12283 Tempe Butte, Tempe, Ariz.

(PC-1)

HAYDEN BUTTE PRESERVE
MANAGEMENT PLAN

May 2017

(PC-2)

HAYDEN BUTTE PRESERVE
MANAGEMENT PLAN

Prepared for:

The City of Tempe
Field Services Division
Public Works Department
31 E. Fifth Street, Garden Level
Tempe, Arizona 85281

Prepared by:

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414 S. Mill Avenue, Suite 207
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In Association with:

Terracon Consultants, Inc.
Geotechnical Engineers
Tempe, Arizona

Dibble Engineering
Civil Engineers
Phoenix, Arizona

Woodward Engineering
Electrical Engineers
Tempe, Arizona

May 2017

(PC-3)

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1.0 CONTEXT:

Introduction:

It has been known by many names....

To the local Native American Pima (Akimel O'Odham) and Maricopa (Xalychidom Piipaash) people it is called 'Oidbad Do'ag, or Dead Field Mountain[1], to the early Hispanic settlers it was called El Vero - the name of a small Watercress-like plant that grew along the south bank at a time when the river flowed closer to the north side of the butte[2], and today we call it Tempe Butte, Hayden Butte and "A" Mountain – based, respectively, on its location, in honor of one of the original Founders of our community and after Arizona State University who installed the concrete "A" on the southern slope in 1955.[3]

However, the best way to begin to get a deeper understanding of the butte is to step back, temporarily put all those names aside, and see it for what it really is – a unique and *living* mountain rising in silent dignity above the desert floor.

It has done so for eons - bearing silent witness to thousands of years of blazing summer heat, blinding dust storms, pounding monsoon rains, much-welcome autumn cool-downs, gentle winter rains and colorful spring wildflower blooms.

Human beings have always been drawn to unique landforms - using them as beacons, directional markers, gathering places and vantage points - and our attraction to Hayden Butte is no exception. This butte has been at the center of our collective lives for a very long time.

It has always been sacred to the Native People who used the mountain for a lookout point, a place from which to measure and mark the seasons and other events in their lives, and a place of

worship – where Shamans would go to leave offerings and pray.[4] Hispanic settlers established their early barrios around the base, and erected a cross on the summit,[5] and early Anglo settlers used the butte first as a landmark – marking a point along the way between Tucson and Prescott where a geologic dike made for a dependable place to cross the river.[6] It was on this site, that Charles T. Hayden, generally acknowledged to be the Founder of Tempe, established a ferry crossing, a homestead and store on land just west of the butte and a flour milling operation which served as a magnet for farmers, laborers, merchants and other adventurous individuals, who gradually settled in the area and built the community that we now call Tempe.[7]

Today, this mountain is an icon – synonymous with the City of Tempe itself. It is considered a landmark, an outdoor classroom and living laboratory for various courses taught at ASU. It is a recreational amenity for residents and visitors alike who hike to the summit for exercise and for the spectacular view afforded to all those who make it to the top.

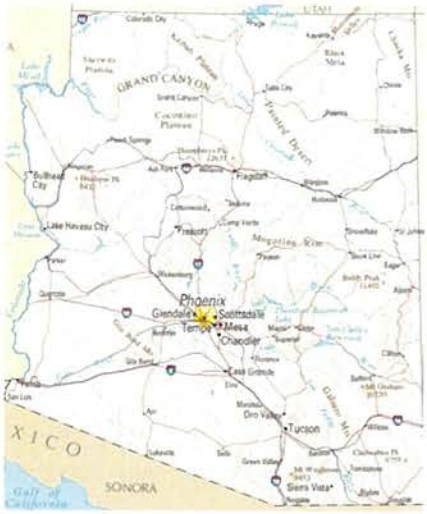
It truly is the center of our community and is well-loved and well-used by all.

The City recognized the importance of the butte and designated it a Preserve in 2002,[8]

> *to establish a preserve of desert land as a habitat for desert vegetation, wildlife and natural resources; and to protect archaeological, paleontological and historical resources and sites, while providing appropriate public access.*[9]

This document is a management plan, developed to identify existing conditions, recommend improvements, implementation guidelines and management best practices that will identify how we can care for and manage this unique and special place.

2.0 EXISTING CONDITIONS:



LOCATION MAP (PC-4)

VICINITY MAP (PC-5)

First, let us take a look at the natural history of the butte.

Hayden Butte is located on the south bank of the Salt River in the Phoenix Basin of Central Arizona - which in turn, is part of the northern portion of the larger Sonoran Desert of the southwestern United States and northern Mexico.[10]

It rises 310 feet from its base at 1,180 feet above sea level to its summit of 1,496', and covers approximately 59 acres,[11] and despite being surrounded by urban development, it has remained an "island of nature" in the middle of the city.

Tempe Butte was established as a park by the City of Tempe in 1973, and as a Preserve, renamed Hayden Butte Preserve, in 2002.[12] It was listed on the Tempe Historic Property Register in August of 2008,[13] and on the National Register of Historic Places in 2011.[14] It is also recognized as a Traditional Cultural Property by the Four Southern Tribes.[15]

2.1 Geology and Soils:

Hayden Butte sits within the Basin and Range physiographic province of the North American Cordillera of the southwestern United States. The southern portion of the Basin and Range province is situated along the southwestern flank of the Colorado Plateau and is bounded by the Sierra Nevada Mountains to the west. Formed during middle and late Tertiary time (100 to 15 million years ago), the Basin and Range province is dominated by fault controlled topography. The topography consists of mountain ranges and relatively flat alluviated valleys. These mountain ranges and valleys have evolved from generally complex movements and associated erosional and depositional processes. Structurally, the site lies within the Hayden Buttes physiographic area.

Hayden Butte is composed of three general rock types that were laid down horizontally in a basin type setting about 15 to 25 million years ago. The lower rock type is rhyolitic rock derived from volcanic ash. The middle rock type consists of sedimentary sandstone and mudstone deposits derived from river deposition, locally referred to as the Tempe Beds. The upper andesitic cap rock type is derived from lava flow. The attached Geologic Map ([1]Arizona State University, 1986) depicts the upper andesitic cap (Tv), the Tempe Beds (Ttb) unit, and slope colluvium deposits (Qsc). Colluvium is a general term applied to loose and incoherent deposits, usually at the foot of a slope or cliff and brought there chiefly by gravity. At Hayden Butte, the recent colluvium consists of up to boulder-sized fragments that have been dislodged under the constant forces of gravity and weathering and have toppled down the surface of the slope. The older colluvium deposits are described as gray, poorly sorted, strongly calichified (cemented by calcium carbonate), angular talus on lower bedrock slopes. After horizontal deposition, the Tempe Butte area was tilted downward toward the south by additional geologic processes. This exposed the Tempe Beds unit on the north side of Hayden Butte, as depicted in the following geologic cross section:

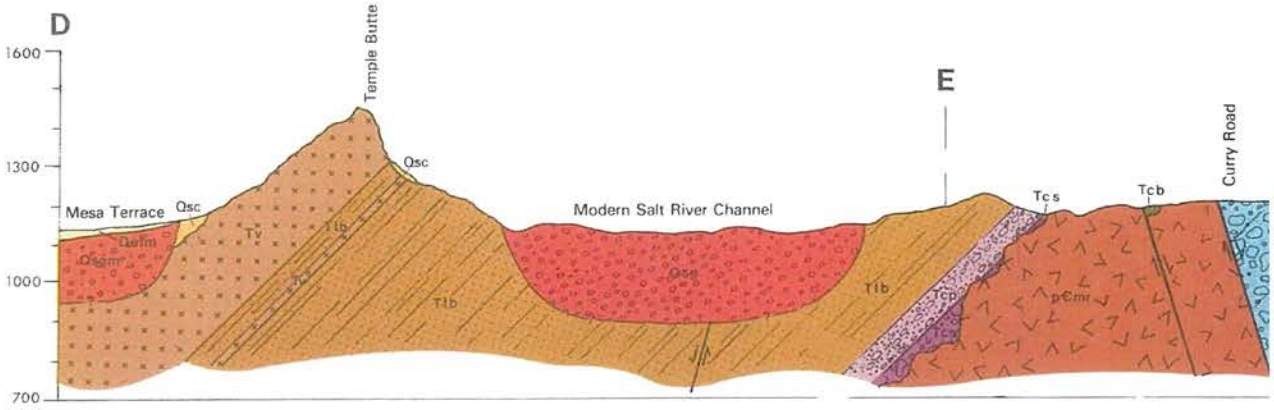


Figure 1: South (left) to North (right) geologic cross-section through Hayden Butte

Figure 1:[1] Pewe, T.L., Wellendorf, C.S., Bales, J.T., 1986, ***Geologic of Papago Park Pediment***: Department of Geology Arizona State University, Geologic Investigation Series Map GI-2-B, scale 1:1,000.

The following photographs depict selected geologic conditions observed at the site:

Photo 1: Andesitic (Tv) rock exposed at the south face of Hayden Butte.

Photo 2: Tempe Beds (Ttb) unit exposed at the northeast face of Hayden Butte.

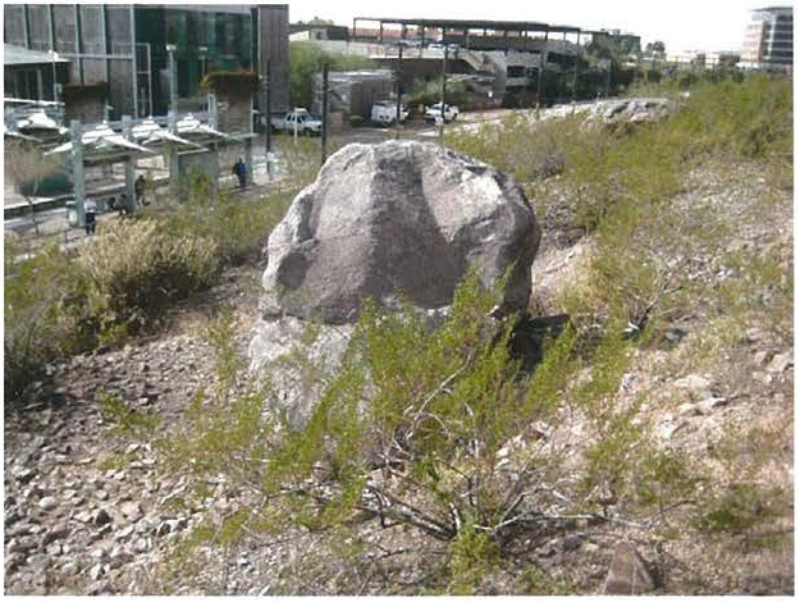


Photo 3: Colluvium boulder at the south edge of Hayden Butte.

Photo 4: Calichified colluvium at the southwest face of Hayden Butte.

Man-Made Fill

The original landscape at Hayden Butte has been altered by man over time. The most significant placement of man-made fill is the result of bedrock excavations completed to construct the water tanks on the south face of Hayden Butte. The excavation spoils were deposited directly south of the tanks as shown in the following photograph:

Photo 5: Looking north at excavation spoils south of water tanks.

Other areas of man-made fill placement occur where hiking trails have been constructed (predominantly on the south and west face of Hayden Butte). In addition, we understand that mineral prospecting may have occurred on the north face of Tempe Butte.

Geologic Hazards

Geologic hazards are defined as geologic conditions or phenomenon that presents a risk or are a potential danger to life and property, either naturally occurring (e.g., earthquakes, volcanic eruptions) or man-made. We consider the most significant geologic hazard at the site to be potential rock-fall associated with cobbles and boulders that are displaced down the existing slopes or at locations where in-place bedrock is

overhanging at present. The occurrence of rock-fall events are the result of continual weathering and gravity acting on the exposed bedrock faces and on the man-made tank excavation spoils in combination with other geologic conditions. The following photos depict these conditions as observed at Hayden Butte:

Photo 7: Loose boulders within the man-made tank excavation spoils.

Photo 8: Loose boulders within the man-made tank excavation spoils.

Slope Stability of Tank Excavation Spoils

We hypothesize that the excavation spoils were dumped in a loose manner onto the natural slope south of the tank locations during construction of the tanks. Slope stability of this dumped rock fill is a geotechnical engineering consideration that Terracon has modeled as part of the scope of work. Based on the existing topography, the slope of the excavation spoils exists at about a 33° slope angle. The angle of repose is defined as the maximum slope or angle at which loose, cohesion-less material remains stable, and typical angle of repose values for sand and gravel soils range from 32° to 36°. Therefore, the existing excavation spoils are considered to be at or near the angle of repose for these materials.

To setup the slope stability model, we have assumed that the excavation spoils were placed on the natural slope without benching or flattening of the natural slope. The natural slope inclination beneath the fill is unknown but was modeled to be consistent with the existing natural slope inclination adjacent to the excavation spoils. Based on visual observation, the excavation

spoils consist of angular rock fill material with cobbles and boulders. Considering the material type, we have estimated shear strength parameters for use in the slope stability model.

The results of the slope stability analysis indicate a factor of safety of about 1.02 for the existing excavation spoils. This factor of safety is based on the estimated natural slope inclination and estimated strength properties of the natural rock and excavation spoils material. The following figures presents the graphical cross-section model and results of the slope stability analyses:

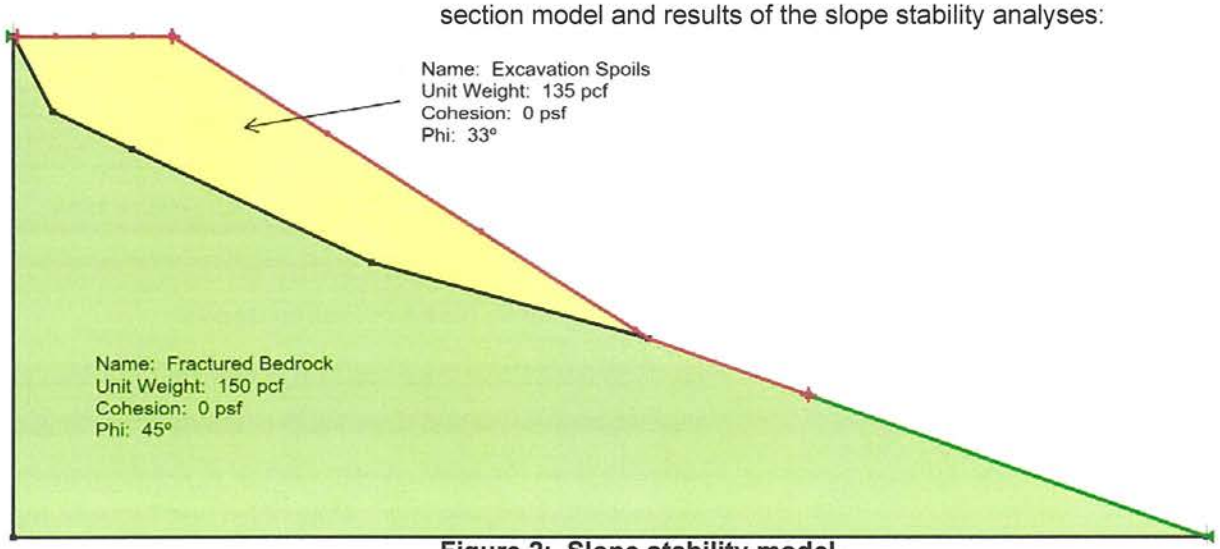


Figure 2: Slope stability model.

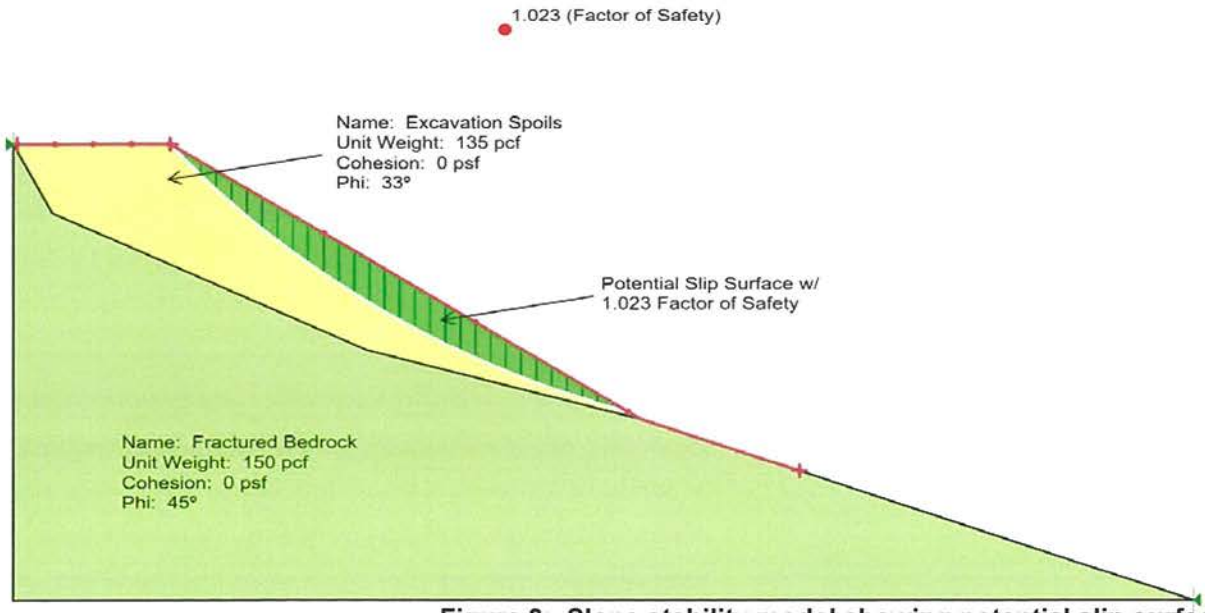


Figure 3: Slope stability model showing potential slip surface and factor of safety.

The results of the preliminary slope stability analyses indicate that the slope of the existing excavation spoils exists at a factor of safety just above one. For comparison purposes, permanent engineered slopes are typically designed for a minimum factor of safety of 1.5. However, considering the elapsed time since placement of the excavation spoils, we consider the likelihood of a significant slope failure of the excavation spoils to be relatively low. However, the continued unraveling of the slope surface and down-slope movement of loose boulders are considered to be relatively high.

Soil Fertility Testing

One sample of the excavation spoils material was taken for soil fertility testing. The test results are presented in Appendix "A".

(See Exhibit 1 - Geology and Exhibit 2 – Historic Flood Control Aerial Photographs)

2.2 Topography:

The topography of Hayden Butte is abrupt, in that it projects upward from the Salt River valley with visual prominence. Yet, much of the butte is quite accessible, requiring only moderate strain to hike. Its proximity to a population center makes it appealing for both recreation and utilitarian uses.

The land slope making up Hayden Butte ranges between gentle and severe. A gentle slope for purpose of this report is considered walkable for most people - whereby natural soils and cobbles are not dislodged from the surface. This is generally up to 15% slope. Surface erosion by mechanical means, including human interface, tends to increase as slope increases. Natural slopes of 30% to over 60% dominate Hayden Butte, limiting access, yet contributing to land disturbance when access is gained.

When access is improved, whether for recreation trails, vehicular access roads, or utility facilities, it is generally done by creating a more gentle slope for those uses. However, where more gentle pads are created, even more severe cut and fill slopes are graded adjacent to the pad, in order to match natural topography within a short horizontal distance from the gentle pad. It is at those cut and fill slopes where erosion can be troublesome. Maintenance at these locations require strategic staff and material resources, not only to reduce erosion from the natural butte surface, but also to protect the public from unstable ground down-slope and rock-fall from upslope.

(PC-6)

Whether the butte topography remained in its natural state, or as slope modifications have been made, erosion occurs. Either following human contact or without it, wind and rain are key factors in mechanical weathering of surfaces. Results of erosion is evidenced in several forms; 1) Fine grained sediment carried in swales and channels, then deposited when the drainage course slope becomes gentle. The southerly segment of Hayden Butte is one of these areas where sediment deposits are found between lower trails and the Light Railway perimeter wall. 2) Rock cobbles can potentially fall from severe slopes. The existing water storage tank area is an example. The pad for the tanks was created by excavating a near vertical upslope and placing the excavated material down slope. Although the geologic formation generally supports this utility, occasionally cobbles will fall or roll from the slopes.

(PC-7)

Topography of Hayden Butte is believed to support existing land use. However, it is recommended that type and location of access be planned, finished grade surfaces should be treated to reduce rate of erosion, and potential rock-fall guided away from human interface, and allow for accessibility for individuals with different levels of mobility, whenever and wherever possible.

(PC-8)

(See Exhibit 3 – Topography and Exhibit 4 - Slope Analysis)

LEGEND:

- Qefb EXTREMELY FINE ALUVIUM OVER BEDROCK
- Qefl EXTREMELY FINE ALUVIUM OVER LEHI GRAVEL
- Qefm EXTREMELY FINE ALUVIUM OVER MESA GRAVEL
- Qsc SLOPE COLLUVIUM
- Ttb TEMPE BEDS
- Tv VOLCANIC ROCK
- ARTIFICIAL COVER, OUTCROPS AND CONTACTS BURIE

BASED ON GEOLOGIC INVESTIGATION SERIES MAP GI-2-B: "GEOLOGY OF PAPAGO PARK PEDIMENT, TEMPE QUADRANGLE, MARICPA COUNTY, ARZONA", DEPEARTMENT OF GEOLOGY, ARIZONA STATE UNIVERSITY, 1

Qefb
Qefl
Ttb
Tv
Qsc
Qefm

N

APPROXIMATE SCALE
1" = 200 Feet
0 100' 200'

EXHIBIT 1

SITE DIAGRAM

Hayden Butte Preserve Management Plan

RIO SALADO PKWY to E. 5th STREET, S. MILL to S. PACKARD DR.
TEMPE, ARIZONA

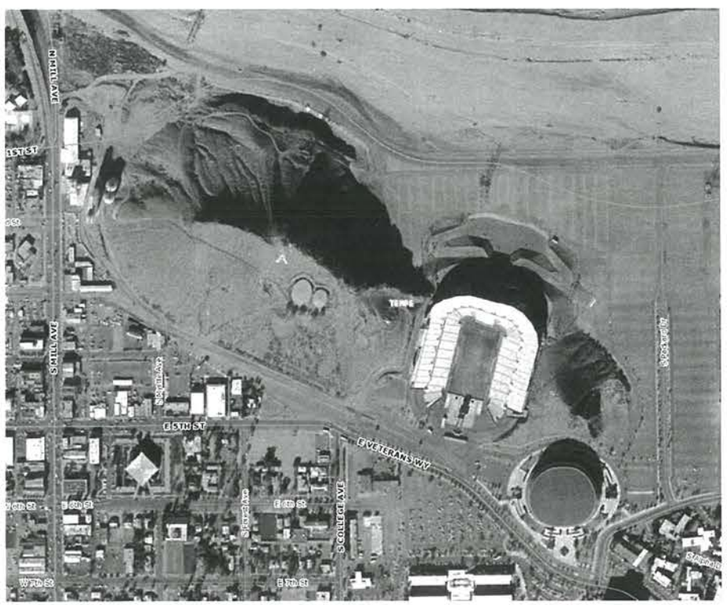
Terracon
Consulting Engineers and Scientists
4685 South Ash Avenue, Suite H-4 Tempe, AZ 85282
PH. (480) 897-8200 FAX. (480) 897-1133

Project No.	65155116		
Scale:	AS SHOWN		
File No.	65155116.DWG		
Date:	02/09/2016		
Project Mngr:	JRH	Checked By:	DRC
Drawn By:	KLJ	Approved By:	DRC

JANUARY 1930

FEBRUARY 1959

FEBRUARY 1969



JANUARY 1979

JANUARY 2002

OCTOBER 2013

APPROXIMATE SCALE
1" = 1600 Feet
0 800' 1600'

N

EXHIBIT 2

AERIAL PHOTOGRAPHS

Hayden Butte Preserve Management Plan

RIO SALADO PKWY to E. 5th STREET, S. MILL to S. PACKARD DR.
TEMPE, ARIZONA

Terracon
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Scale:	AS SHOWN
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Date:	02/09/2016

Project Mngr:	JRH
Drawn By:	KLJ
Checked By:	DRC
Approved By:	DRC

2.3 Drainage:

The drainage of Hayden Butte is primarily sheet flow, with several small to medium-sized drainage channels interspersed throughout the landscape on the south side and several medium to large channels on the north side.

(PC-9)

(PC-10)

On the north side, water empties into a deep gorge, running east to west between the base of the mountain and the southern edge of the Rio Salado Parkway, and subsequently into one large box culvert and a smaller storm drain pipe that run under the parkway and into the City's storm drain system. On the south side, drainage collects at the base of the mountain and north of the Metro Light Rail facilities, where it flows into several catch basins, and into the City's storm drain system.

Generally, these drainage channels function well and erosion is minimal with the exception of areas where the natural flow has been channeled into small culverts installed under the existing access road to the Water Tank bench, and on the hiking trails to the summit. Here the increased flow velocities tend to wash out the downstream portions of the channels where the underlying geology and/or vegetation are not sufficient enough to hold the soils in place. There is also evidence of sediment build up in the small stone sedimentation basins on the downhill side of the culverts.

(See Exhibit 5 - Drainage)

2.4 Flora:

The vegetation on Hayden Butte is typical of that found in the Sonoran Desert Scrub vegetative community where the dominant plant types are; Palo Verde (*Parkinsonia microphyllum*), Mesquite (*Prosopis velutina*), and Saguaro (*Carnegiea gigantea*), with an underbrush of Bursage (*Ambrosia deltoidea* and *Ambrosia*

TREES (PC 11-14)

SHRUBS (PC 15-20)

CACTI (PC 21-24)

dumosa), Creosote Bush (*Larrea tridentada*), bunch grasses and a variety of Barrel (*Ferocactus spp.*), Cholla (*Opuntia spp.*), and Prickly Pear (*Opuntia spp.*), cacti.[16]

Historically, there would have been a more riparian community of Cottonwood, (*Populus fremontii*), Mesquite, (*Prosopis velutina*), and Willow, (*Salix goodingii*), along the river at the base of the north slope, and a Mesquite Forest, or "Bosque" gradually giving way to desert scrub along the eastern, western and southern flanks.[17] However, gradual urbanization has eliminated most, if not all traces of these environments.

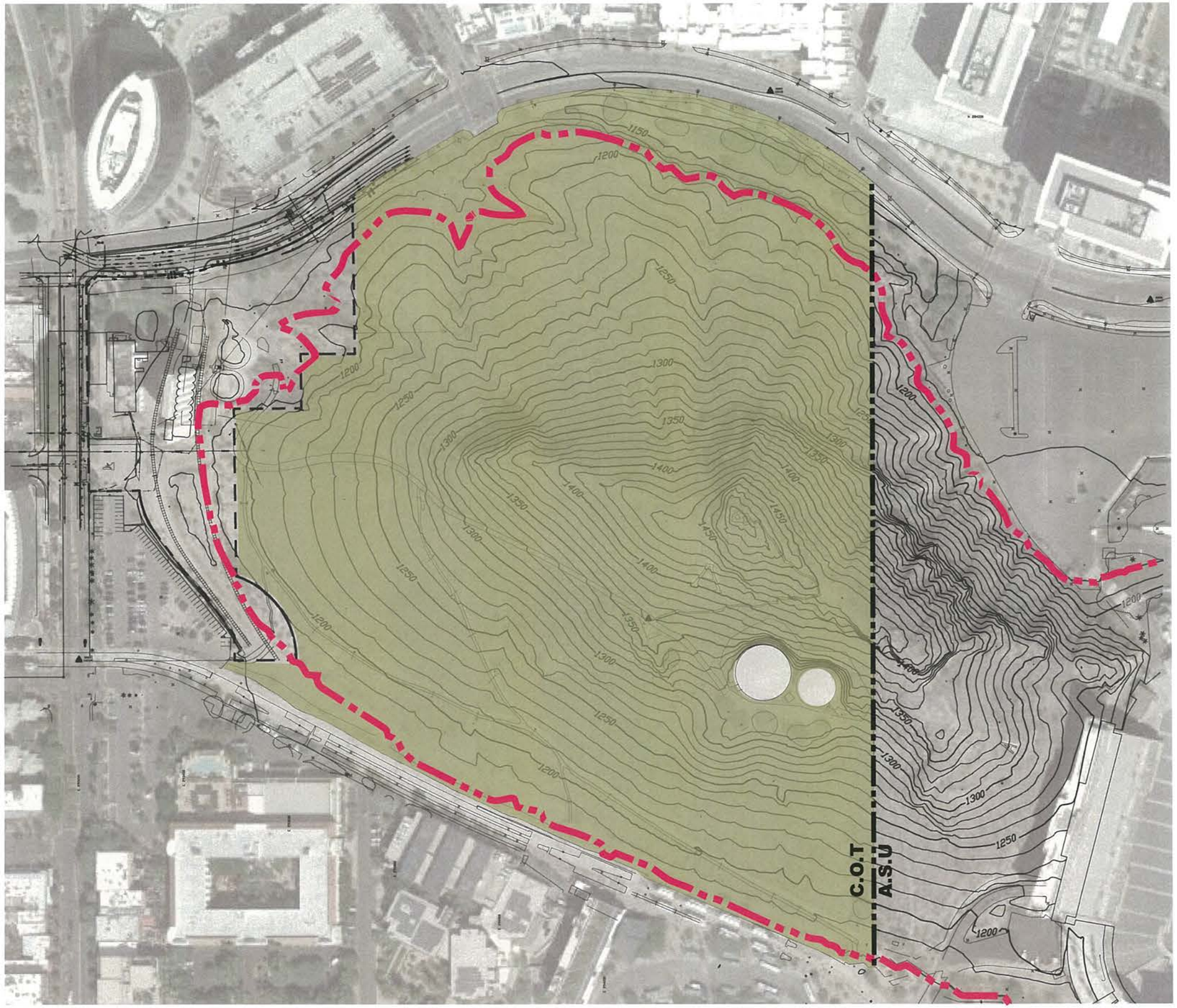
Common trees and other plants found on the butte today include:

Trees:
Whitethorn Acacia / *Acacia constricta*
Blue Palo Verde / *Parkinsonia floridum*
Little-Leaf Palo Verde / *Parkinsonia microphyllum*
Mesquite / *Prosopis spp.*, (non-native)

Shrubs:
Triangle-Leaf Bursage / *Ambrosia deltoidea*
White Bursage / *Ambrosia dumosa*
Desert Hackberry / *Celtis pallida*
Brittlebush / *Encelia farinosa*
Buckwheat / *Eriogonum spp*
Creosote Bush / *Larrea tridendada*

Cacti:
Hedgehog Cactus / *Echinocactus spp.Mammalaria*
Barrel Cactus / *Ferocactus spp.*
Cholla / *Opuntia spp.*
Prickly Pear Cactus / *Opuntia spp.*

Rare / Endangered:
Joint Fir / *Ephedra spp.*



SCALE: 1"= 200' - 00" 0 100' 200' 400' NORTH

the MOORE/SWICK partnership
landscape architects and planners

LEGEND:

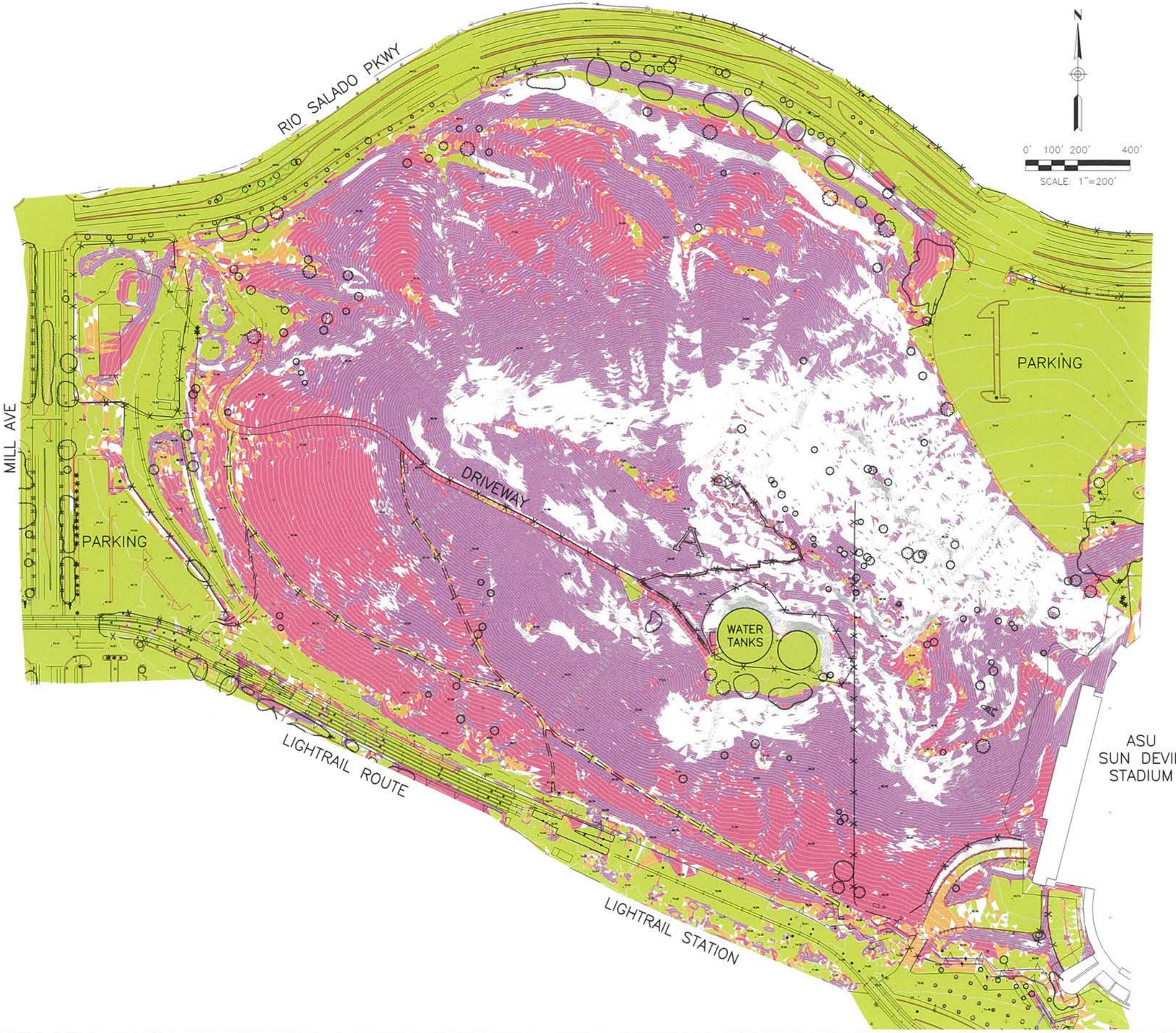
1,180 Contour Line

Limit of Preserve

HAYDEN BUTTE PRESERVE MANAGEMENT PLAN

TOPOGRAPHY

EXHIBIT 3



Dibble Engineering

SLOPE ANALYSIS

SLOPE TABLE				
NUMBER	COLOR	MINIMUM SLOPE	MAXIMUM SLOPE	DESCRIPTION
1		0%	10%	GENTLE
2		11%	15%	WALKABLE
3		16%	30%	EROSION POTENTIAL
4		31%	60%	LIMIT EQUIPMENT ACCESS
5		61% AND GREATER		SEVERE TERRAIN

HAYDEN BUTTE PRESERVE MANAGEMENT PLAN

February 2016

EXHIBIT 4

Plotted on February 11, 2016

the MOORE/SWICK partnership
landscape architects and planners

LEGEND:

- 1,180 Contour Line
- Limit of Preserve
- Centerline of Drainage

SCALE: 1"= 200' - 00" 0 100' 200' 400' NORTH

HAYDEN BUTTE PRESERVE MANAGEMENT PLAN

DRAINAGE

EXHIBIT 5

There are also several non-native, highly-invasive plants that have become established on the butte – either by natural means, or by introduction by humans. These include:

Buffelgrass / *Pennisetum ciliare*:

BUFFELGRASS (PC 25)

Buffelgrass is a shrubby grass 1.5 feet tall and up to 3 feet wide. It looks like a bunchgrass when it's small, (either a seedling or recently burned, grazed or cut). Older plants branch profusely and densely at their nodes, giving mature plants a messy appearance. These nodal branches produce new leaves and flower spikes rather quickly after light rains, making Buffelgrass an extremely prolific seed producer.[18]

Fountain Grass / *Pennisetum setaceum*:

FOUNTAIN GRASS (PC 26)

Fountain Grass is a perennial bunchgrass that was introduced to Arizona from Africa as a landscaping plant. The narrow leaves are brown in winter and green in summer, when the plant produces long, white seed heads. These heads produce large numbers of wind-dispersed seeds, which establish easily outside of landscaped areas. Fountain Grass is commonly seen spreading along roadsides, and in washes and canyons in southern Arizona, where it forms large, dense colonies.

In addition to their tendency to spread uncontrollably, both Buffelgrass and Fountain Grass compete with native species for scarce water and nutrients. Their leaves dry when dormant or dead and produce tinder-dry fuels that quickly carry wildfires. Native Sonoran Desert plants do not form continuous stands and do not produce adequate fuels to carry wildfires. Native trees, shrubs and cacti did not evolve with fire, and are seriously damaged by it. Fires that kill native plants create even more space for exotic / invasive grasses and other non-native species.[19]

(See Exhibit 6 - Flora)


LIZARDS (PC 27-28)



SNAKES (PC 29-31)




BIRDS (PC 32-35)




MAMMALS (PC 36-39)

2.5 Fauna:

Many species of animals make their homes on Hayden Butte. Most of them are smaller reptiles and mammals, although it is conceivable that larger animals such as Coyote, Javelina, etc. once lived on or around the butte before it was cut off from the larger natural environment by urban development.[20]

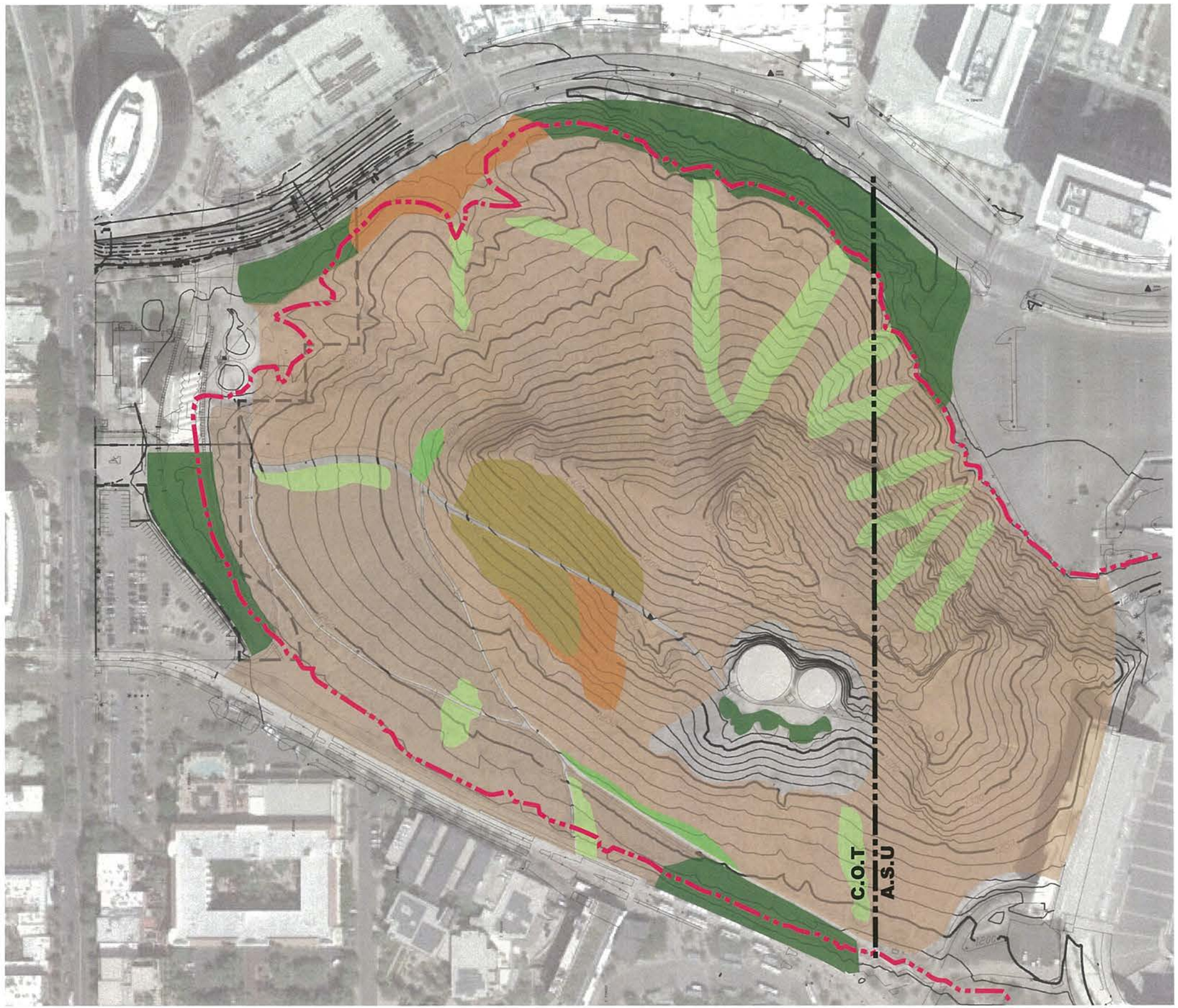
Some of the animals that we find on Hayden Butte today include:

Lizards:
Western Whiptail Lizard / *Cnemidophorus tigris*
Chuckwalla / *Sauromalus obesus*

Snakes:
Western Diamondback Rattlesnake / *Crotalus atrox*
Gopher Snake / *Pituophis melanotheucus alfinis*
Ground Snake / *Sonora semiannulata*

Birds:
Red-Tailed Hawk / *Buteo jamaicensis*
Gambel's Quail / *Callipepla gambelii*
Peregrine Falcon / *Falco peregrinus*
Mourning Dove / *Zenaida macroura*

Mammals:
Merriam Kangaroo Rat / *Dipodomys merriami*
Black-Tailed Jackrabbit / *Lepus californicus*
Western Pipistrel Bat / *Pipistrellus hesperus*
Ground Squirrel / *Spermophilus tereticaudus*



the MOORE/SWICK partnership
landscape architects and planners

LEGEND:

- 1,180 Contour Line
- Creosote / Bursage
- Little - Leaf Palo Verde
- Mesquite
- Barrel Cactus / Mammalaria
- Prickly Pear
- Buffelgrass / Fountain Grass

HAYDEN BUTTE PRESERVE MANAGEMENT PLAN

FLORA

SCALE: 1"= 200' - 00" 0 100' 200' 400' NORTH

EXHIBIT 6

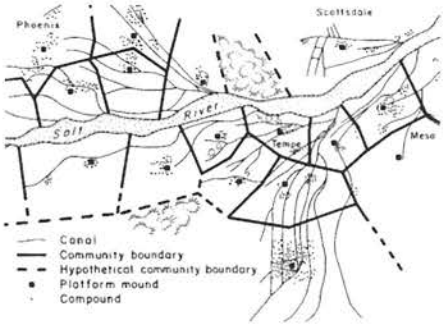
Next, let us consider the human history associated with the butte.

(PC 40)

2.6 Cultural Resources:

Native American people have been living in the area surrounding Hayden Butte for thousands of years.

The pre-historic Hohokam, (or *huhugam* – typically, "the ones who came before", but more accurately, a spirit, state of mind, or way of living - as opposed to a specific people), lived in the region approximately from year 1 of the Current Era to around 1,450 C.E..[21]



(PC 41)

Archaeologists divide the history of the Hohokam into several distinct periods and associated characteristics. These are:

Pioneer Period; (+/- 1 C.E. – 750 C.E.), settlement, ascendancy, agricultural beginnings,

Colonial Period; (750 C.E. – 950 C.E.), population growth, canal building, agricultural expansion, ball courts, trade with neighboring communities,

Sedentary Period; (950 C.E. – 1,150 C.E.), canal system expansion, agricultural expansion, trade expansion, red-on-buff pottery.

Classic Period; (1,150 C.E. – 1,450 C.E.), large adobe complexes and platform mounds, canal system expansion, red-ware pottery, polychrome ceramics, economic and social complexity, changes to settlements along the Salt River.[22]

A large, extensive village settlement, known today as La Plaza Tempe, once existed on the south and east side of Hayden Butte during the Classic Period. It covered approximately 1-square mile and contained several large platform mounds, pit houses, burial sites, cremation pits and other culturally significant features.[23]

(PC 42)

The petroglyphs on the Hayden Butte are highly-significant and unique in that they represent one of the largest and most dense concentrations of Native American rock art in Arizona. These petroglyphs, which number over 500, were created by "pecking" marks into the dark "desert varnish" patina on the existing rock.[24]

Archaeologists and scholars have determined that petroglyph sites are typically found in areas where suitable stone is located in close proximity to a village settlement or water source. Hayden Butte marks the only location is the Salt River Valley where natural bedrock occurs so close to the historic river's edge.[25]

(PC 43)

They have also surmised several possibilities for the purposes that these features could have served – ranging from calendrical, (marking the change of seasons and important times of the year such as the summer and winter solstices and spring and fall equinoxes, planting times, harvest times, etc.), to ceremonial.[26]

In addition to the petroglyphs, many other artifacts and traces of past Native American activities have been found on and around Hayden Butte. These include:

(PC 44)

- Baskets, bedrock mortars, grinding sticks, metates, pestles, pottery and pottery sherds, projectile points, and other ceremonial offerings

- Remnants of past terraced gardens on the north and west side of the butte.[27]

Details from the period between 1,450 and today are somewhat

vague. Archaeologists have unearthed relatively little that can be attributed to the Hohokam, so it is fairly evident that a drastic change in their culture occurred during this time.[28]

It is generally accepted that the historical territory of the Pima was in and around the Gila River valley. The historic territory of the Maricopa, (a coalition of several Yuman-speaking groups), was further to the south in the Yuma area. In the mid-19th century they gradually moved north, through a mutual agreement with the Pima, and subsequently expanded into the upper Salt River Valley, sometime prior to the 1870s.

Pima oral tradition places a group of Pima-speaking people in the upper corner of the valley at the time of the collapse of the Hohokam culture, and accounts handed down by author and historian Anna Moore Shaw, and other ethnographical sources place a Pima village on the Salt River prior to 1860.[29]

Today, the descendents of the Hohokam - the modern Four Southern Tribes of Arizona; (the Ak-Chin Indian Community, the Gila River Indian Community, the Tohono O'odham and the Salt River Pima – Maricopa Indian Community) - all consider the butte an important cultural landmark and recognize the mountain's iconography in their own ceremonial practices.[30]

(See Exhibit 7 – Cultural Resources)

2.7 <u>Historical Elements</u>:

The first Non-Native people to come to this area were Hispanic (and other European-American explorers), including Father Eusebio Kino and Juan Mateo Manje, (Jacobo Sedelmayr, and James Otto Pattie), who passed through the Salt River Valley in the early 1700s on their travels north from Mexico. Theses early explorers noted that the valley was uninhabited at the time of their visits.[31]

(PC 45)

(PC 46)

(PC 47)

In the 1750s, Spanish soldiers built a fort known as the Presidio of Tubac. In 1775, they moved north and established the Presidio of Tucson. When this area became part of the United States in 1853, the Mexican residents became U.S. citizens, and gradually they began moving further north. Some eventually settled into the area that was to become Tempe.[32]

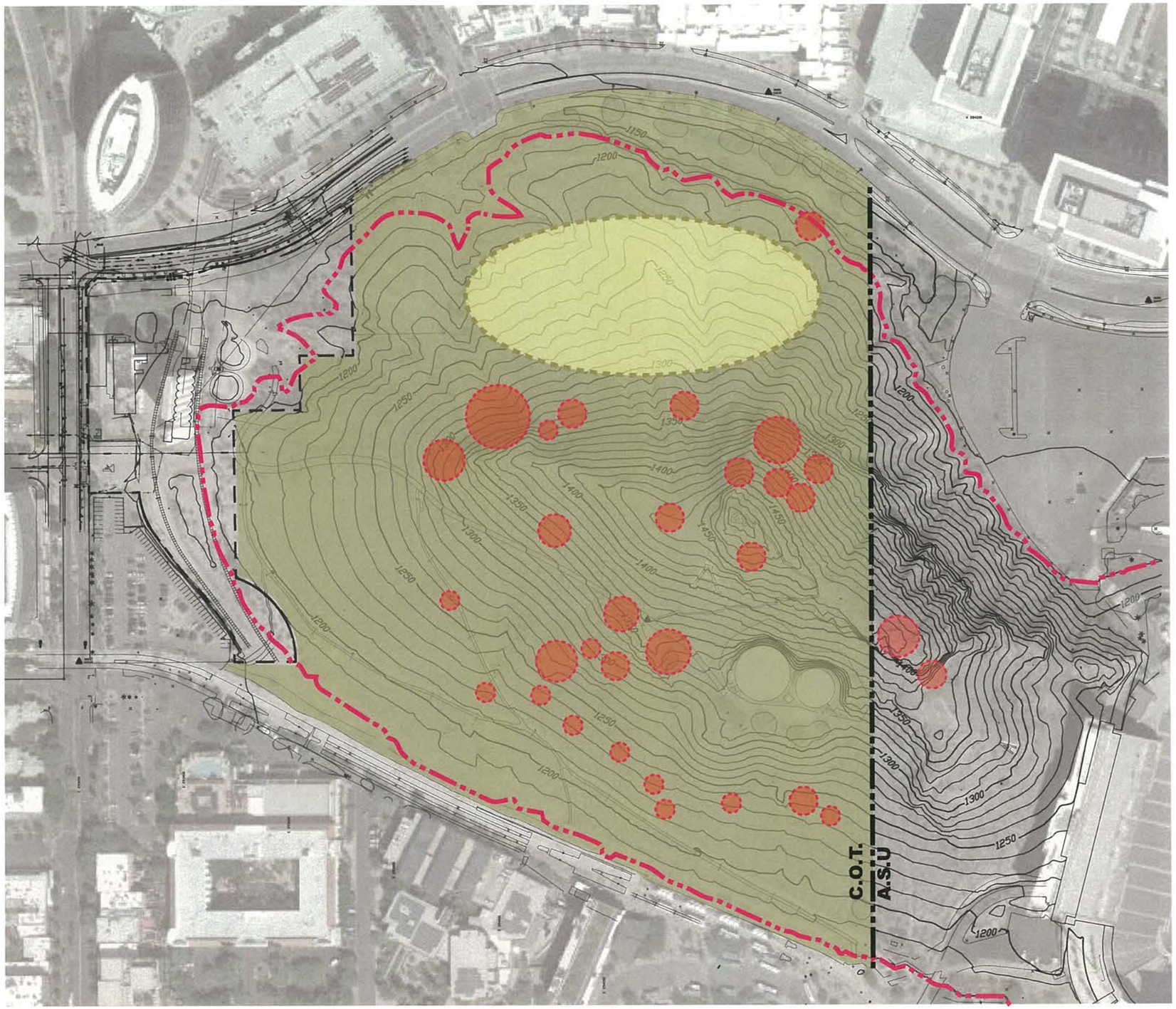
The first written description of the butte itself was recorded by John Russell Bartlett, the United States Boundary Commissioner, who traveled through the area in 1852. Bartlett made note of the "mountain at the edge of the river" and "the ruins of prehistoric canals and villages scattered across the broad plain to the south and east."[33]

After the Civil War, the U.S. Army built Fort McDowell on the Verde River in the east valley, which signaled the beginning of modern settlement of the area.[34]

Following the establishment of Fort McDowell on the eastern edge of central Arizona's Salt River Valley in 1865, enterprising farmers moved into the area. They dug out the irrigation canals left by the prehistoric Hohokam people and built new ones to carry Salt River water to their fields. Valley farms soon supplied food to Arizona's military posts and mining towns.[35]

The first settlers to move to the Tempe area, south of the Salt River and east of Phoenix, were Hispanic families from southern Arizona. They established homestead farms and helped to construct the first two irrigation canals – the Kirkland-McKinney Ditch and the San Francisco Canal, and started small farms to the east and west of a large butte (Hayden Butte). In 1872, some of these Mexican settlers founded a town called San Pablo east of Tempe Butte.[36]

The residents of these communities erected a large wooden cross



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LEGEND:

- 1,180 Contour Line
- Limit of Preserve
- Cultural Resources
- Terraced Farming

SCALE: 1"= 200' - 00" 0 100' 200' 400' NORTH

HAYDEN BUTTE PRESERVE MANAGEMENT PLAN

CULTURAL RESOURCES

EXHIBIT 7

on the summit of the butte that was observed by a traveler on an 1873 visit to town, and documented in the *Prescott Weekly Arizona Miner*.[37]

(PC 48)

They also raised the money to build a new church at the base of the butte - Our Lady of Mount Carmel Church (& Cemetery). The building no longer stands.

Another settlement, known as Hayden's Ferry, developed west of Tempe Butte. Charles Trumbull Hayden, owner of a mercantile and freighting business in Tucson, homesteaded this location in 1870. Within a few years, he had built a store and flourmill, warehouses and blacksmith shops, and a ferry. This community became the trade center for the south side of the Salt River Valley.[38]

(PC 49)

Both settlements grew quickly and soon formed one community. The town was named Tempe, after the suggestion of "Lord" Darrell Duppa, an Englishman who helped establish the new town of Phoenix. Duppa thought that the sight of the butte, the wide river, and the nearby expanse of green fields, was reminiscent of the Vale of Tempe in ancient Greece.[39]

As the small community grew through the intervening years, the butte continued to be the focus of much activity. Many of these activities have been discontinued and the signs of their presence are all but gone, but to fully understand our history and the history of the butte, it's important to mention them here.

In 1887 a private entity, Tempe Land and Improvement Company, bought much of the land surrounding the new community, including the butte.[40]

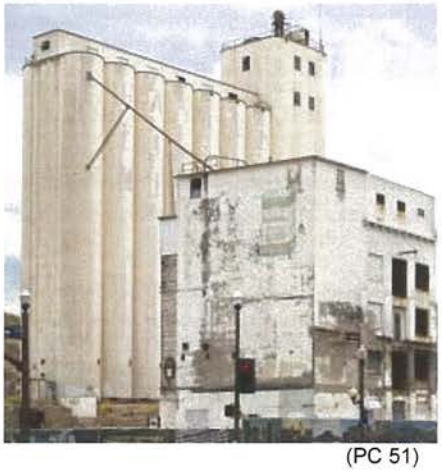
A private mining company, the RW Mattison Company, established a sandstone quarry on the northwest side of the butte in 1892. The excavation scars from this operation are still visible

today, and the stone from this quarry can be seen on several buildings in the downtown area.[41]

(PC 50)

In 1898, citizens erected a large flagpole on the summit of the butte which supported an American flag and marked the United State's entry into the Spanish American War.[42]

As the population grew, so did the need for a more reliable water supply, and in 1902 the town constructed its first community reservoir. It was built of concrete and stone, with a wooden roof and served its purpose until 1948 when a fire burned the roof. It was replaced with the first steel tank, which is still in use today. The outline of the original concrete walls can still be seen on a terrace between the summit and Sun Devil Stadium.[43]


(PC 51)

In 1917, a 600 candle-power beacon was erected on the summit to proclaim Tempe "The Best and Most Progressive Town in the Southwest."[44]

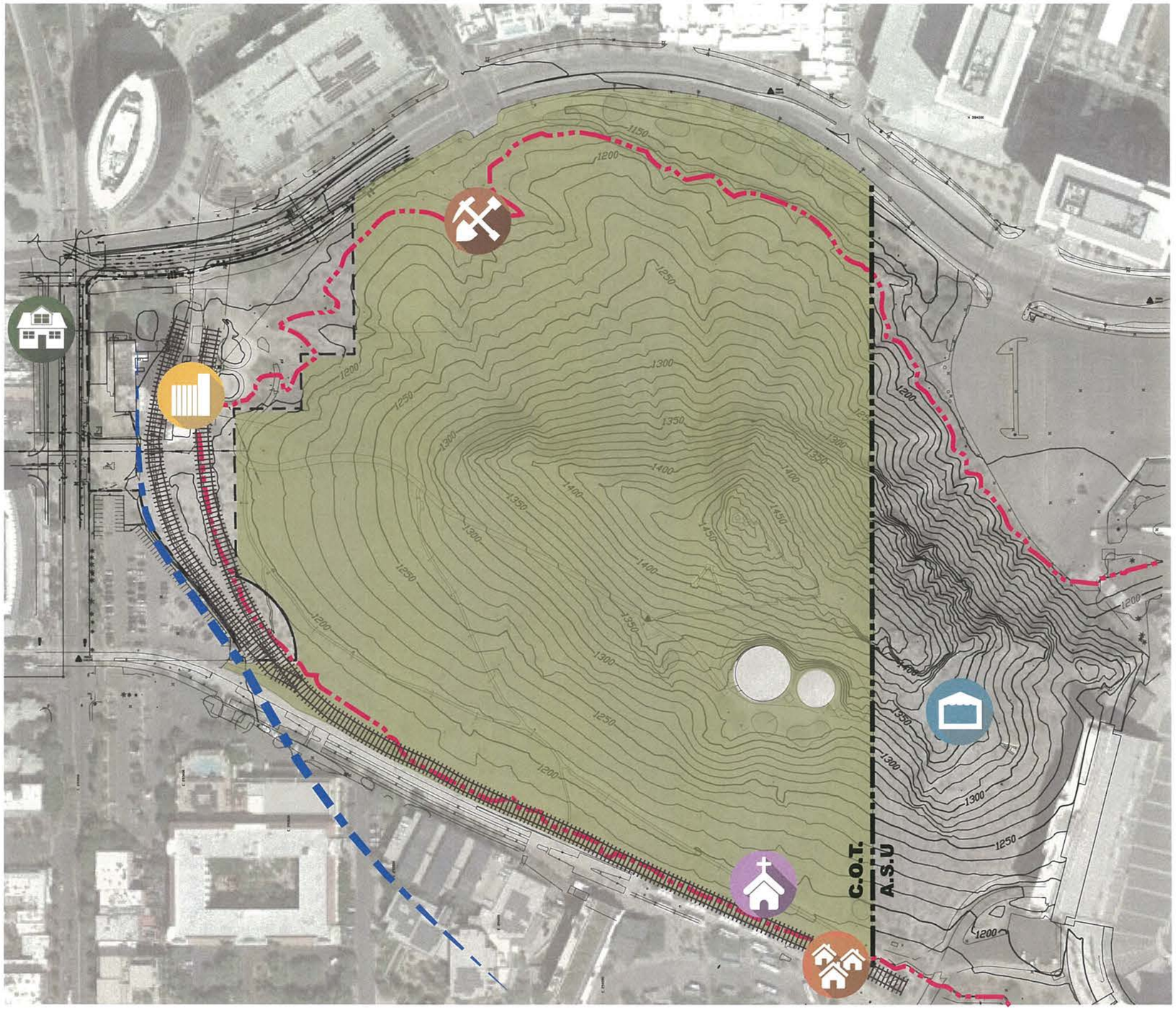
In 1920, the City bought the butte from Tempe Land and Improvement Company.[45]

Some elements from that era that are still in existence and visible from Hayden Butte today, include:

- the Charles T. Hayden Homestead / Mansion
- the Hayden Flour Mill
- the alignment and parts of the historic canal, (known by various names)
- the alignment parts of the historic railroad tracks

Remembering our history is important, and a detailed interpretive signage program should be developed and installed on the butte to tell the story of our community.

(See Exhibit 8 – Historical Elements)



SCALE: 1"= 200' - 00" 0 100' 200' 400' NORTH

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LEGEND:

- 1,180 Contour Line
- Limit of Preserve
- Historic Canal
- Historic Railroad Tracks
- Historic Carl Hayden Homestead
- Historic Hayden Flour Mill
- North End of San Pablo Barrio
- Approximate location of Our Lady of Mt. Carmel RC Church
- Historic Quarry
- Original Town Water Reservoir

HAYDEN BUTTE PRESERVE MANAGEMENT PLAN

HISTORICAL ELEMENTS

EXHIBIT 8

2.8 Contemporary Features:

Although many of the Cultural and Historic Resources described above are gone, a good number still exist as part of the Hayden Butte that we know today.

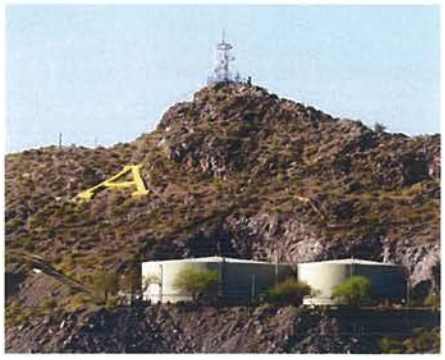
(PC 52)

Other elements and "improvements" have been added over the years to serve the various aspirations and needs of a growing community. These include:

(PC 53)

- Holiday Displays, (1933)

- Main Trail: To provide access and avail themselves of the view, it was suggested by members of the community that a "good, smooth trail" be developed to the summit. This was completed in 1935.[46]



(PC 54)

- Communications Tower and Transmitter Shed, (1949). These structures are owned by the Salt River Project utility company and house various components. The City and other private and public entities have equipment installed on the tower.

- Water Tanks (1949 & 1956).

- Arizona State University "A". The Tempe Normal School class of 1918 was responsible for installing the first letter on Tempe Butte. When the school changed its name to Tempe State Teachers College in 1925, students retained one side of the "N" to form the stem of the "T."

(PC 55)

The school changed its name to Arizona State Teachers College, and in 1938, the letter "A" was installed on the butte. In 1952, a bomb blast destroyed the letter. The present "A" stands 60 feet tall and was built of reinforced steel and concrete in 1955.[47]

- Arizona State University's Sun Devil Stadium was first constructed in 1958, in the saddle between the main/western

portion of the butte and the smaller eastern portion. Historic documents record that a good number of Native American artifacts and other cultural resources were destroyed in the process, including a series of terraced gardens. Renovation of the stadium and repair of the water tanks are currently in process in 2017.

- Trailheads, Overlooks and Rest Stops were introduced in 1994 as part of the "Leonard Monti Trail" in honor of the local businessman and owner of Monti's La Casa Vieja Restaurant, which was housed in the original Charles T. Hayden home.

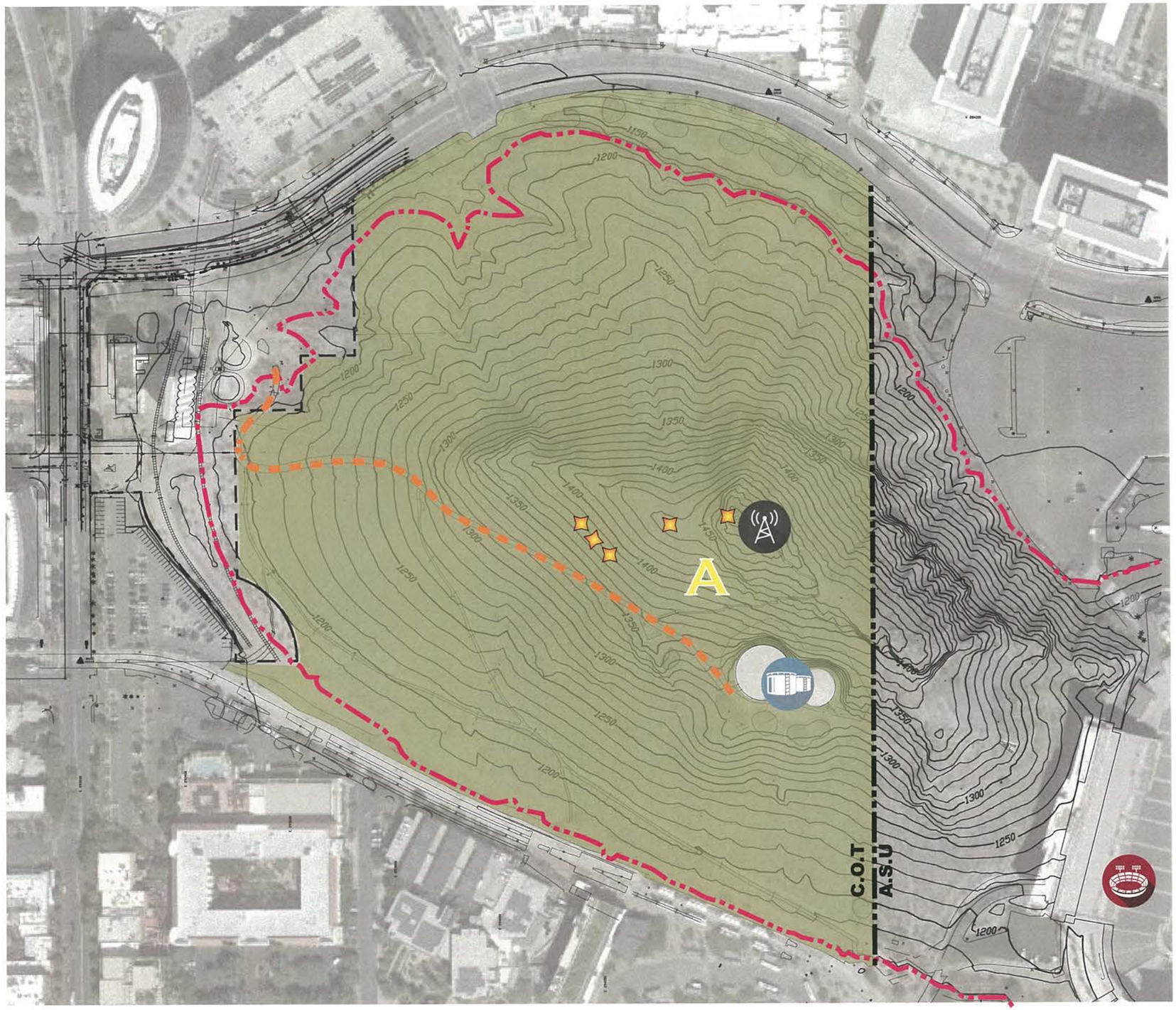
- Interpretive Signage describing the various natural and cultural resources on the butte were installed along the Leonard Monti Trail in 1995.

(See Exhibit 9 – Contemporary Features)

2.9 Land Use / Development:

The following developments are in the area immediately surrounding Hayden Butte Preserve:
- Mission Palms Hotel (1985)
- City of Tempe Police Department (1992)
- City of Tempe Transportation Center (2008)
- Valley Metro Light Rail Station (2008)
- Hayden Ferry Lakeside; mixed-use office and retail development (2001 - 2016)
- State Farm at Marina Heights; mixed-use office development (2016)
- AC Tempe by Marriott; Hotel (2016)
- Lofts at Hayden's Ferry Lakeside; mixed-use multi-family residential and retail (2016)

The following developments are proposed and are at various stages in the City's Planning and Design Process:



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LEGEND:

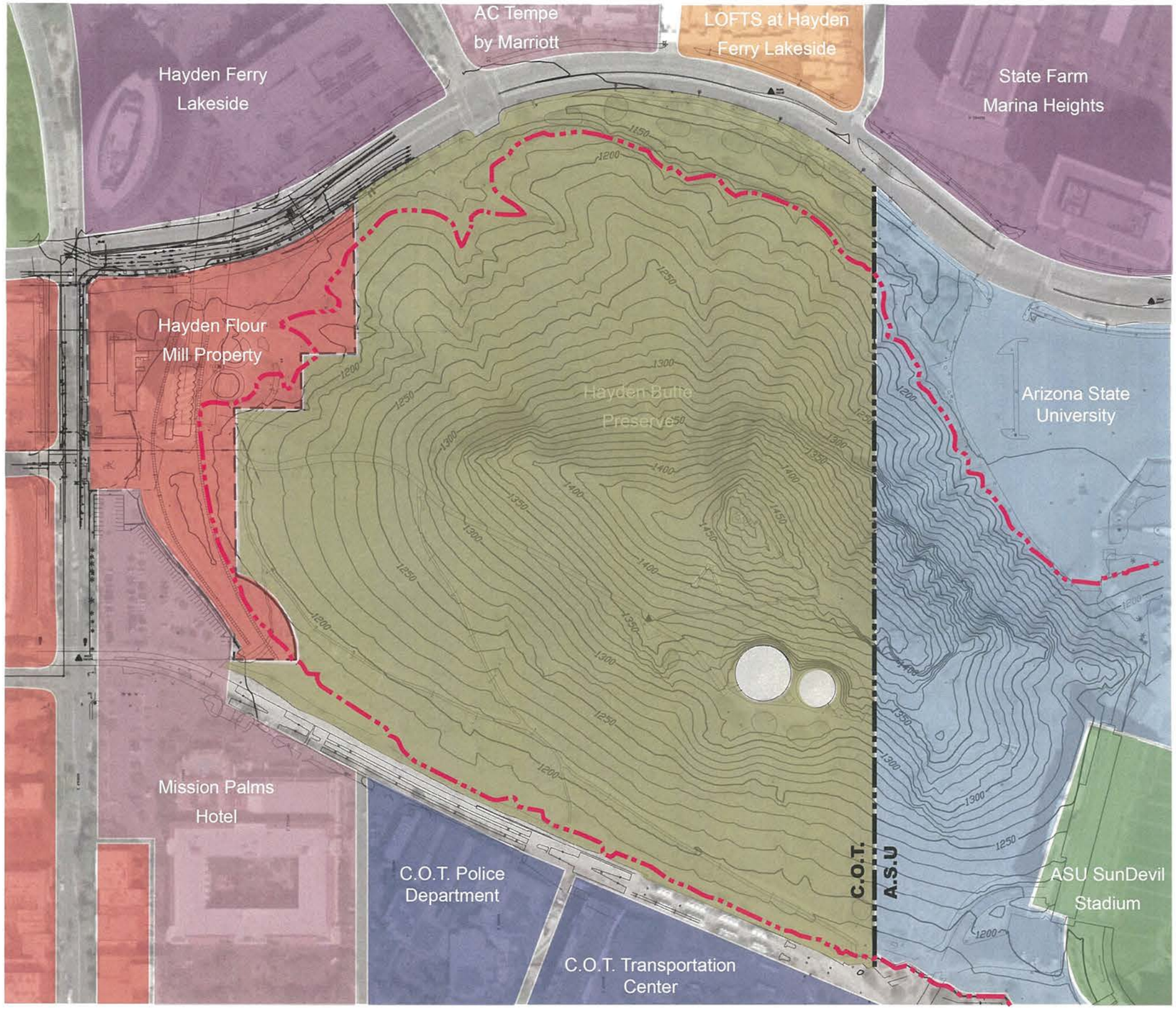
- 1,180 Contour Line
- Limit of Preserve
- Access Road / Main Trail
- Steel Communications Tower and Shed
- Steel Water Tanks
- ASU Sun Devil Stadium
- Holiday Displays
- A — ASU "A"

HAYDEN BUTTE PRESERVE MANAGEMENT PLAN

CONTEMPORARY FEATURES

SCALE: 1"= 200' - 00" 0 100' 200' 400' NORTH

EXHIBIT 9



SCALE: 1"= 200' - 00" 0 100' 200' 400' NORTH

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LEGEND:

1,180 Contour Line

RESIDENTIAL
- High Density Residential

COMMERCE
- Mixed Use - Retail
- Mixed Use - Hospitality

CIVIC / INSTITUTIONAL
- Governmental
- Institutional

OPEN SPACE / RECREATION
- Parks / Developed Open Space
- Recreation
- Preserve

EMPLOYMENT
- Business / Office Park

HAYDEN BUTTE PRESERVE MANAGEMENT PLAN

LAND USE & DEVELOPMENT

EXHIBIT 10

- One | Hundred | Mill; mixed-use hotel, office and retail development built around the old historic Hayden Mansion, the former site of the Monti's Casa Vieja Restaurant.
- Hayden Flour Mill Property; mixed-use hotel, office, residential and retail.

Additional development around Hayden Butte and in the downtown area is an obvious benefit to the economic growth of the City, but it brings both positive and negative impacts to the butte itself. The pros are; more people in the area are a sign of economic success and provide more "eyes on the butte", making it more highly visible and therefore safer for longer periods of the day. The cons are that more people in the area mean more hikers, adding pressure on the butte and increasing the "wear and tear", and requiring need for additional maintenance and security.

(See Exhibit 10 – Land Use & Development)

2.10 <u>Water Utilities</u>:

The ancient Hohokam people, who lived in the area between 1 – 1,450 C.E., built the first canal system in the Salt River valley. They did this using simple hand tools and manual labor.[48] While it started out relatively small, they eventually expanded it into one of North America's largest systems of prehistoric irrigation canals.[49]

The canals enabled these ancient people to build a thriving agricultural-based community that was home to between 50,000 and 100,000 people at its peak.[50] It is generally accepted that a severe drought in the southwest forced the Hohokam to leave the area.[51]

Some time around the 1850s to 1860s, modern Pima and Maricopa people moved up from the south, and settled into the area reestablishing the farming and canal building traditions of their ancestors.[52]

When John Russell Bartlett, Jack Swilling, Charles Hayden and others first came to the area, they noticed remnants of the ancient canal system, and used it as the beginnings of the network of canals that we use today.

In the 1870s, Hispanic settlers constructed the Kirkland-McKinney Ditch and the San Francisco canal, a ditch to power Charles Hayden's flour mill.[53]

In 1902, construction and operation of a 250,000 gallon water storage vessel on Hayden Butte, at approximate elevation of 1,365 feet, was utilized to receive water from a well and pipeline located on the valley floor. Concrete walls 4-feet thick utilized sand and angular basalt rock to fashion the 40-ft x 60-ft vessel footprint. Side walls were 14-ft tall covered by a wood roof. The cast iron pipe approximately 8-inches diameter was southerly oriented downstream from the vessel.[54]

In 1948 the wooden roof burned off the 46 year old water structure, and in 1949 it was replaced with a 1,000,000 gallon welded steel reservoir placed on a gravel foundation. This reservoir is located west of the old concrete/wood reservoir. It required significant hillside excavation to create a level foundation pad. The reservoir is placed on approximately 67% excavated butte and 33% fill formed from the excavated material. This is currently identified as Hayden Butte East Reservoir.[55]

In 1956, additional water demand led to construction of another welded steel reservoir adjacent to Hayden Butte East Reservoir. This has 2,000,000 gallon capacity and is currently identified as Hayden Butte West Reservoir. The reservoir shares the adjacent reservoir's pad, but is placed entirely on the butte's excavation, without fill.[56] These two steel tanks continue to service the City's water needs to this day.

(See Exhibit 11 – Water Utilities)

Dibble Engineering

WATER UTILITIES

HAYDEN BUTTE PRESERVE MANAGEMENT PLAN

February 2016

EXHIBIT 11

Plotted on February 11, 2016

2.11 Electrical Utilities:

The first electrical components installed on Hayden Butte were electric power for the mill, which replaced water power in 1924.[57] An electric light was installed on summit of the butte in 1917. It was put there "to serve as a beacon to acknowledge the progressive nature of Tempe."[58]

APS Power Distribution Into & Across The Base Of The Butte:

In the summer of 2016, the City of Tempe and APS completed a project undergrounding several existing power poles on the southwest side of the butte.

Utility Distribution Serving The Butte Equipment:

The underground electrical distribution feeding the Butte, (namely the Water Tanks, the Tower and Summit equipment), is routed underground from the base of the Butte, up to just below the summit.

The distribution was cut into the Butte and covered fairly well with concrete mixed heavily with native stones – it is very difficult in most places to find it.

The lowest location of the underground distribution is west of the water tank facility, a few feet west of the chain link fence, just above the path to the tanks. There are two semi-flush concrete grade boxes with concrete lids adjacent each other (one for power and one for telecom/data) above the path and parallel to the fence.

The middle location is just below the summit path, in the vicinity where the walking path turns into a stair east of the "A". There are two similar adjacent semi-flush concrete grade boxes with concrete lids at this location.

The underground routing between the low and middle grade box locations can be imagined as some signs of the trench cover are noticeable if you are looking for them – the trench basically follows the tank farm fence line, then starts to break away from the fence near the path.

The underground routing from the middle grade boxes up to the summit equipment could not be located, although some trench cover was visible.

Just below and southwest of the summit, is a final single grade box adjacent to an expanded metal cage containing disconnect switches and a transformer.

Issues:

1. The Butte equipment originates at the base of the butte, adjacent to the Police Station.

2. The concrete grade boxes and covers are deteriorating.

3. The exact composition and condition of the underground distribution is unknown.

Water Tanks:

The water tanks are surrounded by a chain link fence.
The electrical distribution inside the facility is mostly exposed, though there are also walled enclosures housing more equipment.

It is presumed the electrical distribution to the tanks is derived from the underground distribution continuing to the summit (this is not positively known).

Issues:

1. The chain link fence surrounding the tanks does not provide any concealment of the myriad of electrical components and

raceways on the inside face of the fence, and further inside.

2. The visual appearance of the tanks is incongruous with the native desert of the preserve.

Tower And Summit Equipment:

(PC 56)

The summit equipment consists of the tower, supporting equipment inside the fenced yard, and limited equipment outside the fence, including a ground-mounted cage with disconnect switches and transformer, and (3) electrical enclosures mounted to the fence.

Over the years, several private and governmental agencies have added equipment to the tower.

This equipment includes; multiple antennae, and communications platforms, as well as weather equipment within the enclosure.

There is a large grouping of painted PVC conduits emerging from the ground under the fence – the purpose in unknown.

Issue:

1. The large group of PVC conduits emerging from the ground under the fence up to the tower are not properly installed, supported, or protected.

Relocating the antennae to alternate locations will be challenging and costly, but this is the preferred method of addressing the visual blight of the tower.

Temporary Power To The Holiday Displays:

The existing holiday displays are fed electrically from (2) overhead cord sets, on steel cable supports with galvanized poles and down guys.

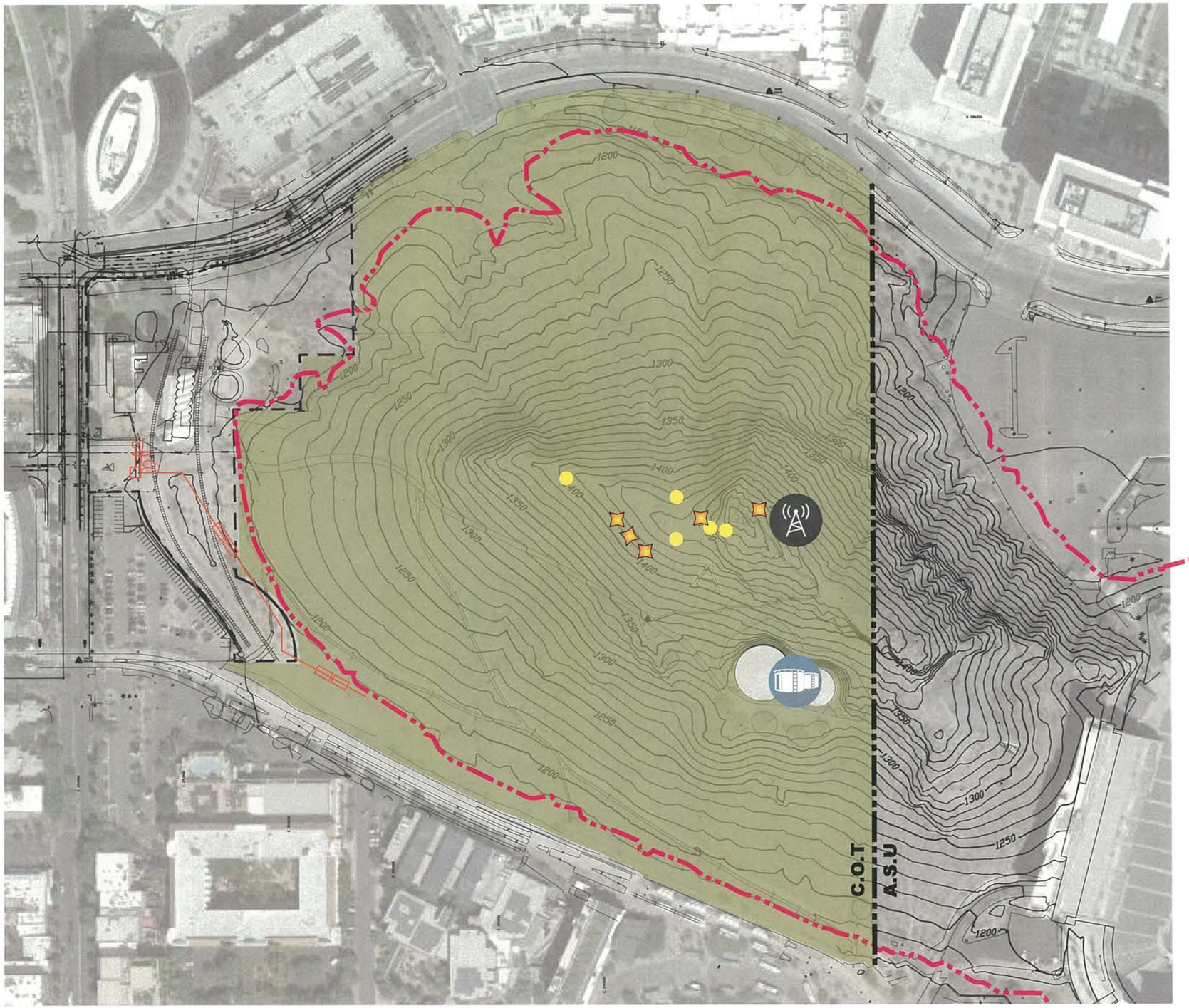
Each display has a tall wood pole with cable connections, and disconnect switch for the connection to the display lighting.

Issues:

1. The wood poles and overhead cord distribution are unsightly and out of character with the preserve. They remain in place throughout the year, even though the displays do not.

2. It is likely the cord sets are deteriorating due to the constant sunlight exposure.

(See Exhibit 12 – Electrical Utilities)



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LEGEND:

- 1,180 Contour Line
- Limit of Preserve
- Power Poles
- Pull Boxes
- Duct Bank
- Switching Cabinet
- Manhole
- Single Phase Transformer
- Water Tanks
- Communications Tower and Shed
- Holiday Displays

HAYDEN BUTTE PRESERVE MANAGEMENT PLAN

ELECTRICAL COMPONENTS

SCALE: 1"= 200' - 00" 0 100' 200' 400' NORTH

EXHIBIT 12

3.0 RECOMMENDED IMPROVEMENTS:

3.1 Recommended Improvements:

The main objective of this report is to formulate recommendations for general clean up and repair, improved functionality, improved aesthetics, the long term preservation and protection of the natural and cultural resources and the long-term management of all resources within the preserve.

Preliminary Geotechnical Engineering Considerations:

Based on the results of our preliminary engineering services for this project and pending the results of a detailed design level geological/geotechnical evaluation, the primary geotechnical issues that need to be considered on the butte include:

- Mitigation of potential rock-fall hazards associated with overhanging bedrock and loose colluvial deposits; and,
- Increasing the stability of the existing made-made fill spoils located south of the tanks on the butte.

Based on visual observations and the results of the preliminary slope stability analyses, consideration should be given to flattening the existing excavation spoils slope and remediating loose boulders capable of tumbling downhill. The existing excavation spoils slope currently exists at a slope inclination of approximately 1.5:1 (horizontal:vertical), and a flatter slope of 2:1 should be considered to decrease the potential for future slope failure. During flattening of the slope, any loose surface boulders should be relocated, buried, crushed or remediated by other methods to reduce the potential for downhill movement. To mitigate the potential for rock-fall associated with overhanging bedrock, these areas should be scaled and flattened in the final design.

The excavation spoils material generally consists of fine gravel to boulder sized rock fragments created from excavation of the bedrock at the existing tank locations. These materials have a high void ratio and permeability and would likely require some amount of amendment with finer grained soils to create an environment capable of sustaining plant growth.

Design Level Geological/Geotechnical Engineering Services

The recommendations outlined in this report are based on a limited scope of services and should be considered preliminary in nature and are not completely suitable for final design of the project. In order to confirm and/or modify the preliminary engineering recommendations, a complete geotechnical evaluation should be completed as part of the final design of the project.

Based on the geotechnical/geologic conditions identified during this evaluation, it is recommended that a final geotechnical engineering evaluation consist of the following key elements:

- Obtaining subsurface data at the location of the proposed slope improvements to collect samples of the tank excavation spoils and the underlying material;

- Conducting appropriate laboratory testing to determine the shear strength properties of the soil that comprise and underlie the tank excavation spoils slope;

- Performing detailed slope stability analyses and determining geotechnical engineering recommendations to address the stability of the planned slope improvements;

- Performing rock-fall analyses to identify the potential for future rock-fall and potential mitigation measures;

- Preparing a final geotechnical engineering report to be used in the design and construction of proposed improvements.

This report provides recommendations for future improvements. Design phase engineering services should be undertaken to address the primary geological/geotechnical issues identified at the site and for other project related design requirements. The analysis and recommendations presented in this report are based upon the data obtained from the site reconnaissance and from other information discussed in this report. This report does not necessarily reflect variations that may occur across the site or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction.

Eradicate Exotic Vegetation:

Begin a program to eradicate and remove all invasive, non-native Buffelgrass and Fountain Grass in accordance with Section 5.2 – Recommended Management Practices.

Erosion Control:

Repair all erosion where it occurs in areas of bush-wacked trails, drainage channels and culverts, tailings, etc., in accordance with Section 5.2 – Recommended Management Practices.

Graffiti Removal:

Remove all graffiti where it occurs on both natural and man-made surfaces in a manner that will cause the least amount of damage to the existing surface.

*__NOTE__:
ANY GRAFFITI REMOVAL FROM SURFACES CONTAINING PETROGLYPHS SHOULD BE DONE UNDER THE SUPERVISION OF CITY PRE-APPROVED AND/OR PRE-QUALIFIED ARCHAEOLOGICAL CONSERVATOR, OR SIMILARLY TRAINED INDIVIDUAL ACCEPTABLE TO THE CITY OF TEMPE.

Rock Staining:

Stain stone veneer on Trailheads and Overlooks to blend with the color of the adjacent indigenous stone using Eonite®. Permeon®, Natina® or other similar, pre-approved non-toxic staining product - in accordance with the manufacturer's printed instructions.

Improve Access Control:

Define, or reestablish, points of entry to the Hayden Butte Preserve.

Consider adding a new Trailhead on the north side of the butte, at the extreme northwest corner of the ASU Stadium Parking Lot and Rio Salado Parkway. This Trailhead would be a gateway to a new trail that would serve visitors who will be coming to the butte from the new commercial and residential development along the Tempe Town Lake, following the alignment described below.

Improve Accessibility and ADA Compliance:

Any physical improvements to the Hayden Butte Preserve facilities should be done in a manner that assures full compliance with the standards set forth in the most recent edition of the ADA Standards for Accessible Design as published by the U.S. Department of Justice, to the greatest extent possible. These improvements may include, but not be limited to: access from adjacent properties and public transportation facilities, parking

facilities, signage, trailheads and trails, (where the natural topography permits), trail surfaces, rest areas and overlooks.

Remove Existing ASU/City Boundary Fence:

Continue discussions with ASU to remove the existing chain link fence that currently runs up the south side of the butte in the College Avenue alignment.

Removing the fence would eliminate a visual blight from the landscape on the south side of the mountain, and may encourage the expansion of the Preserve status to the adjacent ASU property, while maintaining critical access control to the ASU Stadium.

Concurrently, any existing steel fences, gates, handrails, etc. should be; A) replaced with redesigned, weathered steel elements, B) sand-blasted and allowed to rust to a desert-compatible patina, or C) stained to a similar color using one of the products listed above.

Upgrade Existing Signage:

Develop a cohesive Signage and Wayfinding package for the Hayden Butte Preserve. All signs should be designed to be compatible with the character of a desert nature preserve - "related, but different", fabricated from low-profile integrally-colored and/or textured concrete, stone, or weathered steel with compatible and highly-durable graphics and lettering. Consideration should be given to individuals of varying abilities, incorporating Braille and / or properly chosen and scaled fonts to accommodate a wider audience. Specific elements should include:

- I.D./Monument Signage at each of the 4 or 5 trailheads
- Directional/Wayfinding Signs at each of the trailheads and

at key points along the trails

- Interpretive Signs along the trails from the base to the summit – to "tell the story" and educate visitors about the various environmental, cultural and historical resources on and around the butte

- Limited Regulatory Signs – listing the hours when the Preserve is open, advising people to remain on the trails and not deface or remove anything, prohibiting overnight camping. These Regulatory Signs will give notice to visitors and assist the Police with enforcement.

Trail Improvements:

Redefine the existing trail system by eradicating and revegetating all bush-wacked trails, improving degraded and eroded surfaces and introducing proper signage.

Consider replacing the existing asphalt access road trail with an integrally-colored and medium to coarsely-textured concrete trail ("rodded" concrete - similar to heavy broom/raked finish on boat ramps), to be more compatible with the natural desert colors and textures on the mountain.

Repair the severely eroded steps between the Water Tanks and the summit. Consider replacing wooden steps with more durable integrally-colored and/or textured concrete or stone steps.

Construction of a new pedestrian connection linking the State Farm / Marina Heights Development with the area along E. Fifth Street and Veterans Way is under discussion between ASU, the City of Tempe, State Farm and other stakeholders.

Consider introducing a new trail to serve the north side of the butte. This trail would begin at the Trailhead on the Rio Salado, described above, and would wrap its way around the north side of the butte, between the 1,150' and 1,160' contour lines, leading to a point-of-connection with the existing Access Road/Trailhead, on the northeast corner of the Flour Mill property*.

The trailhead at the southwest corner of the Preserve, accessed from the parking area, will be eliminated when a new trailhead is constructed as part of the proposed Hayden Flour Mill Development.

Revegetation:

The overall intent of any landscape or revegetation efforts shall be to reestablish and maintain the natural vegetative communities on the butte while maintaining public safety.

Replant all areas damaged by erosion, bush-wacked trails and tailings with cacti, shrubs and grasses that are native to the Preserve. Plant the same type, size, density and patterns of plants as seen in adjacent, undisturbed areas.

Even native desert plants need some form of irrigation to help them survive until their root systems become established. Barring the use of traditional above or below ground drip irrigation system, which would be visually intrusive, or necessitate extensive and unwanted trenching, there are several products on the market that could provide the temporary water to revegetation plants. Products such as Dri-Water®, (a natural, cellulose-based product), or other polymers absorb water and slowly release it into the root zone of the plant over the course of 30 to 90 days. They are commonly used on reclamation and revegetation projects in remote areas where an automatic irrigation system is not an option.

Water Tanks:

Periodically repair, prime and paint the exterior of the two steel Water Tanks with a color that is more compatible with the adjacent undisturbed natural stone on the mountain.

The chain link fence around the water tanks does not provide any concealment of electrical components and raceways on the inside face of the fence, and further inside.

The Water Tanks and associated equipment and facilities are unsightly and detract from the character of the preserve. Proper mitigation measures should be implemented to help them blend better with their surroundings.

Communications Tower and Equipment Shed:

Of all the man-made elements on the butte, one of the more detracting is the Communications Tower and it's associated Equipment Shed. Representatives of the Salt River Pima – Maricopa Indian Community have stated that relocating these two elements is their highest priority.

A less transparent fence could be installed to limit the view of all the electrical equipment, or the equipment (and walls, enclosures, etc.) could be painted to better match the Butte.

City Staff and Salt River Project are currently reviewing options for removing and relocating the tower and equipment.

Holiday Displays:

The Holiday Displays were first installed on the butte in 1933.

Over the years, they have been the subject of various challenges and threatened lawsuits filed by the American Civil Liberties

Union, based on the potential violation of the Constitutional Principal of the Separation of Church and State, (Religious symbols in a Government-owned Park / Preserve).

In 1985, a group called the Friends of Tempe Butte took over the responsibility of annually erecting, maintaining and removing the displays and the City agreed to allow other private sector groups to erect their own displays. To date there have been no further challenges to the practice but the question remains as to whether or not a public Preserve is an appropriate place for such displays.

Perhaps a moratorium on adding displays could be established now, as well as a specific date, (ten years from now for example), that all displays must be permanently removed.

Remove the overhead cord sets, steel cable supports, and cable down guys. Cut the existing wood poles down to approximately 24" AFG so there is a fixed item to secure cabling and disconnects to the poles are already anchored in the ground. Change the overhead system to a true temporary system of a single wet location, sunlight resistant cord set that would be routed on the ground (SOOW cord), protected where needed, and removed after the displays are taken down.

Power Supply:

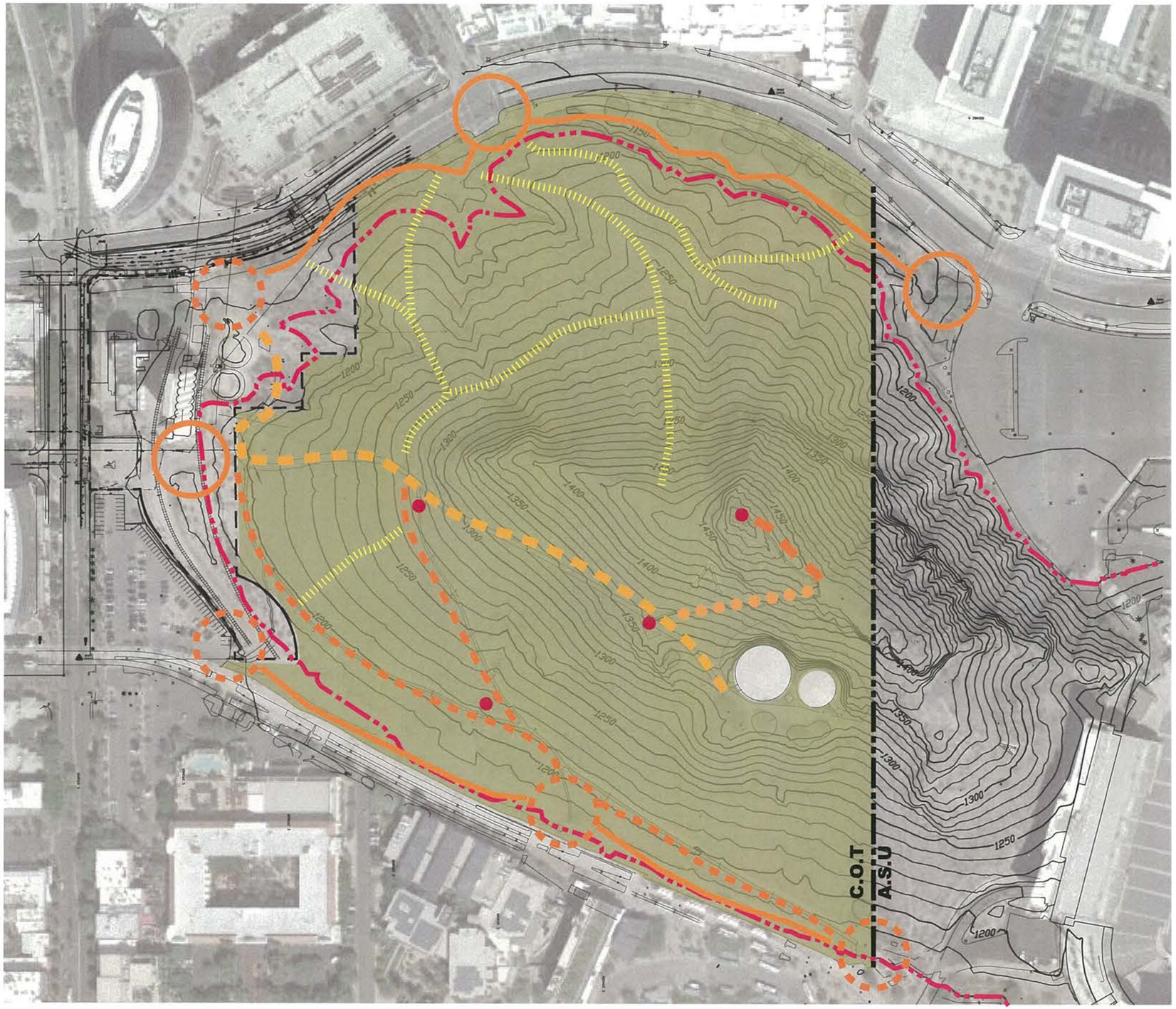
The flush in-grade boxes and covers for accessing power should be replaced at some point. This is not an immediate issue, but should be scheduled for in the next few years so that further deterioration does not cause a safety hazard. We would suggest the existing system be thoroughly inspected to verify there are no safety hazards that require repair.

The "A":

The "A" has become an icon and point-of-pride not only for those

associated with Arizona State University, but also for members of the greater community at large. As mentioned earlier, it has been in place since 1955. It serves as an anchor to the University, a backdrop to all University sporting events and a symbol of Tempe itself.

(See Exhibit 13 – Trailheads and Trails)



the MOORE/SWICK partnership
landscape architects and planners

LEGEND:

- 1,180 Contour Line
- Limit of Preserve

EXISTING

- Trailhead
- Trail
- Overlook
- Trail with Severe Erosion (To be Repaired)
- "Bush-Wacked" Trails (To be Revegetated)

PROPOSED

- Trailhead
- Trail

HAYDEN BUTTE PRESERVE MANAGEMENT PLAN

TRAILHEADS & TRAILS

SCALE: 1"= 200' - 00" 0 100' 200' 400' NORTH

EXHIBIT 13

4.0 PROJECT IMPLEMENTATION GUIDELINES:

***NOTE:**

GIVEN THE ARCHAEOLOGICAL AND ENVIRONMENTAL SENSITIVITY OF THE HAYDEN BUTTE SITE, IT IS HIGHLY RECOMMENDED THAT ANY PERSON DOING INVESTIGATIVE, SURVEY, PLANNING, DESIGN, CONSTRUCTION OR MAINTENANCE AND MANAGEMENT WORK ON THE BUTTE, (INCLUDING THOSE ASSOCIATED WITH ASU OR OTHER COMMUNITY VOLUNTEER GROUPS), SHOULD:

1. Complete the Cultural Sensitivity Training Course as taught by the Salt River Pima – Maricopa Indian Community, (Contact: Shane Anton, Salt River Pima – Maricopa Indian Community Cultural Program Manager: 480.362.6331).

2. Obtain and review the Sensitive Sites Protocol as provided by the Arizona State Historic Preservation Office, (SHPO), (http://azstateparks.com/SHPO/etiquette.html)

When this training is not feasible due to timing or other issues, and physical presence on the butte is required, a Compliance Observer or appropriately trained City staff member should be present.

Any improvements on Hayden Butte Preserve should be held to a more stringent set of planning, design and construction standards. The review and approval process for such projects, while adhering to the City's current DPR and Construction Permit review process, should supplement this process - being more detailed and focused on issues related to the Preserve - given the extreme sensitivity of the site. The City's Parks Department has ultimate authority over the Preserve, and will provide this oversight and approval.

The following can serve as a checklist to guide City Staff, Developers, Consultant Planning and Design Teams, Contractors, and others who are undertaking projects on or around the butte:

Overall Intent:
To preserve and protect the natural desert environment on the butte in as natural a state as possible, and where limited development or improvements are desired, do so in a manner that respects and preserves the natural environment and desert character of the butte, as well as the cultural and historic resources on the butte. Create the least amount of disturbance and damage possible, and where this is unavoidable or where it occurs, restore the area to its pre-construction condition to the greatest extent possible.

4.1 Data Gathering:

Intent:
To assure that any individual, group or team proposing new development or improvements on or adjacent to the butte is aware of the many different elements and highly-sensitive areas that exist on the butte that require special protection and preservation.

Information to acquire shall include:

- Aerial Photographs
- Boundary / Topographical Data
- Archaeologically Sensitive Site Locations
- Land Ownership / Land Use Information
- Previously Prepared Plans, Reports and Studies
- Utility Corridors and Easements

This information shall be compiled and used to establish an accurate base map and Site Plan for the project.

4.2 Site Inventory and Analysis:

Intent:

To thoroughly document the existing, pre-design, pre-construction conditions on the specific site of the proposed development or improvements, so that informed and intelligent decisions can be made for improvements that will be the most compatible with and will cause the least amount of damage or disturbance to the natural environment and cultural resources on the butte.

Additional, site-specific information that should be obtained includes:

- Current Archaeological Survey
- Geology/Soils Data
- Detailed Topological Survey
- Detailed Drainage Patterns
- Native Vegetation Inventory, (species, densities, patterns)
- Wildlife Habitat Survey
- Detailed Photographic Survey of the Proposed Project Area
- Views to and from the Site

The results of this phase shall be assembled and included in the Concept Summary Report, described below, and shall include narrative text and illustrative graphics and photographs to accurately describe the existing conditions on the site.

4.3 Planning and Design:

Intent:

To plan and design developments or improvements that will protect, preserve and compliment the character of the existing desert environment by considering features including, but not limited to, landforms, drainage patterns, significant specimens and/or stands of vegetation, animal habitat, cultural and/or historic resources, contemporary features, utilities and views, and by

employing proper layout, forms, colors, materials and textures, with a low-impact approach, to meet program requirements as well as City, community and other Stakeholder concerns.

Conceptual / Schematic Design:

Prepare graphic exhibit(s) sufficient to illustrate the general concept of the proposed development or improvements and demonstrating the general approach to grading, identifying parking areas, pedestrian/vehicular access points, trailheads and trails, signage, pedestrian amenities, lighting, landscape/revegetation, irrigation techniques, etc..

Submit Concept Summary Report with illustrative graphics, narrative descriptions and proposed materials palette – for City, and other Stakeholder approval prior to proceeding to the Design Development phase.

Design Development:

Prepare a Design Development package demonstrating further and more detailed design thinking and responding to City and Stakeholder review comments on the Conceptual/Schematic Design Package.

Any existing significant rock outcropping, tree, cactus or archaeological/cultural feature shall be identified, located and protected in place.

Proposed grade modifications should be kept to a minimum, and compliment the natural forms of the adjacent topography. Unnatural, "engineered" slopes shall be avoided. Incorporating low retaining walls of 3' or less, of the proper material and terraced if necessary, is preferred to having large exposed cut or fill slopes. Acceptable wall materials include; native or complimentary natural stone, weathered steel gabion baskets, or integrally-colored and textured concrete. Drainage areas with existing erosion, or the potential to erode shall be treated in a manner that looks natural –

using natural stone and vegetation. Unnatural, "engineered" solutions, such as concrete, Gunnite® or large areas of non-native rip-rap shall be avoided.

Where possible, grading for improvements shall comply with the most recent edition of ADA Standards for Accessible Design as published by the U.S. Department of Justice.

Other materials or equipment proposed for the project, such as benches, bike racks, drinking fountains, signage, trash receptacles, etc. shall be chosen for their compatibility with the natural desert character.

Any proposed landscape improvements shall match the species, pattern and density of adjacent undisturbed areas, and shall be established with the long-term goal of being able to survive without the need for a permanent irrigation system.

Submit the Design Development package to the City – for review by various departments and distribution to other Stakeholders, and acceptance by Parks Department staff, prior to proceeding to Construction Document phase.

Construction Documents:

Prepare detailed plans and specifications describing the proposed work and site restoration to be done.

In addition to the actual work, include delineations of the locations for all Contractor off-site parking, staging, storage, and clean-out areas as well as a clearly defined Limit of Construction – to be enclosed by lockable fencing for the duration of the construction process.

A Performance Bond shall be required to insure that funding will be available to repair any damage that occurs to the site during construction will be restored to pre-construction condition.

Submit Construction Document Package to the City for review, approval and permitting prior to proceeding to the Advertisement and Bidding phase.

4.4 Construction:

Intent:
To implement the project while minimizing the impact of any construction on areas designated to remain undisturbed, and to blur the edges and smooth the transition between any new construction and adjacent undisturbed areas.

Conduct a Pre-Construction Meeting with representatives of the City, the Design Team, the Contractor and other interested Stakeholders, to describe goals and objectives of the project, (including the requirements of the SRP-MIC and SHPO Guidelines), and secure agreement, in writing, from all participating individuals.

Indentify all Contractor parking areas, access points, lay-down/staging, delivery and storage areas.

Establish, and stake, a Construction / Development Envelope and obtain City approval of the location prior to installing lockable Construction Limit Fencing, as identified and shown on the Construction Documents.

Identify and maintain all access points and trails, or alternative routs to trails, throughout the duration of the construction process. Inform citizens and users of any temporary path closures or lack of access.

Protect existing drainage from sedimentation and pollution throughout the duration of the construction process. Document approach with a Stormwater Pollution Protection Plan.

Prepare a Vegetation Protection and/or Salvage Plan, identifying the location of an off-site nursery and maintenance program.

Identify Concrete Clean-Up / Wash-Out Areas, or specify and provide portable / removable wash-out basins.

Recycle all unused materials, packaging and construction waste when possible.

Obtain written Approval from the City on all of the above, prior to proceeding with construction.

Prior to the start of construction, salvage all native ground-toppings, including stone, topsoil, vegetation, (where practical), and natural surface debris within the limits of construction, and stockpile for later reuse.

Maintain a clean and orderly site throughout the construction process.

Conduct ongoing monitoring with written and photographic documentation during construction.

Upon substantial completion of construction, restore the site to blend with that of adjacent/undisturbed areas using the materials previously stockpiled.

Request final inspections and secure City and other Stakeholder approval prior to Final Acceptance, Project Close-Out and final payment.

5.0 MANAGEMENT PRACTICES:

5.1 Current Management Practices:

Although the major activities taking place on Hayden Butte are exercising, hiking and sight seeing, throughout the year there are several activities and events that are organized either by the City of Tempe, Arizona State University or local community groups. These include:

- "A" Mountain Tours; put on by ASU at various times throughout the year
- ASU Class Fieldwork; conducted by various classes at ASU throughout the year
- Painting of the "A"; conducted by ASU
- "A" Mountain Clean Up and Restoration; put on by the ASU Global Institute of Sustainability, in association with Earth Day, in April
- "A" Mountain Lantern Walk and Lighting of the "A"; put on by the ASU Alumni Association, (since 1917), the Friday before Homecoming Week in mid-October
- Guarding the "A"; put on by ASU during the week prior to the annual ASU/U of A football game in late November
- Erection of the Holiday Displays; installed by the Friends of Tempe Butte, in early December
- Launching Firework Displays; put on by both the City and ASU at different times throughout the year.

While many of these activities and events are long-standing community traditions, the fact that the butte is officially designated a Preserve that is listed both on the City of Tempe's Historic Property Register, as well as the National Register of Historic Places mandates a higher level of oversight and stewardship of this important resource.

Parks Department staff is responsible for maintaining everything along the hiking paths on the butte, from the trailheads to the top of the mountain. This includes:

- Emptying trash receptacles every Monday and Friday
- Maintaining trail edges and surfaces
- Reestablishing the grades at the railroad tie steps along the trail
- Replenishing decomposed granite
- Landscape Maintenance, including pruning the Mesquite trees at the Water Tanks once a year
- Coordinating any volunteer projects associated with the butte

Currently, the maintenance on the north side of the butte is focused on clearing debris from homeless encampment sites. Located in the gorge areas extending from north to the west. These cleanups are a coordinated effort involving the Parks Department, the Police Department and Social Services.

The Bike Officer Team is responsible for patrolling and maintaining order in the downtown area – which includes Hayden Butte Preserve. The recent addition of a position dedicated to Parks in the Central City addresses the unique challenges of the parks in the downtown area.

In general, conditions on the butte are fine during the daytime – when most if any calls would be to respond to assist a hiker in a dangerous situation. The situation at night, however, is a different story.

It is during the evenings and late night, after the City's 10:00 PM curfew, when the butte is visited by individuals from the A.S.U. student body, from the Mill Avenue crowd, and eventually in the later hours, homeless individuals, who return to spend the night in their mountain encampments. Responding to calls during these times can be more dangerous for the officers due to the difficulty of walking on a dark mountain loaded down with a full compliment

of equipment that the Officers carry, as well as the "disposition" of the individuals involved.

The Preserve could be safer with the following improvements:

- Better gates and / or fencing at approved point of entry
- Improved signage, defining the times when the park is open, requesting that people remain on designated trails and prohibiting overnight / urban camping.

5.2 Recommended Maintenance and Management Practices:

The City should identify which kind of activities and events are permitted in the Preserve, which kind are prohibited and then define the formal guidelines and regulations that various individuals, groups or organizations need to follow to apply for permission to conduct the specific activities in which they are interested.

To assure that no further damage or degradation of the environmental or cultural resources of the butte occurs, anyone responsible for overseeing, conducting or participating in Maintenance and Management operations on the butte, shall be held to the same basic requirements as those mentioned in Section 3.0 Recommended Improvements, namely :

1. Complete the Cultural Sensitivity Training Course as taught by the Salt River Pima – Maricopa Indian Community, (Contact: Shane Anton, Salt River Pima – Maricopa Indian Community Cultural Program Manager: 480.362.6331).

2. Obtain and review the Sensitive Sites Protocol as provided by the Arizona State Historic Preservation Office, (SHPO), (http://azstateparks.com/SHPO/etiquette.html)

Specific tasks that should take place on a regular basis as a part of any long-term Maintenance and Management Program include:

Maintain Access Control:

Check to see that all gates and fencing are in place, secure and functioning properly, on a weekly basis. Maintain locks, (and keep track of keys).

Erosion Monitoring:

Periodically check to see that all bush-wacked trails, drainage channels and cut / fill slopes are stable. Repair as required by replacing all eroded soil back into the eroded channel or gully, properly compacting it in place and securing with native stone, branches and twigs from the adjacent landscape.

Clean out downhill side of all culverts, as required.

Graffiti Removal:

Remove any graffiti as soon as possible after it first appears.

NOTE:
ANY GRAFFITI REMOVAL FROM SURFACES CONTAINING PETROGLYPHS SHOULD BE DONE UNDER THE SUPERVISION OF CITY PRE-APPROVED AND / OR PRE-QUALIFIED ARCHAEOLOGICAL CONSERVATOR OR SIMILARLY TRAINED INDIVIDUAL ACCEPTABLE TO THE CITY OF TEMPE.

Stain any rocks, stone overlooks, fences, gates, handrails, etc. that have become damaged, scratched or scarred using Eonite®. Permeon® or Natina® in accordance with the manufacturer's printed instructions.

Petroglyph Monitoring:

A formal program, developed under the direction and supervision of an Archaeologist, historical expert or other qualified individual, should be established and implemented, to monitor the condition of this priceless, historically significant and irreplaceable resource.

Signage Monitoring:

Periodically review the condition of the existing and new signage. Clean and repair as necessary, and if damage is too extensive and irreparable, replace the sign in a timely manner.

Trail Monitoring:

On a weekly basis or more, walk the trails from the various trailheads around the base to the summit to observe their condition and document, using field notes and photography, any areas where there is noticeable degradation and / or failure. Areas to observe include the trailheads, concrete steps, access road and wooden steps north of the Water Tanks to the summit. Report and repair any damage in a timely manner. Maintain ADA access wherever applicable.

Debris / Litter / Pet Waste / Trash Removal:

Continue to walk the trails from the various trailheads around the base to the summit, emptying any trash receptacles as necessary and replacing the plastic liner bags with new bags, and picking up any random debris litter, pet waste or other trash observed.

Vegetation Monitoring:

Regularly observe the condition of the vegetation in natural, undisturbed areas, as well as areas that have been revegetated to determine if the plants are thriving and providing sufficient cover to

mimic the natural conditions and prevent erosion. If an unnatural bare spot is noticed, install plants of the type, size, density and pattern to match adjacent undisturbed areas.

Eradicate any Buffelgrass or Fountain Grass plants whenever they are encountered. Removing seed heads will slow the spread of these grasses. Since they seed several times a year, vigilance is required. The only way to prevent future seed production and to reduce the threat of wildfire is to remove all the plants, pulling them up by hand or digging them out with a crowbar or pick and shovel. Disposing of the entire plant after removal will eliminate seeds caught in the leaves at the base of the plant, which can spread after the plant is uprooted.

After removing, backfill and re-grade the area to blend with adjacent grade and consider planting native species in the area. Check the area periodically for seedlings, and pull while they are still young.[59]

***NOTES:**

UNDER NO CIRCUMSTANCES SHALL ANY PLANT THAT IS NOT NATIVE TO THE HAYDEN BUTTE BE INTRODUCED WITHIN THE PRESERVE.

ALL CITY OF TEMPE PARKS / LANDSCAPE MAINTENANCE PERSONNEL RESPONSIBLE FOR MAINTENANCE TASKS ON THE BUTTE, SHOULD BE TRAINED IN DESERT HORTICULTURE AND THE PROPER PLANTING, CARE AND PRUNING OF NATIVE SONORAN DESERT VEGETATION.

UNDER NO CIRCUMSTANCES SHALL PRE-EMERGENT HERBICIDES BE USED TO ERADICATE INVASIVE WEEDS AS THIS WILL IMPEDE THE GERMINATION AND GROWTH OF DESIRED NATIVE VEGETATION.

Tailings Monitoring:

Although the tailings have been relatively stable for the past several decades, there are indications that continuous mechanical weathering of the slope by rain and wind have gradually been eroding the slope, exposing existing boulders to potentially becoming loose and rolling downhill, (See Section 2.1 – Geology and Soils for a more detailed discussion of this issue).

These slopes should be observed on a weekly basis, and also after every major storm, to assess the stability of the boulders, identify any further erosion and implement corrective measures.

Paint Water Tanks:

On an annual basis, observe the condition of the painted finish on the steel Water Tanks, and when they begin to appear damaged and / or faded, notify the Water and Engineering Divisions to repaint.

Prior to finalizing the contract to repaint, solicit the input of the Historic Preservation Commission, Parks Department staff and other interested Stakeholders, to evaluate if the previous color is still acceptable, or if a different color should be considered.

Volunteer Projects:

Volunteers, including Contractors, individuals, various class groups from A.S.U. or other Civic and Community organizations are a great way to fulfill a desire to contribute, while supplementing existing City resources. However, in a sensitive environment such as the one found on Hayden Butte, and without the proper supervision, volunteers can end up doing more harm than good.

In instances where the assistance of volunteers is acceptable, it should only happen under the direct supervision of a Pre-

Approved / Pre-Qualified individual from City Staff who has completed the courses described above and who has previous experience working with volunteer groups in a sensitive desert environment.

Prior to beginning any activity, the City should conduct a Pre-Operations Meeting - to describe goals and objectives of the project, review the rules of participation and secure buy-in, in writing, from all participants.

During and immediately after the operation, the individual in charge should report any damage that occurs during the operation to the proper City Officials, so that it can be mitigated in a timely manner.

Footnotes:

1 Scott Solliday; *Tempe (Hayden) Butte & Environs Archaeological & Cultural Resource Study, Component 3; Context Study, (SHPO-2002-2393)*
2 Arizona State University; *ASU Online Tour, (www.tours.asu.edu/tempe/a-mountain)*
3 City of Tempe Website, from *Wikipedia; (www.wikipedia.org/wiki/tempe_butte)*
4 Scott M. Kwiatkowski & Thomas E. Wright; *Tempe (Hayden) Butte & Environs Archaeological & Cultural Resource Study, (SHPO-2002-2393)*
5 *Weekly Prescott Miner, July3, 1873*
6 Scott Solliday; *Tempe (Hayden) Butte & Environs Archaeological & Cultural Resource Study, Component 3; Context Study, (SHPO-2002-2393)*
7 City of Tempe Website; from *Wikipedia, (www.wikipedia.org/wiki/tempe_butte)*
8 City of Tempe Website
9 City of Tempe Website
10 Scott M. Kwiatkowski & Thomas E. Wright; *Tempe (Hayden) Butte & Environs Archaeological & Cultural Resource Study, (SHPO-2002-2393)*
11 Billy Kiser, City of Tempe*; National Register of Historic Places Registration Form for Tempe Butte*
12 City of Tempe Website
13 City of Tempe Website
14 City of Tempe Website
15 Scott Solliday; *Tempe (Hayden) Butte & Environs Archaeological & Cultural Resource Study, Component 3; Context Study, (SHPO-2002-2393)*
16 Archaeological Consulting Services*; Hayden Flour Mill Project*
17 Archaeological Consulting Services*; Hayden Flour Mill Project*
18 Arizona – Sonora Desert Museum website; *Invaders of the Sonora Desert Region*
19 Arizona Native Plant Society website; *Threats to Arizona Native Species: Buffelgrass and Fountain Grass*
20 Scott Solliday; *Tempe (Hayden) Butte & Environs Archaeological & Cultural Resource Study, Component 3; Context Study, (SHPO-2002-2393)*
21 Billy Kiser, City of Tempe*; National Register of Historic Places Registration Form for Tempe Butte*
22 Billy Kiser, City of Tempe*; National Register of Historic Places Registration Form for Tempe Butte*
23 Billy Kiser, City of Tempe*; National Register of Historic Places Registration Form for Tempe Butte*
24 Billy Kiser, City of Tempe*; National Register of Historic Places Registration Form for Tempe Butte*
25 Billy Kiser, City of Tempe*; National Register of Historic Places Registration Form for Tempe Butte*
26 Billy Kiser, City of Tempe*; National Register of Historic Places Registration Form for Tempe Butte*
27 Scott M. Kwiatkowski & Thomas E. Wright; *Tempe (Hayden) Butte & Environs Archaeological & Cultural Resource Study, (SHPO-2002-2393)*
28 Billy Kiser, City of Tempe*; National Register of Historic Places Registration Form for Tempe Butte*
29 Scott Solliday; *Tempe (Hayden) Butte & Environs Archaeological & Cultural Resource Study, Component 3; Context Study, (SHPO-2002-2393)*
30 Billy Kiser, City of Tempe*; National Register of Historic Places Registration Form for Tempe Butte*
31 Scott Solliday; *Tempe (Hayden) Butte & Environs Archaeological & Cultural Resource Study, Component 3; Context Study, (SHPO-2002-2393)*
32 City of Tempe Website
33 City of Tempe Website
34 City of Tempe Website
35 City of Tempe Website
36 City of Tempe Website; *A Brief History of Tempe*
37 *Weekly Prescott Miner, July3, 1873*
38 City of Tempe Website; *A Brief History of Tempe*
39 City of Tempe Website; *A Brief History of Tempe*
40 Irene Benedict; *The Butte*
41 City of Tempe Website
42 City of Tempe Website; *A Brief History of Tempe*
43 Irene Benedict; *The Butte*
44 Scott Solliday; *Tempe (Hayden) Butte & Environs Archaeological & Cultural Resource Study, Component 3; Context Study, (SHPO-2002-2393)*
45 Irene Benedict; *The Butte*

46 Scott Solliday; *Tempe (Hayden) Butte & Environs Archaeological & Cultural Resource Study, Component 3; Context Study, (SHPO-2002-2393)*
47 Arizona State University; *ASU Online Tour, (www.tours.asu.edu/tempe/a-mountain)*
48 Billy Kiser, City of Tempe*; National Register of Historic Places Registration Form for Tempe Butte*
49 Billy Kiser, City of Tempe*; National Register of Historic Places Registration Form for Tempe Butte*
50 Billy Kiser, City of Tempe*; National Register of Historic Places Registration Form for Tempe Butte*
51 City of Tempe Website
52 City of Tempe Website; *A Brief History of Tempe*
53 City of Tempe Website; *A Brief History of Tempe*
54 Andy Romance
55 Andy Romance
56 Andy Romance
57 City of Tempe Website
58 Irene Benedict; *The Butte*
59 Arizona Native Plant Website; (www.aznps.com/invasives.php)

Photo / ImageCredits:

PC 1 *Tempe Butte, Tempe Arizona*; Tempe Historical Museum, (photographer unknown)
PC 2 *Tempe Butte, Tempe Arizona*; Tempe Historical Museum, (photographer unknown)
PC 3 *Tempe Butte, Tempe Arizona*; K. Moore
PC 4 *Location Map;* State of Arizona
PC 5 *Vicinity Map;* Google Earth
PC 6 *Hayden Butte South Slope;* K. Moore
PC 7 *Hayden Butte South Slope;* K. Moore
PC 8 *Hayden Butte South Slope;* K. Moore
PC 9 *Stone Drainage Feature;* K. Moore
PC 10 *Erosion;* K. Moore
PC 11 *Whitethorn Acacia;* Ladybird Johnson Wildflower Center
PC 12 *Blue Palo Verde;* Mountain States Wholesale Nursery
PC 13 *Little-Leaf Palo Verde;* K. Moore
PC 14 *Mesquite;* ASU
PC 15 *Triangle-Leaf Bursage;* (photographer unknown)
PC 16 *White Bursage;* Calphotos, UC Berkeley
PC 17 *Desert Hackberry;* Ann Epple
PC 18 *Brittlebush;* Wikipedia
PC 19 *Flattop Buckwheat;* Southwest Desert Flora
PC 20 *Creosote Bush;* Red Cliff Desert Reserve
PC 21 *Hedgehog Cactus;* Monique Dinkel
PC 22 *Barrel Cactus;* (photographer unknown)
PC 23 *Cholla;* (photographer unknown)
PC 24 *Prickly Pear Cactus;* (photographer unknown)
PC 25 *Buffelgrass;* Arizona Sonoran Desert Museum
PC 26 *Fountain Grass;* Arizona Desert Xeriscape
PC 27 *Western Whiptail Lizard;* Erki Enderson
PC 28 *Chuckwalla;* Creative Commons
PC 29 *Western Diamondback Rattlesnake;* Skulls Unlimited
PC 30 *Gopher Snake;* Reptiles Magazine
PC 31 *Ground Snake;* William Farr
PC 32 *Red-Tailed Hawk;* Greg Lasley
PC 33 *Gambel's Quail;* Jim Burns
PC 34 *Peregrine Falcon;* All About Birds
PC 35 *Mourning Dove;* U.S. Fish & Wildlife Service, Wikicommons
PC 36 *Merriam's Kangaroo Rat;* Democratic Underground
PC 37 *Black-Tailed Jackrabbit;* Daniele G., Deviant Art
PC 38 *Western Pipestrel Bat;* Sonoran Wildlife Solutions
PC 39 *Ground Squirrel;* Cotinis
PC 40 *Hohokam in Arizona;* Arizona Ruins
PC 41 *Hohokam Canals and Community Boundaries;* Fish
PC 42 *Hayden Butte Petroglyphs;* Glyph Hunter
PC 43 *Hayden Butte Petroglyphs;* Glyph Hunter
PC 44 *Hayden Butte Petroglyphs at Solstice;* Pueblo Grande Museum
PC 45 *Our Lady of Mount Carmel Church;* Tempe Historical Museum
PC 46 *Salt River Crossing with Hayden Butte in Background;* Tempe Historical Museum
PC 47 *Hayden Homestead;* Tempe Historical Museum
PC 48 *Hayden Flour Mill;* Tempe Historical Museum
PC 49 *Hayden Flour Mill;* Hayden Flour Mill.com
PC 50 *Monti's La Casa Vieja Restaurant;* East Valley Tribune
PC 51 *Hayden Flour Mill;* AZ Central
PC 52 *Hayden Butte Holiday Display;* Americans United for the Separation of Church and State
PC 53 *Hayden Butte Communications Tower;* City of Tempe
PC 54 *Hayden Butte Water Tanks and ASU "A";* Reddit
PC 55 *ASU Sun Devil Stadium;* Pinterest
PC 56 *Hayden Butte Communications Tower;* City of Tempe

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Interviews:

Robert Bartelme – C.O.T. Maintenance Department
Officer Ryan Conway – C.O.T. Police Department
David Heck – Deputy Director, C.O.T. Internal Services

Additional Thanks To:

Jerod Smith – C.O.T. Curator of History, Community Services / Library and Cultural Services

Scott Soliday – Archaeologist / Owner, Mexico Arizona

Research

Appendix "A":

TAILINGS SOIL FERTILITY REPORTS

MOTZZ LABORATORY, INC.

Soil Analysis Report

Jesse R. Huston
Terracon
4685 S. Ash Ave
Suite H4
Tempe, AZ 85282

Project: 65155116
Sampler:
Date Received: 2/26/2016
Date Reported: 3/1/2016

PO Number: 65155116

Lab Number: 916452-01 **65155116** **Crop: Landscape**

Soil Complete Test	Method	Result	Units	Levels
pH	1:1	8.8	SU	Very High
Electrical Conductivity, EC	1:1	0.15	dS/m	Low
Calcium, Ca	NH4OAc (pH 8.5)	2,100	ppm	High
Magnesium, Mg	NH4OAc (pH 8.5)	39	ppm	Low
Sodium, Na	NH4OAc (pH 8.5)	15	ppm	Low
Potassium, K	NH4OAc (pH 8.5)	42	ppm	Low
Zinc, Zn	DTPA	1.1	ppm	Medium
Iron, Fe	DTPA	5.6	ppm	Medium
Manganese, Mn	DTPA	2.4	ppm	Low
Copper, Cu	DTPA	0.90	ppm	High
Nickel, Ni	DTPA	0.018	ppm	
Nitrate-N, NO3-N	Cd-Reduction	3.8	ppm	Low
Phosphate-P, PO4-P	Olsen	8.7	ppm	Low
Sulfate-S, SO4-S	Hot Water	2.1	ppm	Low
Boron, B	Hot Water	0.17	ppm	Low
Free Lime, FL	Acid Test	High		
ESP	Calculated	0.6	%	
CEC	Calculated	11.0	meq/100g	

Levels are generalized and apply to most cropping environments.
Low means a high probability that applying nutrient will elicit a growth response.
Medium means a moderate probability of plant growth from application.
High means little or no response expected from application of this nutrient.
Very High means adding the nutrient may reduce growth or cause imbalance.

Victoria Normandin, LLC
Email: vicn@cox.net
602-799-7248

Date: 3/3/2016
Report: 916452
Information provided by the laboratory: For landscape purposes. Material appears to be crushed rocks and fine gravel. Analysis performed on 2 mm particles (-10 mesh).

The pH of the soil is high at 8.8.
EC is very low at .15 dS/m.

Nutrient content of the soil component (-10 mesh) is limited.
Nitrate-N is low at 3.8 ppm; Phosphate –P is low at 8.7 ppm; Potassium is very low at 42 ppm.
A blended N-P-K fertilizer can be applied to supply: 2 lbs N, 2 lbs P_2O_5 and 1-2 lbs K_2O /1000 sq.ft.

The Ca:Mg ratio is extremely wide at 54:1. $MgSO_4$, Epsom Salt, can be applied at a rate of 2 lbs/1000 sq.ft.
Micronutrients, Fe, Zn, Mn, Cu, B, are moderate to low, but in good proportion to each other. Choose a Blended N-P-K fertilize that also contains Fe, Zn and Mn. Adequate boron is typically supplied in the irrigation water.

Laboratory commented that sample contains crushed rock and fine gravel. Although I do not know the percent of gravel in the sample, the low nutrient availability of the soil infers low moisture holding capacity. A good quality compost/organic material can be mixed into the root zone at a rate of ~ 10% by volume to increase plant available water.

Thank you,

Victoria Normandin

Victoria Normandin, CPAg

Note: Soil Nutrient interpretations and recommendations are based on the Soil Complete/Standard Analysis Report provided Motzz Laboratory.