

Appendix L

Monitoring and Adaptive Management Plan

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Planting Plan

Recommended Plantings

The planting zones for Spring Creek can be characterized as Wetland and Riparian, and generally follow classification depicted in Figure 1. The following sub-sections (1, 2, 3) provides a list of species suitable for each habitat type of the Fountain Creek watershed.

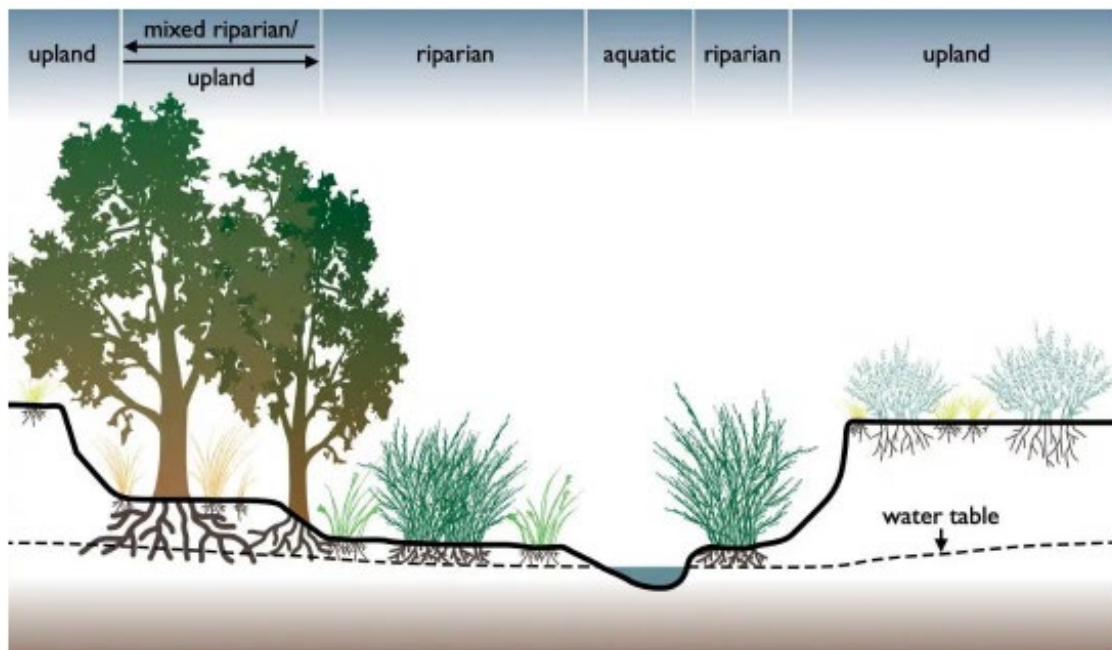


Figure 1. Planting zones of typical transitional habitats

Sub-Section 1. – Wetland Plantings

The wetland planting would be composed of Tufted hairgrass (*Deschamsia cespitosa*) supported by Arrowhead (*Sagittaria latifolia*) and Marshy milkweed (*Asclepsia speciosa*). Wetland zones are areas of high plant density, and Tufted hairgrass tends to form these highly dense clumps. Reach 2 of the 206 Spring Creek study will be the only Reach where wetland plantings are being considered, since Reach 2 had historical wetland characteristics. The range of ‘plug per square foot’ for wetland species is recommended by the Natural Resource Conservation Service (NRCS a) to be between and for 206 Spring Creek the planting density would be 0.50 plugs/ft². Table 1 summarizes the species, number of plants and wetland planting area planned for Reach 2 based on the TSP. Such planting density of the selected species can rapidly provide fast vegetative cover, a characteristic of the wetland zone.

Table 1. Summary of Wetland Plantings for Reach 2 based on the recommended ALT.

Location	Common Name	Scientific Name	Number of Individual Plants	Wetland Planting Area (sq ft)
Reach 2	Tufted hairgrass	<i>Deschamsia cespitosa</i>	3,512	47,420
	Arrowhead	<i>Sagittaria latifolia</i>	408	
	Marshy milkweed	<i>Asclepsia speciosa</i>	402	

Sub-Section 2. – Riparian Plantings

The riparian plantings would be composed of mostly Coyote willow (*Salix exigua*), a key riparian species that is considered a fast-growing plant that can spread via root suckers. Additional species to incorporate with the Coyote willow are the Narrowleaf cottonwood (*Populus angustifolia*), and Wild plum (*Prunus americana*). Riparian plantings are considered for all three Reaches of the 206 Spring Creek study. The range of ‘plug per square foot’ for riparian plantings is recommended to be between 0.25-0.50 plugs/ft² (NRCS b) and for 206 Spring Creek the planting density would be 0.35 plugs/ft². With this density, the riparian plantings would establish 2-3 ft apart, allowing room for the plant to grow and fill in the space over time. Table 2 summarizes the riparian plantings based on the recommended plan.

Table 2. Summary of riparian plantings for all Reaches based on the recommended plan.

Location	Common Name	Scientific Name	Number of Individual Plants	Riparian Planting Area (sq ft)
Reach 1b	Coyote willow	<i>Salix exigua</i>	130	600
	Narrowleaf cottonwood	<i>Populus angustifolia</i>	3	
	Wild plum	<i>Prunus americana</i>	4	
Reach 2b	Coyote willow	<i>Salix exigua</i>	5,655	28,608
	Narrowleaf cottonwood	<i>Populus angustifolia</i>	69	
	Wild plum	<i>Prunus americana</i>	110	
Reach 3b	Coyote willow	<i>Salix exigua</i>	4,186	22,911
	Narrowleaf cottonwood	<i>Populus angustifolia</i>	57	
	Wild plum	<i>Prunus americana</i>	110	

Sub-Section 3. – Seeding For the Fill, Spoil and other Upland Areas

The standard seed mix includes a variety of upland/riparian mix species with different structure, height and blooming periods. The seeding method would follow the broadcast protocol with preliminary calculations suggesting a seed mix of 22.5 lbs/ac for the seeding of the fill and spoil areas that will mostly be considered upland. A species list summarizing the component of the

seed mix is planned to be developed during the design phase of the Spring Creek project. Table 3 provides an example of a seed mix.

Table 3 Example of a Seed Mix for Spring Creek. Note that a specific list would be updated during the design phase of the project.

Common Name	Species Name	General Lifeform	Rate (pls lbs/acre)
Indian ricegrass	<i>Achnatherum hymenoides</i>	Graminoid	2.5
Sand sage	<i>Artemisia filifolia</i>	Shrub	0.5
Four-wing saltbush	<i>Atriplex canescens</i>	Shrub	0.3
Side oats grama	<i>Bouteloua curtipendula</i>	Graminoid	1.0
Blue grama	<i>Bouteloua gracilis</i>	Graminoid	0.5
Rocky mountain bee plant	<i>Cleome serrulata</i>	Forb	0.5

Operations, Maintenance & Monitoring

Monitoring

The level of monitoring should be consistent with the magnitude of the project and the degree of risk and uncertainty with the probable success of the mitigation. Post-project changes in channel capacity could prove to be highly variable and could produce periodic post-construction adjustments (Miller, Kochel 2010). USACE would conduct post-construction monitoring for the first growing season and will consist of visually monitoring percent cover, stream condition and the presence of wetland features. Permanent photo points would be established to document vegetation establishment and stream/wetland condition. After the first year of monitoring, the project would be assessed by USACE to determine the success of restoration and if the trajectory of the project is progressing as anticipated. If project goals are being met, then monitoring would be complete. The local non-federal sponsor will then be responsible for yearly inspection of the project features. If monitoring determines that restoration goals are not being met, then Adaptive Management (AM) measures would be considered by USACE to correct deficiencies and address uncertainties.

Baseline Conditions

Members of the Environmental Resources Section, or a biologist from USACE would be present on-site during all stages of the construction to ensure proper project implementation. USACE Biologists and Engineers would also review and understand the ‘as-builts’ site conditions, including elevations, number of species to be planted, photo points, and conditions of the current stream-channel and structural features (Stone-toe protection, Boulder Clusters, Riparian Plantings and Stewardship Area), immediately after construction to document ‘baseline conditions’ or ‘as-built’ conditions.

Indicator 1 – Riparian Vegetation Cover

Following the first year after construction and planting, the riparian vegetation planting areas should be monitored once annually during the growing season (i. e. generally May 1 through October 31, optimally June 15 through August 1). The spatial-extent coverage and general condition (e. g. survival, vigor and overall status) of riparian vegetation will be evaluated using rapid-assessment tools, annotated maps and repeatable photo points. The focus will be on identifying significant patches of dead or stressed plantings for the purpose to inform re-planting efforts and maintenance needs. Plant surveys should be mapped using GIS and described through a Monitoring Report.

Indicator 2 – Invasive Plant Species

The riparian vegetation monitoring plan for Indicator 1 will also note the percentages of invasive species in the project area. The spatial extent and density of invasive plants, especially the species listed in State and County noxious weeds list will be evaluated for the purpose of informing maintenance needs. Plant surveys should be mapped using GIS and described through a Monitoring Report.

Indicator 3 – Stream Condition

Monitoring stream condition and in-stream features should occur annually, typically during the summer when low flows are present and hydrologic conditions would be stabilized as compared to spring runoff. Analyze and document the stream-channel condition including stream's morphology, physical structure and floodplain connectivity using rapid assessment tools (e. g. FACStream) and repeatable photo points. Photo points should be mapped using GIS and Stream Condition should be described through a Monitoring Report.

Indicator 4 – Wetland Habitat Integrity

Monitoring wetland features should occur annually, typically during the summer when low flows are present, and hydrologic conditions would be stabilized as compared to spring runoff. The presence of key wetland features including large/small woody debris (e. g. basking logs or leaf litter), habitat complexity (e. g. bank benches, deep pools, active and passive para-fluvial zones and other components of geomorphology), and emergent vegetation (e. g. vegetation structure, complexity and vigor) will be monitored and documented seasonally between March and September to qualitatively document wetland habitat structure and function. The primary method to be used could include water-depth or water-quality measurements, repeatable photo-points, and Rapid-Assessment tools (e. g. FACWet). Wetland surveys and photo-points should be mapped using GIS and described through a Monitoring Report. Table 4 provides a summary of the monitoring description and schedule.

Table 4. Summary of Monitoring

Measure	Description of Monitoring
Bank Stabilization via Boulder Toe Protection	<p><u>Boulder Toe Protection:</u></p> <ul style="list-style-type: none"> • Monitoring of Toe Structure condition should occur annually, typically during the summer when low flows are present, and hydrologic conditions would be stabilized as compared to spring runoff. • Analyze and document the stream-channel condition including stream’s morphology, physical structure and floodplain connectivity using rapid assessment tools and repeatable photo points. • Monitoring should determine if any movement of material or unexpected scour has occurred, structure flanking or signs of undermining. • Photo points should be mapped using GIS and Stream Condition should be described through a Monitoring Report.
Riparian Plantings	<p><u>Riparian Vegetation Plantings:</u></p> <p>Monitoring should be conducted monthly during the first full growing season after construction.</p> <ul style="list-style-type: none"> • Thereafter, monitor once annually during the growing season (i. e. generally May 1 through October 31, optimally June 15 through August 1). • The spatial-extent coverage and general condition (e. g. survival, vigor, and overall status) of riparian vegetation will be evaluated using rapid-assessment tools, annotated maps, and repeatable photo points. • Initially, survival of installed plants can be monitored by a physical count (Method), but later on, as cover density increases, it may be necessary to use percent cover as an indicator of plant health and survival. • The focus will be on identifying significant patches of dead or stressed plantings for the purpose to inform re-planting efforts and maintenance needs. See the El Paso County Noxious Weed List for Class A weeds that require complete eradication versus Class B and Class C weeds that should be controlled. • Plant surveys should be mapped using GIS and described through a Monitoring Report.
Instream Habitat Structures	<p><u>Boulder Clusters:</u></p>

<p>(Boulder Clusters and Constructed Rock Riffle)</p>	<ul style="list-style-type: none"> • Monitoring Instream Structure condition should occur annually, typically during the summer when low flows are present and hydrologic conditions would be stabilized as compared to spring runoff. • Analyze and document the stream-channel condition including stream’s morphology, physical structure and floodplain connectivity using rapid assessment tools and repeatable photo points. • Monitoring should determine if any movement of material or unexpected scour has occurred, structure flanking or signs of undermining. • Photo points should be mapped using GIS and Stream Condition should be described through a Monitoring Report.
<p>Invasive Species Removal</p>	<ul style="list-style-type: none"> • The riparian vegetation monitoring plan for Indicator 1 will also note the percentages of invasive species in the project area. • The spatial extent and density of invasive plants, especially the species listed in State and County noxious weeds list will be evaluated for the purpose of informing maintenance needs. • See the El Paso County Noxious Weed List for Class A weeds that require complete eradication versus Class B and C weeds that should be controlled. • Plant surveys should be mapped using GIS and described through a Monitoring Report.
<p>Access Road into Reach and as Recreation Path</p>	<p><u>Access Road/Path:</u></p> <ul style="list-style-type: none"> • <u>Surface Monitoring:</u> Repair of the road/path surface to address wear, cracks or other forms of surface damage. Including potholes, erosion, drainage issues and culvert function, and possible pooling areas.
<p>Covered Area with Picnic Table</p>	<p><u>Informative Sign:</u></p> <ul style="list-style-type: none"> • Monitor the readability, visibility, and physical damage (e. g. fading, vandalism, missing signs or safety concerns).

Operations & Maintenance

The local non-federal sponsor would be responsible for operational and maintenance (O&M) of project features in perpetuity for the life of the project. This could include protection of plantings from wildlife or human presence for several years until vegetation is adequately established coupled with annual noxious weed removal plans. The in-stream structures may require minor reshaping or material replacement if they are disturbed by high-water events. Some woody debris or sediments may accumulate on or around the in-stream structures, and if it is deemed to be causing impairments to the structural function, it should be removed to reduce the risk of failure. Annual inspections and reports should be completed for up to five years. Table 5 provides the description of each maintenance action for each of the measures of the TSP.

Table 5. Maintenance Summary

Measure	Description of Maintenance	Maintenance Schedule
Bank Stabilization via Boulder Toe Protection	<p><u>Boulder Toe Protection:</u></p> <ul style="list-style-type: none"> • In general, Stone Toe Protection usually requires minimal level of maintenance. A key maintenance action for the Boulder Toe Protection is the removal of debris that may have accumulated around or on top of the boulders. Any unnatural debris (trash, construction material) should be removed and discarded. Any natural debris (woody/plant material, sediment, other rocks) can remain in place as long as debris does not alter the preferred flow way of water, or the debris does not harm aquatic/riparian habitats or is a hazard to public safety. 	<p>Quarterly</p> <p>*and after a strong storm or high flow event</p>
Riparian Plantings	<p><u>Riparian Vegetation Plantings:</u></p> <ul style="list-style-type: none"> • <u>Initial Irrigation:</u> Watering plantings for the initial establishment period during the first growing season. Newly planted vegetation requires consistent watering until they can establish their root system. <ul style="list-style-type: none"> • Water daily, 1-2 weeks after planting. • Water 2-3 times per week, 3-8 weeks after planting. 	<p>Daily during the Initial Irrigation phase.</p> <p>Monthly during the growing</p>

	<ul style="list-style-type: none"> • Water weekly, 8-16 weeks after planting. • <u>Mulching</u>: Apply a layer of mulch around the plants to suppress weed growth, retain moisture and regulate the variation of soil temperature. • <u>Manual Weeding</u>: Manual removal of weeds to reduce competition for nutrients and water. • <u>Pruning & Thinning</u>: Prune dead or damaged branches to promote healthy growth. Thinning helps shape the plants as they mature, and it can maintain sight lines needed for a healthy planting area. • Replace dead or unhealthy plants. <p>The goal is a plantings survival rate of 70% - 80%.</p>	<p>season and into the summer months</p> <p>*and after a strong storm or high flow event</p>
<p>Instream Habitat Structures (Boulder Clusters and Constructed Rock Riffle)</p>	<p><u>Boulder Clusters:</u></p> <ul style="list-style-type: none"> • In general, maintenance requirements for Boulder Clusters require minimal level of maintenance. A key maintenance action for the series of Boulder Clusters is the removal of debris that may have accumulated around or on top of the boulders. Any unnatural debris (trash, construction material) should be removed and discarded. Any natural debris (woody/plant material, sediment, other rocks) can remain in place as long as debris does not alter the preferred flow way of water, or the debris does not harm aquatic/riparian habitats or is a hazard to public safety. 	<p>Quarterly</p> <p>*and after a strong storm or high flow event</p>
<p>Invasive Species Removal</p>	<p><u>Invasive Species Removal:</u></p> <p>The recipient shall eradicate invasive species of plant within the Invasive Species Removal site. The recipient shall identify and isolate invasive plants for manual removal (Mechanical) or application of herbicide (Chemical). The herbicide used should contain tracking dyes to avoid or minimize impacts to other vegetation. The Invasive Species Removal site should be maintained so that invasive plants cover less than 5% of the total</p>	<p>Monthly during the growing season and into the summer months</p> <p>Quarterly during the winter season</p>

	<p>plant cover. (add plant list from Fountain Creek Watershed Plan).</p> <p><u>Mechanical Methods:</u> hand pulling and using other hand tools to remove the plant and its roots.</p> <p><u>Chemical Methods:</u> using herbicides and applying to kill or limit the spread of invasive flora using backpack sprayers.</p>	
Access Road into Reach and as Recreation Path	<p><u>Access Road/Path:</u></p> <ul style="list-style-type: none"> • <u>Road/Path Upkeep:</u> Maintenance actions include the sweeping, cleaning and removal of large woody debris and litter or other forms of debris. • <u>Surface Maintenance:</u> Repair of the road/path surface to address wear, cracks or other forms of surface damage. 	<p>Annually</p> <p>*and after a strong storm or high flow event</p>
Covered Area with Picnic Table	<p><u>Picnic Table:</u> Apply a sealant product to protect wood from rapid deterioration and replace damaged parts of the picnic table.</p> <p><u>Informative Sign:</u> Update any fading sections and fix any cracks or damaged spots.</p>	<p>Quarterly</p> <p>*and after a strong storm or high flow event</p>

Adaptive Management

Adaptive Management Plan

The local non-federal sponsor would be responsible for operational and maintenance (O&M) of project features in perpetuity for the life of the project. This could include protection of plantings from wildlife or human presence for several years until vegetation is adequately established coupled with annual noxious weed removal plans. The in-stream structures may require minor reshaping or material replacement if they are disturbed by high-water events. Some woody debris or sediments may accumulate on or around the in-stream structures, and if it is deemed to be causing impairments to the structural function, it should be removed to reduce the risk of failure. Annual inspections and reports should be completed for up to five years. Table 6. summarizes the adaptive management options for each of the Spring Creek indicators.

Table 6. Proposed Adaptive Management Option Matrix for Spring Creek.

Indicator	Conditions of Concern	AM Action Option 1	AM Action Option 2
Riparian Cover	Poor growing conditions (e. g. excessive or limited soil moisture) cause large areas >20 ft ² of plantings to die or fail to establish. As a result, the riparian zone does not meet the performance target.	<ul style="list-style-type: none"> • No action, consult. • Plant native plants suitable to site conditions. 	<ul style="list-style-type: none"> • Expand riparian planting zone with new planting scheme elsewhere. • Potentially change plant palette to reflect more drought; or aquatic tolerant species.
Invasive Plants	Non-native, and/or invasive plant species rapid encroachment into stream and riparian zones, that appear to be outcompeting and dominating native plantings. Presence of El Paso County Class A Noxious weeds.	<ul style="list-style-type: none"> • No action, consult. • Remove Class A noxious weeds. 	<ul style="list-style-type: none"> • Increase vegetation treatment area and/or potency level. • Explore alternative treatment strategies

<p>Stream Conditions</p>	<ul style="list-style-type: none"> • In-stream structure anchors fail, and stone/boulder/rock riprap material is moved downstream and potentially interfering with the stream’s preferential flow ways and drainages. • Significant sedimentation and erosion resulting in >20% change in the constructed channel’s morphology and cross-section. 	<ul style="list-style-type: none"> • No action, consult. • Remove or reposition material that has been moved. 	<ul style="list-style-type: none"> • Resurvey stream channel and other problem areas to compare to as-built condition, • Assess damage, and correct as needed.
<p>Wetland Habitat Integrity</p>	<ul style="list-style-type: none"> • Poor growing conditions (e. g. limited soil moisture) causing large areas (>20 ft²) of plantings to die or fail to establish. As a result, the wetland does not meet its performance target. • Development of homogeneous conditions, where habitat complexity decreases with wetland features such as woody debris, bank benches, pools, and other wetland bio-geomorphology components become perturbed. 	<ul style="list-style-type: none"> • No action, consult. • Plant native plants suitable to site conditions. 	<ul style="list-style-type: none"> • Explore options such as recruitment of large woody material from surrounding wetlands, and i • Replace features to increase habitat complexity.