Pipe Spring National Monument
Vegetation Management Plan Phase I
Alternative Actions

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Introduction

The purpose of this plan is to examine existing vegetative conditions throughout Pipe Spring National Monument, evaluate the appropriateness of those conditions and make long term recommendations for changes to and management of the vegetation within the Monument.

The Pipe Spring National Monument (PISP) staff has identified in scoping sessions related to this project, five vegetation management/land use zones within the monument, and a sixth zone immediately adjacent to the east (see Map 1).

Monument (40 acres)
- Visitor Zone (VZ) 7.4 acres
- Historic District (HD) 9 acres
- Shrubland/Grassland Zone (SGZ) 14 acres
- Hillside Zone (HZ) 5.6 acres
- Administrative Zone (AZ) 4.acres

Adjacent Area
- Tribal Zone (TZ) 2.7acres

This report describes the desired future condition for vegetation monument-wide and for each of the six management zones. PISP has several proposed actions that could affect vegetation. The report takes into account several proposed actions at PISP and vegetation management specific projects oriented to achieve the desired future condition.

The following report describes the condition of existing vegetation and the desired future condition for vegetation monument-wide and for each of the six management zones. Proposed actions in each zone are described and both positive and negative impacts estimated. Estimates of potential impacts are based on research studies conducted on the monument, PISP archival material, scientific references, discussions with PISP staff and other resource experts, site reconnaissance, and best professional judgment (see References).

Existing Conditions Monument-Wide

The Visitor Zone landscape is the most disturbed within the monument. Little remains of the topsoil, topography, or hydrology. Consequently, most existing vegetation is early to mid-successional in species composition. The existing community is lacking in species diversity and age diversity when compared to relatively undisturbed shrub steppe communities in the region.

The Historic District Zone is primarily a cultural landscape characterized by introduced shade trees, native desert shrub steppe and pinion/juniper woodland. The native desert shrub steppe community has been disturbed by historic activities associated with ranching, as well as more current NPS activities. The community has a deficient perennial grass/annual forb understory and no perceivable biological soil crust. The area

bordering the Hillside Zone to the north is dominated by pinyon/juniper woodland species with a shrub, perennial grass and annual forb understory. As noted in the PISP Avian Inventory Report, junipers observed in the NE of the HDZ may be following a successional pattern through which desert shrub steppe is over time replaced by pinyon/juniper communities (Johnson, Holmes, and Stuart 2004, 30).

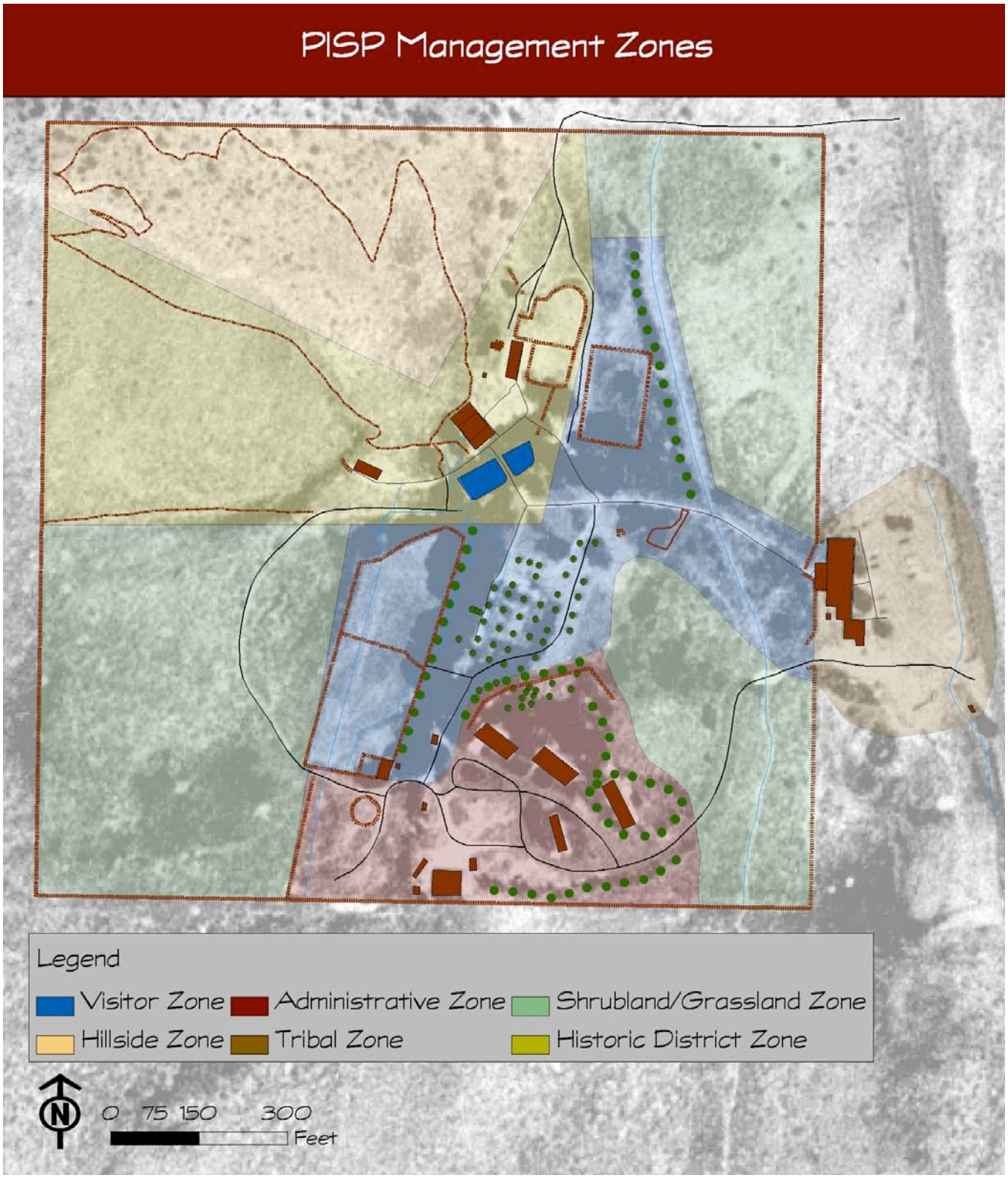
The introduced trees in this zone are clustered near the fort and around the ponds. .Relict Siberian elms (*Ulmus pumila*) to the west of the fort are contributing historic features that are in decline, with seedlings/saplings growing in their shadows. The cottonwoods and *Ailanthus* within and adjacent to the ponds have died or have been in decline over the past 15 yrs, matching trends seen throughout the monument. Seeps from the ponds support cultivated roses and herbaceous riparian species. Further north within the historic zone are the remnants of silverleaf cottonwoods (*Populus alba*) near the chicken house and barren areas where *Ailanthus* once grew. A few decadent cottonwoods remain.

The Hillside Zone is comprised of the pinyon-juniper plant community, one of most predominant habitat types adjacent to the monument. With the exception of a lack of mature pinion pine and Utah juniper, there is a diversity of age classes in the stand, comprised of these species.

In general, the Shrubland/Grassland Zone plant communities are degraded. Grasses and forbs are minimal, replaced with dominant shrub species. Consequently the pre-settlement pattern of grassland interspersed with shrub species is no longer evident (Alexander 1998). Biological soil crust exists in a few isolated locations but is generally absent from this zone. The riparian plant community in the SW corner of the SGZ has been stressed by drought and lack of spring water which used to flow from the irrigation ditch across the corral and into the arroyo.

Structures, roads, parking, utilities, lawn, shrubs and shade trees give the Administrative Zone the characteristics of a suburban development. The introduced plantings are sprinkler irrigated and are in general in good condition. *Ailanthus* has invaded several planting beds on the southwest corner of the AZ. The lawn panels are in decline. They are an unnatural food source for cottontail rabbits, whose population on PISP exceed regional norms and degrade some of the plantings in the VZ.

The condition of existing vegetation on tribal land east of the entry road has not been studied. Condition of the lawn and shade trees east of the visitor center are in good condition. Trees in the parking lot appear stressed and several decadent trees were recently removed.


PISP Management Zones
Legend
Visitor Zone
Administrative Zone
Shrubland/Grassland Zone
Hillside Zone
Tribal Zone
Historic District Zone
N
0 75 150 300
Feet

Map 1

Desired Future Conditions Monument-Wide

- Establish a landscape that to the greatest extent possible, complements, and reduces conflicts with, the depiction of a 19th century landscape associated with Mormon pioneer settlement, in the Historic District.

- Natural resources will reflect a variety of successional ecosystems – from desert grasslands to overgrazed ranchland – from pre-European contact, 19th century conditions to present conditions.

- Maximize use of spring water for cultural and natural resources

- Minimize use of culinary water (pumped well water) for cultural and natural resources

- Maintain integrity of vegetation as related to the cultural resources of the monument

- Maintain/ enhance habitat for long and short distance migrating birds and other native species

- Potentially control rabbit and other rodent populations while optimal vegetative conditions are reestablished.

- Replace/ remove exotic ailanthus selectively, and exotic elms outside of Historic District.

Visitor Use Zone (VZ)

(Map 2)

Desired Future Condition

- Support adjacent Historic District Zone with compatible elements such as orchard, native and pioneer gardens and native vegetation
- Provide for safe visitor use (picnic and garden harvesting), movement, and interpretive opportunities
- Transition from contemporary context to Historic District Zone

Condition of Existing Vegetation (Native)

The Visitor Zone landscape is the most disturbed within the monument. Historically the VZ was grazed, trampled, cultivated for pasture, gardens and orchards and developed (campground, irrigation system, picnic lawn, visitor center and parking lot). Natural water courses were modified to support irrigation needs and divert flood waters (McKoy 1997). Little remains of the topsoil, topography, or hydrology. Consequently, most existing vegetation is early to mid-successional in species composition. Dominant species include four-winged salt brush, rabbit brush and sand sage. The existing community is lacking in species diversity and age diversity when compared to undisturbed (relatively undisturbed) shrub steppe communities in the region.

Condition of Existing Vegetation (Introduced)

A chronological record of the introduction (and sometimes removal) of non-native plants in the Pipe Spring area from 1863 to the mid-1980s has been compiled (Newton 2007)

from the PISP administrative history, *Cultures at a Crossroads* (McKoy, 2000). Most of the plants were introduced for utilitarian and ornamental purposes (fruit, forage, shade, wind breaks etc.) Plants listed as having been introduced (principally planted in the VZ and HD) include cottonwood, poplar, elm, willow, ailanthus, black locust, apple, peach, apricot, and plum trees, currant, grape and wild rose. For the most part, exact introduced species or cultivars have not been identified in the original source material, although specific reference is made to Carolina and Lombardy poplar, silver-leaf cottonwood, and Pottawatomie plums. As noted in the PISP *Pre-settlement Vegetation Literature Survey* by Alexander, *Populus alba* (white poplar or silver-leaf cottonwood), *Populus fremontii* (Fremont or Western cottonwood), and *Populus nigra* (Lombardy poplar), were planted by the Woolley family in the 1880's (Alexander, 1998). The current species list included by Alexander identifies the same three poplars as introduced tree species presently growing on-site, as well as Robinia pseudoacacia (black locust), and Ulmus pumila (Siberian elm).

Time (many plants are in scenesiance) and the recent six year drought have stressed introduced plants. These problems have been exacerbated by decreased spring flows which have reduced water available for irrigation. Ground water levels may also have been altered by drawing down the aquifer via regional pumping. Additional stressors could include salt build up in irrigated soils, limited biological soil crust and lowered water table issues noted above.

With few exceptions, the introduced plants and plantings are seriously degraded. Although located outside the HD, they have a supportive role to play and are an integral part of the interpretive program and long term visitor enjoyment. In addition, they are important habitat for several bird species that breed on the monument and migratory neo-tropical birds. These species use PISP as a rest stop during their transcontinental migration.

Actions

1- Revitalize the decadent poplar hedgerow along the corral with one of several options :
   - 1A Option: Cut down all the existing trees (most of which are old and in decline), save grapes and plums and as much of the understory vegetation as possible and replant the tree component of the hedgerow with fastigiated (tall, narrow, vertically formed) species
   - 1B Option: Selectively thin the existing hedgerows by > 50%, remove every other tree plus any that are hazardous, saving as much understory vegetation as possible, and replant new fastigiate populus sp. in spaces made available by removal of existing trees. Over the next 20 years the remaining poplars would be removed and replaced with fastigiate populus sp.
   - 1C Option: Similar to option B, but the stumps of cut trees are not treated, instead saving the dominant sucker and cutting off all others. The dominant sucker is then pruned to replace the removed decadent tree.

2- Selective removal of scattered *Ailanthus* trees throughout Visitor Zone

3- Replace *Ailanthus* trees at south end of the hedgerow with willow/cottonwood plantings

4- Realign the flood ditch and redesign the cross section to enhance its ecological function and appearance, while retaining designed flow capacity.

5- Save and revitalize plums along walkways north and west of the orchard and currant thickets along the walkway north of the orchard.

6- Develop "living grasslands" plots to reintroduce native vegetation in controlled zones. Any or all of the following option could be pursued.
   - 6A Action: Create native vegetation plot south of the Monument trail between the Monument boundary and the flood drainage channel
   - 6B Action: Create native vegetation plot north of the Monument trail between the Monument boundary and the flood drainage channel
   - 6C Action: Create native vegetation plot south of the Monument trail between the flood ditch and the present picnic area, and around southside of picnic area
   - 6D Action: Downsize the large corrals west of the poplar hedgerow, retaining the south end as a corral, and developing a native vegetation plot in the northern end of currently existing corrals

7- Revitalize orchard. Any or all of the following option could be pursued.
   - 7A Action: The spacing and distribution of fruit trees in the present orchard does not create a strong visual grid. Downsize and fill in the existing orchard with additional fruit trees representative of the historical period (apple, peach, apricot, and plum)
   - 7B Action: Ground surface beneath orchard is difficult to maintain, and prone to invasion of exotics. Plant a cover crop in the orchard.
   - 7C Action: Reconstruct surface flow system utilizing gravity flow from pond for historical interpretation, retaining existing pressurized irrigation system as back-up.
   - 7D Action: Consider the addition of a nursery to grow replacement stock.

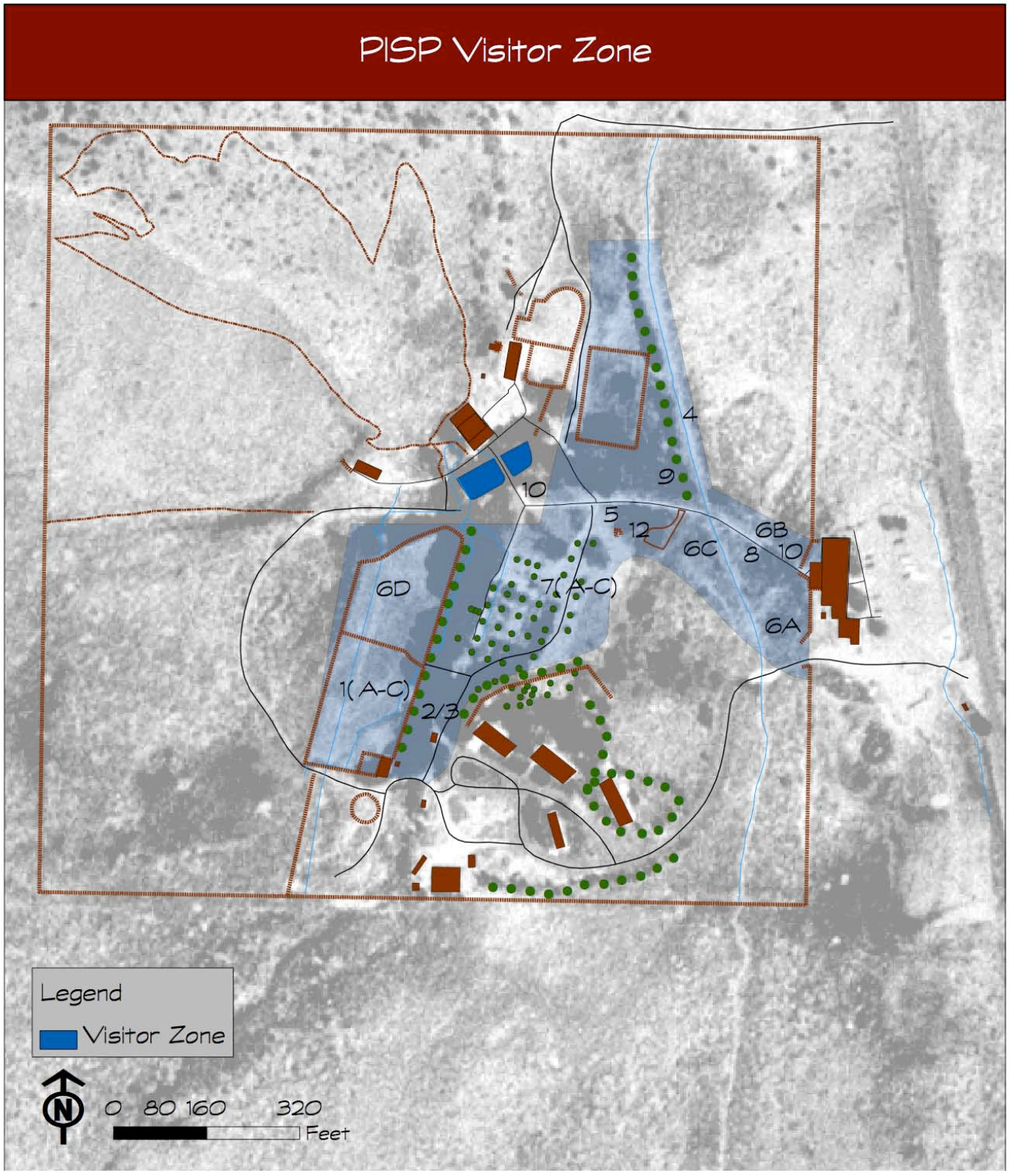
8- Replace and widen all concrete walkways in VZ and HD. (Project prospectively scheduled for funding in FY 2010.)

9- Phased removal of the cottonwood tree line on the west side of the flood ditch

10- Consider relocation of demonstration garden to historically accurate location below ponds.

11- Reestablish native plant community characteristics

12- Enhance black locust planting in picnic area, and add drip irrigation and crushed local stone mulching


PISP Visitor Zone
4
9
10
5
12
6B
6C
8
10
6D
7(A-C)
6A
1(A-C)
2/3
Legend
Visitor Zone
N
0 80 160 320
Feet

Map 2

1 Action: Revitalize the decadent poplar hedgerow along the corral with one of several options:

1A Option: Cut down all the existing trees (most of which are old and in decline), save grapes and plums and as much of the understory vegetation as possible and replant the tree component of the hedgerow with fastigiated (tall, narrow, vertically formed) species.

Positive Impacts

Structurally weak, unsightly and potentially dangerous trees would be removed. Decadent poplars would be replaced by vigorous new plantings (see species list below). Tree spacing could be modified to improve plant growth health and make more efficient use of available water. Planting times (years) could be staggered to create a uniform, historically representative visual character yet allow for a longer lifespan for the hedgerow.

Negative Impacts

Option A would eliminate for at least 15 years what was noted in the PISP Avian Inventory as an extremely important habitat component for both migratory and resident breeding birds (Johnson, Holmes, and Stuart 2004). Likewise, it would eliminate for the same time period a critical element of the visual landscape associated with the historic period. Valuable visual screening of highway 389 would also be removed. Soil disturbance as well as noise and dust pollution would be associated with tree removal. Tree removal in several locations will be difficult and, if not well executed, could endanger the vineyard. The stumps of the removed trees would require a chemical treatment to prevent re-growth.

1B Option: Selectively thin the existing hedgerow by > 50%, remove every other tree plus any that are hazardous, save as much understory vegetation as possible, and replant new fastigiate poplars in spaces made available by removal of existing trees. Over the next 20 years the remaining poplars would be removed and replaced with fastigiate poplars as described above.

Positive Impacts

The variety of age classes in the hedgerow would increase its value as wildlife habitat and as a visual screen. Fifty percent of the existing habitat for wildlife and screening of the highway would be retained in the initial phase. The spacing would reduce competition for water and provide ample space and access to sunlight to support new plant growth.

Negative Impacts

Negative Impacts associated with option B would be similar to those described for option A. The visual character of hedgerow would be irregular because of variable plant dates and species differences. This would not reflect the historic hedgerow's uniform character for some time.

1C Option: This option is similar to option B with exceptions. The stumps of cut trees are not treated, instead saving the dominant sucker and cutting off all others. The dominant sucker is then pruned to replace the removed decadent tree.

Positive Impacts

Replacing the decadent poplars with dominant suckers would preserve both the historic landscape pattern and historic genetic material. This option may be more successful and less labor intensive since suckers are generally hardy, genetically the same as the parent plant, and new trees will not need to be established. Mike Kuhns, Utah State University Extension Forester, believes that this is a viable option that could be augmented with new plantings of white poplar (M. Kuhns, pers. comm). Chemical treatment will not be required to treat stumps, reducing the environmental impact of the proposed action.

Negative Impacts

The Negative Impacts would be similar to those described for option B. In addition, the water conservation benefits (wider spacing of new trees requires less water) and habitat benefits of planted poplars would be lost.

Species Options: Pros/Cons

Lombardy poplar *Populus nigra* 'Italica'

Positive:
- Historically accurate

Negative:
- Short Lifespan

other fastigiate (narrow, upright form) cottonwood

Positive:
- Better habitat for wildlife
- Possesse historical visual similarities
- Moderate lifespan / disease resistant

Negative:
- Not historically accurate

Note: Several fastigiate poplars exist which warrant consideration including: *Populus alba* 'fastigiata'-- Bolleana poplar, *Populus canadensis* 'eugenei'--Carolina poplar, *Populus simonii* 'fastigiata'--Chinese Poplar, *Populus nigra* 'Thevestina'. Hybrid cultivars include *Populus x* 'Walker', *Populus x* 'Hill', *Populus x canadensis* 'Prairie Sky, and *Populus x canescens* 'Tower'. Pros and cons of these and other species to be researched as part of phase 2 of this study.

2 Action: Selective removal of scattered *Ailanthus* trees throughout Visitor Zone. *Ailanthus altissima,* tree of Heaven, was an early introduction to Utah by Mormon pioneers. Its ease of growth and relatively luxuriant foliage made it a favored tree to create instant green in a newly settled arid landscape. Benjamin Ferris in his work *Utah and the Mormons*, 1854, describes the streets flanking the temple block in Salt Lake City as "planted with locust and ailanthus trees, cooled by two running streams of water from the hillside" (Tucker, 1867). A letter in the Woolley Family Collection notes that *Ailanthus* trees were planted (along with cottonwood, elm, and willow) near the fort during the 1885-1891 period of Woolley occupancy of PISP (McKoy 2000, 41). Although *Ailanthus* has fallen out of favor for its propensity to sucker and overtake native plants, it should be viewed during the period of significance of PISP as a generally admired exotic. Recommendation is to control suckering growth to prevent overly wild forestation, but to allow selected specimens to grow, continually regenerating overstory trees for shade, visual, and historic character in the VZ and HD.

<u>Positive Impacts</u>

Selective removal of *Ailanthus*, some of which appear to be diseased and dying, would control an aggressive species that out competes native species and consumes valuable water resources. Planting cleared spaces with native shrub steppe species will stabilize the disturbance site and expand the area dominated by shrub-steppe species in the V Zone. Maintaining a selected ongoing population of the tree will ensure historic integrity, provide shade, and create visual interest.

Negative Impacts

Removing some *Ailanthus* will reduce the carbon sequestering capacity of the monument, reduce on-site shade, and visually open the site, exposing sections of the "A" Zone to visitor views. In the short term soil would be disturbed and noise levels would be high during tree removal. Conversely, *Ailanthus* is an invasive plant, which competes with other species. Keeping some *Ailanthus* requires commitment to an ongoing maintenance schedule to control sprouts and suckers.

3 **Action: Replace *Ailanthus* trees at south end of the hedgerow with a mixed cottonwood/willow plantings and extend the existing ditch.** This area of PISP was devoid of trees in early photographs, and the *Ailanthus* grove in this location has apparently self-seeded; an example of the propensity of the species to spread invasively when not controlled.

Positive Impacts

Planting a patch of willow/cottonwood habitat within the VZ would replace willow habitat west of the corral in the SGZ which is in decline due to altered drainage patterns. Overflow water from the poplar hedgerow would be captured and used to irrigate the willows. This water is currently diverted west across the south corral into a natural wash. Vegetative evidence suggests that most of the diverted water is lost to infiltration before reaching the wash. The new willow/cottonwood planting would not only replace critical bird habitat, but it would also screen portions of the AZ from visitor views once it matured.

Negative Impacts

Removal of *Ailanthus* would to a limited extent expose some maintenance structures to visitor views from the pond and fort area. It could take 8-10 years before the willow/ cottonwood planting would be tall enough to screen these facilities. Planting willows and a few carefully located cottonwoods in this location will require removal of *Ailanthus* root wads, re-grading the site into a retention basin and extension of the irrigation ditch to deliver water to the planting site, extending the ditch from its existing south end to the north end of the retention basin. Construction will disturb the soil and create noise and dust. Cultural artifacts could be unearthed. The extension of the irrigation ditch will endanger, and likely destroy the declining willow patch in the southwest. Minor

site disturbance would occur during weed control and could continue for 3-5 years.

4 Action: Realign the flood ditch and redesign the cross section to enhance its ecological function and appearance, while retaining designed flow capacity.

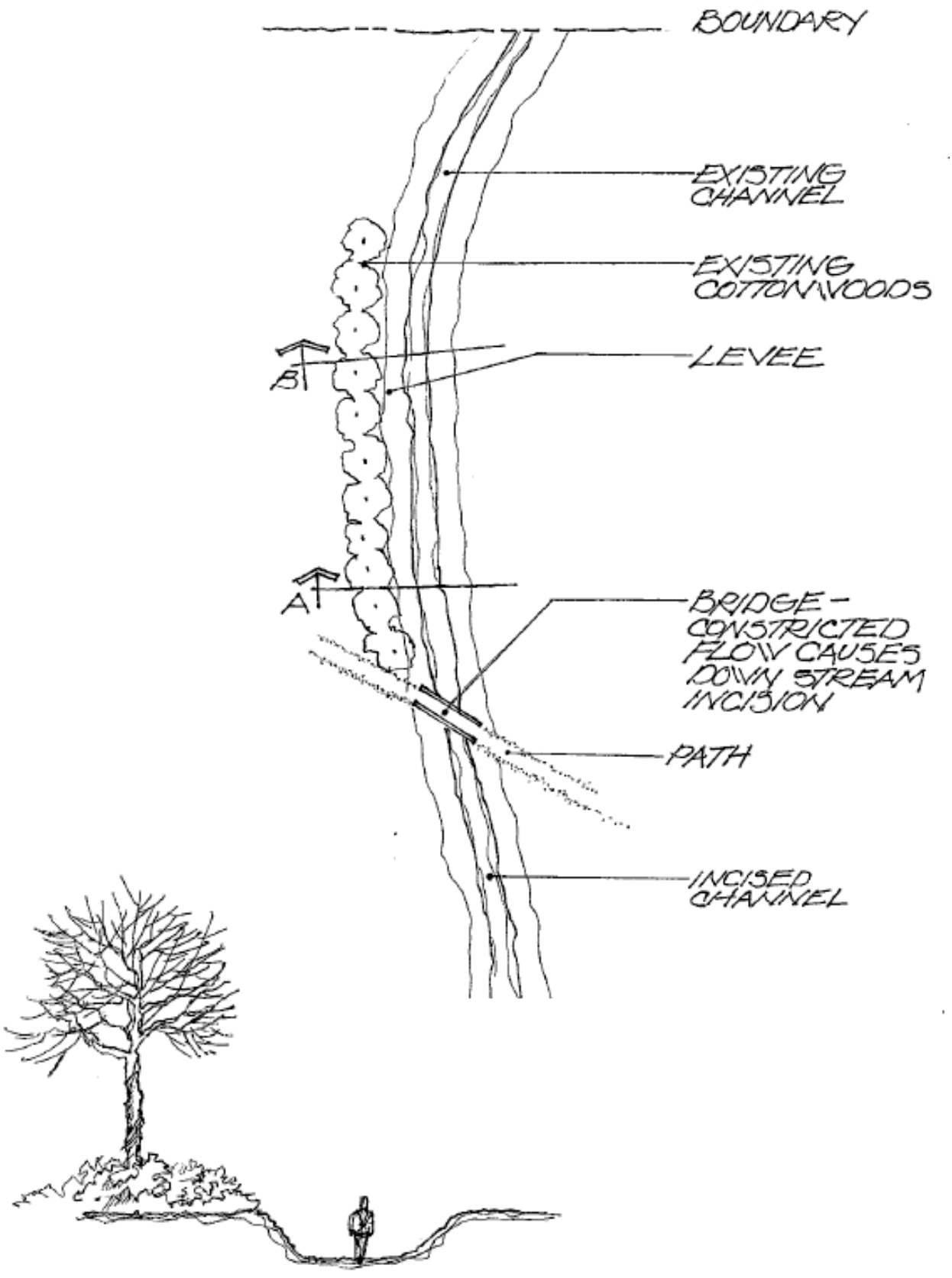
Early plan drawings including the 1947 master plan shown to the right, indicate a more naturally curving alignment of the drainage which accommodated flood conditions through the wash. Following the construction of a campground and later a parking lot in the flood plain, flooding issues became commonplace. (McKoy 2000). The current straight alignment dates from the 1960s, and is the final culmination of several efforts to artificially realign, deepen, and line the channel beginning in the 1930's. One of these realignments is indicated on the 1947 master plan. (source: NPS Technical Information Center, reproduced in McKoy 2000, 355)

<u>Positive Impacts</u>

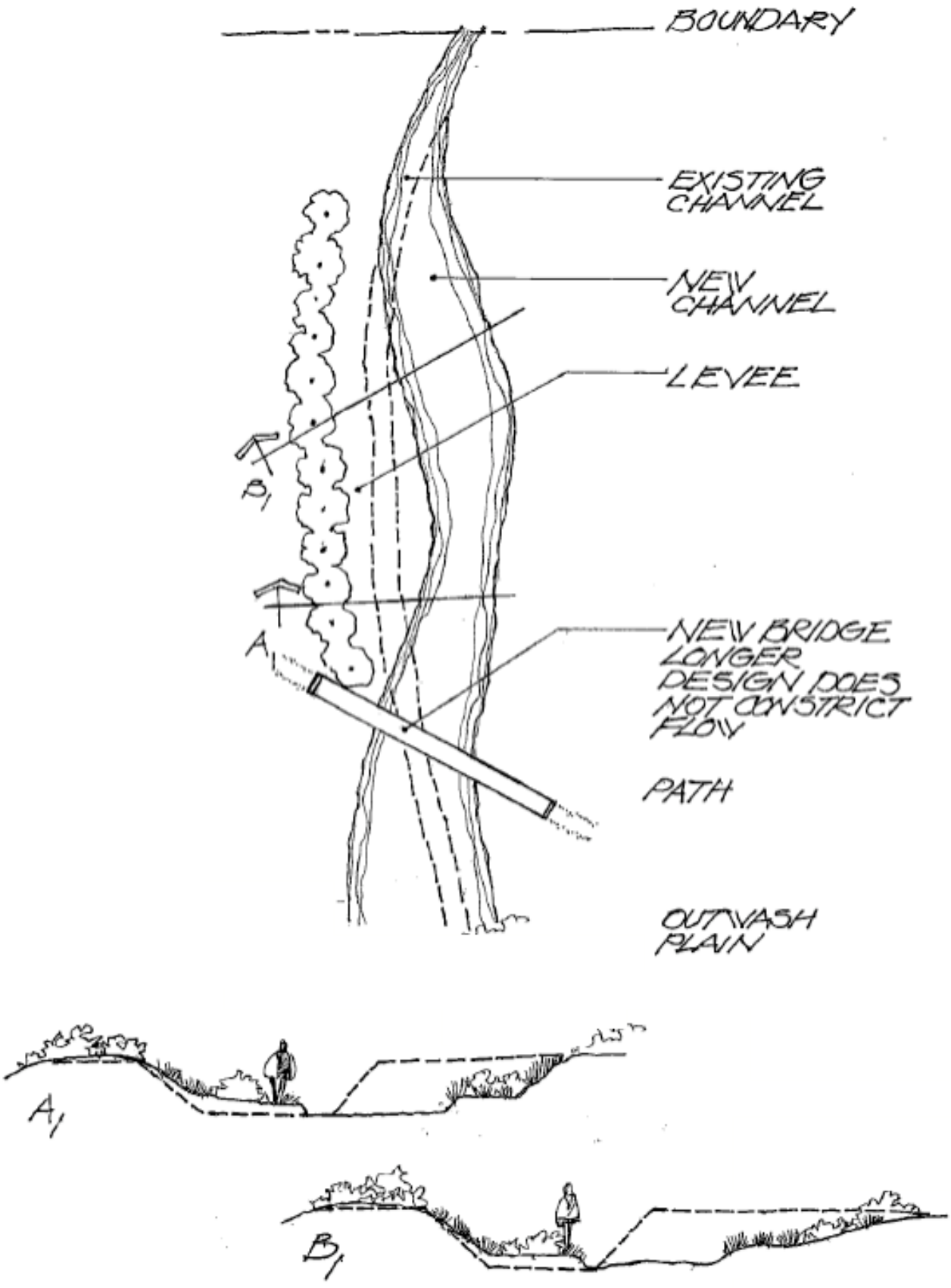
A reconfigured flood ditch would appear more natural to PISP visitors, would enhance their experience and be more supportive of the historic period than the "ditch". In addition, the re-contoured ditch would reintroduce natural floodplain functions, creating sites for "wash" deposited sediments needed for native plants to colonize and for natural succession to occur.

<u>Negative Impacts</u>

Reconfiguring the flood ditch would require moving large quantities of soil. A site to deposit excess cut (which is likely) would have to be located and it, in turn, would be impacted. Some shrub-steppe vegetation would be removed. Short term impacts would include noise and dust associated with construction. The regraded site would be prone to invasive exotic plant species and maintenance of the site would be required until revegetation plantings became established.



Existing Channel – Plan and Section (not to scale) – note uniformity and depth of channel



Proposed Channel Realignment – Plan and Sections (not to scale), showing curvature and wider channel, and variation of bank treatment

5 Action: Save and revitalize plums along walkways north and west of the orchard and currant thickets along the walkway north of the orchard.

Positive Impacts

Saving and revitalizing the thicket conserves plants that are fully grown, plants that would take years to grow to this stage in another location. Both the plum and currant bushes may be at the least historically compatible and possibly actually descended from historic plants. Therefore nurturing and revitalization of these plants is highly appropriate.

Negative Impacts

Revitalizing the plum and currant thickets would require selective pruning to enhance plant vigor. Thinning could reduce roosting and brooding habitat quality for several species of birds. It also increases the possibility of introduced disease and/or insects to the plants.

6 Action: Develop native vegetation restoration plots to reintroduce native vegetation in controlled zones. Any or all of the following actions could be pursued.

6A Action: Create native vegetation plot south of the monument trail between the monument boundary and the flood drainage channel (Plot established – October, 2008).

Positive Impacts
This location for a native vegetation plot would be readily accessible to visitors. The native plants would enhance the experience of moving from the visitor center to the fort and offer new interpretive opportunities for the park staff.

Negative Impacts
Portions of this are were formerly occupied by a campground, and may require extensive excavation and remedial soil treatment prior to planting, with associated visual, noise, and dust disruption during installation.

6B Action: Create native vegetation plot north of the monument trail between the monument boundary and the flood drainage channel

Positive Impacts

This location for a native vegetation plot would be readily accessible to visitors. The native plants would enhance the experience of moving from the visitor center

to the fort and offer new interpretive opportunities for the park staff. It would work particularly well with a possible relocation of the Paiute camp (see SG3, p. 36).

Negative Impacts

Portions of this area were formerly occupied by a parking lot, and may require some excavation and remedial soil treatment prior to planting, with associated visual, noise, and dust disruption during installation.

6C Action: Create native vegetation plot south of the Monument trail between the flood drainage channel and the present picnic area

Positive Impacts

This location for a native vegetation plot would be readily accessible to visitors. The native plants would enhance the picnic area in its present location and offer new interpretive opportunities for the park staff.

Negative Impacts

Portions of this area were formerly occupied by a campground, and may require some excavation and remedial soil treatment prior to planting, with associated visual, noise, and dust disruption during installation.

6D Action: Retain, but downsize the south corral and develop a native vegetation plot in the northern portion of the existing corral.

Positive Impacts

This location for a native vegetation plot would be readily accessible to visitors. The native plants would enhance the contextual setting for the fort and offer new interpretive opportunities for the park staff. Aggressive management will help prevent shrubland invasives from dominating.

Negative Impacts

The south corrals, with a surface of bare soil dark gray in color, are relatively rich in nutrient and organic material. These soil conditions are ideal substrate for several species of weeds i.e. ragweed and Russian thistle. Thus, retaining any part of the south corral also retains habitat for weeds and a weed seed bank which could be disseminated elsewhere in PISP. Controlling weeds will require continuous mechanical or chemical removal.

The site has a slope to the south which increases aridity due to a higher exposure to solar radiation. Slope also increases the potential for soil erosion. Both these attributes make restoring natural vegetation on any part of the site more difficult. Also, because the slope drops away from the viewer the display of native vegetation, particularly shorter plants, would be less obvious. Developing any part of this area as a native plant plot would require eradication of weeds either mechanically or chemically.

The corrals are functional and are a supporting element for the historic district. If the corral, as downsized, was not retained and extra corral space was needed at a later date, a new location would have to be found. Developing new corral facilities would require vegetation removal and surface disturbance and associate Negative Impacts described earlier.

7 Action: Revitalize orchard. Any or all of the following actions could be pursued.

7A Action: The spacing and distribution of fruit trees in the present orchard does not create a strong visual grid. Downsize and fill in the existing orchard with additional fruit trees representative of the historic period (apple, peach, apricot, and plum)

Positive Impacts

A compact and complete grid of trees would enhance the visual character of the setting. The introduction of additional species (e.g. plum, apricot, and peach) would more closely represent the plants documented during the period of significance. A smaller orchard would require less water, water that could be used elsewhere to meet vegetation management objectives. The area no longer an orchard would be restored with native plant species which would reduce bare

ground sites available for weeds, or alternatively, turned into a garden plot (see VZ12) and/or nursery (see VZ7D). Furthermore, a healthy orchard would increase habitat for bees, butterflies and other insects (food for birds).

Negative Impacts

The orchard area has been extensively disturbed over a long period of time and is devoid of native vegetation. The proposed action would further disturb the soil surface. Dust and noise would be short-term impacts associated with planting activities. It is possible that rabbit herbivory would have to be controlled either by constructing exclosures around the plantings, protecting individual plants, and/or reducing the rabbit population to levels found outside the monument. These measures would be required until the plantings become well established and for some of the fruit trees protection may need to be permanent.

7B Action: Ground surface beneath orchard is prone to invasion of exotics making it difficult to maintain. The lack of ground cover may be causing a concentration of salt in the soil. Plant a cover crop in the orchard.

Lucerne (alfalfa) was commonly present in 19th C orchards, used for forage, improvement of the soil, and as a potential cash crop. Accounts from the Woolley occupation period suggest that alfalfa was grown down-slope from the ponds,

perhaps in the area of the existing large, "west" or "south" corral (Shapins Associates 2006, 14). Planting with an annual cover such as perennial ryegrass to serve as a temporary nurse crop would assist in the establishment of alfalfa. Occasional renovation of alfalfa will be necessary as its vitality deteriorates after a number of years, requiring rotation with wheat or ryegrass for a two year period prior to replanting.

Positive Impacts

A cover crop would stabilize exposed dirt surface, reducing dust. Once established, it would out-compete invasive weeds. An alfalfa cover crop would add nitrogen to the soil. It would also reduce soil temperatures, potentially resulting in increased water retention. (This point is debatable, as noted under negative impacts).

Negative Impacts

The orchard area has been extensively disturbed over a long period of time and is devoid of native vegetation. The proposed action would further disturb the soil surface temporarily. Dust and noise would be short-term impacts associated with planting activities. It is also likely that rabbit herbivory would have to be controlled either by constructing exclosure around the entire orchard area, and/or reducing the rabbit population to levels found outside the monument. These measures would be required until the cover became well established. A cover crop of alfalfa could compete with the trees for available water since it is a deep-rooted species. Periodic revitalization (approximately ten year cycles) will require some investment of time and energy.

7C Action: Reconstruct surface flow system utilizing gravity flow from pond for historical interpretation, retaining the existing pressurized system as back-up in the event of low spring outflow.

Positive Impacts

The use of spring water from pond run-off in a gravity flow is historically accurate, and offers a valuable interpretive opportunity. It also addresses PISP goals to maximize use of available spring water and minimize use of piped culinary water.

Negative Impacts

The orchard area has been extensively disturbed over a long period of time and is devoid of native vegetation. The proposed action would further disturb the soil surface temporarily. Dust and noise would be short-term impacts associated with demolition and construction of a new irrigation system. Uncertainty of long-term water availability from springs creates a degree of risk. Surface irrigation is more labor intensive, requiring staff time.

7D Action: Consider the addition of a nursery to grow replacement stock in part of the area currently occupied by orchard.

The dedication of a small area to the propagation and the growth of new plants was common practice on 19th C farmsteads. An on-site nursery would provide acclimatized plant material ready for immediate transplant should existing plants need replacement. It would also provide the opportunity for experimentation with heritage plants.

Positive Impacts

Growing replacement stock on-site would guarantee a steady supply of acclimatized plant material. Heirloom cultivars of fruit could be propagated to ensure viability of potentially historic stock, particularly the historic Concord grape and Pottawatomie plum. As indicated by the Woolley 1886 description of the site, the area recommended below the ponds was under intensive cultivation for currants, garden, and orchard. Placement of a nursery here would reinforce the agrarian focus of that area, and utilize spring water from the ponds.

Negative Impacts

The rabbit herbivory would have to be controlled either by constructing a fenced exclosure around the nursery area, protecting individualized plants, and/or reducing the rabbit population to levels found outside the monument. These measures would need to be permanent to protect young plants.

8 Action: Widen all concrete walks in the VZ from visitor center to the fort

Positive Impacts

The widened walk would better accommodate visitor movement, meet accessibility standards and reduce the occurrence of off-trail walking which compacts soil and damages plants. In addition, the widened walk surface would help facilitate interpretive activities.

Negative Impacts

Widening the walkway will result in the disturbance of the soil surface and increase the square footage of impervious surface in the monument. Construction may impact the root zone of aged plants and some currants may have difficulty with the stress that would occur.

9 Action: Phased removal of the cottonwood tree line on the west side of the flood ditch.

Pinion pine previously established along the tree-line would be conserved and augmented with additional pinion and juniper as necessary to create a naturalized clumping pattern, as the cottonwoods are allowed to die off and are removed over time. Drip irrigation may be necessary as an interim measure to establish the pine.

Positive Impacts

The removal of the irrigated tree line would eliminate a dominant visual line that does not support the landscape character of the historical period. Indeed it detracts from the historic oasis quality of the fort and pond. Removal of the irrigation system and elimination of significant water use for cottonwoods would free up water for more beneficial (historically relevant) uses in PISP.

Negative Impacts

Removal of the tree line (originally planted to presumably screen Red Hills Housing development on the Kaibab Paiute Reservation) would reduce the carbon sequestering capacity of the monument. It will also eliminate important foraging and roosting habitat for both neo-tropical migrators and resident breeding birds, although some cottonwood habitat will eventually be replaced with juniper or pinion habitat. Soil disturbance, noise and dust associated with tree and irrigation system removal would occur as described elsewhere. Some limited and inadequate screening would be lost.

10 Action: Consider relocation of demonstration garden to historically accurate location below ponds.

Early historical documentation refers to vegetable gardens on the site, and has been noted by others, these gardens would logically have occurred down-slope of the springs and ponds to take advantage of gravity fed furrow irrigation. As noted

in the 2006 CLI, the Winsor family established a garden ringed by currant bushes west of the orchard in 1872, perhaps developing the ponds south of the fort at this time as the source of irrigation water (Shapins Associates 2006, 14). A back up pressurized irrigation system would be advisable and most likely use no more system water than current garden.

Positive Impacts

Relocating the demonstration garden down slope of the ponds would reflect the historic location, creating stronger interpretive opportunity. This option might allow for irrigation from the ponds and the associated benefits of reducing the use of culinary water.

Negative Impacts

The relocation would require the deconstruction and reconstruction of the garden, causing site disturbances as described elsewhere.

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11 Action: Reestablish native plant community characteristics through selective thinning of shrubs and grass/forb reintroduction. If successful, this option may be applied throughout the monument.

Positive Impacts

A successful planting of native grasses and forbs would recreate the pre-settlement vegetation palate and would give park visitors that experience. It would also create new interpretive opportunities. Moreover, the success of native grasses and forbs would facilitate the restoration of the biological soil crust and expand habitat for wildlife and overall floral and faunal species diversity on the monument.

Negative Impacts

Selective thinning of shrubs and planting of grasses and forbs in cleared areas would produce minor disturbances to the soil surface associated with the removal of shrubs. The soil would be more substantially disturbed when cleared areas were prepared for seeding grasses and forbs. Minor site disturbance and mechanical weed removal or application of herbicides associated with weed control could persist for three to five years or until new plantings become established. Dr. James MacMahon, Trustee Professor of Biology at Utah State University, cautions that the restoration of native landscapes in this environment is very difficult (J. MacMahon 2007, pers. comm). Much depends on weather and longer climatic cycles, invasive species and herbivory. A failed planting leaves a site that is ideal for invasion by non-native species.

12 **Action: Enhance Black Locust planting in picnic area, add drip irrigation, and replace bark mulch with crushed local rock mulch.** Existing trees are in poor health, are scraggly in appearance, and offer little shade for picnicking. Soil is very porous and drought-prone, making watering difficult under current conditions.

Positive Impacts

Proposed action will make the existing picnic area more functional and aesthetically pleasing, assuming picnic area is to remain in its existing location. Drip system will maximize efficient application of water in a droughty site setting. Crushed local rock would be more compatible aesthetically with the historic period than shredded bark.

Negative Impacts

Enhancement of vegetation in this area, while representative of the relatively dense growth in the 1930's campground and subsequent picnic area on this site, is not historically accurate to the period of significance of the nearby Historic District, creating a false sense of oasis in originally barren area.

Historic District Zone (HDZ)

(Map 3)

Actions within the historic district Zone shall be governed by the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (1995). The standards include the categorization of actions as: 1) preservation, 2) rehabilitation, 3) restoration, 4) reconstruction. Vegetative manipulation and management of the HDZ has varied considerably over time. The current approach established by PISP staff is preservation with limited restoration and rehabilitation as needed.

Desired Future Condition

Preserve historic integrity by prioritizing the maintenance/enhancement of contributing elements and secondarily the maintenance/enhancement of compatible elements.

Existing Condition

The HDZ is primarily a cultural landscape characterized by introduced shade trees, native desert shrub steppe and pinion/juniper woodland. The native desert shrub steppe community is dominated by sagebrush (*Artemisia spp*), saltbush (*Atriplex spp.*), and rabbitbrush (*Chrysothamnus spp.*). This community has been disturbed by historic activities associated with ranching, as well as more current NPS activities. The community has a deficient perennial grass/annual forb understory and no perceivable biological crust. The area bordering the Hillside Zone to the north is dominated by juniper/juniper woodland species with a shrub, perennial grass and annual forb understory. As noted in the PISP Avian Inventory Report, junipers observed in the NE of the HDZ may be following a successional pattern through which desert shrub steppe is over time replaced by pinyon/juniper communities (Johnson, Holmes, and Stuart 2004, 30).

The introduced trees in this zone clustered near the fort and around the ponds were for most of the historic period the only trees growing on the site. The 1885 sketch of the fort by Tissandier depicts only a few trees growing around the ponds in an otherwise barren landscape … a quality retained and depicted by photographs into the early 20th C. It is documented that *Ailanthus*, cottonwood, elm, and willow were planted near the fort during the Woolley period of 1885-1891 (NRHP 2000). Relict Siberian elms (*Ulmus pumila*) to the west of the fort are contributing historic features, their planting noted in Woolley family histories circa 1886. The remaining older trees are in decline, with seedlings/saplings of the dying elms growing in their shadows.

View of Pipe Spring fort from the east sketched by Tissandier, 1885, showing earliest trees in area of building. (PISP neg. 5013, reproduced in Shapins, Assoc., PISP CLI, June 2005)

The cottonwoods and *Ailanthus* within and adjacent to the ponds have been in decline over the past 15 yrs, matching trends seen throughout the monument. The reason for this decline is unclear and may be due to natural processes, changes in the water table, a prior period of drought, or disease. As noted by PISP staff during the Dec. 2007 briefing, many of the trees along the south pond walls have died, and it is expected that the remainder will be dead within a few years. Seeps from the ponds support cultivated roses and herbaceous riparian species such as common mallow, bind weed, and Kentucky blue grass.

The riparian vegetation surrounding the ponds, springs and seeps has created an oasis of critical importance in the context of the surrounding arid landscape to migratory and some breeding bird species. The cottonwoods in particular provide essential migratory bird stop-over habitat which is deserving of protection and management (Johnson, Holmes, and Stuart 2004, 33,37).

Further north within the historic zone are the remnants of silverleaf cottonwoods (*Populus alba*) near the chicken house, as well as barren areas near the wagon where *Ailanthus* once grew. A few decadent cottonwoods remain in this area.

View of fort from the north, September, 1923, showing dense deciduous growth in pond area. (source National Archives, Record Group 79, reproduced in McKoy 2000)

Actions

Note: PISP staff is presently considering alternatives for the repair of the ponds. The alternatives below consider only vegetation management options.

1- Removal and replacement of pond trees, following one of two options

- 1A Option: Removal of trees within the east, south, and west walls. Outside of all walls (including north), establish some new trees and selectively replace some existing trees.
- 1B Option: Removal of trees within the east, south and west pond walls at the time of reconstruction/rehabilitation of ponds. Establish new trees within east, south, and west walls. Selective replacement of existing trees outside of all walls, including north wall.

2- Rehabilitation of elms west of fort, following one of two options

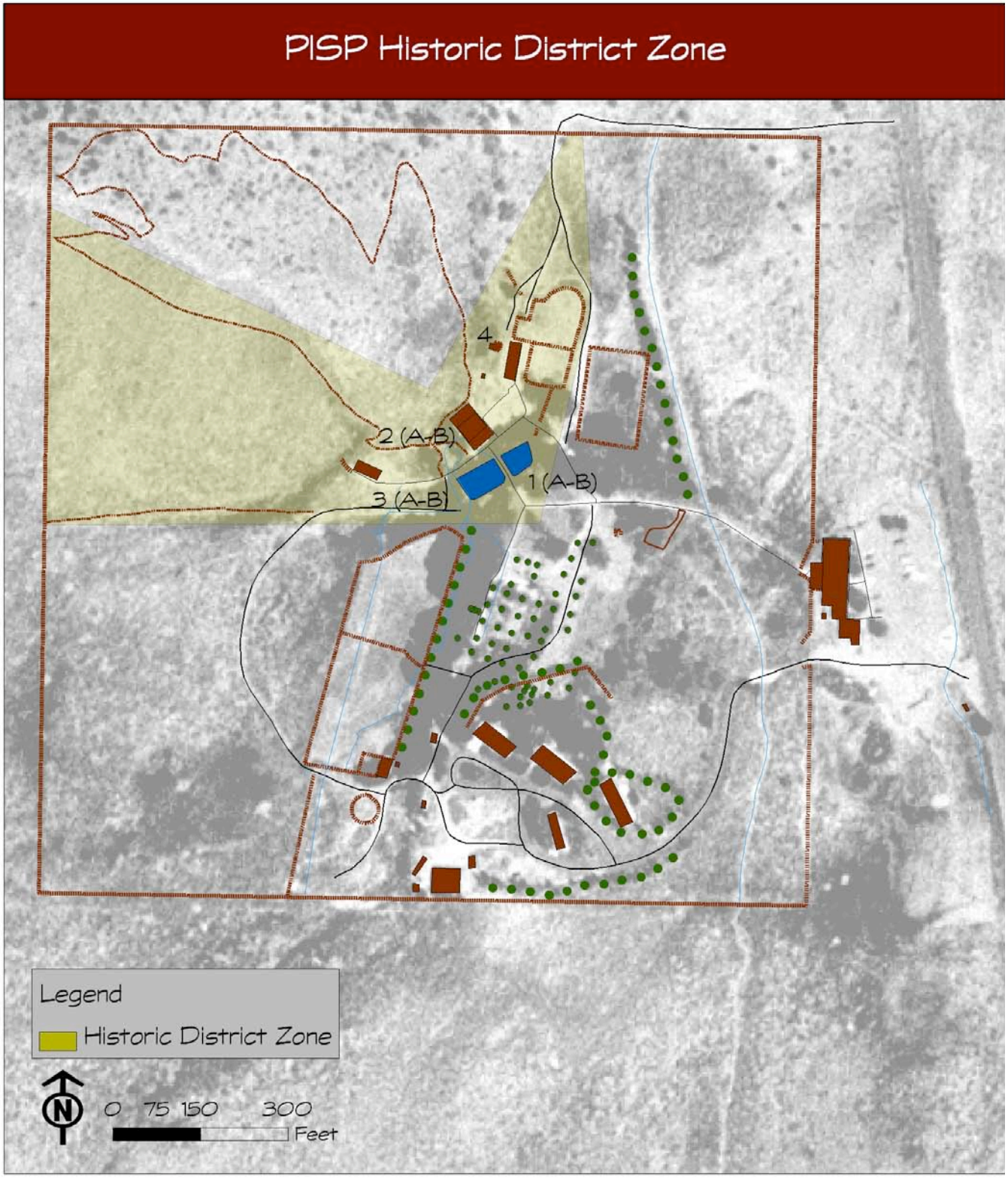
- 2A Option: Preservation of elms west of the fort with gradual replacement by undergrowth offspring
- 2B Option: Removal of elms west of the fort and replacement by adjacent offspring

3- Preservation of historic wagon road trace, and West cabin spring outflow with selective removal of vegetation. Any or all of the following actions could be pursued..

- 3A Action: Clear invasive natural and exotic vegetation from historic road trace.
- 3B Action: Clear exotic vegetation from West Cabin spring outflow.

4- Replacement of trees north of the chicken house

5- Selective thinning of shrubs


PISP Historic District Zone
4
2 (A-B)
1 (A-B)
3 (A-B)
Legend
Historic District Zone
N
0 75 150 300
Feet

Map 3

1 Action: Removal and replacement of pond trees following one of two options. Trees presently surrounding the ponds are dead or dying. Their trunks and root systems penetrate the walls surrounding the ponds, causing leakage and ongoing maintenance issues. The pond walls are slated for reconstruction, with the possible addition of an impermeable pond liner, necessitating action with respect to tree replacement.

1A Option: Removal of trees within the east, south, and west walls. Outside of all walls (including north), establish some new trees and selectively replace some existing trees. An irrigation system will be necessary.

Positive Impacts

A long-term positive impact of removing the trees within the pond walls is the improved structural integrity of the ponds' earthen dam structures and a concurrent reduction in pond maintenance. The removal of dead and dying trees will prevent the root voids and associated rodent burrowing activities that are considered primary contributors to pond leakage. It would thereby reduce water loss, conserving water for beneficial uses elsewhere. The replacement of the trees in a controlled environment outside the pond structures will create the feeling of the historic vegetation pattern that gives this area the quality of an "oasis" and provide important wildlife habitat without compromising the structural integrity of the new pond embankments.

Negative Impacts

Perhaps the most grievous impact of the removal of trees within the pond walls would be the loss of the unique and ethereal character created by the protruding and leaning trees. This would be both a loss of aesthetic and historic value. The replacement with poplars outside the pond walls would require the construction of an external irrigation ditch or pressurized irrigation system and as mentioned by PISP staff, the potential disruption of archaeological resources. Root systems and suckering growth from new plants may re-invade the pond walls. In addition to the cost of an additional irrigation system, its construction and the removal/replacement of trees would create a disturbance of the soil surface, noise and dust. Construction activities and their results would also affect PISP visitors, for which this area is a major attraction. Assuming the necessary comprehensive removal of the existing trees in conjunction with pond repair activities, there would be a considerable loss of vegetation stratification and shaded microclimates until the replacement trees were well established. This would affect migrating and nesting bird species, water temperatures, and macro-invertebrate populations within the ponds. Establishing a engineered drip irrigation system will use some amount of additional water system water, however, it will be countered by spring water presumably saved as a result of trees not consuming or transpiring spring water from the ponds. Replacement with Lombardy poplars would have an impact as different than current tree types.

1B Option: Removal of trees within the east, south and west pond walls at the time of reconstruction/rehabilitation of ponds. Establish new trees within the east, south, and west walls. Selective replacement of existing trees outside of all walls, including north wall. An irrigation system will be necessary.

Positive Impacts

The removal of trees around the ponds at the time of the reconstruction/ rehabilitation of the ponds would complement reconstruction/rehabilitation activities. The replacement of the trees in the reconstructed walls would reestablish the unique character and historic integrity of the pond area and its long term existing trees. Park staff note that the north walls do not seem to be

significant sites of pond leakage, whereas the walls down-slope are contributors to the problem. Retaining the trees in the north wall would preserve some representative qualities of the historic and cultural landscape and will retain the habitat values of the woodland adjacent to the ponds. Pond reconstruction with a pond liner and establishing an engineered drip irrigation system to these trees should deter root growth into the ponds and possibly more efficiently provide water to the trees only in the quantities necessary for their survival, therefore, overall conserving water more efficiently.

Negative Impacts

Negative Impacts are similar to those associated with the removal of trees as mentioned in the above optional actions. Retention of existing trees outside pond walls will require some degree of maintenance activity and irrigation efforts. Establishing a engineered drip irrigation system will use some amount of additional water system water, however, it will be countered by spring water presumably saved as a result of trees not consuming or transpiring spring water from the ponds.

2 Action: Rehabilitation of elms west of fort, following one of two options

Note: complete removal without replacement is not an option. The elms are contributing features that must be represented. Under Section 106 complete removal would be an Unmitigated Adverse Effect.

2A Option: Preservation of elms west of the fort with gradual replacement by undergrowth offspring . In this option the elms will be managed in a state of decay for as long as possible.

Positive Impacts

Preserving the elms until seedlings/saplings have established preserves the historic landscape and enhances the authenticity of the visitor experience. It provides a protective microclimate for the growing seedlings/saplings while also minimizing the impact of the loss on bird species and enhancing the habitat quality for species dependant on dead wood and snags. This action is most likely to be successful. Under Section 106, 2A would likely be No Adverse Effect.

Negative Impacts

The preservation of the elms may require considerable man-power related to the removal of dangerous limbs, the treatment of conditions contributing to their decline (disease, drought etc.), and the promotion of replacement seedlings. If the dying elms are retained until the seedlings/saplings have become established, the risk of damage to the fort by falling limbs is increased. The controlled removal of dead trees is difficult and unpredictable, also increasing the risk of damage to the fort and surrounding trees. Noise and dust associated with the periodic maintenance and ultimate removal of the dead elms would disrupt the visitor experience.

2B Option: Removal of elms west of the fort once they have reached a critical state of decay and replacement by undergrowth offspring. In this option, the elms will be completely removed once they begin to seriously decline.

Positive Impacts

Completely removing the elms once they reach a critical point of decay would prevent possible damage to the fort and surrounding trees due to limb loss and/or collapse. It would also require less maintenance and a single disturbance event, reducing the impact of noise and dust on the visitor experience.

Negative Impacts

The complete removal of the elms (once they have reached a critical state of decay) would negatively affect some bird species. The removal could also threaten the successful establishment of replacement elms by eliminating a microhabitat important to young trees. This may require more maintenance to prevent failure. The fort could be damaged during the removal of the stumps if roots are well established beneath the structure. Shredding the stumps into mulch may significantly reduce this risk. Noise and dust associated with removal would disrupt visitor experiences for a short time. The historic landscape would also be seriously degraded by the loss of the mature elms until the replacement elms reached similar heights. Under Section 106, 2B would likely be a Mitigated Adverse Effect.

3 Action: Preservation of historic wagon road trace, maintaining West cabin spring outflow with selective removal of vegetation. Any or all of the following actions could be pursued.

3A Action: Clear invasive natural and exotic vegetation from historic road trace.

Positive Impacts

The historic road trace will appear as it presumably would have looked at the time of its continuous historic use, thus enhancing the historic district and the cultural landscape.

Negative Impacts

Some soil disturbance in the road trace itself will occur and possibly encourage the promotion of exotic vegetation.

3B Action: Clear exotic vegetation from West Cabin spring outflow.

Positive Impacts

The maintenance of the West cabin spring outflow will preserve the historic integrity of the spring's flow pattern. It will promote the flow of spring water over a greater distance and the utilization of that spring water by increased amounts of native plants and possibly native wildlife.

Negative Impacts

Removal of exotic vegetation from the West cabin spring outflow will cause some soil disturbance and may cause some disturbance of invertebrates.

4 Action: Replacement of trees north of the chicken house. According to the PISP CLI prepared in 2006, the few silver-leaf cottonwoods clustered to the west of the chicken house could be offspring of historic plantings, however as no historical evidence has been located to document their origin, they are noted by the report as being of undetermined significance. It is proposed that a couple of clumps of Populus alba (silver-leaf cottonwood) be planted in the area, and existing weakened trees be removed over time as new plantings mature.

Positive Impacts

The trees adjacent to the chicken house provide bird habitat and soil stabilization along the hillside. The trees also possibly represent the movement of groundwater within PISP. The preservation of the existing clustering pattern has interpretive qualities

Negative Impacts

The replacement of the dead trees with young trees would require maintenance until the replacement trees become self sustaining.

5 Action: Selective thinning of shrubs

Positive Impacts

The selective removal of shrubs would prevent encroachment into areas used for circulation or historic interpretation.

Negative Impacts

The selective thinning of shrubs would create localized soil disturbances associated with removal of shrubs. The thinning of shrubs may also interfere with natural successional processes and expose surfaces to invasion by exotic grasses.

Hillside Zone (HZ)

(Map 4)

Desired Future Condition

- Natural processes predominate
- Visitor use- views, trail and waysides, experience of natural environment and distant views

Condition of Existing Vegetation

This small zone in the northwest corner of the monument is comprised of the pinyon-juniper plant community, one of most predominant habitat types adjacent to the monument. The pinion-juniper zone is dominated by two-needle pinion (*Pinus edulis)*, Utah juniper *(Juniperus osteosperma)*, sagebrush *(Artemisia spp*.), Utah serviceberry *(Amelanchier utahensis)*, roundleaf buffaloberry (*Shepherdia rotundifolia*), green rabbitbrush *(Chrysothamnus viscidiflorus*), snakeweed (*Gutierrezia spp., Cowania mexicana*), Mormon tea (*Ephedra viridis)*, yucca *(Yucca spp.*), and cactus (*Opuntia spp*.) With the exception of a lack of mature pinion pine and Utah juniper, there is a diversity of age classes in the stand, comprised of these species.

A study cited in the PISP Avian Inventory suggests that vegetative change in pinion/juniper communities of the Great Basin has occurred at drastic rates over the past century. According to Cole et al, "the most severe vegetation changes of the previous 5,400 years occurred during the last 200 years and these changes can be primarily attributed to grazing by livestock". During this period, plants consumed by cattle and sheep such as winterfat, ricegrass, sagebrush, roundleaf buffaloberry, greasewood, and pinion pine have declined significantly, while aggressive invasive species have taken their place (Johnson, Holmes, and Stuart 2004, 29).

Actions

1 Action: Continue current policy of allowing natural processes to operate in the zone. Annual monitoring of vegetation will continue, as will trail maintenance and the removal of invasive exotic vegetation.

Positive Impacts

Allowing the Hillside Zone to evolve naturally will increase the probability that a representative pinion-juniper woodland will persist within the monument boundaries.

Negative Impacts

Minor soil disturbance will continue, associated with removal of non-native species.

Shrubland/Grassland Zone (SGZ)

(Map 4)

Desired Future Condition

Natural processes predominate with potential for enhancement (i.e. native grass restoration) for visitor understanding of pre-European contact. As noted in the PISP CLI, the surrounding natural desert-scrub landscape is a contributing feature to the historic landscape.
Visitor use- view/ observe/ retain some flexibility for guided tours and interpretive trails

Condition of Existing Vegetation

The Shrubland/Grassland Zone plant community is dominated by four winged saltbush (*Atriplex sp.*) with smaller patches of rabbitbrush (*Chrysothamnus sp.*) and basin big sagebrush (*Artemisia tridentata Nutt. spp. tridentata*). In general, the SG Zone plant communities are degraded. Grasses and forbs are minimal, replaced with dominant shrub species, the result of historic grazing and more recent site disturbances such as construction and demolition of the CCC camp, construction and removal of the campground and other similar activities leading to introduction and competition from exotics. Consequently the pre-settlement pattern of grassland interspersed with shrub species is no longer evident (Alexander 1998). Biological soil crust exists in a few isolated locations but is generally absent from this zone. The recent drought has stressed plants throughout the monument. The riparian plant community in the SW corner of the Shrubland/Grassland Zone has been stressed by drought and lack of spring water which used to flow from the irrigation ditch across the corral and into the arroyo.

Actions

1- Treatment of shrubland zones. Any or all of these actions could be pursued.
   - 1A Action: Retain shrubland/grassland as it currently exists
   - 1B Action: Selective thinning of shrubs and grass/forb reintroduction
   - 1C Action: Creation of small plots for intensive grass and forb reintroduction

2- Continued monitoring of vegetation and removal of non-native invasive species

3- Alternative location for Paiute camp with related trails

1 Action: Treatement of shrubland zones. Any or all of the following actions could be pursued.

1A Action: Retain shrubland/grassland as it currently exists.

Positive Impacts

Existing SG vegetation would continue to perform ecosystem functions such as site stabilization, erosion control, wildlife habitat (at a minimal level) and others. Although not pre-settlement in species composition, the existing SG vegetation projects a general western landscape character.

Negative Impacts

The generally degraded condition of vegetation in the SG zone would persist. The level of native species diversity would remain low, and park visitors would be deprived of the experience of a pre-settlement vegetation palate.

1B Action: Selective thinning of shrubs and grass/forb reintroduction

Positive Impacts

A successful planting of native grasses and forbs would recreate the pre-settlement vegetation palate and would give park visitors that experience. It would also create new interpretive opportunities. Moreover, the success of native grasses and forbs would facilitate the restoration of BSC and expand habitat for wildlife and overall floral and faunal species diversity on the monument.

Negative Impacts

Selective thinning of shrubs and planting of grasses and forbs in cleared areas would produce minor disturbances to the soil surface associated with the removal of shrubs. The soil would be more substantially disturbed when cleared areas were prepared for seeding grasses and forbs. Minor site disturbance and mechanical weed removal or application of herbicides associated with weed control could persist for three to five years or until new plantings become established. As noted earlier in this report, the restoration of native landscapes in this environment is very difficult (MacMahon 2007, pers. comm). Much depends on weather and longer climatic cycles, invasive species and herbivory. A failed planting leaves a site that is ideal for invasion by non-native species.

1C Action: Creation of small plots for intensive grass and forb reintroduction

Positive Impacts

Positive Impacts would be the same as those described above.

Negative Impacts

Negative Impacts would be the same as those described above, except they would be confined to smaller plots.

2 Action: Control of Invasive Exotics

Note: In addition to controlling invasive exotic plants in newly planted areas, PISP intends to control them throughout the SG Zone.

Positive Impacts

The control (complete eradication is not feasible) of invasive plants would enhance growing conditions for native species. It would also give PISP visitors a more accurate representation of pre-settlement native species and native plant communities.

Negative Impacts

Negative Impacts would include minor site disturbance associated with mechanical removal and/or the application of herbicides at locations where invasive plant species occur throughout the SG Zone.

3 Action: Alternative location for interpretive Paiute camp with addition of supporting trail

The proposed relocation of the camp and access trail northwest of the visitor center on the east side of the flood ditch would require minor site clearing, the relocation of camp structures and restoration of former parking lot site.

Positive Impacts

The proposed relocation of the campsite to the site described above would place it adjacent to the visitor center, where the pre-settlement story is told, and in a plant community context appropriate to that time period. Exiting the museum, visitors would experience a transition from the pre-settlement to post settlement periods, with the flood ditch serving as the “timeline” between the two. This location could benefit from the context created by the proposed grass/forb plantings previously discussed depending upon location chosen for this effort. The

proposed location is in an area where the plant community is classified as degraded on the monument vegetation map. Thus the development of the campsite would not disturb the limited number of high quality plant communities on PISP. The old campsite (which is in the Visitor Zone) would be revegetated with native shrub, grass and forb species extending the native plant context west across the ditch.

Negative Impacts

Relocation of the Paiute camp would produce minor disturbances to the site, including removal of shrubs and soil regrading to create the campsite and for the access trail. Shrub removal and soil disturbance will create habitat for invasive plants which will have to be controlled mechanically or with chemicals. No significant loss of wildlife habitat is expected.

Administration Zone (AZ)

(Map 4)

Preferred Future Condition

PISP has specified several attributes of its described future condition for the Administration Zone.

- Maintain/enhance a livable and functional landscape for residents and workers while utilizing historically compatible elements
- Provide screening to minimize visual impacts and enhance aesthetics
- Discourage visitor access through screening

Existing Condition

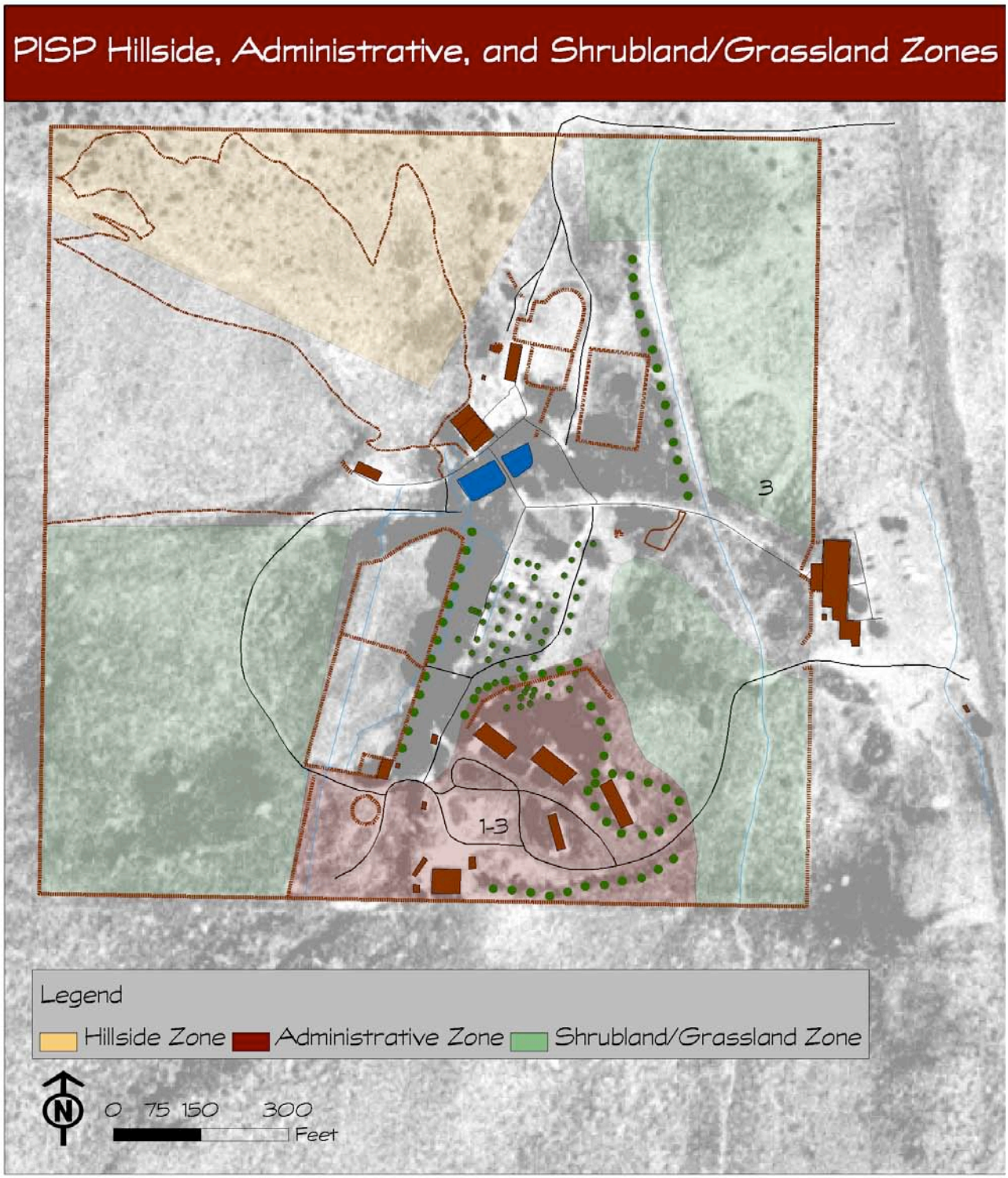
Structures, roads, parking, utilities, lawn, shrubs and shade trees give the AZ the characteristics of a suburban development. Plantings, primarily of introduced tree and shrub species are configured for aesthetic and utilitarian purposes such as screening and climate control. The introduced plantings are sprinkler irrigated and are in general in good condition. They are moderately effective in screening views of the AZ. *Ailanthus* has invaded several planting beds on the southwest corner of the AZ. The lawn panels are in decline. They are an unnatural food source for cottontail rabbits, whose population on PISP exceed regional norms and degrade some of the plantings in the VZ. The wood panels on the north side of the AZ (placed for flood control) are visible from the VZ and slightly detract from the visitor experience.

Actions

1- Phased removal or minimization of the lawn and exotic vegetation with the exception of deciduous shade trees. It would, over time, convert portions of the existing designed landscape to a more waterwise palate of plant materials. Additional shade trees, native or adapted to low water use such as single-leaf ash (*Fraxinus anomala*) and netleaf hackberry (*Celtis reticulate*) would be added as needed.

2- Replace asphalt parking with pervious pavement (paving treatments that allows percolation through the surface) that would demonstrate best management practices for storm water management by retaining runoff on site.

3- Phased removal of lineal poplar tree screens around the AZ and the planting of understory pinion/juniper trees for screening purposes. Additional pinion/juniper trees, planted in drifts would be added to the AZ, VZ, and SG Zones to screen the development from the visitor center and visitor-approach corridor along highway 389.


PISP Hillside, Administrative, and Shrubland/Grassland Zones
3
1-3
Legend
Hillside Zone
Administrative Zone
Shrubland/Grassland Zone
N
0 75 150 300
Feet

Map 4

1 Action: This proposed action would require phased removal or minimization of the lawn and exotic vegetation with the exception of deciduous shade trees. It would, over time, convert portions of the existing designed landscape to a more waterwise palate of plant materials.

Positive Impacts

Removing the non-native shrubs, ailanthus, and ground covers, including the lawn, would enhance the visual and ecological compatibility with the setting. It would also reduce irrigation requirements, freeing water for more beneficial uses. Eliminating the lawn would help reduce the unnaturally high population of rabbits which have in the past devastated grassland restoration plots.

The renewed landscape would retain the shaded microclimate provided by existing deciduous trees around residential units, reinforced as necessary with new plantings of ash and hackberry, this reducing the need for air-conditioning.

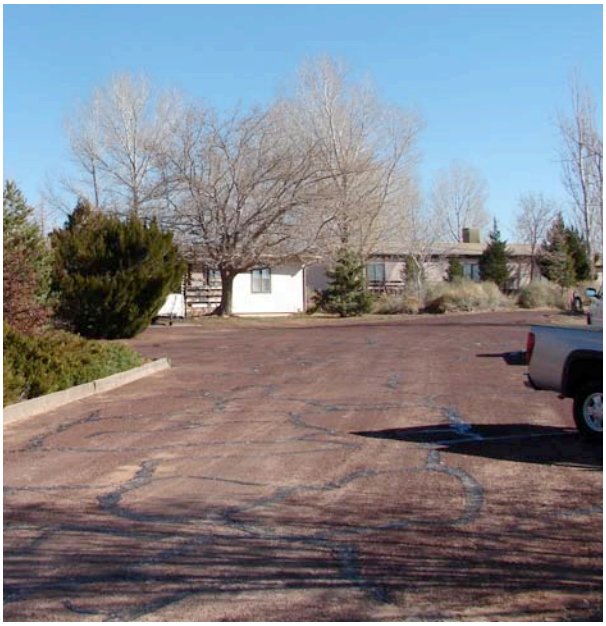
Negative Impacts

AZ residents would be adversely affected by the demolition of existing plantings and paved areas. Noise, dust, mud and inconvenience would be major irritants. The area would be rather barren for a time as new plantings of native species become established and grow.
Construction activities and their results would also affect PISP visitors, although to a lesser degree. Impacts from the removal of screen plantings are discussed elsewhere in this document.

2 Action: Replace asphalt parking with pervious pavement (paving treatments that allows percolation through the surface) that would demonstrate best management practices for storm water management by retaining runoff on site.

Positive Impacts

The black asphalt heat sink would be removed. Decomposed granite or pea gravel placed in geogrid matrix (pervious pavement) would allow precipitation to percolate directly into the ground, eliminating storm water runoff. This surfacing has recently been installed in parking lots at the Utah Botanical Gardens, Kayesville, and at the Grand Staircase Escalante NM Visitor Center in Escalante, and is performing well, even during snow removal.



Negative Impacts

Removal of asphalt parking would require heavy demolition activity and installation of the pervious surface with associated noise and dust. The asphalt removed would be recycled. Park employees and visitors would be inconvenienced during construction.

3 **Action: Phased reconfiguration of poplar tree screens around the AZ and the planting of understory pinyon/juniper trees for screening purposes. Additional pinion/juniper trees, planted in drifts would be added to the AZ, VZ, and SG Zones to screen the development from the visitor center and visitor-approach corridor along highway 389.**

Need for visual screening of Administrative Zone as viewed from Highway 389

Poplar tree screens along the north and south sides of the AZ are presently configured in an unnatural lineal configuration, creating forced lines on the visual landscape. Selective removal of some trees from the north row with additional planting of a few more to form clusters will result in a more natural landscape pattern while conserving the screening value from higher elevation view points. A similar approach can be taken along the southern row for provision of shade. Naturalized drifts of pinion pine and junipers will provide visual screening at ground level from both sides. Existing poplars can remain in place until new plantings are partially established to minimize impact of change. The placement of new trees will be adjusted based on the location of archaeologically significant land.

Positive Impacts

The proposed actions for both the north and south tree lines would eliminate historically incongruous lineal elements from the landscape. The trees have lost their screening function from eye level because the bottom branches are eight to ten feet above grade. In time, the pinion and juniper trees would provide year round visual screening of the AZ both from the Monument and from highway 395, add additional shade and provide wind screening.. Consultations with the tribe will be necessary because some of the screen plantings will have to be planted on tribal land to create an effective screen that appears natural.

Need for visual screening of Administrative Zone as viewed from Visitor Zone

Negative Impacts

Removal of trees would temporarily reduce the carbon sequestering capacity of the monument, and bird habitat would be temporarily reduced until new plantings become established. Short term disturbance to soil and accompanying noise/dust pollution would occur as described elsewhere.

.

Pinion and juniper trees are relatively slow growing, consequently it may require over 30 years before they fully screen the AZ at ground level. The pinyon/juniper plants would likely require temporary irrigation until they became established.

Pinion/juniper in naturalized drifts near park

Tribal Zone (TZ)

(Map 5)

Desired Future Condition

The Tribal Zone is an interface between the Visitor Zone and the Shrub/grassland Zones, which exists outside the Monument boundaries where management responsibilities are shared. Proposals discussed below will require a cooperative partnership between PISP and the tribe.

Desired future conditions include:

- Creating an appropriate "fit" of the visitor center within the surrounding landscape context.
- Reducing the visual intrusion of surrounding development within park area

Condition of Existing Vegetation

The condition of existing vegetation on tribal land east of the entry road has not been studied. Condition of the lawn and shade trees east of the visitor center are in good condition. Trees in the parking lot appear stressed and several decadent trees were recently removed.

Actions

1- Visual screening of Red Hills housing area

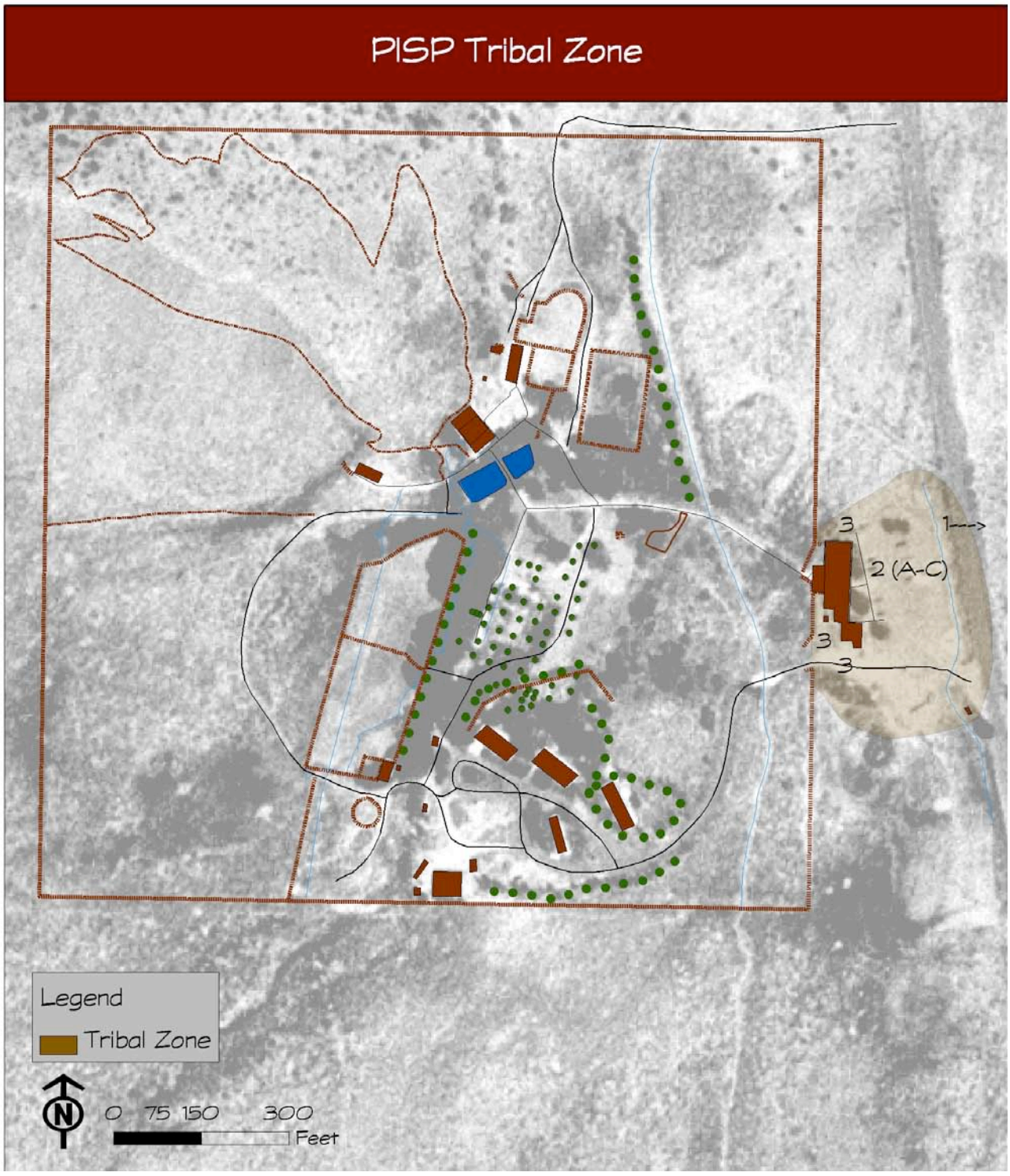
2- Remove or reduce lawn panels on east side of visitor center and replace with native species, following one of three options:

2A Option: immediate removal of the lawn and replacement with native shrub-steppe species

2B Option: Phased removal and revegetation

2C Option: Removal of the lawn except for patches left beneath existing shade trees (area that could be used for picnics)

3- Improve screening of utility installations adjacent to visitor center (propane tank on northwest side of visitor center, propane tank behind ZNHA shop, and dumpster south of visitor center).


PISP Tribal Zone
3
1--->
2 (A-C)
3
3
Legend
Tribal Zone
N
0 75 150 300
Feet

Map 5

1 Action: Visual screening of Red Hills housing area

PISP would enter into discussion with the tribe to explore the possibility of plantings on tribal land on the western edge of the Red Hills housing complex. Screening plants would include pinyon pine and Utah juniper. These species would be planted in drifts that reflect the spacing pattern they exhibit in existing native stands in the region.

view of Red Hills housing from Monument

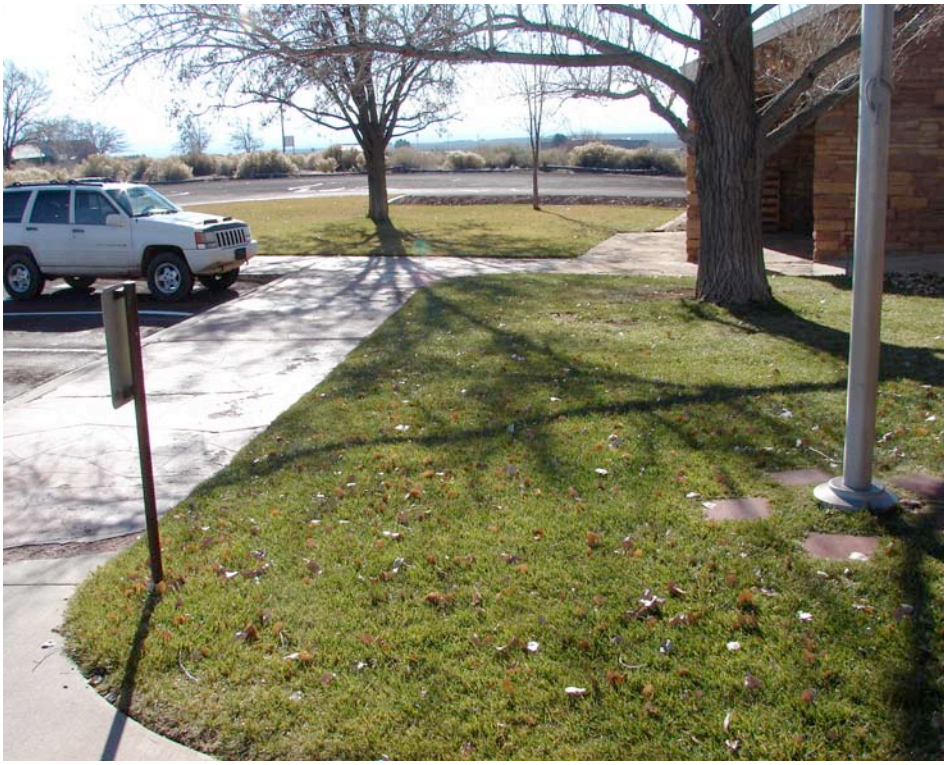
Positive Impacts

From PISP, views of the Red Hills development would be screened and the native plant contextual setting of the Fort would be enhanced. The proposed screen planting would benefit both the tribe and PISP. Screening would block views from Red Hills to the PISP visitor center parking lot and other areas within the monument without blocking longer views to the south and west across tribal land. Plantings on the west side of the housing units would also provide afternoon shade and shield living areas from the wind. The screen planting would sequester carbon and would provide additional habitat for pinyon/juniper-woodland bird species.

Negative Impacts

Implementing the screen planting may involve the removal of some shrubs and would disturb the soil surface at each planting site. Weed control would be required and thus soil surfaces could continue to be disturbed or chemicals applied. These activities would retard BSC development. Although not a negative impact, it is important to note that it will likely require over 20 to 30 years before tree heights will provide the desired level of screening.

2 Action: Remove or reduce lawn panels on east side of visitor center and replace with native species, following one of three options:



2A Option: Immediate removal of the lawn and replacement with native shrub-steppe species

Positive Impacts

The proposed action would remove the visually and ecologically incongruent lawn areas and replace them with congruent native plants. The redesigned irrigation would only supply water to the existing trees, thus saving water to be used elsewhere. It would also remove an artificial food source for cottontail rabbits**.** The current rabbit population in PISP appears to be higher than the population in adjacent native habitats. Rabbits are doing significant damage to native grasses, new Indian rice grass plantings and orchard stock. Eliminating the lawn panels (artificial food source) could reduce the rabbit population in PISP.

It is likely that the rabbit population would have to be curtailed or plantings protected to give new plantings a chance to survive. This could require the construction of rabbit exclosures around new plantings, individual plant protection and/or a reduction of the rabbit population to levels consistent with levels found outside the monument. The role of gophers and other burrowing rodents on new plantings is unknown but they may have also played a role in the decimation of previous grass plantings. Further research is needed.

Negative Impacts

The removal of the lawn panels would disturb the soil surface and require the redesign of the irrigation system to accommodate new plantings and sustain existing cottonwood trees. These activities would stress the large cottonwood trees in the lawn panels, a potential negative impact since the trees shade and cool the VC. Turf areas shaded by cottonwoods and used by picnickers would be lost.

2B Option: Phased removal and revegetation

Positive Impacts

The positive impacts would be similar to those discussed under option A. The phased removal would limit the size of the space disturbed and thereby reducing the magnitude of the negative impacts associated with soil disturbance and cottonwood stress.

Negative Impacts

As with option A, the removal of the lawn panels would disturb the soil surface and require the redesign of the irrigation system to accommodate new plantings and sustain existing cottonwood trees. These activities would stress the large cottonwood trees in the lawn panels, a potential negative impact since the trees shade and cool the VC. Turf areas shaded by cottonwoods and used by picnickers would eventually be lost.

2C Option: Removal of the lawn except for patches left beneath existing shade trees (area that could be used for picnics)

Positive Impacts

Option C would save the major lawn areas now used by picnickers because of the turf and shade provided.

Negative Impacts

Would retain visually contrasting and historically incongruous patches of green lawn, as well as maintaining an artificial food supply for rabbits. Because of previous construction disturbance, it is unlikely that cultural artifacts would be unearthed in any of these options.

3 Action: Improve screening of utility installations adjacent to visitor center) propane tank on northwest side of visitor center, propane tank behind ZNHA shop, and dumpster south of visitor center).

Positive Impacts

Painting the tanks and dumpster a gray/green color would reduce their visual impact. Planting of native shrubs would better reduce their visual presence in the viewshed.

Negative Impacts

Negative Impacts would be similar to those described elsewhere that involve minor site disturbance to install plantings

Side Bar 1

Rabbits

After discussion with USU wildlife ecologist F. Knowlton and range scientist F. Busby, we all agreed that what appears to be happening with herbivore on new PISP plantings is the “candy store phenomenon”. This occurs in landscapes that tend to have reduced supplies of forage or browse, often the result of historic overgrazing. When small scale restoration planting or controlled burns are used to restore the native species they become the “candy store”. Herbivores prey on these sites because they are concentrations of high quality forage or browses.

One solution would be to plant a diversity of warm season grasses and forbs in several locations in the monument. These species are just breaking dormancy when the first litters (usually the largest) or rabbits are born. Very little of the warm season species biomass is available to herbivores, hence damage to plants is limited. However, as pointed out by Knowlton, cottontail rabbit population explosions which occur in 10-15 year cycles in this shrub landscape are a complicating factor.

Rabbit exclosures can be effective, but they are expensive to install and rather unsightly, certainly not in character with the historic period. Rabbits could be live trapped and transported off the monument for release. This is a labor intensive and time consuming action. Further, the supply of potential immigrants from outside PISP is virtually endless, so live trapping would be an on-going activity. Maintaining a healthy population of natural predators such as coyote, fox, bobcat, and large raptors in the immediate region would suppress the population but is not possible unless support can be gained from the tribe to alter policies and practices of predator control. As noted earlier, eliminating lawn areas may also help reduce the population.

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