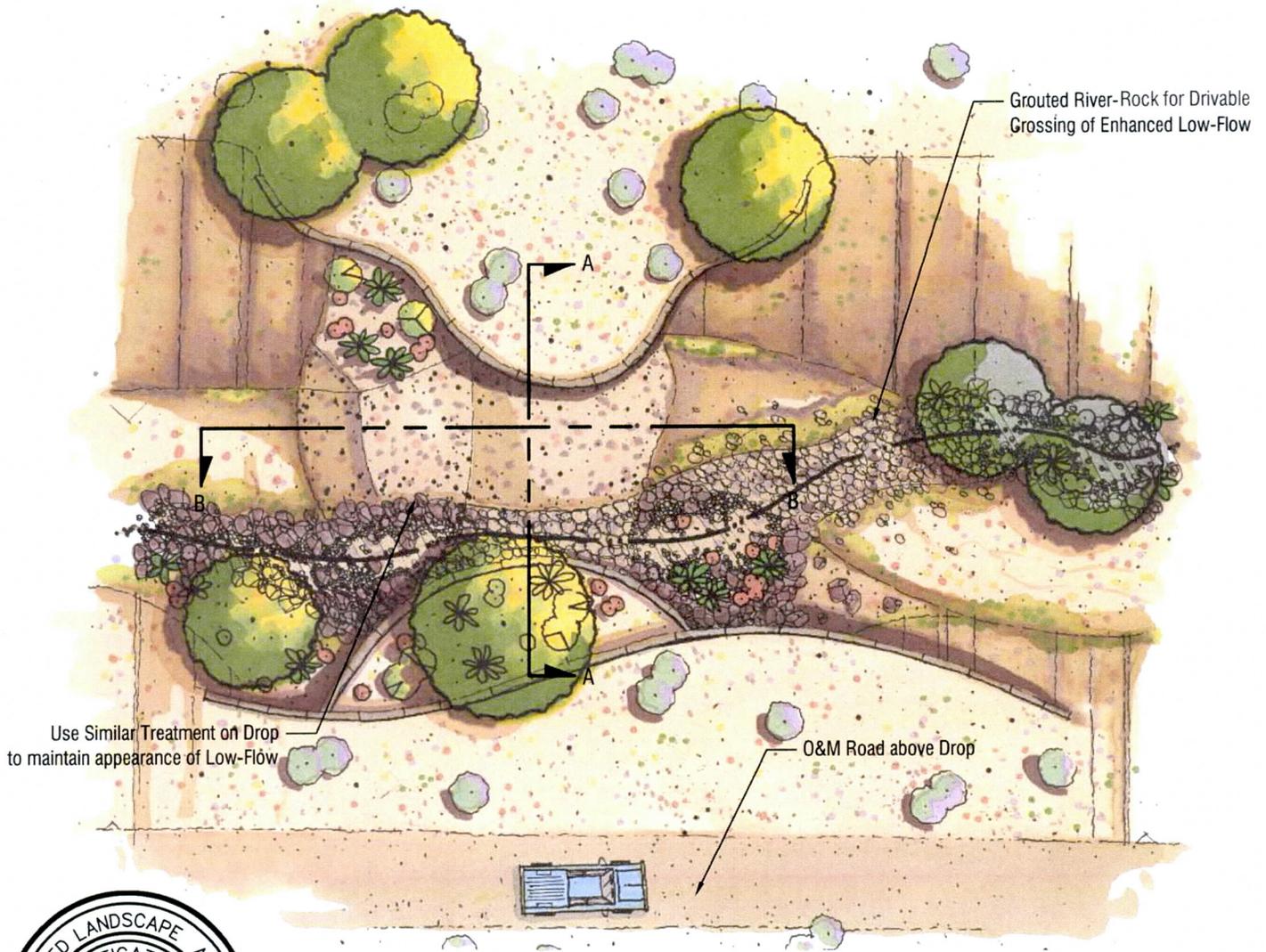




White Tanks FRS No. 3

Outfall Channel Final Design

FCD 2009C012 - LANDSCAPE ARCHITECTURE PRE-DESIGN REPORT



Expires 09-30-2012
December 17, 2009

Prepared for:

Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009
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Prepared by:



In association with:





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December 17, 2009

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Hoskin • Ryan Consultants, Inc.
creative engineering solutions

December 2009



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1 INTRODUCTION

EPG, in association with Hoskin-Ryan Consultants, Inc., (HRC) has been contracted by the Flood Control District of Maricopa County (District) to prepare a Landscape Architecture Pre-Design Report for the White Tanks FRS No. 3 (FRS#3) Outfall Channel project. The District is in the process of performing rehabilitation to FRS#3, including a new principal outlet that discharges adjacent to the Beardsley Canal. The project provides a channel along the Jackrabbit Trail corridor, to convey the principal outlet flows from FRS#3 to FRS#4 (Figure 1). The outfall channel will extend south from the principal outlet at FRS#3 to the existing FRS#4 inlet channel north of McDowell Road, and lie within the Town of Buckeye and unincorporated Maricopa County.

The goals of the project include:

- Provide an outfall for the FRS#3 principal outlet flows.
- Intercept and convey the 100-year flood flows reaching the channel to the planned outfall at FRS#4.
- Reduce the effective FEMA 100-year floodplain along Jackrabbit Trail.
- Accommodate the future widening of Jackrabbit Trail.
- Provide an opportunity to implement trail linkage as part of the Maricopa County Regional Trail System.

The existing FRS#4 inlet channel is a concrete-lined channel which extends from south of Interstate 10 to north of McDowell Road. North of the existing concrete-lined channel, the existing Jackrabbit Channel and Wash are a series of unlined channels and ditches of varying dimensions and capacities. Between Missouri Avenue and the Bethany Home Road alignment, natural drainage patterns continue across the Jackrabbit Trail alignment from west to east. North of the Bethany Home Road alignment to FRS#3, the predominant land slope is to the east, towards the Beardsley Canal.

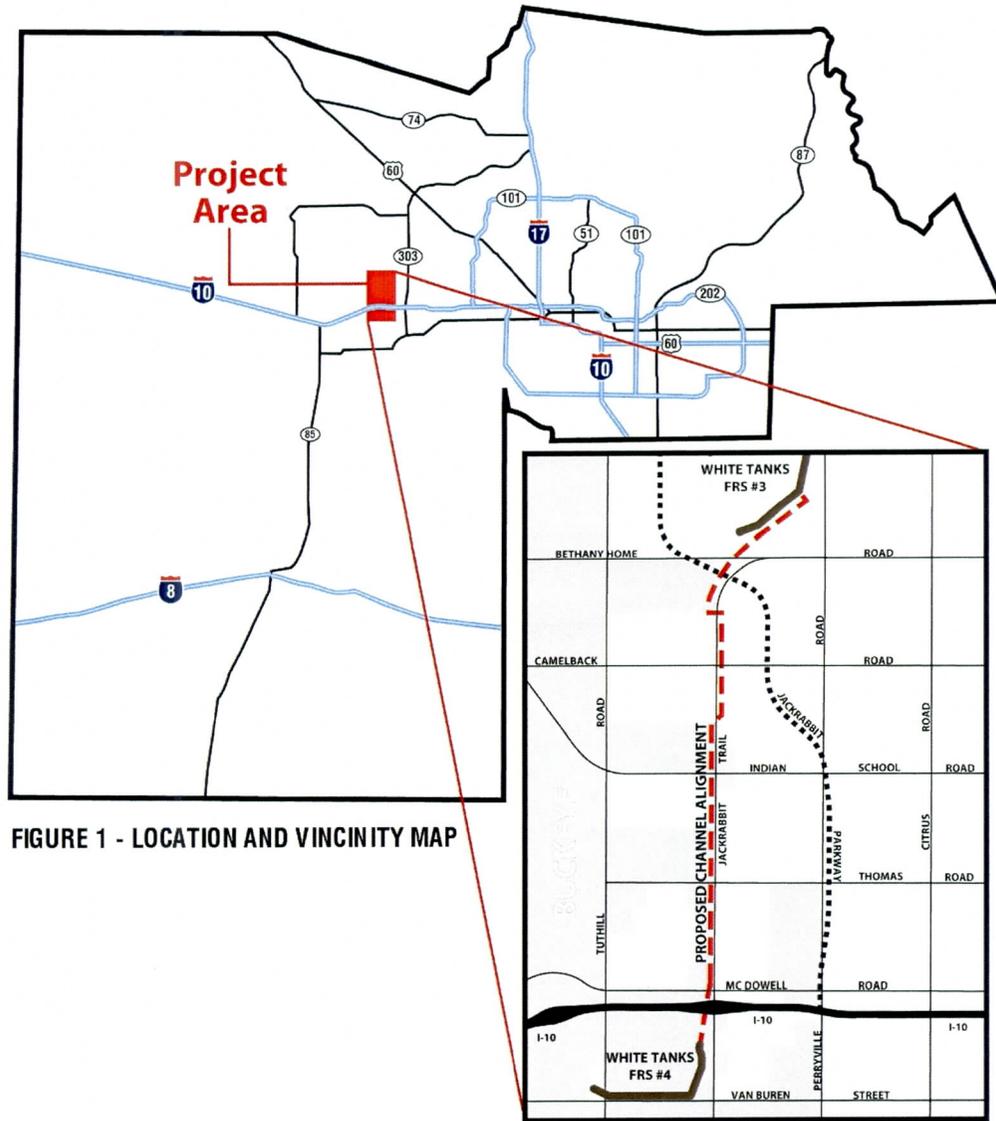


FIGURE 1 - LOCATION AND VICINITY MAP

1.1 Purpose

A primary objective of the District's board-approved *Policy for the Aesthetic Treatment and Landscaping of Flood Control Projects* (Ref. 2) is to preserve, enhance, and complement the visual character of local communities while protecting the natural and beneficial functions served by floodplains within Maricopa County.

30% design plans (Ref. 1) were completed in July, 2009, that incorporated preliminary landscape aesthetic goals consistent with the District's *Policy for the Landscaping and Aesthetic*



Treatment of Flood Control Projects (Ref. 2). The proposed design suggests that concrete structures incorporate aesthetic treatments such as integral color and texture, form liners, and integrated natural boulders. The 30% Design also used a meandered channel configuration within existing District-owned right-of-way and, where the District did not already own right-of-way, propose 214 feet of right-of-way width acquisition to incorporate further landscape aesthetic goals. The proposed Operations and Maintenance (O&M) road associated with the channel will also be used to accommodate a portion of Segment 35 of the Maricopa Regional Trail.

Landscape materials proposed under the HRC 30% Design included the use of Mesquites, Ironwoods, Palo Verdes, Bursage, Brittlebush, Creosote, Desert Broom, and Saltbush for planting design. Native plant salvage and in-place vegetation preservation were also proposed for the project. Ground cover treatments proposed included the use of a native hydroseed mix along with gravel mulch for erosion protection, rip-rap, and boulders. These landscape materials are considered appropriate for the desired landscape design theme.

A Site Analysis was conducted for the project by EPG (Ref. 3). This Landscape Architecture Pre-Design Report further analyzes the HRC proposed landscape design concepts and incorporates the findings of the Site Analysis Report. Design criteria for the project are included and will be further refined during the 30% Landscape Architecture Design Plans. Consistent with the previous studies and design efforts, the LA Pre-Design Report uses the nine distinct separate reach divisions in reference to the channel as illustrated in Figure 2 – Proposed Design Schematic and explained further in the 30% Design Report.

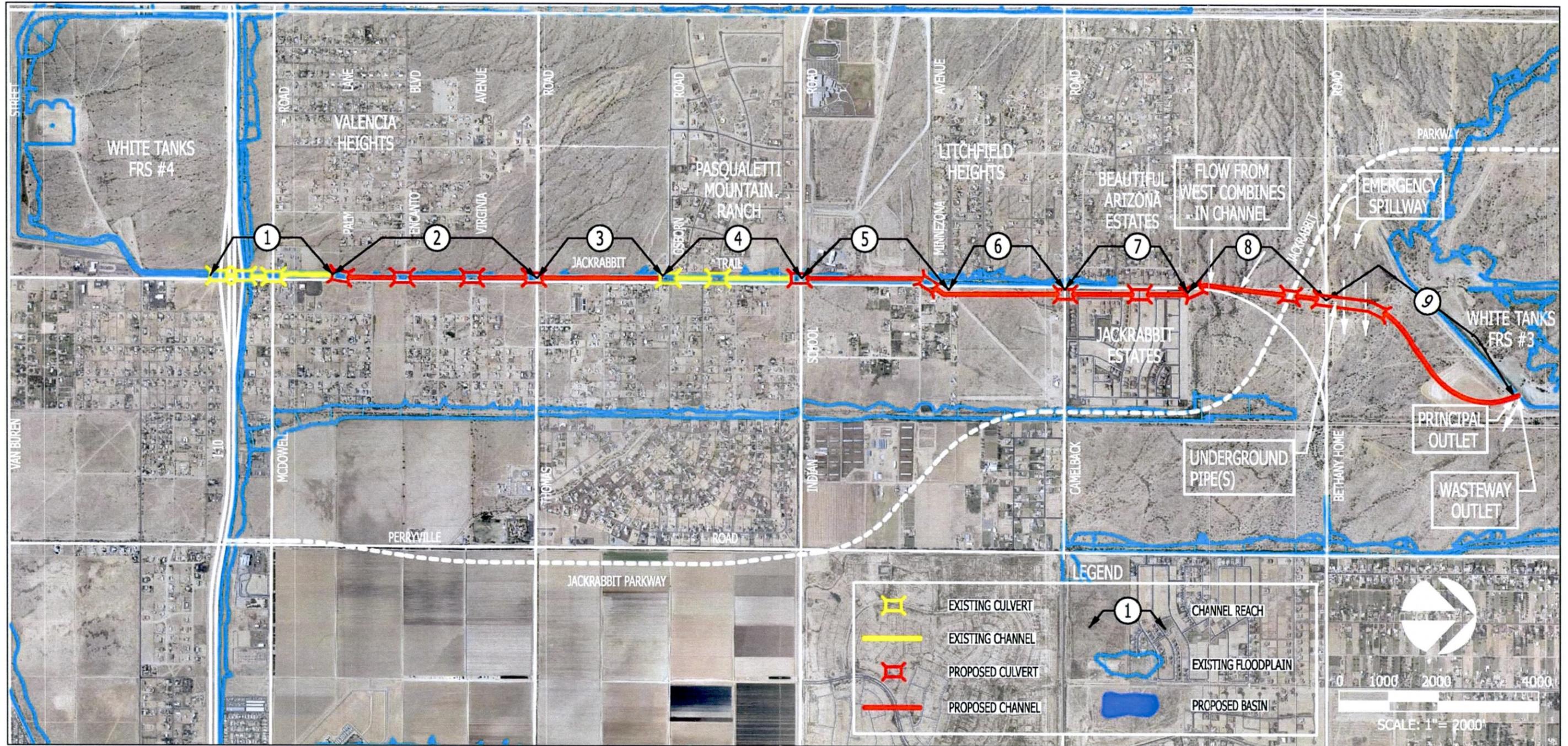


FIGURE 2 - PROPOSED DESIGN SCHEMATIC



2 SITE ANALYSIS REPORT SUMMARY

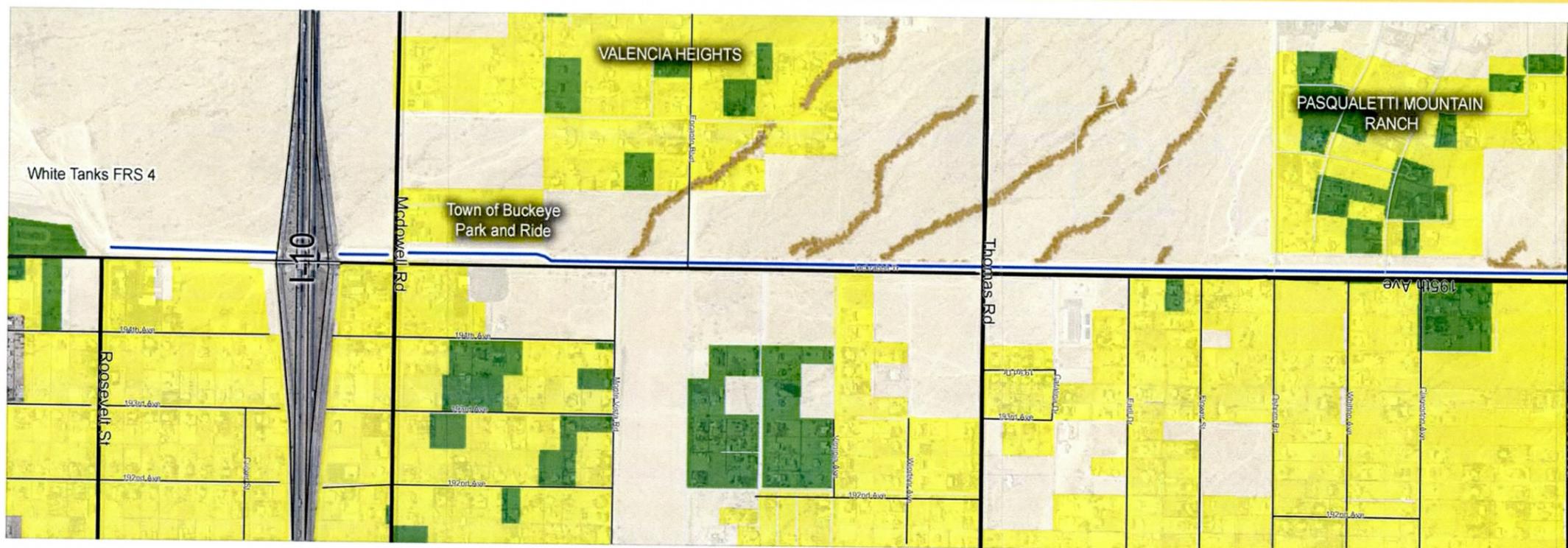
EPG completed a site analysis of the project (Ref. 3) in order to:

- Identify and document the existing and planned land, resource, recreation and community contexts of the study area.
- Identify opportunities and constraints for developing a multi-use facility that best responds to the flooding, land, resource, recreation and community contexts of the study area. These should be achieved through the application of appropriate flood protection methods, landscape architectural design theme(s), aesthetic design and landscape treatments, and the integration of identified recreation or open space resources.

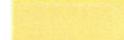
A summary of these findings are included in the sections below.

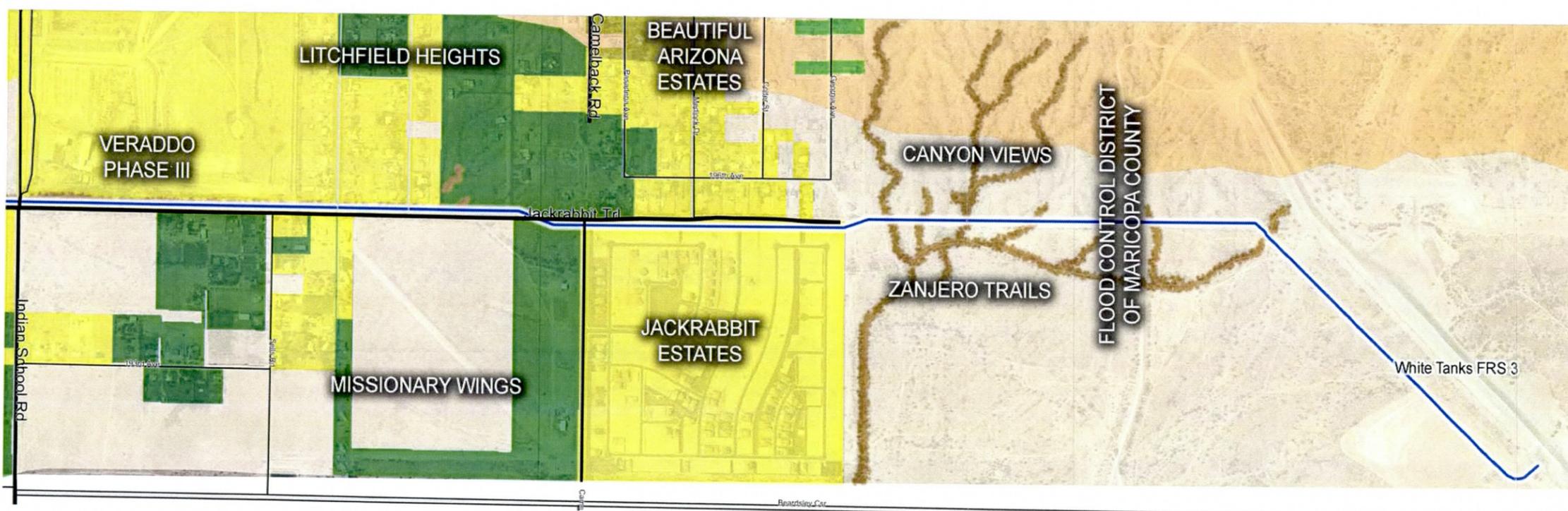
2.1 Scenery, Recreation, Open Space, and Environmental Resources

Based on the scenery resource assessment in the Site Analysis Report, the channel project should be designed using a flood protection method that is “soft-“ or “semi-soft” structural with a Natural Sonoran Desert Wash landscape design theme. This information was derived from the existing landscape character units shown in Figure 3 – Scenery Resources and Major Landowners. Currently, planned project landscape aesthetics are not likely to include supplemental irrigation or non-native plant materials. Cost-share partnering as well as O&M responsibilities will be a major consideration for the District where a development desires these enhancements.



LEGEND

-  NATURAL LOWER BAJADA
-  NATURAL VALLEY PLAINS
-  RURAL LOWER BAJADA
-  RURAL VALLEY PLAINS
-  SUBURBAN LOWER BAJADA
-  SUBURBAN VALLEY PLAINS
-  NATURAL VALLEY WASH



-  PROJECT ALIGNMENT
-  MAJOR STREET
-  MINOR STREET



Figure 3 – Scenery Resources and Major Landowners



The following developments and property owners were identified along the proposed channel alignment:

*Flood Control District of Maricopa County
Maricopa County Department of Transportation
Town of Buckeye - Jackrabbit Trail and the future Park and Ride Facility
Missionary Wings
Jackrabbit Estates (Shea Homes)
Canyon Views (Klondike)
Zanjero Trails (MWD)
Beautiful Arizona Estates
Pasqualetti Ranch
Litchfield Heights
La Familia
Verrado Phase III (DMB)*

Future plans for Jackrabbit Trail include designation as a major arterial street which includes the need for additional right-of-way. The Jackrabbit Trail corridor was studied by the Maricopa County Department of Transportation (Ref. 4).

The Maricopa Region Trail Segment 35 (Ref. 5) lies along the Jackrabbit Trail corridor and should be incorporated within the channel limits where possible. Also, recreation connectivity could occur within the adjacent developments including the Verrado Phase III master planned community. Future Maricopa Trail segment connections include Segment 59 (a second-phase trail segment), located along the Buckeye Flood Retarding Structures and the I-10 corridor, and Segment 111 which will connect Segment 35 through the White Tank Mountain Regional Park to the Hassayampa River. Maricopa County Parks and Recreation Department has expressed interest in locating a trailhead within the open space area owned by the District associated with FRS#3. A potential active recreation park is planned for the FRS#4 area that would be owned and managed by the Town of Buckeye.

The District property associated with FRS#3 was identified as the primary open space resource within the immediate project area which will connect with regional park and open resources



via the Maricopa Trail. Figure 4 – Regional Recreation Resources shows the relationship of the Maricopa Trail with open space areas and District's dams.



Photo 1 - Natural Lower Bajada Downstream of FRS# 3

Environmental resources that were assessed during the site analysis included cultural, biological, topographical, and visual resources.

Vegetation along the project corridor is dominated by large Palo Verde trees with the understory vegetation consisting of grasses and small shrubs that include native and non-native species. The District Environmental Program Manager has conducted an assessment of the existing vegetation along the proposed channel alignment to determine the feasibility and likely success of preserving vegetation in place as well as determining the value of salvaging plant material from within the project limits. However, the findings from this assessment were not available to the project team at the time of writing, but will be incorporated into the future design considerations.

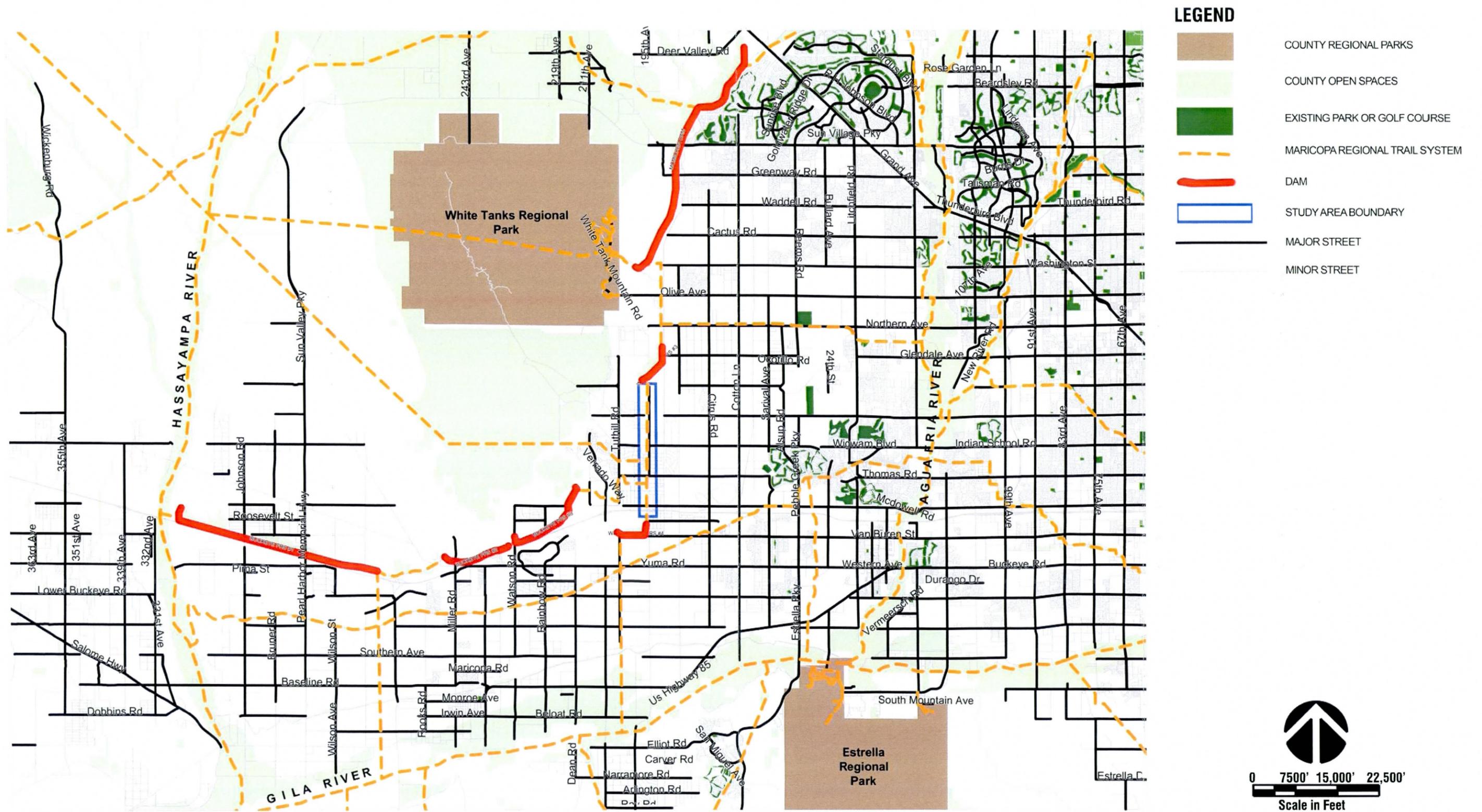


FIGURE 4 - REGIONAL RECREATION RESOURCES



Photo 2 - Natural Valley Wash Downstream of FRS# 3

The slope of the study area becomes progressively steeper from the FRS#3 outlets south to the FRS#4 inlet. To accommodate this condition, the 30% Design recommended the use of grade control structures beginning near Indian School Road and increasing in frequency to the south. The aesthetic treatment of these structures is discussed later in this report.

Preservation of the existing ornamental planting is a secondary goal of the project and depends on the willingness of the adjacent community or homeowner's associations to be cost-share partners. In the photo below, the natural vegetation on the west side of Jackrabbit Trail contrasts with the ornamental plantings on the east side at Jackrabbit Estates.



Photo 3 - Existing Vegetation along Jackrabbit Trail at Jackrabbit Estates

The proposed channel alignment is within $\frac{1}{4}$ mile of two areas of high viewer sensitivity under the criteria used for District scenery resource assessments. These include the residential areas along the channel corridor as well as Jackrabbit Trail. Future users of the Maricopa Trail would also be considered highly sensitive viewers. Views of the channel from residences, Jackrabbit Trail, the Park and Ride, and especially at road crossings, where vehicle occupants can look directly up the channel alignment, should be considered distinctive or significant and treated accordingly.

Distinctive features within the study area include the existing vegetation along the Jackrabbit Wash, tributary washes and natural undeveloped areas vegetation, some of which may be salvaged and relocated or preserved in place. The undisturbed open space on the



District property associated with FRS#3, and the existing ornamental planting and perimeter wall along Jackrabbit Estates are distinctive. Opportunities to preserve or enhance these areas should be considered beneficial to the project.

Disturbed areas include the FRS#3 structure and existing semi-hard and concrete channels and inlets. These areas are discordant with the design theme and should include aesthetic enhancements.

2.2 Land and Resource Opportunities and Constraints

The Site Analysis Report was used to identify opportunities and constraints to the objectives of the project landscape and aesthetic goals.

The opportunities and constraints identified are shown in Figure 5 – Opportunities and Constraints Map, and include the following goals:

- Incorporate the desired landscape design theme and compatible flood protection structural methods to the greatest extent possible in new, as well as existing, channel reaches and facilities.
- Promote multi-modal connectivity between developments along the channel corridor.
- Facilitate neighborhood identity and local community project acceptance.
- Accommodate the Maricopa Regional Trail and provide for a desirable trail experience.
- Enhance access to open space and recreation resource areas.
- Preserve or salvage existing vegetation to enhance channel aesthetics.
- Protect and enhance both internal views from the project and external views of the channel.
- Maintain flows in significant washes.

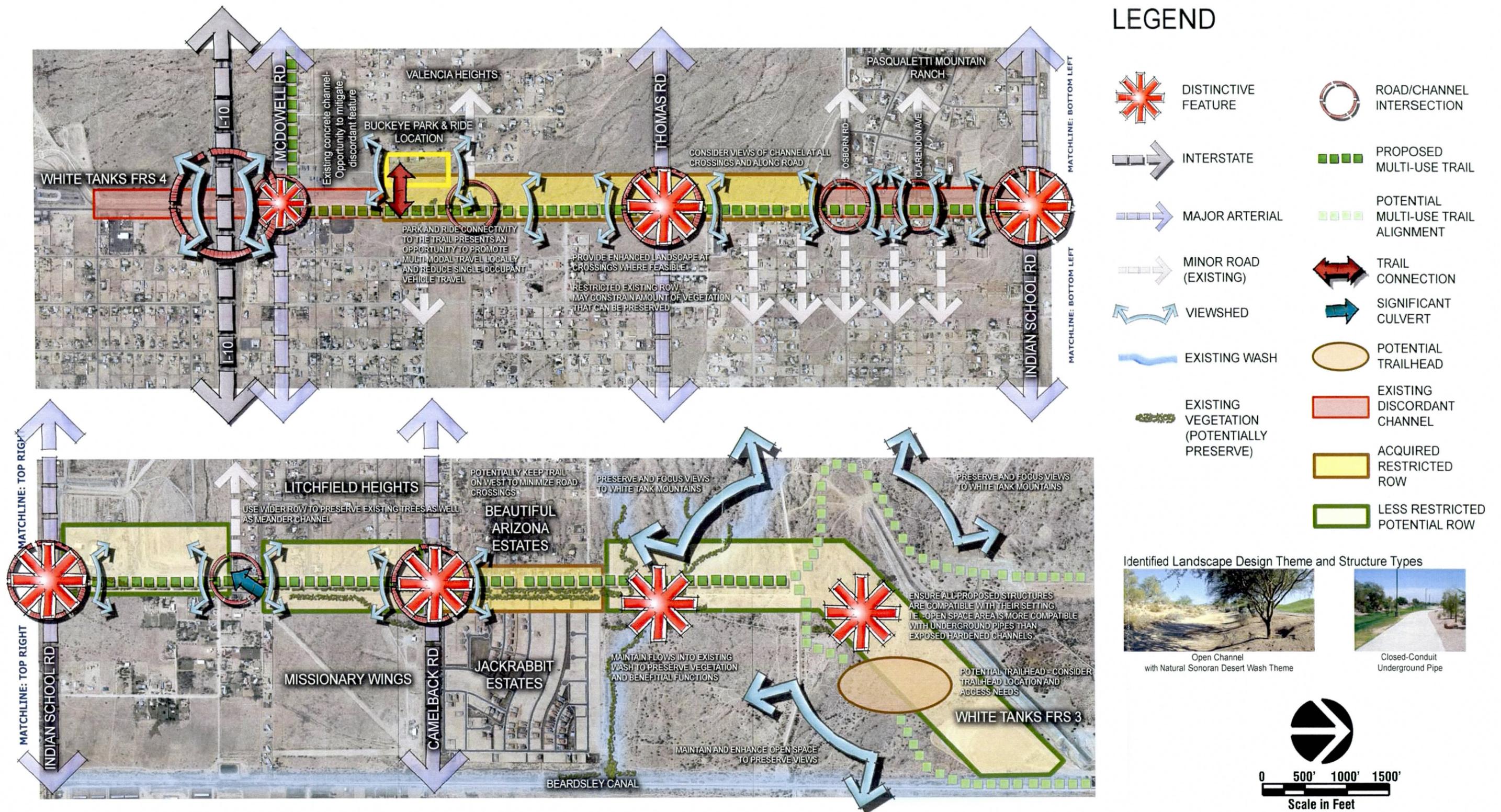


Figure 5 – Opportunities and Constraints



3 DESIGN CRITERIA

The design criteria and considerations identified below for the individual reaches are based on common characteristics such as available right-of-way, existing topographic character, and the surrounding setting. A Value-Analysis workshop was conducted at the District (Ref. 9) at which the 30% Design was evaluated. EPG and HRC have reviewed the various recommendations and have further evaluated their feasibility in this Pre-Design phase.

EPG and HRC worked together to develop the various design concepts presented below. These concepts can be applied to facilities, structures and landscape design components through-out the project. In addition, alternative solutions for Reaches 6, 7, and 9 are also being considered. (Ref. 7) These alternatives along with proposed landscape aesthetic guidelines are discussed in more detail in Sections 3.3 and 3.4.

3.1 Open Channel Concepts

As discussed in Section 2.2 and in the Site Analysis Report, to include a Natural Sonoran Desert Theme the channel design should seek to achieve the following visual characteristics:

- Emulate the visual character of a natural wash, with dendritic drainage patterns that include small islands and gravel bars.
- Use native plant material along the wash edge that includes Mesquite, Willow, and Palo Verde trees along with xeri-riparian shrub species.
- Provide conveyance features sized to replicate and accentuate the scale of natural drainage forms.



Photo 4 - Representative Photo of a Natural Lower Sonoran Desert Wash

A natural wash on a piedmont plane may have a sandy bottom of 10 to 20 feet in width and a wide, shallow overbank area. The banks would be eroded and provide sufficient moisture to support vegetation along the low-flow banks as shown in Photo 4. The 100-year capacity of the channel would be carried in a flat, broad floodplain with little or no xeri-riparian vegetation along the flood fringe.

The broad, trapezoidal form of the earthen channel design proposed in the 30% Design differs from a natural channel configuration. Typically trees are not planted within the main flow area of the channel.

Four options should be considered for the FRS#3 outfall channel as discussed in Sections 3.1.1 through 3.1.4. These are:

1. Natural Form Channel - For landscape aesthetics, the preferred design is a natural wash configuration similar to the shape of a margarita glass with a shallow, steep-sided low-flow channel. The right-of-way needed for the more naturalistic wash configuration may



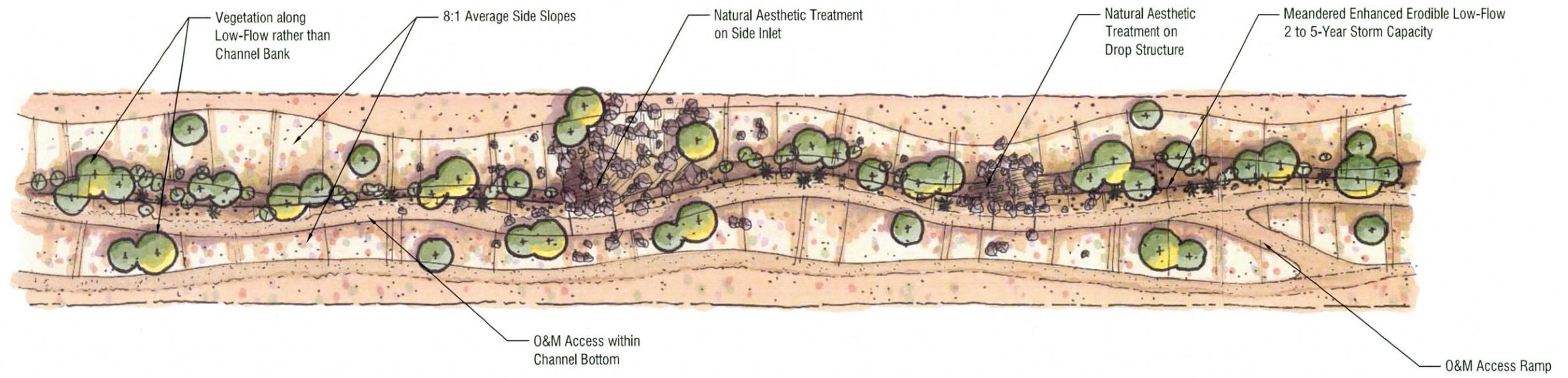
be offset, to some extent, by removal of the need for a separate landscape setback. This option is described in more detail in Section 3.1.1.

2. Meandered Trapezoidal Channel - If the design requirements of the natural form wash option are too restrictive, mimic the components of a natural wash form within a trapezoidal open channel using a meandered low-flow and soften the trapezoidal form through the use of side-slope variation and channel meander. This option is described in more detail in Section 3.1.2.
3. Restricted Channel - Use limited hardened features as described in Section 3.1.3 that would provide opportunities to achieve more of the landscape aesthetic goals such as vegetation preservation and implementing the Natural Sonoran Desert Wash Theme in areas where right-of-way is restricted and the open channel cannot be meandered or include sufficient side slope warping.
4. Hardened Channel - Use a hardened channel in a very limited area as discussed in Section 3.1.4.

3.1.1 Natural Form Channel

A meandered open channel that is fully compatible with the Natural Sonoran Desert Wash Theme is depicted in Figure 6 below. This concept includes the following criteria:

- Provide sufficient right-of-way to accommodate an approximate 2- to 5-year low-flow with a steep erodible side slope that tapers into an 8:1 average side slope that would accommodate a 100-year flood along with the required freeboard. This channel width needs to be determined through engineering analysis.



Typical Plan View

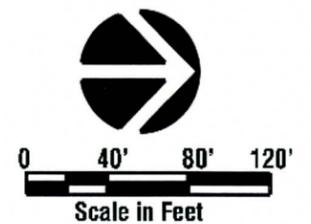


Figure 6 – Natural Form Channel



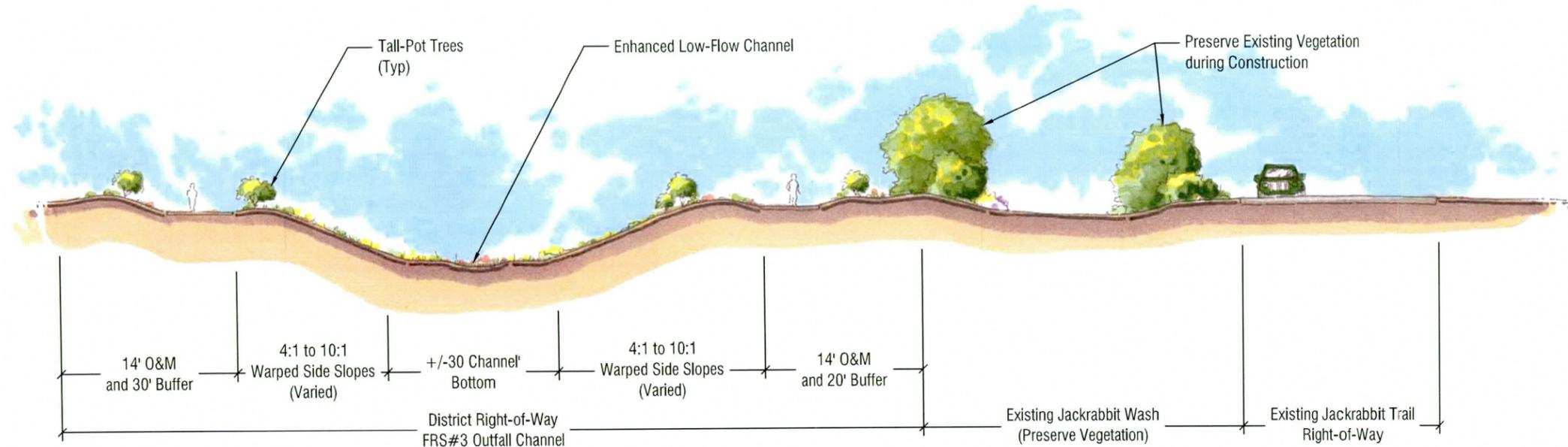
- Design the channel with a Manning's 'n' value that accommodates vegetation along the low-flow including native desert trees and shrubs. The 30% Design used a 'n' value of 0.035 for landscaped channels, however, a higher 'n' value would help reduce velocities and also the number of drop structures.
- Meander the O&M road along the top of the channel within the freeboard elevation.
- Use hydroseed and a 3 inch minus decomposed granite mulch within the 100-year flood area to resemble a natural desert landscape with desert pavement and scrub plant materials that transition into a xeri-riparian plant palette along the 5-year low-flow.

A modification to this concept could include a braided group of lower capacity washes that are designed to accommodate equal capacity, lower design floods. This alternative may include a group of 20-year channels that braid together within a channel width designed to accommodate a 100-year event plus freeboard. Vegetation along the tops of these "braided washes" could better replicate a natural system than a single, 100-year semi-soft channel.

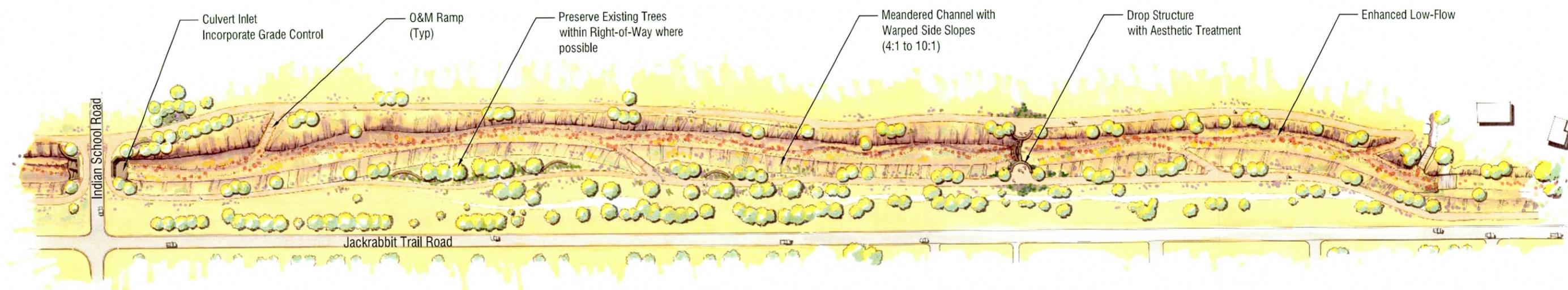
3.1.2 Meandered Trapezoidal Channel

A meandered open channel that is based on the 30% plan configuration is depicted in Figure 7 and includes the following criteria:

- Provide sufficient right-of-way to accommodate side-slope warping that ranges from 4:1 up to 10:1.
- Provide a 14-foot wide drivable access throughout the open channel between culvert or closed-conduit segments. A minimum 55-foot outside turn radius is



Typical Section - NTS



Typical Plan View

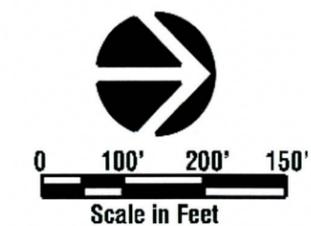


Figure 7 – Meandered Trapezoidal Channel



required for this access. The access includes drop structures, as discussed further in Section 3.2.

- Provide a low-flow feature that consists of a defined material and edge that is visually dominant within the channel configuration and creates the impression of greater meander within the channel bottom. Options for this low-flow include:
 - Use of a larger aggregate rock within a 1'-foot deep, 10-foot wide channel. Occasional landscape boulders would edge the low-flow along with xeri-riparian hydroseed plants. Small container-grown shrubs would create an immediate effect and further define the low-flow edge.
 - Specify a hydro-seed mix within the low-flow that is composed of bright-colored native flowers. These could include Angelita Daisies, Desert Marigold, or other desert flowering shrubs and self-seeding annuals.
 - Salvage the accumulated sand within the existing drainage along Jackrabbit Trail and replace this material in the low-flow during channel construction within a braided, 1-2 feet deep channel. This sandy-bottom low-flow would be edged using one of the methods described above.
 - Use soil cement as the bottom of the low-flow. Edging of the low-flow could then be composed of either loose soil with any of the above



treatments, an additional off-set lift of soil cement, or a shallow grouted slurry with integral boulders. This slurry would be water-worn during construction to create the appearance of exposed natural rock. This feature could be stained using a desert patina and would be repeated in hard-structural features to create a continuous design theme.

- Meander the channel top and O&M road to avoid existing vegetation.
- Create visual interest through the use of “enhanced landscaping” at the road crossings. This could be achieved through a combination of the following:
 - Align the channel to create sufficient space at these intersections for enhanced planting. A recommended 30'x30' area on both sides of the crossing is desirable. 15'x15' should be considered a minimum goal.
 - Grade the enhanced focus area to serve as a water harvesting basin to help supplement the tall-pot trees located in these areas. Direct road run-off into these basins through grading design.
 - Use landscape boulders, container-grown shrubs, and drought- and sun-tolerant succulents to create immediate impact while the remaining landscape becomes established.
 - Develop a themed feature that could be used throughout the channel. This could include a recycled concrete bench or sculptural element that would further serve to promote the green programming of the District. Use recycled concrete from a local construction project or

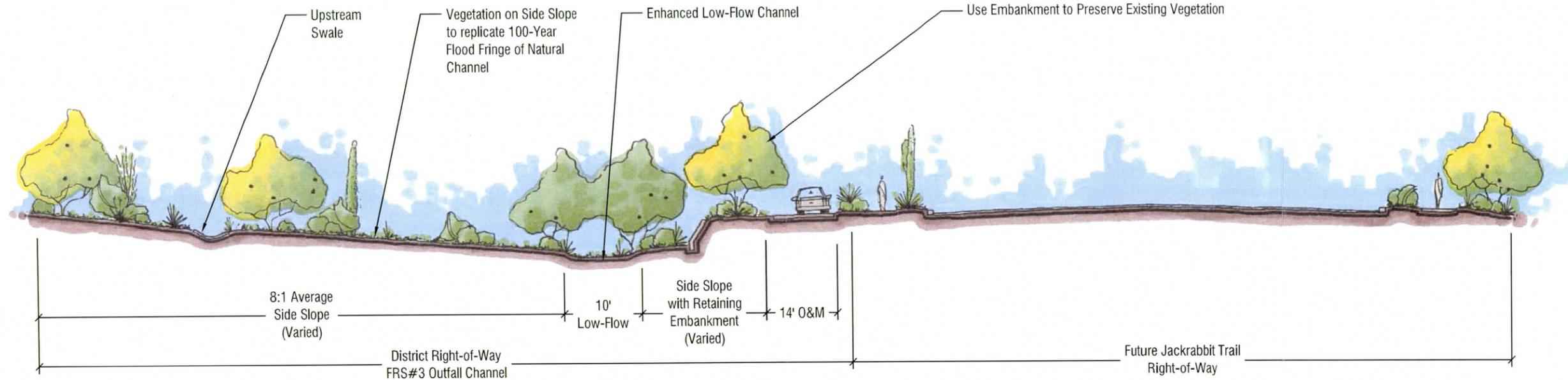


removed portions of the concrete channel in Reach 1. These would be stacked and mortared into a design form with a broken paving base, a recycled rebar sculpture, or a similar treatment.

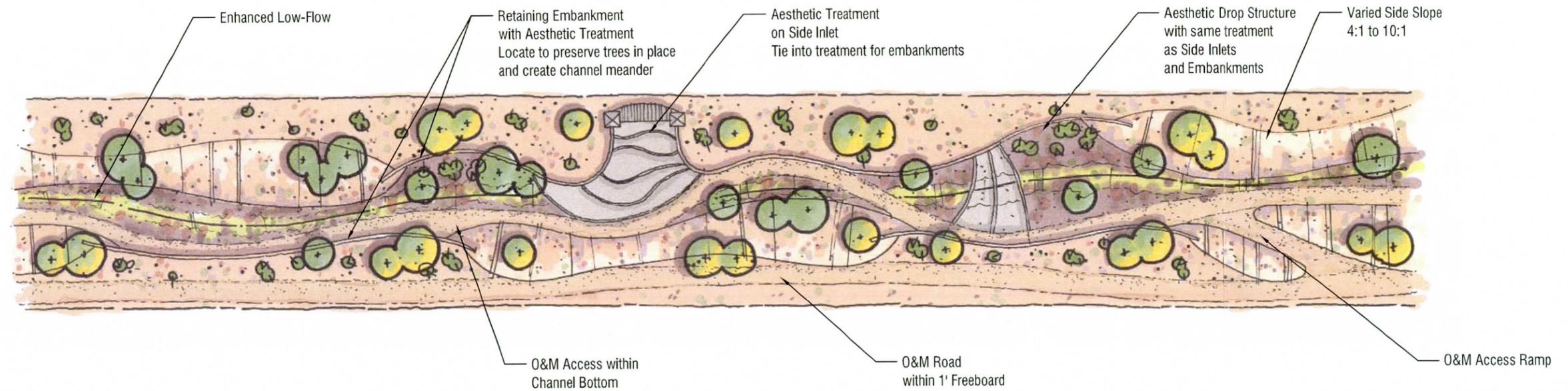
3.1.3 Restricted Open Channel

A meandered open channel that represents a modification of the 30% Design configuration is depicted in Figure 8 and should be considered for areas where existing right-of-way is restricted. Implementation of this concept includes the following:

- Use a retaining embankment feature within the channel on one side to reduce the need for a steep side slope in this location. This embankment would be alternated in location and length within the channel bottom to avoid the appearance of a uniform, “cookie-cutter” element. Embankment height should be 1 foot higher than the water-surface elevation to minimize the risk of failure during an event and to reduce the need for a toe-down. Preferably, treatment of this embankment would match the treatment selected for the drop structures and other hard structures.
- Meander the channel configuration and use embankments to preserve existing trees to the greatest extent possible.
- Provide a 14 feet wide drivable access through-out the open channel between culverts or closed-conduit segments. A minimum 55-foot outside turn radius is required for this access. This access would include drop structures, as discussed further in Section 3.3.



Typical Section - NTS



Typical Plan View

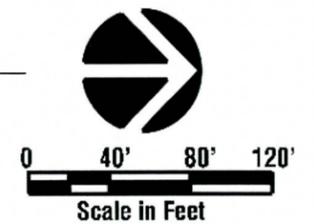


Figure 8 – Restricted Channel



- Establish a low-flow feature and road-crossing enhancement as discussed in Section 3.1.1.

3.1.4 Hardened Channel

A hardened channel is being considered as an alternative for Reach 7 and there is a portion of existing concrete channel in Reach 1. While a hardened channel is not context sensitive based on the scenery resource assessment described in the Site Analysis Report (Ref. 3). If the final design proceeds with the hardened channel within the District owned parcels, the following design criteria should be considered:

- Reduce District-owned right-of-way to the minimum required to convey flows. Allow for more open space within the Jackrabbit Estates development side of the project.
- Use the open space created to establish a north-south pedestrian connection to Colter Avenue from the north of the development.
- Provide opportunity for the development to use the existing channel within Jackrabbit Estates to create an east-west pedestrian link.
- Design channel to preserve the existing screen wall and Jackrabbit Trail landscape in place.
- Reuse the rip-rap from the drainage channel within Jackrabbit Estates to line the hardened channel within Reach 7.
- Provide landscape and dark brown decomposed granite within the District right-of-way in the transition area between the top bank of the channel and the O&M road.

Figure 9 shows a cross-section of this alternative.

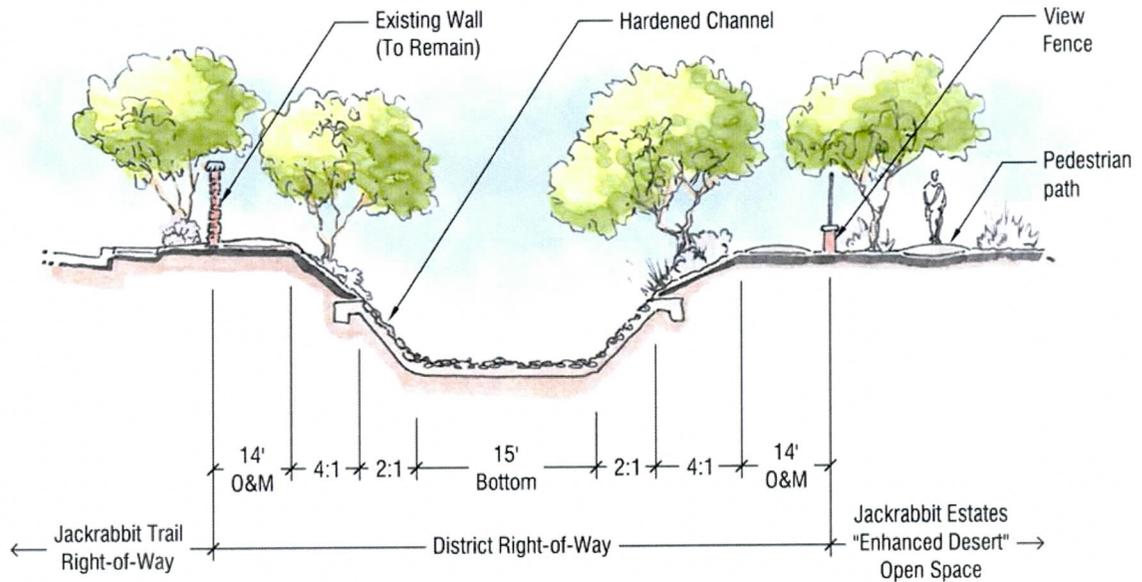


Figure 9 – Reach 7 Hardened Channel Concept

3.2 Design Considerations by Reach

The overall goal for the FRS#3 outfall channel is to design a facility that both responds to the unique character and conditions within each reach of the channel and provides a sense of design continuity for the entire project. The following design considerations have been developed based on this goal and, following further refinement, will be used to develop the Landscape Architecture 30% Plans. Detailed descriptions of the reaches are included in the 30% Design Report (Ref. 1) in Section 5.1.

3.2.1 Reach 1

The FRS#3 outfall channel design must tie into and relate to the existing concrete channel that serves as the inlet to FRS#4. Because this connection will take place near Palm



Lane, it will be highly visible from the entrance to the Town of Buckeye Park and Ride. Design guidelines for this reach include:

- Use concrete treatment to create continuity with the upstream end of the project. This treatment should be feathered downstream.
- Use a stain or other treatment to create a continuation of the low-flow feature from the earthen channel into the concrete channel.
- Extend landscaping downstream beyond the current transition to the concrete channel.
- Create a focused landscape treatment at the Palm Lane crossing to enhance the view over the undesirable visual character of the existing concrete channel.
- Incorporate the Maricopa Trail into the O&M road for this segment of channel.

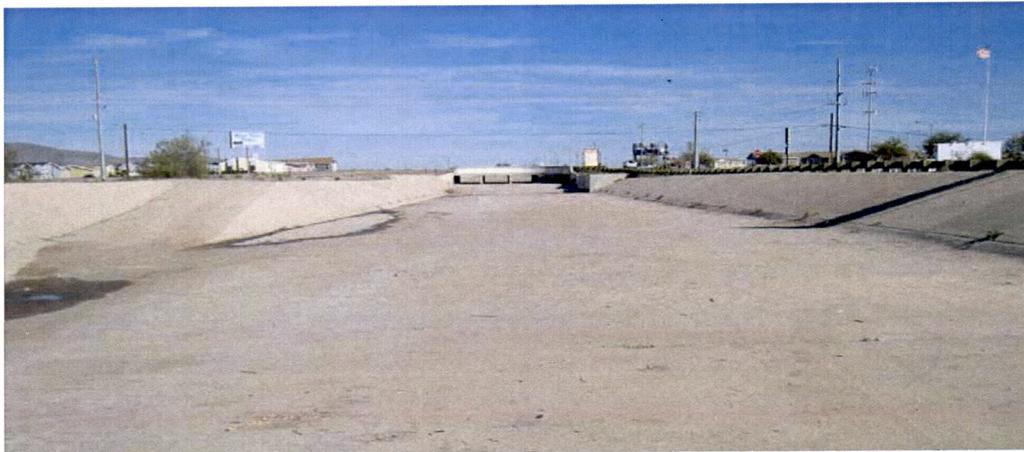


Photo 5 - Existing Concrete Channel at Reach 9: View from I-10 north to McDowell Road Culverts

3.2.2 Reaches 2 and 3 – “Restricted Channel”

The layout of the alignment of the channel is an important feature in developing a semi-soft structure. With the restriction in right-of-way in these two reaches, the design team has



developed a concept that will allow for greater channel meander within the available right-of-way as described in Section 3.1.2. Design criteria for these two reaches would include:

- Adjust channel alignment using the alternating aesthetic enforced wall described in the Restricted Open Channel Concept to preserve existing vegetation (Section 3.2.3), use a more natural channel configuration rather than a trapezoidal form, and create more defined visual interest and channel meander.
- Create a defined, erodible low-flow within the bottom of the channel that more closely meets the character of a Natural Sonoran Desert Wash Theme. This would include a higher 'n' value to allow some trees to be located in the bottom of the wash along the low-flow.
- Meander the O&M road along the side of the channel to accommodate the Maricopa Trail alignment.
- Incorporate aesthetic treatment for the drop structures that is consistent with other features and structures in the channel.



Photo 6 - Reach 2

3.2.3 Reach 4 – “Restricted”

In this reach, the existing channel is linear and has many existing drop structures, side inlets, box culverts and wing walls that have no aesthetic treatment. The following design criteria will help to integrate the existing facilities into the overall design.

- Establish a low-flow within the existing channel to create continuity.
- Replicate new concrete surface treatments from new channel segments on existing structures.
- Use concrete or rock stain to color the structures.
- Replace poorly maintained side inlets.

- Consider the use of a concrete form that transitions from a natural boulder to the existing concrete “dragon’s teeth” energy dissipaters or remove velocity dissipaters if allowable and cost effective.
- Create visual focus points at the road intersections to draw the eye away from the discordant channel character.



Photo 7 – Reach 4: Existing Channel Looking South Towards Clarendon Ave. Culverts

3.2.4 Reach 5 – “Natural Form”

The District does not currently own right-of-way in the portion of the project along the planned Verrado Phase III development. The 30% plans recommended a right-of-way width of 214 feet to accommodate channel meander and side-slope warping along with an additional 65 feet of right-of-way to account for the full buildout of Jackrabbit Trail. The following design criteria for this reach are based on this opportunity:

- Design the channel using the meandered open channel guidelines described in Section 3.1.1. or 3.1.2.

- Use channel and O&M road meander to avoid existing vegetation. Preserve existing vegetation in any areas possible.
- Maintain the trail access on the O&M road and meander the road around existing trees.

The Verrado Phase III development shows a retention basin at the corner of Indian School Road and Jackrabbit Trail. This basin is impacted by the need to acquire right-of-way for the FRS#3 outlet channel. Since replatting of this will be necessary potential multi-use benefits could be considered. Other benefits could be derived if recreation facilities or view-fence enclosed lots are seen as an amenity.

Multiple outlets converge at the inlet of Reach 5. Reach 6 outlets into Reach 5 through culverts under Jackrabbit Trail while a significant wash enters the channel from the west and the Jackrabbit Wash enters the channel system from the north. This relationship is shown in the 30% Design (Ref. 1) and will require treatment of the structures and wash configurations to integrate these features into the overall design.

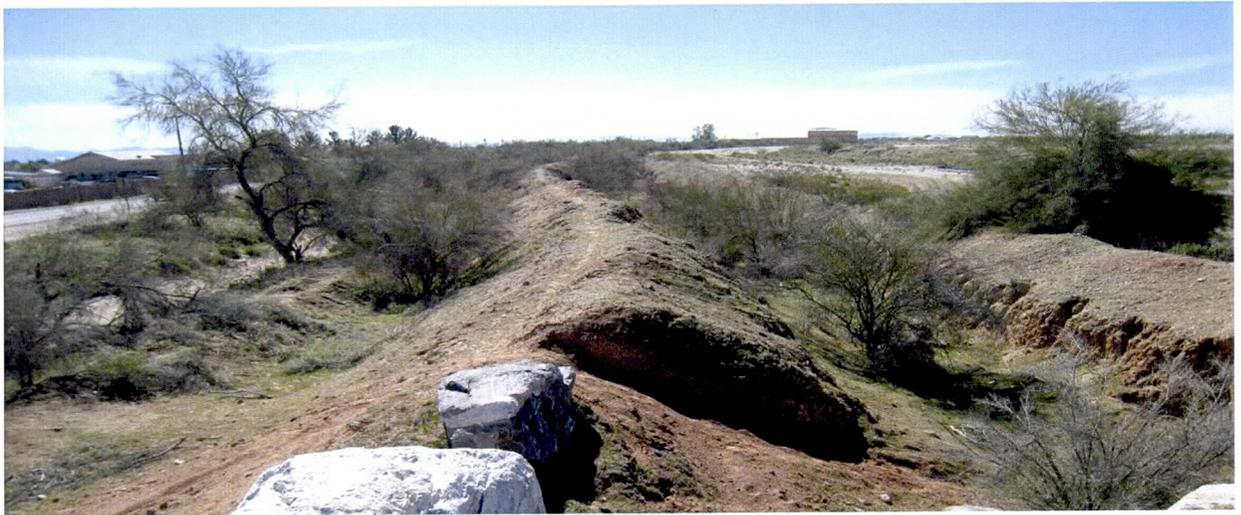


Photo 8 – Reach 5: DMB Verrado Phase III along Jackrabbit Trail



3.2.5 Reach 6 – “Natural Form”

Reach 6 is located on the East side of Jackrabbit Trail. The District does not currently own right-of-way in the portion of the project along the planned Missionary Wings development. This area is currently under evaluation and the final design configuration in this reach may vary from that proposed in the 30% Design. These alternatives include the use of underground conduit. In the 30% Design, the channel was planned to cross Jackrabbit Trail at Sells Drive between Reach 5 and Reach 6. The 30% plans recommended a right-of-way width of 214 feet on the east side of Jackrabbit Trail to accommodate channel meander and side-slope warping. The following design criteria for this reach are based on this opportunity:

- Design the channel using the meandered open channel guidelines described in Section 3.1.1 and 3.1.2.
- Separate the Maricopa Trail from the channel and keep the alignment on the west side of road. This would require Maricopa County Parks and Recreation to develop agreements with the Litchfield Heights community, but would remove the need for at-grade road crossings at two locations. In Reach 7 Jackrabbit Estates may prefer not to have the trail enter their development.
- Landscape aesthetics for the underground culvert alternative would be dependent on the extent of property owned and maintained by the District. This alternative simplifies the landscape aesthetics and may be preferable to an open channel. If the channel or conduit are kept on the west side of Jackrabbit Trail, the Maricopa Regional Trail connection would be continued upstream to FRS#3.

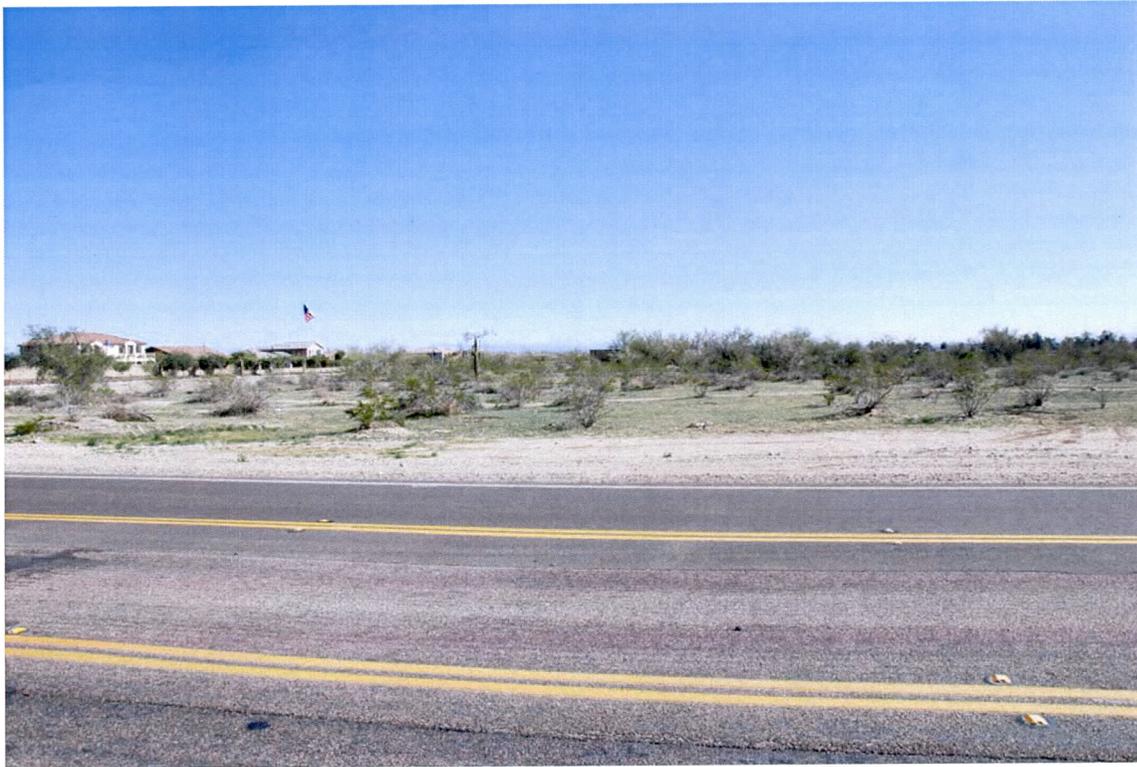


Photo 9 – Reach 6: 30% Design location along Missionary Wings Development

3.2.6 Reach 7 – “Restricted” and “Hardened”

Alternatives for Reach 7 are under reevaluation. The 30% Design proposes the use of an unlined channel through the Jackrabbit Estates subdivision. The District currently owns multiple platted lots which they purchased from Shea Homes, and the 30% Design includes an open channel within these parcels. Other alternatives under consideration include an underground conduit or a narrower hard-lined channel.

3.2.6.1 Open Channel

If the final design proceeds with the current 30% Design, the following design criteria should be considered:

- Design according to the guidelines described in Section 3.1.3.



- Maintain the Maricopa Regional Trail on the west side of Jackrabbit Trail.
- Maximize the use of the existing landscape along Jackrabbit Trail as established. In places this could include the preservation of the theme wall and irrigated landscape.
- Incorporate ornamental vegetation within the channel and at road crossings to establish a connection with the development.
- Use dark brown decomposed granite to match the existing color within the landscape setback along Jackrabbit Trail. The decomposed granite source should be from a local pit to reduce costs.

3.2.6.2 Closed Conduit

The closed conduit alternatives are preferred for aesthetic and public acceptance reasons. If the final design proceeds with an underground pipe within the District owned parcels, the following design criteria should be considered:

- Based on comments from two property owners who attended the PAAC 1 held on December 2, 2009, the open space should be landscaped using an “enhanced desert” landscape design theme.
- Maintain the Maricopa Trail on the west side of Jackrabbit Trail.
- Maintain the landscaping along Jackrabbit Trail established by the community to the greatest extent possible. This would include the preservation of the theme wall and irrigated landscape.



- Incorporate enhanced ornamental vegetation at road crossings to establish a connection with the development.

3.2.6.3 Hardened Channel

If the final design proceeds with a hardened channel option, the design guidelines described in Section 3.1.4 should be considered.



Photo 10 – Reach 7 along Jackrabbit Trail at Jackrabbit Estates

3.2.7 Reach 8 – “Natural Form”

Reach 8 is an open channel that will run on the west side of the Jackrabbit Trail north to the District-owned property associated with FRS#3. This reach is crossed by a wash that will require a significant side inlet structure. This structure should be designed with a similar treatment as used throughout the remainder of the channel.



Open channel design in this location should be consistent with the natural form channel guidelines in Section 3.1.1.



Photo 11 – Reach 8 Wash

3.2.8 Reach 9

Several alternatives for Reach 9 are under consideration as discussed in detail in the HRC Engineering Pre-Design Report (Ref. 7). General design guidelines and aesthetic considerations are provided in Table 1 below for each alternative:

Table 1: Reach 9 Design Alternatives

| Earthen Channel | Underground Pipe | Sedimentation Basin |
|------------------------|-------------------------|----------------------------|
| Reach 9 Alternative 9B | Reach 9 Alternative 9D | Reach 9 Alternative 9E |

Landscape design plans were prepared by EPG for the Phase II FRS#3 Rehabilitation project, and include aesthetic contour berming downstream (Ref. 8). Each of the three categories includes recommendations for the integration of these berms into the final design.



3.2.8.1 Earthen Channel Alternatives

Alternative 9B (Ref. 7) proposes the use of an earthen channel that begins at the FRS#3 principal outlet, follows the FRS#3 alignment to the south-west, and crosses under the emergency spillway through an underground conduit.

Visually the two alternatives differ in the proposed structures required for the wasteway. Alternative 9B uses one of the two principal outlet pipes for the wasteway outlet to the Beardsley Canal. Alternative 9B removed the need for a hard structure wasteway which is preferable from a visual resource perspective.

Figure 10 – Earthen Channel Alternatives, shows a possible design concept for this area that includes modification of the berming to integrate the channel into the natural form of the berms along with the use of tall-pot planting and hydroseed to reestablish the natural sonoran desert vegetation. Berming would help to minimize the effect of a FEMA levee.

3.2.8.3 Underground Pipe Alternatives

This alternative would use an underground in place of the channel. Because the primary structure is an underground pipe, the current berm design for FRS#3 could be used with modifications. Visually, this alternative is the most preferred since it would require the least amount of disturbance and

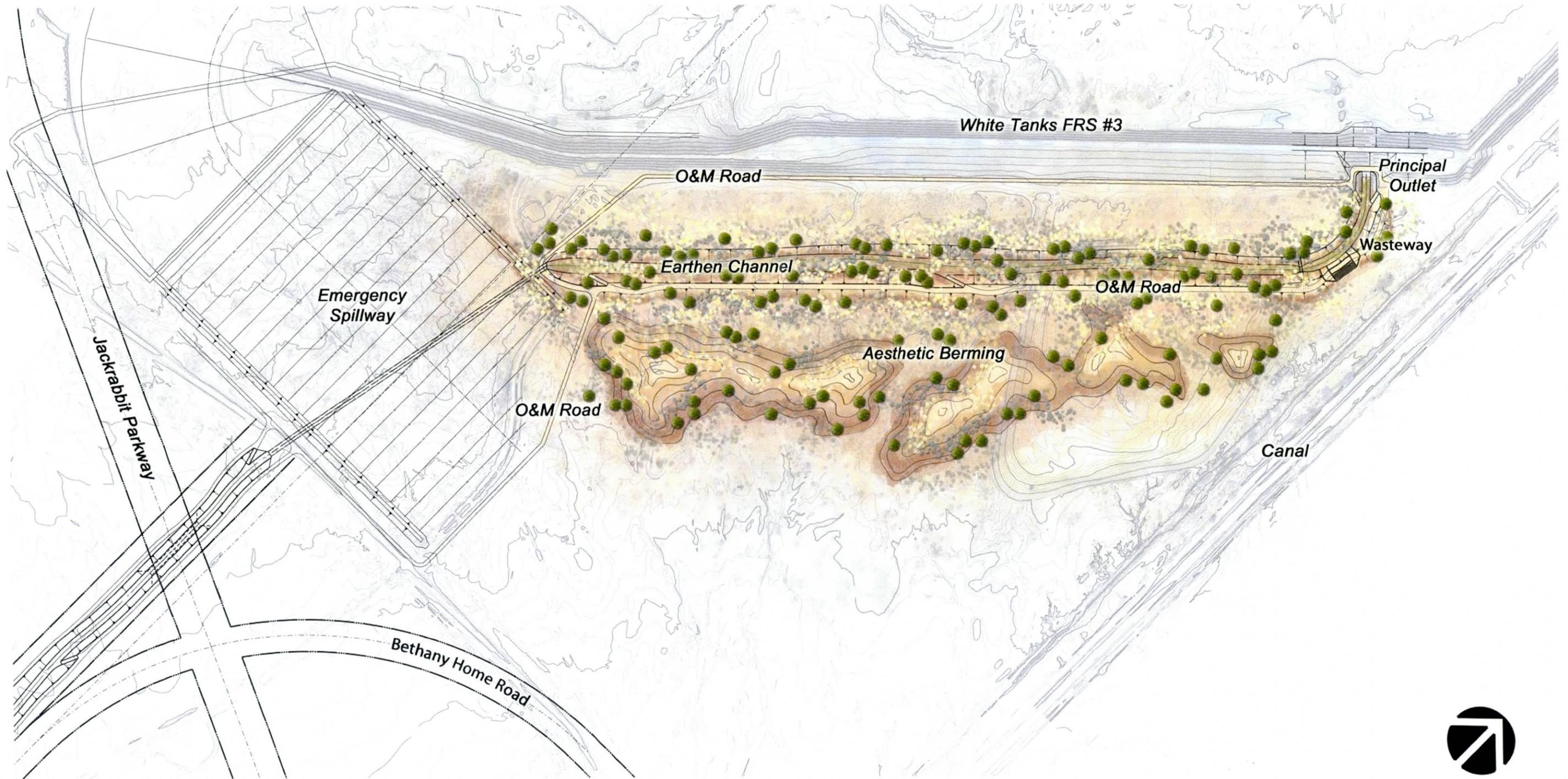


Figure 10 – Reach 9 Earthen Channel Alternatives



maintains the current berm design which would screen the FRS#3 from future views.

Figure 11 – Underground Pipe Alternative, shows the current design for the downstream FRS berms. Tall-pot plants and hydroseed would be used to reestablish the natural sonoran desert vegetation disturbed during the FRS rehabilitation.

3.2.8.3 Sedimentation Basin Alternative

Alternative 9E (Ref. 7) would use a sedimentation basin in place of the channel. This basin configuration closely matches the grading concept previously proposed (Ref. 8) and follows the FRS#3 alignment to the southwest. The flow would cross under the emergency spillway with a segment of underground conduit.

Visually, this alternative provides a more natural form than the channel alternative as it allows for a broader, more shallow feature that is similar in character to the surrounding context. Greater disturbance of natural areas downstream of FRS#3 may offset this benefit in the short-term until new vegetation can establish. Berming would be added downstream of the basin to screen the FRS#3 from views from the future Jackrabbit Parkway and Bethany Home alignments.

Figure 12 – Sediment Basin Alternatives, shows a possible design concept for this area would include berming to integrate the basin into the natural

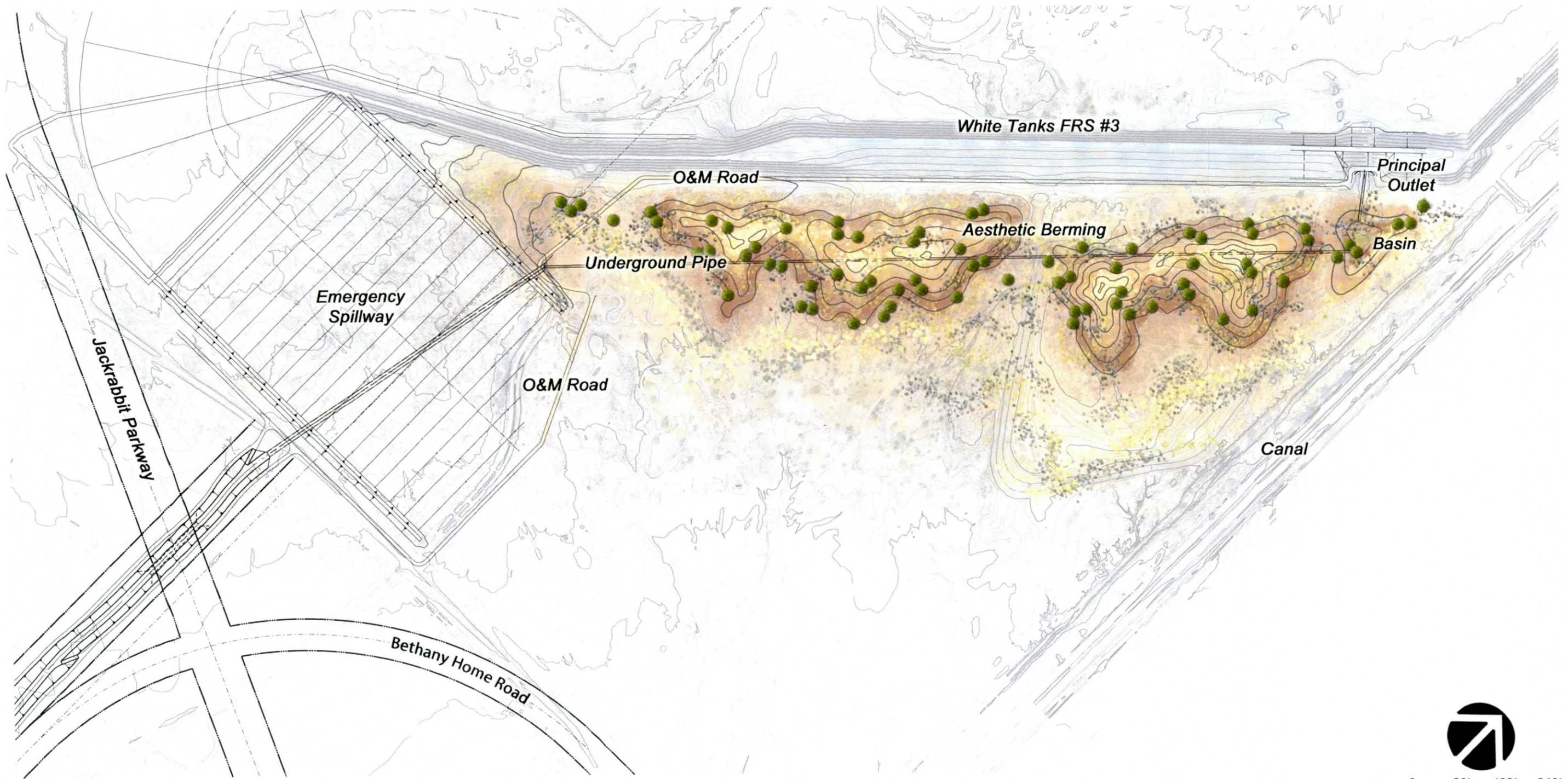


Figure 11 – Reach 9 Underground Pipe Alternatives

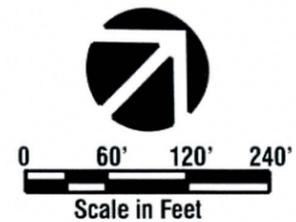
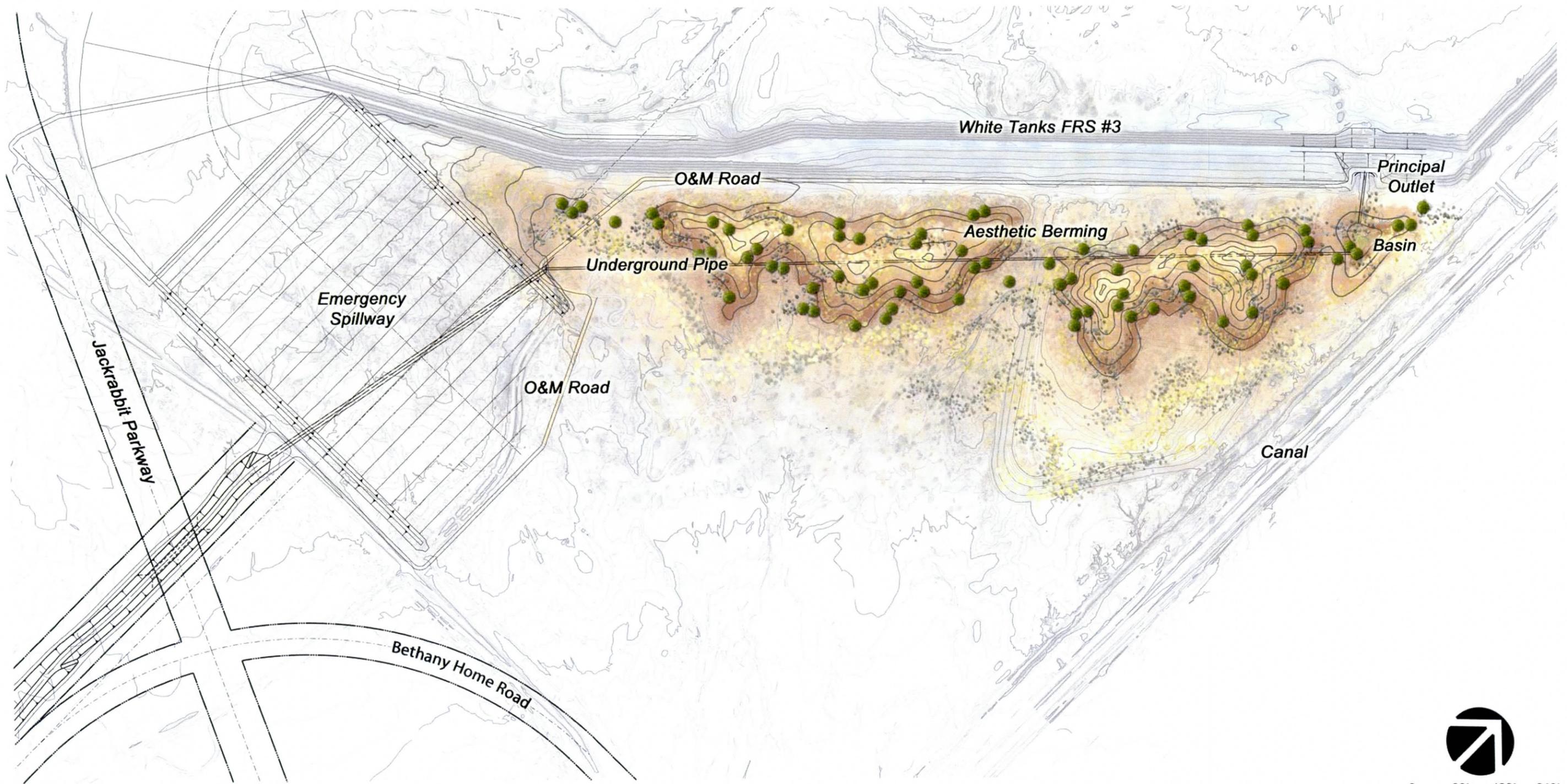


Figure 11 – Reach 9 Underground Pipe Alternatives

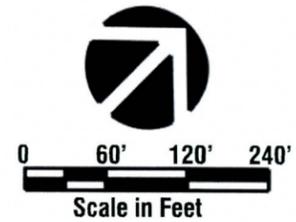
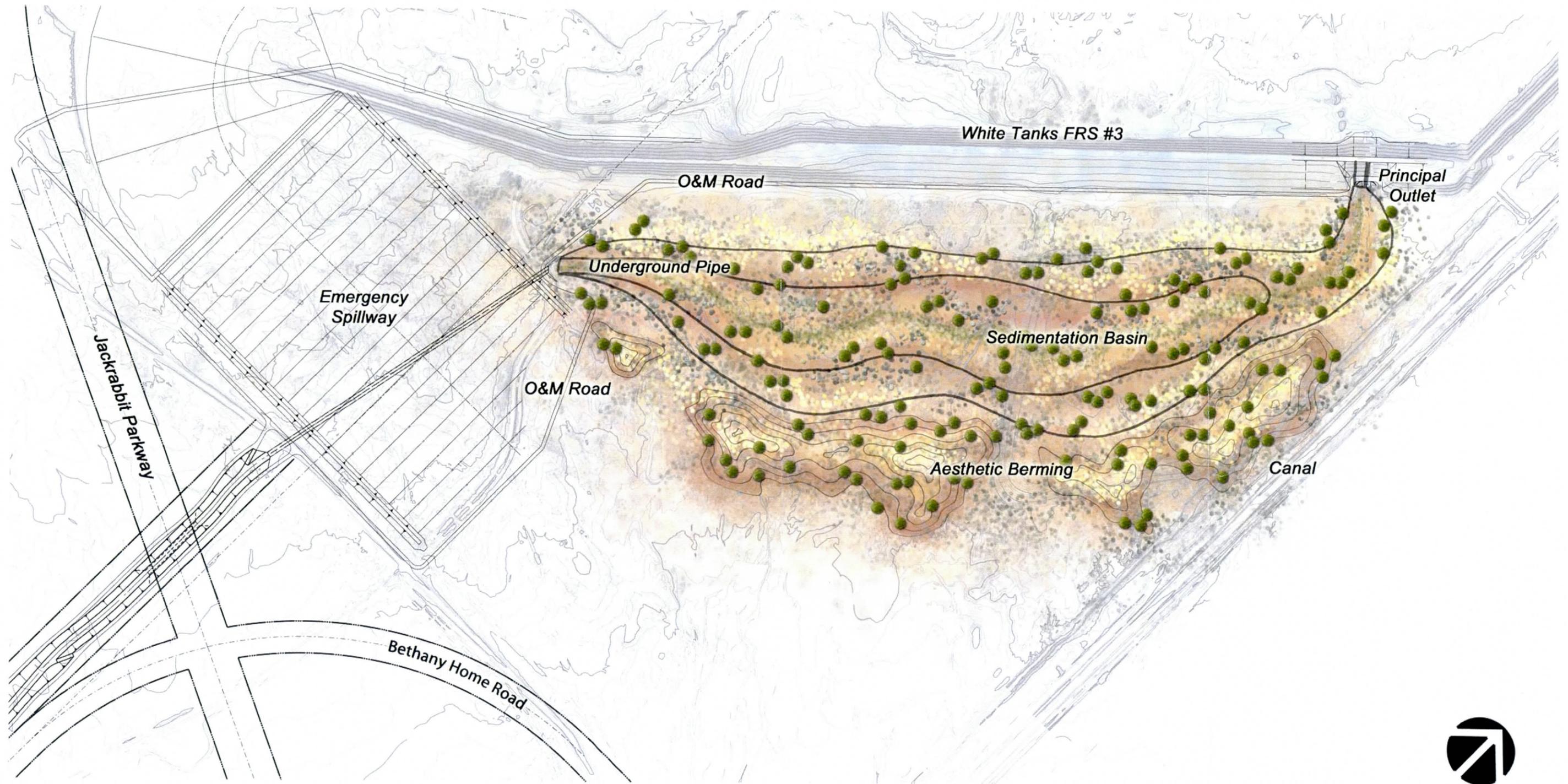


Figure 12 – Reach 9 Sedimentation Basin Alternative



landscape and provide a screen to the FRS#3. This concept would also use tall-pot plantings and hydroseed to reestablish the natural sonoran desert vegetation which was disturbed during the FRS#3 rehabilitation (Ref. 8).



Photo 12 – Reach 9 Downstream of FRS# 3

3.3 Aesthetic Treatment of Structures

In keeping with the Natural Sonoran Desert Wash Design Theme and to be considered a semi-soft structure, the hard facilities within the project should be designed to minimize negative distractions from the overall naturalistic form and materials used in the project design. The use of appropriate landscape aesthetic treatments in the form, texture, and color of structures is important to this goal. Textures and colors that rusticate the structures will blend with the natural setting. Architectural textures, colors, and forms will create visual interest through contrast with the natural forms and materials of the channel. There are a range of options between these treatments. Further



discussion at the Landscape Architecture 30% Design should focus on development of a consistent design palette for the overall project using selected treatments.

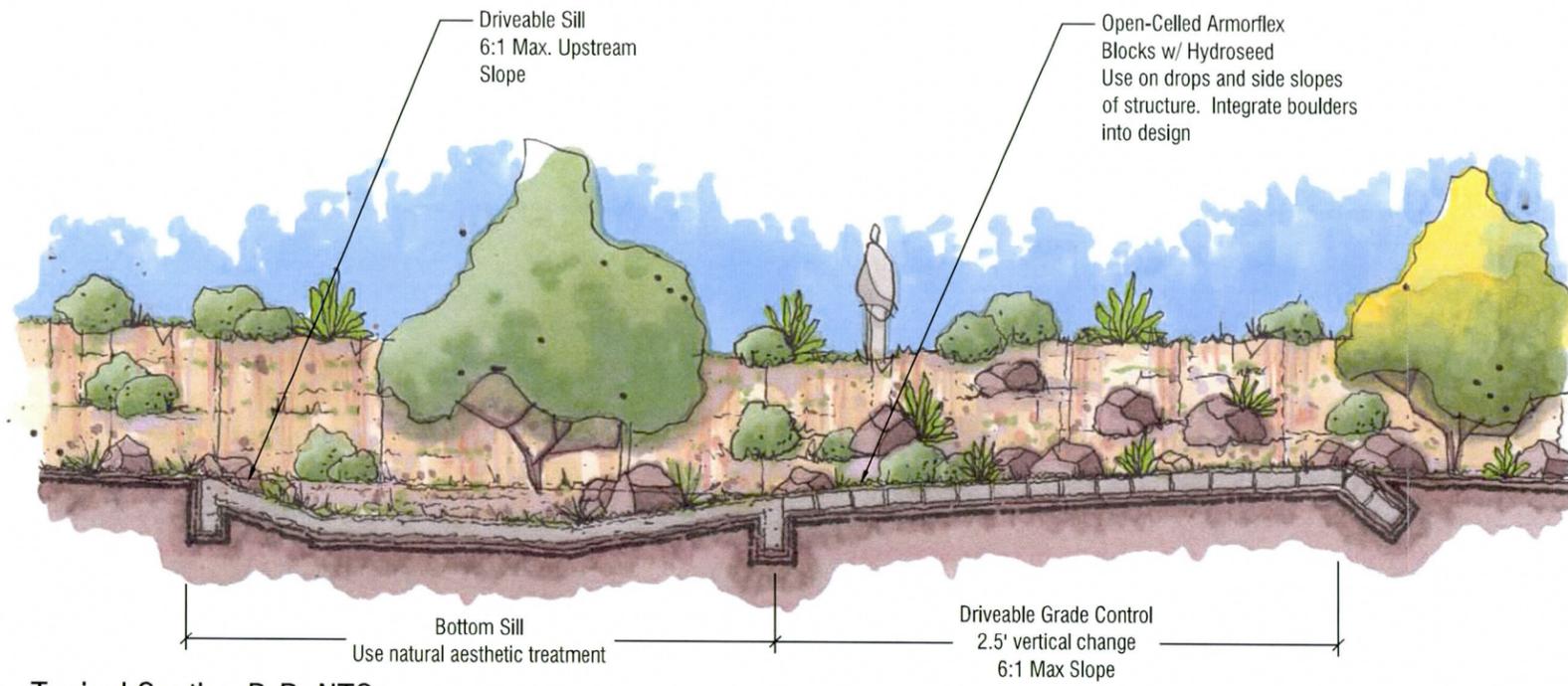
3.3.1 Drop Structure and Headwall Concepts

Figures 13, 14 and 15 present a range of drop structure and headwall treatments, forms, and materials that may be appropriate. The following design criteria should be considered during design refinement:

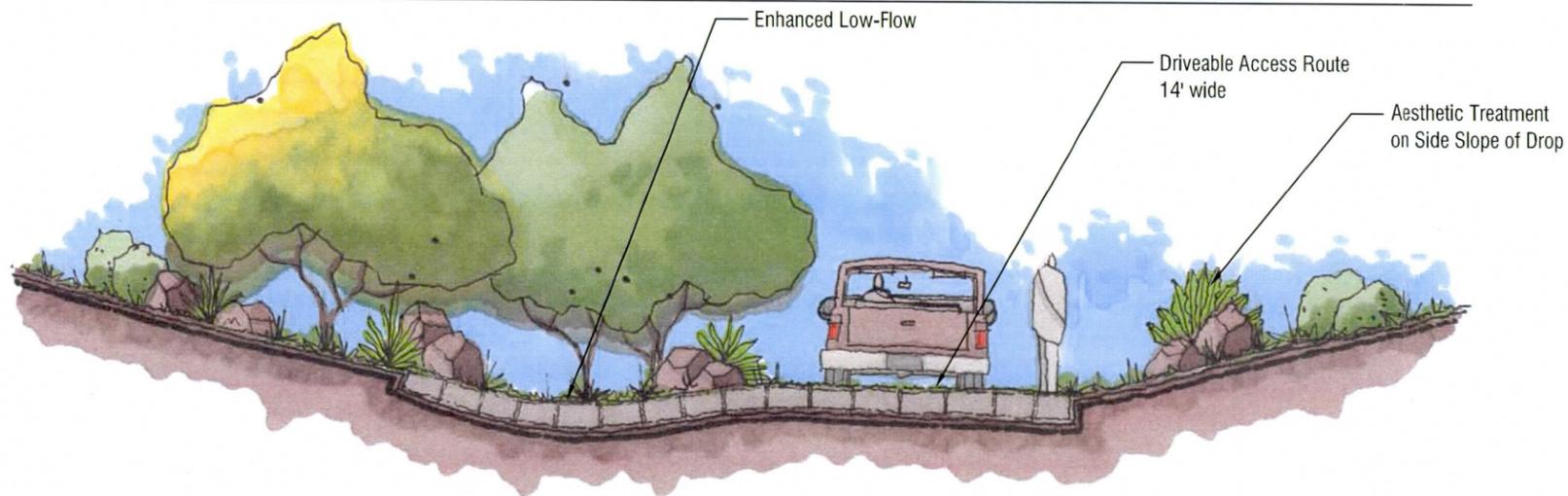
- Drop structures that are located within the open channel must provide a drivable path. This access should be a minimum of 14 feet wide and have a maximum 6:1 slope. Materials within this access route must be traversable by wheeled vehicles.
- Materials and design elements used in the drop structures should be integrated into other elements of the design.
- Observance of the drop structures from multiple angles should be considered, and the appearance of multiple drops in a series looking upstream of the channel will also be critical.

3.3.2 Structural Treatments

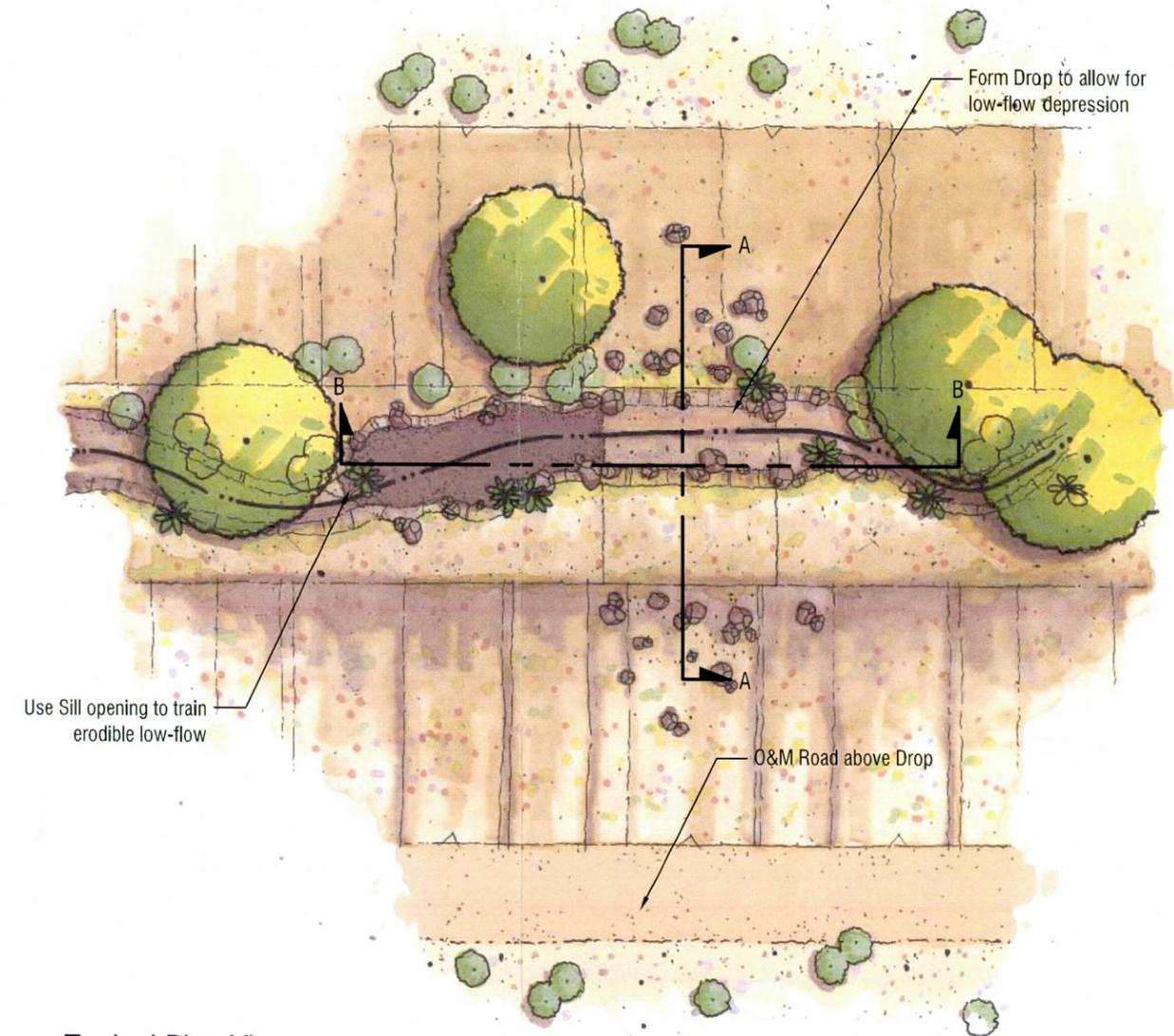
- Figures 16 and 17 represent a range of concrete types, textures, and materials. Figure 17 includes a range of color palettes that are considered appropriate for the project. Any treatment needs to consider District O&M for long-term maintenance and public opinion. Individual developments may wish to incorporate specific themes in reaches that are adjacent to their properties. Where this is the case, consideration of how these themes can be integrated into the overall channel design should be considered.



Typical Section B-B: NTS



Typical Section A-A: NTS



Typical Plan View

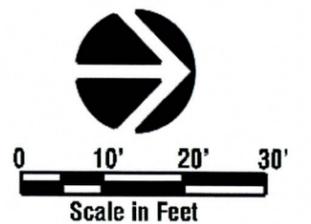
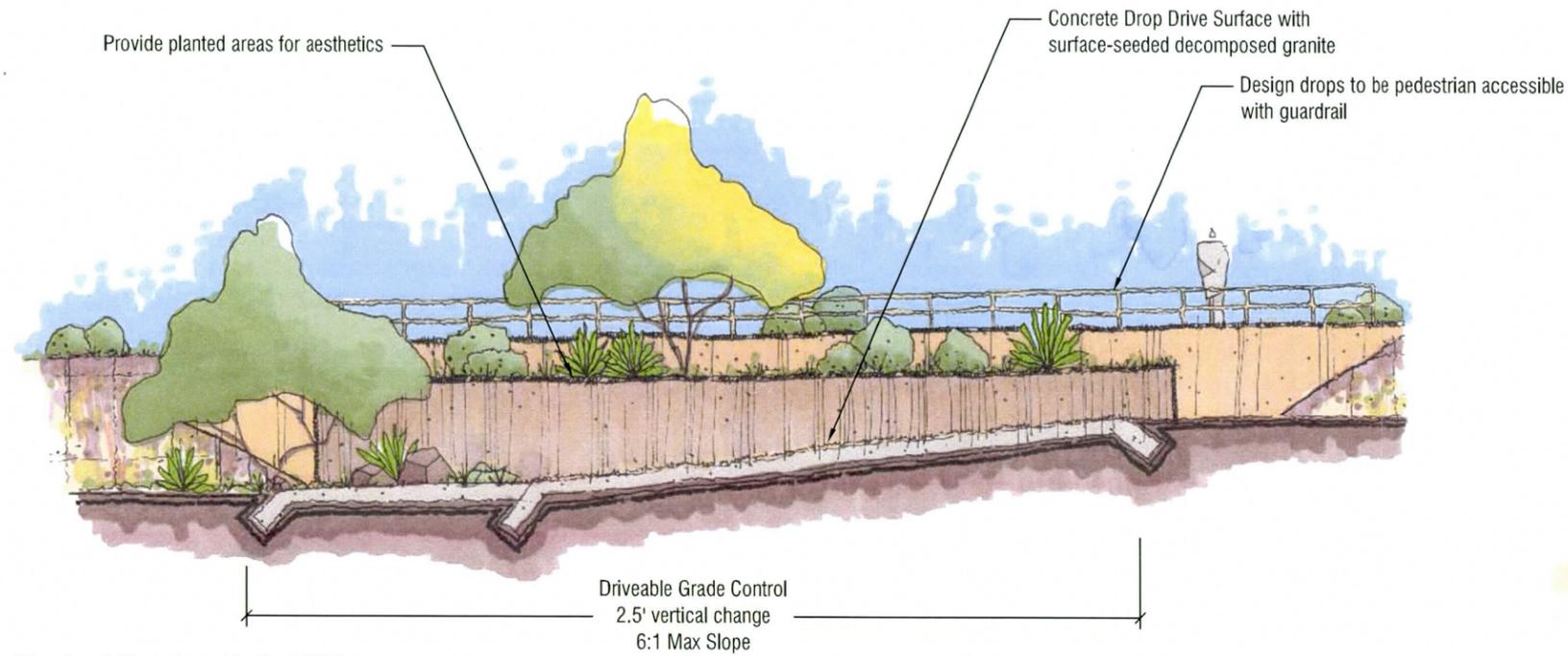
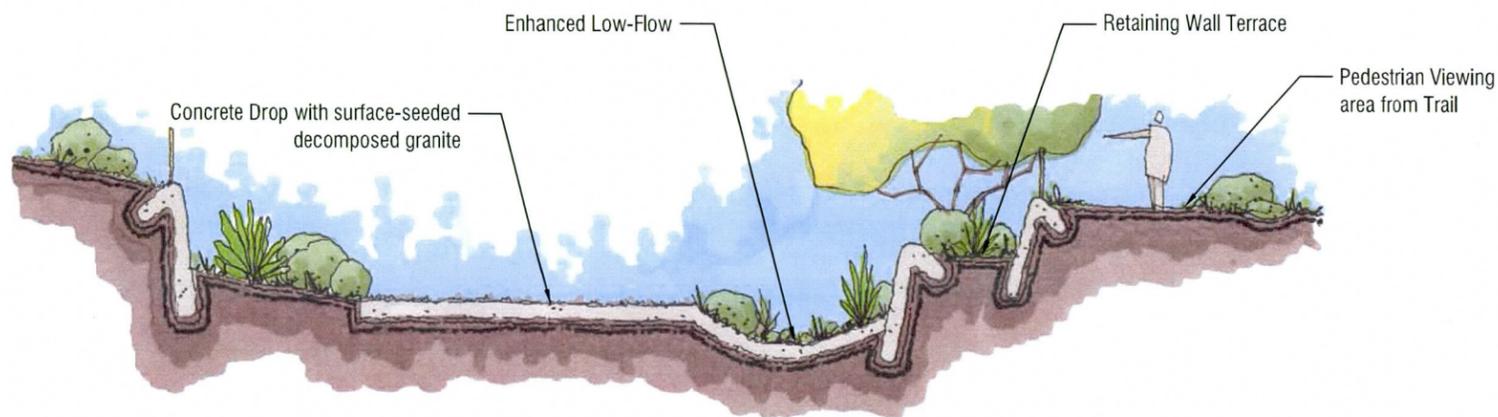


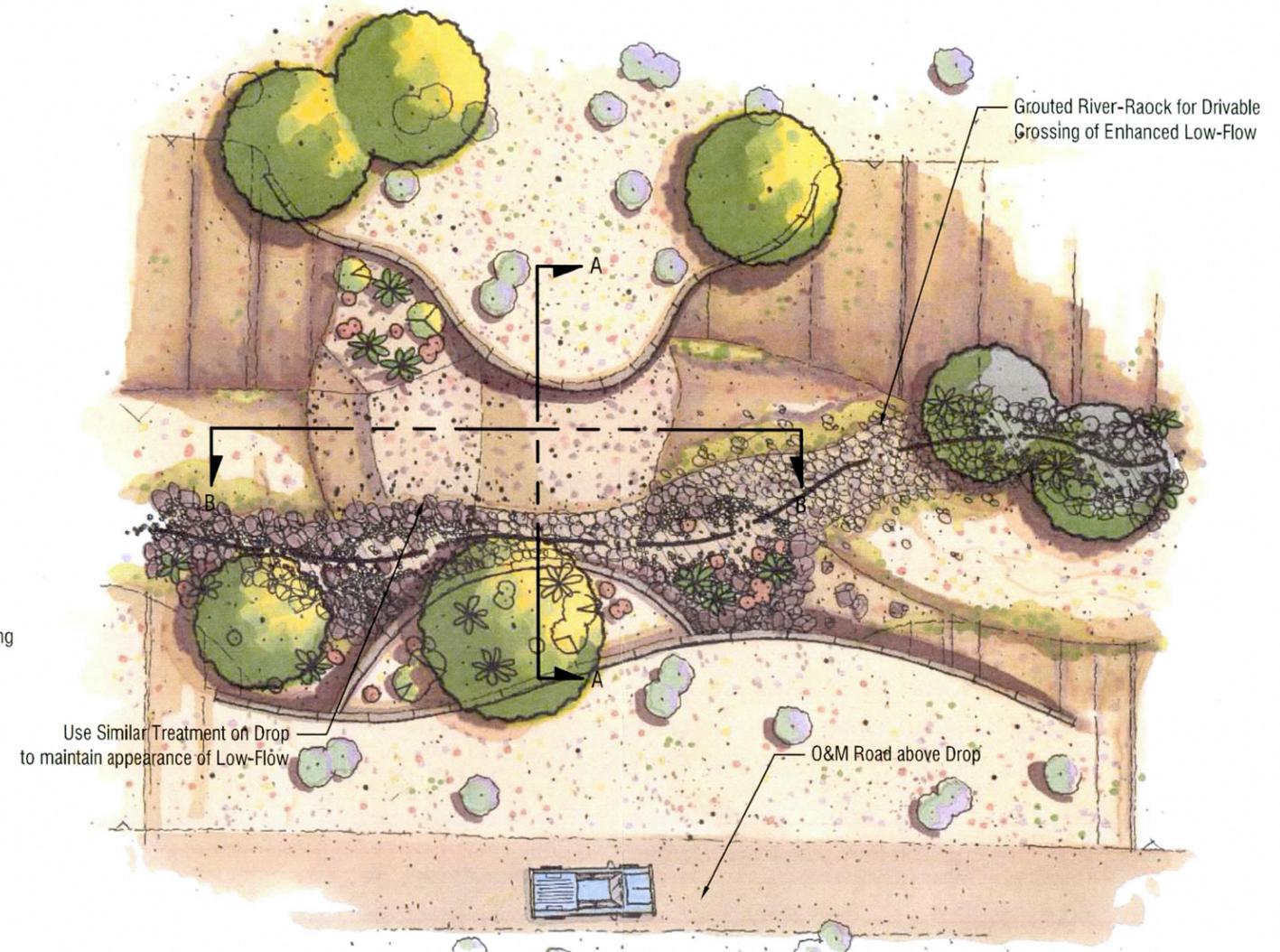
Figure 13 – Drop Structure Concepts



Typical Section B-B: NTS



Typical Section A-A: NTS



Typical Plan View

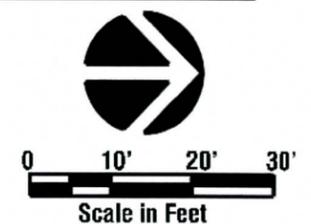
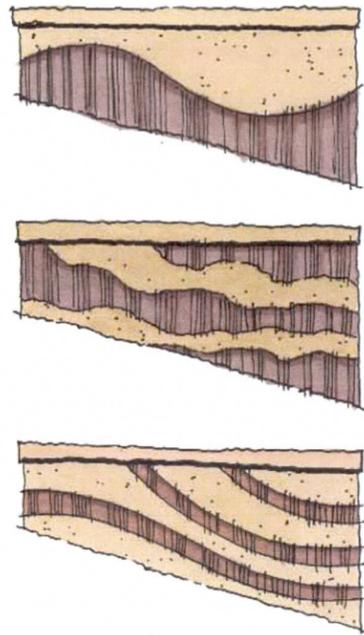
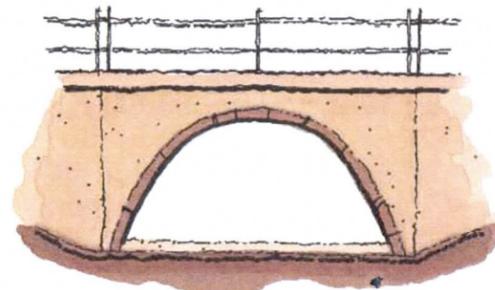


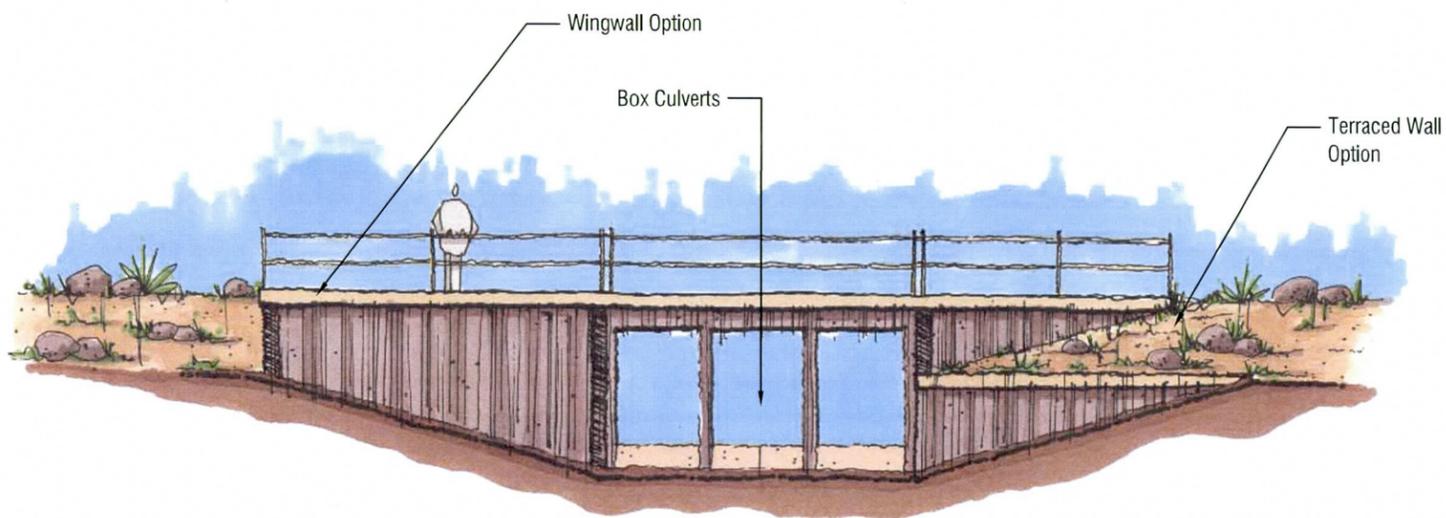
Figure 14 – Drop Structure Concepts



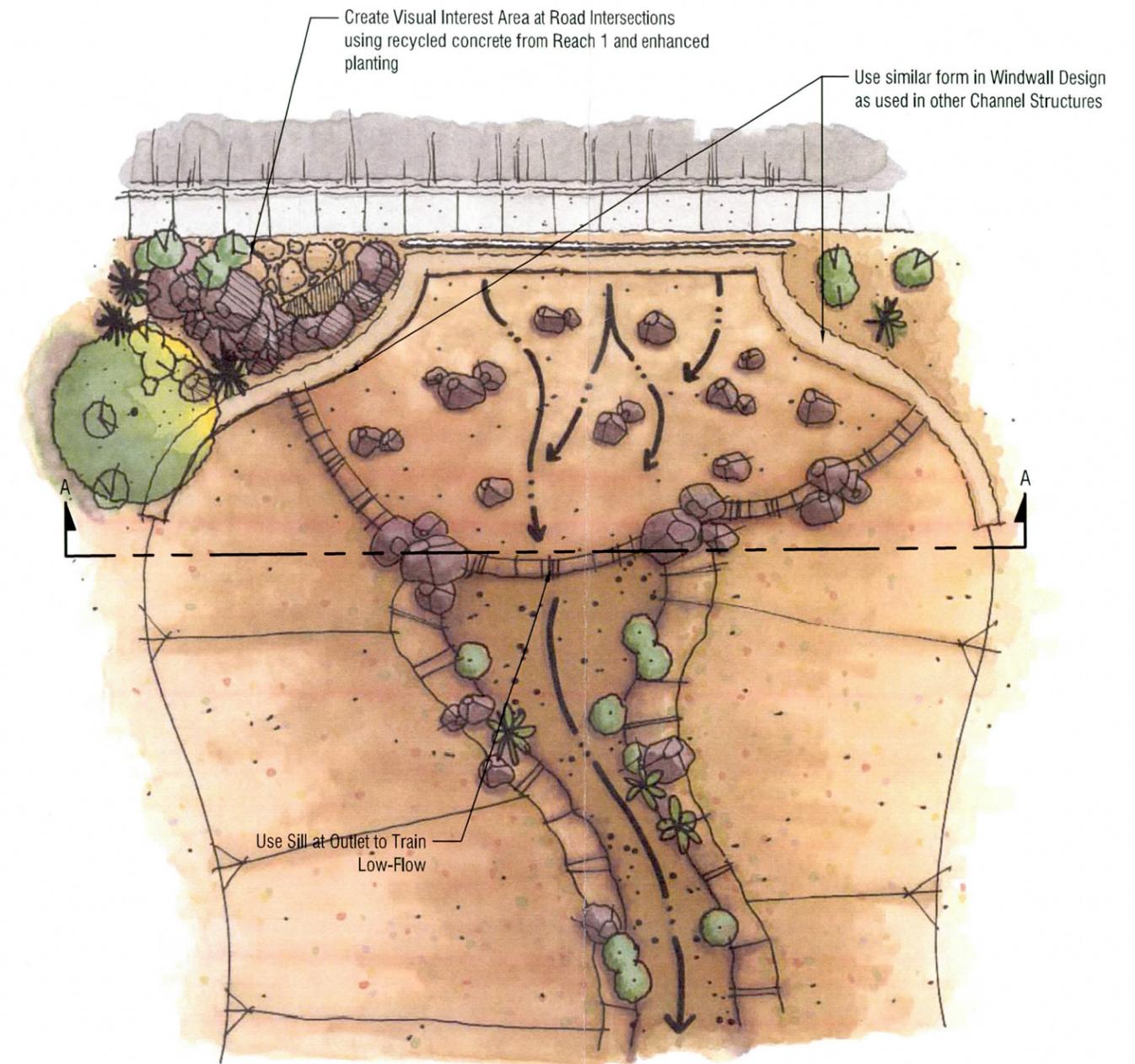
Possible Wingwall Treatment Patterns



ConArch Option



Typical Section A-A: NTS



Typical Plan View

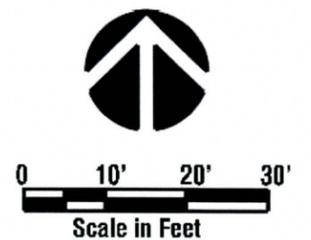
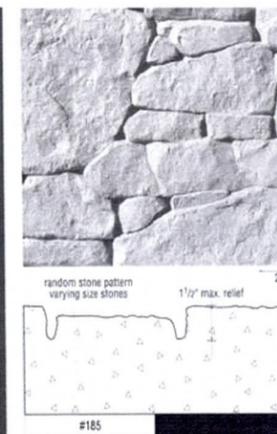
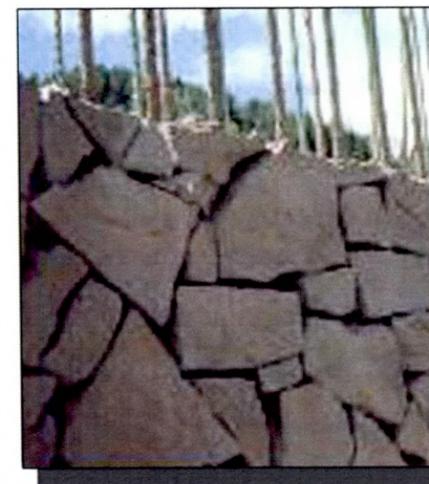
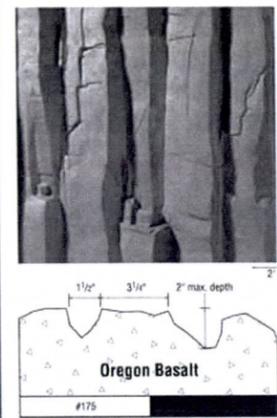
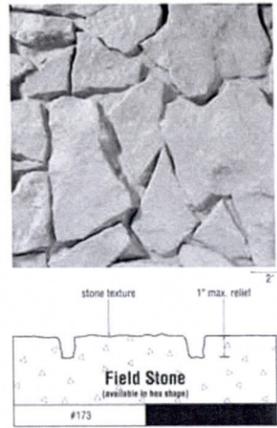


Figure 15 – Headwall Concepts

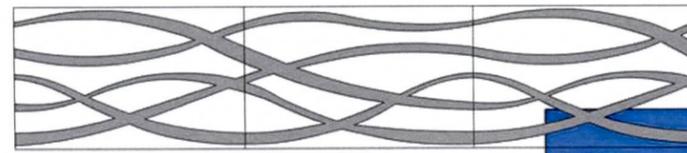


TEXTURES AND FORMS

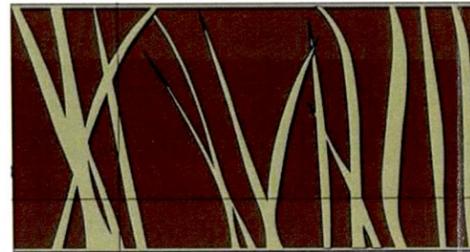
NATURAL



ORGANIC



ALOHA WAVE FORMLINER



WESTERN RANGE GRASS CONCRETE PATTERN

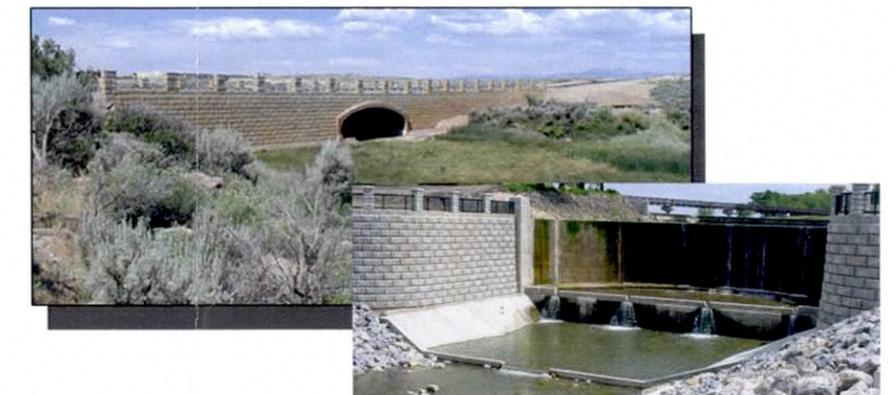
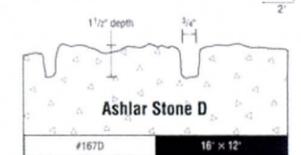
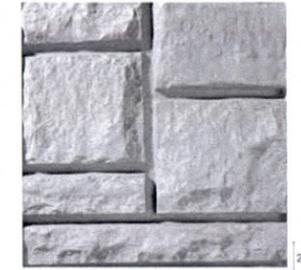
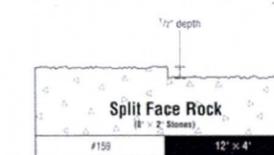
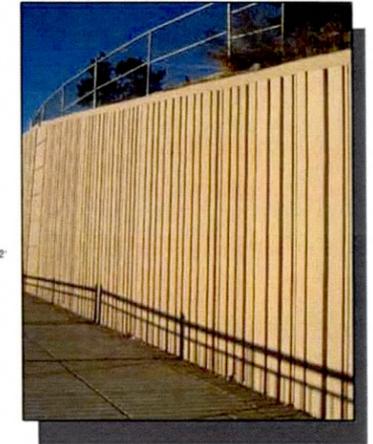
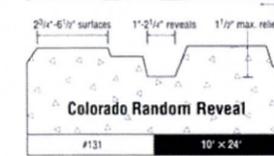
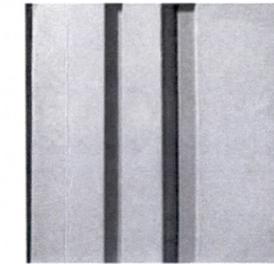
EXPOSED AGGREGATES



DESERT PATINA STAINS

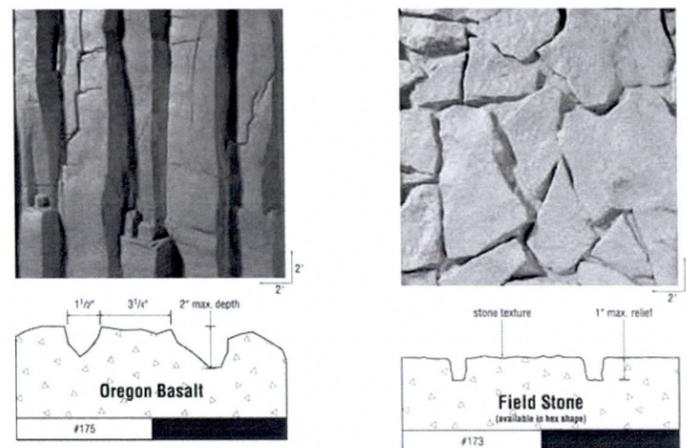


ARCHITECTURAL

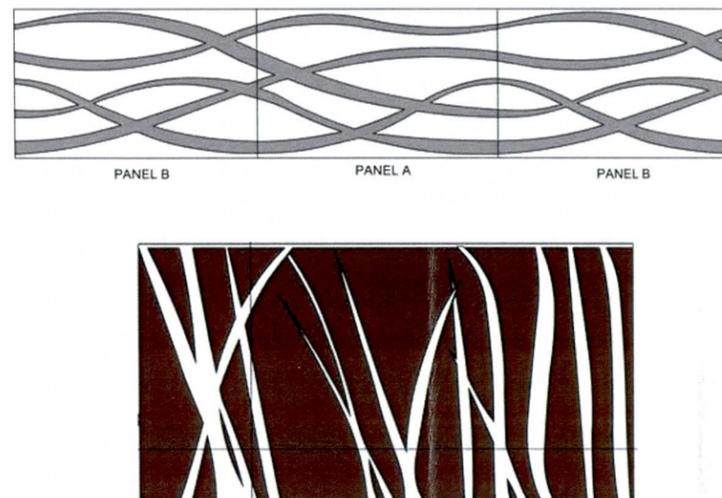




**ELASTOMERIC URETHANE RUBBER FORMLINER
UP TO 100 USES PER LINER**



**PLASTIC FORMLINER
UP TO 10 USES PER LINER**

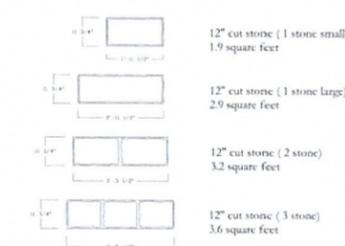


**POLYSTYRENE FORMLINER
UP TO 8 USES PER LINER**



12" Running Bond

1-3/4" thick, 1-1/2" maximum relief



COLOR PALETTES

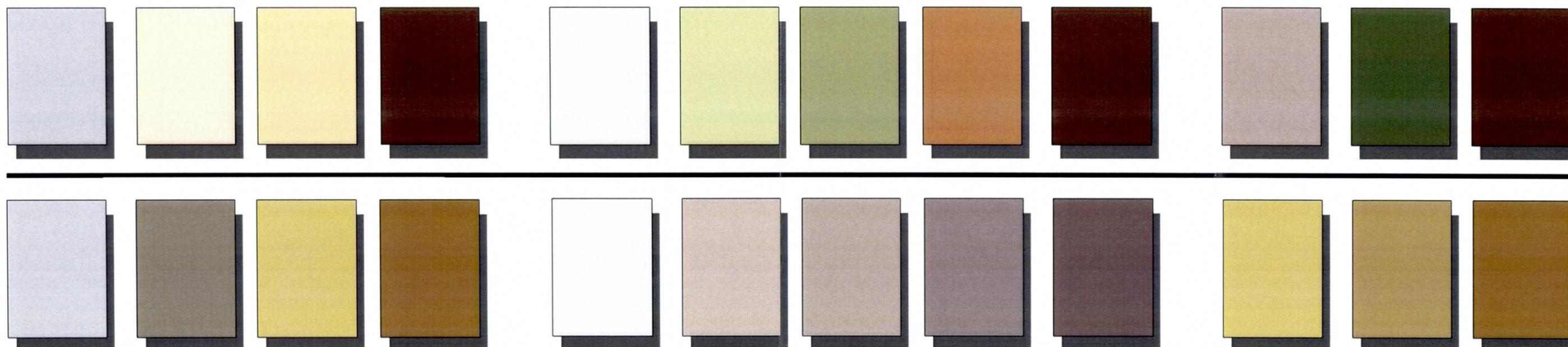


Figure 17 – Materials and Colors



- Materials selected for the project must be durable and provide for minimal maintenance.
- Selected construction materials should discourage skateboarding and vandalism through rough textures. Vertical surfaces should consider graffiti removal techniques.



4 COST COMPARISONS

Initial unit pricing was begun as part of the pre-design effort to determining comparative costs for using a variety of surface treatments of the various structural features proposed. This information, included in Table 2: Landscape Aesthetic Treatment Cost Comparisons, will be further expanded and refined during 30% Plan Development and is presented for consideration when reviewing the various drop structure, headwall, and other treatments for implementation in the project.

Table 2: Landscape Aesthetic Treatment Cost Comparisons

| Treatment | Unit Cost (sq. ft.) | Cost for Application to one side of a 400 sq. ft. Culvert (Headwall and two Wingwalls) |
|--|---------------------|--|
| Formliner – Elastomeric, Low End | \$14.00 | \$5,600 |
| Formliner - Elastomeric, High End | \$50.00 | \$20,000 |
| Formliner – Plastic, Low End | \$1.50 | \$600 |
| Formliner – Plastic, High End | \$7.00 | \$2,800 |
| Formliner – Polystyrene | \$8.00 | \$3,200 |
| Desert Varnish Stain, Installed | \$0.35 | \$140 |
| Paint – Heavy Duty (1 coat primer, 2 coats paint), Installed | \$1.35 | \$540 |
| Sand Blasting, Heavy | \$5.85 | \$2,340 |
| Medium Broom Finish | \$4.00 | \$1,600 |
| Exposed Aggregate, Local Rock | \$1.19 | \$476 |



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