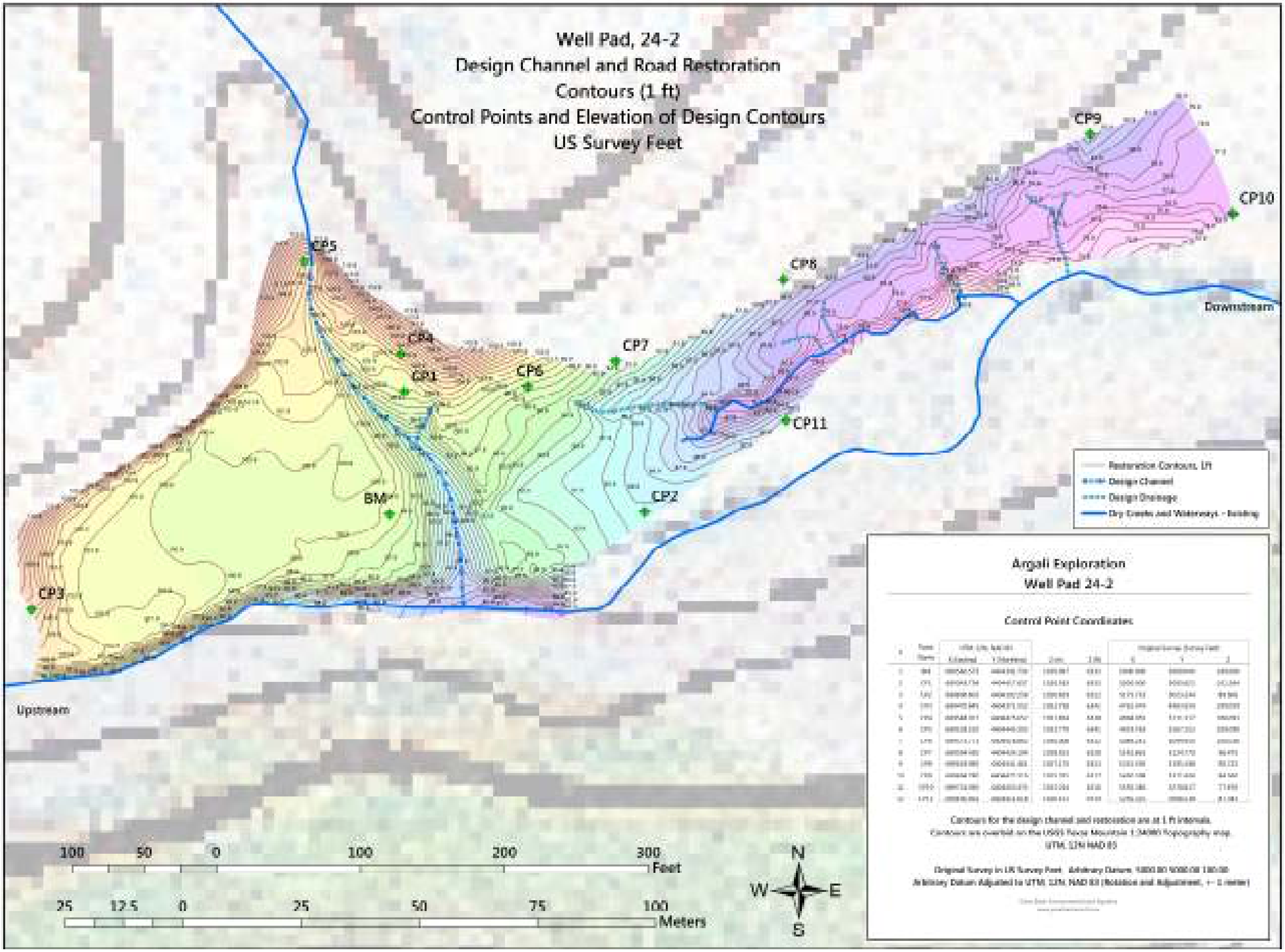

Figure G3. Overview of control points, design topography with elevations in feet, and drainages.