Memorandum

TO: Gary Walker, Walker Ranches
FROM: Claudia Browne and Vince Sortman**,** Biohabitats, Inc**.;** Alan T. Carpenter, Ph.D Land Stewardship Consulting, and ; Laurie Clark, P.E., Clark Engineering LLC
DATE: October 18, 2013
RE: Walker Ranches Site Visits Summary

1.0 Introduction

The purpose of this memorandum is to summarize our evaluation of the 1) extent to which construction and reclamation of the Southern Delivery System (SDS) pipeline easement (easement) across the Walker Ranches property has led to or could reasonably lead to environmental damage, 2) severity of that damage, and 3) estimated cost to cure the environmental damage.

Site visits to Walker Ranches were conducted by Biohabitats Inc. (Claudia Browne and Vince Sortman) and Alan Carpenter on March 4, April 5, April 16, 2013, and September 20, 2013. The visits included driving and walking along the SDS easement to investigate features of interest, such as the irrigation pipe, erosion mats, the grading of the easement, drainages, riprap placed to control erosion, and the vegetation in undisturbed areas adjacent to the easement. During the visits, Claudia Browne and Vince Sortman focused their attention on features related to soil and water movement, and Alan Carpenter focused his attention on matters relating to vegetation. However, we all noted examples of environment damage when we observed them. Observations were marked on site maps and/or recorded with a Geographic Positioning System (GPS). (The scale of the color aerial photographs was 1 inch on the aerial photograph equaled 200 feet on the ground.) Information from the field observations was transferred into GIS for more detailed mapping purposes. It should be noted that the site visit on September 20, 2013, while it included the entire easement on the Walker Ranches property, allowed for only a cursory observation of damage caused by recent precipitation events. While we were able to record some features with a GPS unit, those mapped features do not include all of the damage observed. Also some of the features shown on the attached maps were drawn without the aid of a GPS unit and are estimates based on landmarks in the field.

2.0 Overall Findings

Our findings are described in the following subsections for 1) drainage on the easement, 2) vegetation on the easement, and 3) off-easement areas.

2.1 Drainage Evaluation on Easement

The main observation of drainage on the Walker Ranches property is that the easement is crowned, in approximately the middle of the easement, for nearly the entire length on the property with the exception of major drainages that cross the easement. This crowning negatively impacts the drainage pattern on most of the easement and associated off

easement areas. In negatively impacted locations where prior to the pipeline construction the natural runoff patterns flow across the easement (i.e., were cross slope), the crowning redirects the natural flow pattern along the easement rather than allowing it to flow across the easement. This means that areas outside of the easement are cutoff from water that would naturally flow onto them. Because water is directed away from some areas, this also means that water is directed to areas that wouldn't naturally receive this water. On the Walker Ranches property some of this water is directed into small drainage swales that cross the easement. These small drainage swales are not sized to carry the redirected water and are easily overwhelmed with excess water often causing severe erosion. The water that is redirected along the easement also concentrates sooner than it would in its natural flow pattern which creates the potential for sediment erosion. In some areas this excess water and sediment moves off the easement and negatively impacts undisturbed areas of native vegetation. In areas of the easement that are not cross slope to the surrounding areas, impacts are occurring due to the concentration of runoff along both sides of the crown. We observed numerous rills and several gullies along the easement created by redirected, concentrated runoff.

Additionally, we observed several areas where ruts, created by construction equipment, have exacerbated the concentration of water along the easement. Throughout most of the length of the easement on Walker Ranches, there are also soil berms along both edges that alter the runoff patterns by concentrating flow. When sufficient flow is concentrated, it leads to sediment erosion. We observed numerous rills and several gullies along the easement created by concentrated runoff and erosion due to these impacts.

Another observation of drainage on the Walker Ranches property was the concentration of runoff on the access road which runs along the west side of the easement. The access road is a two track created by trucks and other construction equipment that traversed the easement to maintain the irrigation system and other maintenance items on the easement. Similar to the crowning, but in reverse function since the access road is a depressional feature, the access road intercepts runoff and concentrates it in a long, linear feature. Because the access road is depressional it functions as a drainage ditch – quickly concentrating water and conveying intercepted runoff for long distances. In some cases, the access road conveys runoff past small drainage ways that would naturally convey the runoff in another direction. This means that the access road conveys the water to another drainage swale that is not sized for the extra water. The concentration of water along the access road leads to sediment erosion and the creation of rills and gullies.

Most of the intercepted water and sediment generated by rill and gully erosion along the easement and access road were transported to unnamed drainage ways that cross the easement. In some cases the swales that were created across the easement were overwhelmed by the additional discharge, and we did observe large amounts of sediment deposition in some drainage ways.

In several places along the easement, check dams and straw waddles were not correctly installed and are ineffective for erosion control. Where surface runoff encounters waddles and check dams that are too high, water is redirected and concentrated. Additionally,

some of the check dams are causing excessive erosion and downcutting on the downstream side.

Steele Hollow has its own unique set of erosion problems. Steele Hollow is about twenty feet deep where the easement crosses. The slopes disturbed by pipeline installation were graded to what appears to be 2:1 slopes (two feet horizontal for every one foot vertical). These slopes were then seeded (we assume) and covered with a coir fiber erosion control mating. The steep slopes and long lengths of the slopes (at 2:1 a 20' high slope would be 40' long) create the potential for soil erosion. While the matting protects against water drop impacts, the matting is not in full contact with the slope, so water is able to concentrate underneath of the matting and erode soil. We did not observe any terracing of the slopes or installation of some type of technique that would breakup concentrated flow on the slopes. Also the soils along the easement are predominantly composed of silty, clay loam which is easily eroded. During our April 2013 site visit, we noticed rills had formed on the slopes under the matting. We were not aware of any precipitation events and therefore we believe the rilling was caused by irrigation of the slopes. During our September 2013 site visit we noticed that the rills had increased in size most likely due to continued irrigation and precipitation. We expect that the rills will continue to erode and increase in size if not repaired.

2.2 Vegetation Evaluation on the Easement

The entire length of the pipeline easement on the Walker Ranches property runs through plant communities that have a high component of shrubs. The most common shrubs on lands adjacent to the pipeline easement are candelabra cactus (*Cylindropuntia imbricata*), four-wing saltbush *(Atriplex canescens*), and shadscale (*Atriplex confertifolia*), with lesser amounts of winterfat (*Krascheninnikovia lanata*) and snakeweed (*Gutierrezia sarothrae*). Understory herbaceous plants are primarily grasses, typically alkali sacaton (*Sporobolus airoides*), galletagrass (*Hilaria jamesii*), blue grama (*Chondrosum gracile*) with lesser amounts of sand dropseed (*Sporobolus cryptandrus*) and purple three-awn (*Aristida purpurea*). Prickly-pear cactus (*Opuntia polyacantha*) is common in undisturbed areas along the entire easement. Forbs appeared to be sparse; annual sunflower (*Helianthus annuus*) was fairly common in spots.

During our initial site visit, we observed remarkably few noxious weeds on the Walker Ranches property. A number of tamarisk (*Tamarix ramosissima*) plants were growing in Steele Hollow. We also observed a few, scattered List C noxious weeds (*Halogeton glomeratus*), which are alkaline, plus several Russian thistle plants (*Salsola collina*, *S. australis*), annual species but not listed as noxious weeds by the State of Colorado. Given the size of the property, its low elevation, and history of livestock grazing, the property was remarkably free of non-native plant species.

During the September 20, 2013, site visit, however, we observed abundant weeds on the easement including halogeton and Russian thistles, a few common mullein plants (*Verbascum thapsus*) and one puncturevine plant (*Tribulus terrestris*) – both List C noxious weed species). We also observed many plants of cowpen daisy, an alien, annual

species. The cover of alien weeds was almost certainly limiting the establishment and growth of the seeded species.

The absence of shrub seeds in the revegetation mix is particularly perplexing, given abundance of shrubs along the pipeline easement. Observations of the pipeline right-of-way for the Fountain Valley pipeline, which was constructed several decades ago, showed a virtual lack of shrubs along that easement. Thus, spontaneous colonization of that pipeline by shrubs is happening very slowly, if at all. It appears that the plant diversity requirement for revegetation of the SDS pipeline easement will not be met for decades unless shrub seeds are planted in the easement.

The hay mulch applied to the SDS pipeline easement has been substantially redistributed by wind, which blows primarily from the west, in spite of the fact that the mulch had been crimped. Overall, we estimate that about 15% – 20% of the soil surface within the pipeline easement is covered with mulch. In many locations, we noted the presence of mulch extending several yards east of the eastern edge of the easement, indicating that it had been transported there by prevailing westerly winds. Mulch is typically visible in the cuts in the soil where the mulch was crimped, but the mulch is typically absent between the cuts. The spotty distribution of the mulch will make establishment of plants from seed in the easement significantly more difficult compared to a situation where the mulch were distributed more uniformly. The poor performance of the hay mulch indicates that mulch application that is much more resistant to redistribution by wind is needed.

Given the severe regional drought that is on-going, plant establishment will be a challenge, even with irrigation. It is imperative that the reclamation contractor monitor the status of the irrigation system constantly to deal with breaks, leaks, clogged emitters, and other problems. Interruption of irrigation for an extended period of time, particularly during a period of hot, dry, and windy weather, could lead to a complete failure of the seeded plants to establish. Observation along the easement in September revealed that a strip about 25 – 30 feet in width down the center of the easement had poor grass plant establishment, perhaps a result of inadequate amounts of irrigation reaching the center of the easement.

As noted in Section 2.1, there are numerous areas where grading impacts (e.g., berms, crowning, ruts, access roads) impede the movement of sheet flow from adjacent, undisturbed land across the easement, thereby reducing the amount of water available to germinate seeds and support seedling and sustained plant growth.

Because of compacted soil and continued vehicle use, it will be difficult to revegetate the access “road” which runs along the western edge of the easement. As noted in Section 2.1, the vehicle tracks in the road channel runoff water in some locations, which create erosion on and off the easement.

Certain areas of the easement have furrows or grooves or drill rows that channel runoff water and prevent sheet flow. This could create major erosion and prevent water adequate to support plant establishment from reaching certain areas on the easement.

2.3 Off-Easement Evaluation

As mentioned above, improper restoration of the easement to preconstruction topographic conditions along with redirected flow by the access road and poor grading has resulted in loss of beneficial water to off-site areas. Based on preconstruction topography, we estimate 65 acres have been affected off the easement due to surface flow redirection. It is difficult to predict the exact response to this loss of water, but it is safe to say that the existing vegetation outside of the easement will be negatively impacted by the depressed water conditions.

Also above, we pointed out that because the easement is redirecting water, some off easement areas are receiving more water. Typically the excess water and sediment is conveyed to an existing, unnamed drainage way. Where these unnamed drainages flow to a stock pond the excess sediment will necessitate more frequent replacement of the ponds to maintain sufficient storage volume. In several areas the excess water and sediment were discharged off of the easement before they reached an existing drainage channel. Although the additional water could be beneficial to existing vegetation, larger storms could produce erosive conditions. We did observe large areas of sediment deposition in these off easement discharge areas. Continued deposition and accumulation of sediment could also lead to loss of vegetation.

3.0 Treatment Recommendations and Estimated Cost

3.1 Repair Approach

Based on our evaluation of the impacts described in Section 2, it appears that most of the easement needs to be regraded to establish land surface contours that match those that existed prior to the pipeline construction. The overall restoration approach would include removing the existing irrigation system, stripping and stockpiling topsoil, excavation and haul-off of excess soil, regrading and repair of significantly eroded areas, placement of topsoil (stockpiled and supplied), installation of an irrigation system that provides uniform water distribution across the entire width and length of the easement, followed by reseeding of the entire easement with a new seed mix that contains forbs, shrubs and additional grass species in addition to those previously specified. Following reseeding, high-quality mulch would be applied with a tackifier. Some areas, especially drainage ways will require the installation of coir fiber erosion control matting. All regraded areas would also require the installation of straw wattles to check runoff and minimize soil erosion until vegetation can be established.

There are three primary grading treatments that are recommended as described below. Refer to Restoration Exhibits 1-20 for the approximate locations of each treatment. Note, out of the 98 acres of easement on the Walker Ranchers, there are approximately 13.3 acres which will require reseeding without one of the grading treatments.

Treatment 1--Crown repair (53.2 acres)

- remove existing irrigation pipe
- salvage topsoil

- regrade and remove excess soil from crown
- replace topsoil including supplied topsoil
- seed with a mix that has shrub and forb components, as well as additional grass species
- install mulch with appropriate tackifier
- install erosion control matting and Best Management Practices (BMPs) at appropriate intervals (maximum of 0.25-acre contributing area)
- install buried irrigation piping that has improved coverage,
- near-term maintenance (years 1-5)
- long-term maintenance (years 6-10)

Treatment 2–Crown & erosion repairs on easement and access road (9.5 acres)

- remove existing irrigation pipe
- salvage topsoil
- regrade and remove excess soil from crown
- regrade and repair eroded areas of easement including access road
- replace topsoil including supplied topsoil
- seed with a mix that has shrub and forb components, as well as additional grass species
- install mulch with appropriate tackifier
- install erosion control matting and Best Management Practices (BMPs) at appropriate intervals (maximum of 0.25-acre contributing area)
- install buried irrigation piping that has improved coverage,
- near-term maintenance (years 1-5)
- long-term maintenance (years 6-10)

Treatment 3 – Erosion repairs on drainage ways (22 acres)

- remove existing irrigation pipe
- remove existing erosion control matting
- salvage topsoil
- regrade and repair eroded as well as elevated areas of easement (this includes shaping appropriately sized swales across easement, grading terraces or water bars on Steele Hollow slopes, installing riprap to stabilize headcuts, etc.)
- replace topsoil including supplied topsoil
- seed with a mix that has shrub and forb components, as well as additional grass species
- install mulch with appropriate tackifier
- install erosion control matting and Best Management Practices (BMPs) at appropriate intervals (maximum of 0.25-acre contributing area)
- install buried irrigation piping that has improved coverage,
- near-term maintenance (years 1-5)
- long-term maintenance (years 6-10)

Note: All acreages are approximate and being used for cost estimating purposes. A thorough assessment and design should be performed to obtain more accurate repair areas and cost estimates.

3.2 Repair Costs

Estimates of the cost to repair are presented in Table 1 and are based on the assumptions listed below.

1. Although there are patches of native vegetation developing, the necessary earthwork (regrading in Treatments 1-3) will disturb vegetated patches and non-treatment areas. Additionally, many of the non-treatment areas include weed species and unvegetated patches. Therefore, we assume that the entire site will need to be revegetated.
2. Revegetation items (Nos. 1-16 in Table 1) are based on Total Terrain's S3 Bid Form unit prices, because their bid was rated a close second to the Western Reclamation bid and included many of the components needed for a successful project (i.e., comprehensive seed mix and buried irrigation system). Because the Total Terrain bid covered the entire S3, the amounts are prorated here to obtain the cost to revegetate the Walker Ranches portion only. The S3 easement on Walker Ranches covers approximately 27,800 linear feet (Station 800 to Station 1078) which is 69.75% of the 40,000 linear feet in S3. To account for the increase in contractor prices since the time of the bid, a 5% markup is provided: bringing, the final estimate for revegetation costs in items 1-16 to $3,294,580 (rounded).
3. Treatment 1 repair (Items 17a and 17b in Table 1) assumes the volume of material that will need to be removed from the crowning is estimated at 24,053 cubic yards (CY). This is a very rough estimate based on field run cross sections taken at several locations along the easement on the Walker Ranches property. We also assume that out of the total volume of crowned soil material, 18,892 CY could be used to repair onsite erosion (at $9/CY) and 5,161 CY of subsoil would need to be hauled offsite (at $16/CY). These costs include the cost to remove irrigation pipe, excavate soil, haul off excess soil, excavate and stockpile topsoil, spread stockpiled topsoil, disc subsoil, disc topsoil, engineering/surveying, and contingency.
4. The volume of earthwork needed to remove the crown in Treatment 2 areas (Item 18 in Table 1) is estimated to be 2,567 CY. This is a very rough estimate based on field run cross sections taken at several locations along the easement on the Walker Ranches property. To capture costs to repair, we used a price of $16.00 per CY to restore these areas which includes removing irrigation pipe, excavating soil, hauling off excess soil, excavating and stockpiling topsoil, spread stockpiled topsoil, disc subsoil, disc topsoil, engineering/surveying, and contingency. . It also includes riprap to repair headcuts. The price of $8/CY for 18,892 CY in Treatment 1 Areas includes using this material to repair erosion in Treatment 2 areas.
5. Treatment 3 areas (Items 19a, Table 1) include approximately 29,111 CY of regrading at $9/CY. This item includes removing irrigation piping and regrading drainage ways that cross the easement to create stable swales. It also includes installation of coir matting and riprap. We assumed an average depth of 1' of excavation and grading across the designated areas to arrive at the 29,111 CY (with the exception of Steele Hollow described below and in 19b and 19c).
6. Steele Hollow is designated as a Treatment 3 area because it is a drainage way, but has considerations that are listed separately in Table 1, Items 19b and 19c.

We estimate approximately 2,074 CY of grading to repair these slopes including terracing. We assumed an average depth of 1' across the slopes to obtain the 2,074 CY. The cost in Item 19c includes installation of coir matting over an area estimated to be 6,222 SY at $5/SY.

7. Item 20 in Table 1 is based on the price of $35.00 per CY for local topsoil replacement. The topsoil cost assumes delivery to the site and spreading to specified depth and area. We are estimating a total of 84.5 acres that require regrading/restoration (Treatments 1-3). We assume roughly 20% of this area has lost topsoil due to erosion; therefore roughly 17 acres would need imported topsoil. Using a topsoil depth of 6" would require 13,633 CY of topsoil imported. At a unit price of $35/CY the cost for imported topsoil placement would be $477,155.
8. Item 21 covers the cost of fencing to exclude cattle from the revegetation area. A unit cost of $2/ft installed was used for 11 miles of fencing to include crossings and fencing around Steel Hollow. This is 5 strand, 12.5 gauge barbed wire with 6 ft. steel posts and wood post bracing every 1/4 mile on 12 ft. centers (without stays).
9. Maintenance and monitoring are included in Item 13 of the Total Terrain bid, however, 2 years is likely inadequate to ensure long-term survival. As such, Item 22 extends near-term maintenance for 3 years (to year 5). This includes monitoring and repairing erosion control BMPS, irrigation pipes, weed control, reseeding, and fence repair. The estimate assumes
    - Labor: 2 crew persons (one skilled entry field technician and one junior engineer/range or plant scientist) will be needed full time for 6 months, and 8 hours/twice a month for the remaining 6 months.
    - Temporary Erosion Control: straw wattles and erosion control mats will be replaced twice per year—in early spring and late fall. Check dam repair will occur at an estimated rate of $1,000 per day for equipment and operator (for one week at a rate of 3 check dams/day, 3xs per year). Erosion control matting included in Treatment 3 is 87,333 SY and will need replacement at $5/SY twice per year—in early spring and late fall.
    - Weed control is expected to consist of mowing, which will be feasible given the buried irrigation line. This approach also assumes extensive weeds never become established, and therefore widespread chemical usage may be avoided. It is assumed that at least one member of the crew will have a pesticide applicator license for as-needed spot treatment, but the line item does not include the purchase of herbicides as it would only be minimal.
10. Item 23 assumes that long-term maintenance will be needed from years 6-10 to monitor the vegetation and drainage and to address erosion control repairs and spot weed treatment. The estimate assumes 2 crew persons (one skilled entry field technician and one junior engineer/range or plant scientist) will be needed once a week for 6 months and 8 hours/twice a month for the remaining 6 months.
11. Item 24 in Table 1 covers the cost to revegetate small channels adjacent to the easement that have been impacted by drainage from the easement. We assume that five such channels need to have plants established in their bottoms for a distance of 300 feet each to help hold soil in place. Inland saltgrass (*Distichlis*

stricta) and western wheatgrass (*Pascopyrum smithii*) are rhizomatous plants that would be effective as transplanted 10-cubic inch tubes stock. The estimated cost for 4,500 total plants (three plants per linear foot) plus delivery and installation is $13,500.

12. Item 25 covers the cost to replace the off-easement ponds that will be impacted by excess sediment accumulation. The estimated cost is based on information provided by Clark Engineering and ranch owner, Gary Walker. This estimate covers cut and fill earthwork for 8 stock ponds or dewatering and removing sediment to restore available volume.
13. This cost estimate assumes restoration recommendations will be implemented and beneficial surface and subsurface waters will be restored to the potentially impacted off-site areas.

The total cost of repair, based on the recommended treatments and maintenance items described above and in Table 1, is $9,136,894 based on the breakdowns presented below.

Subtotal of Walker Ranches Easement Revegetation	$3,294,582.00
Subtotal Additional Repair Costs-On-Easement	$5,157,032.00
Subtotal Additional Repair Costs-Off-Easement	$ 699,800.00
Total Cost to Repair	**$9,151,414.00**

3.3 Timeline

Given the poor performance of the vegetation test plots after two years of irrigation was terminated, more than two years of irrigation will be required for the seeded plants to become sufficiently established to thrive without irrigation water. Prudence would indicate, given the on-going drought, that irrigation should be applied for five years and include monitoring of soil moisture throughout the soil profile (up to 60 inches deep) to ensure soil moisture is sufficient to sustain the desirable plants when irrigation is terminated. As noted in the assumptions above, long-term maintenance will be needed for up to 10 years.

3.4 Groundwater and Springs severed by SDS S3 Pipeline Construction

Through discussion with the owner and observations on the Walker Ranch and of USGS mapping it appears that the S3 Raw Water Pipeline did not provide piping of groundwater or springs across the pipeline construction. The pipeline contractor did confirm with the owner that they encountered areas of gravel deposits that were dry at the time the pipeline was constructed. Due to the drought and lack of moisture during the previous years, no free flowing springs or groundwater was present. However, per the contractor no provisions to keep the springs and groundwater flowing across the easement were made. Therefore we have identified an area of approximately 280 acres more or less of bottom grasses that may not receive sub-irrigation as the springs and groundwater has potentially been severed.