

# Value Analysis Study

July 7 – 9, 2008

## Buckeye Area Drainage Master Plan Flood Control District Maricopa County, Arizona



## Value Analysis Final Report

August 11, 2008



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**Value Analysis Study  
Buckeye Area Drainage Master Plan**

Flood Control District, Maricopa County, Arizona

July 7 – 9, 2008

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**SECTION A: EXECUTIVE SUMMARY**

*"He has the right to criticize who has the heart to help," A. Lincoln*

## Introduction

This report includes recommendations for value enhancement of the Buckeye Area Drainage Master Plan (ADMP) to be implemented in Maricopa County, Arizona. They stem from a value analysis (VA) workshop initiated by the Flood Control District of Maricopa County Arizona. The workshop was held in Phoenix, Arizona, July 7 – 9, 2008. The VA workshop focused on review of the overall master plan layout, site work, and engineering systems.

This value analysis workshop provided a rigorous and in-depth examination of the value that will be provided by the new Buckeye ADMP project. The workshop found that an extraordinary amount of careful thought and planning on the part of the owner and engineers has resulted in a project that will provide great value to the Buckeye community.

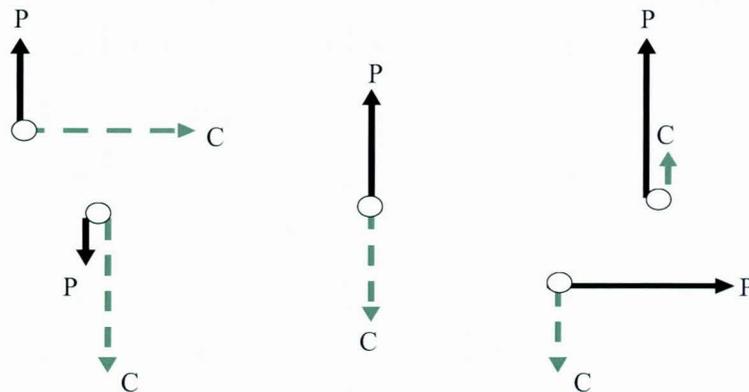
Documents reviewed included:

- Buckeye ADMP Proposed Alternatives Analysis Summary report June 26, 2008
- VA Design Presentation (Power Point) by Dibble Engineering, July 7, 2008

The following diagram illustrates the various ways value can be added to a project. For example the arrows in the lower right corner indicate an idea which maintains performance and reduces costs. The arrows in the center indicate an idea that raises performance and lowers cost. The VA team generated all types of ideas as illustrated to help improve the value of the project.

## Value Enhancement

P = Performance (Benefits) C = Cost (Life Cycle Costs)



## Value Analysis Recommendations

The value analysis team identified over 40 ideas for value enhancement. Of these, 10 were selected for development into recommendations for improving the performance and / or lowering the initial and life cycle cost of the project. "Big Ideas" included:

- Master plan (alternative 3) re-layout to direct flows north to south rather than east to west for consistency in historical drainage patterns, significant cost savings, and improved implementation phasing (see proposals VA-15, VA-16).
- Consider options to reduce land cost, to include VA-2 and VA-17
- Modification to master plan that reduce right-of-way requirements, to include VA-18, VA-20, VA-27, and VA-23
- Give development credits for locating recreational amenities adjacent to flood control facilities to lower cost (VA-22).
- Consider conc. open channels for urban and industrial areas for reduced construction cost (VA-23).
- Include storm drains as part of local improvements (10 year design) and remove storm drains from regional plan for cost savings (VA-25).

The following summary (**Table 1**) lists each proposal by number, description of the change, benefits and cost impact. Owner benefits included: improved flood control, enhanced multi-use space, protection of habitat, additional complemented setting, less condemnation of property, easier phased implementation, additional access to railroad spurs, initial cost savings and life cycle cost savings. Some recommendations will generate significant savings for the project while others will add additional performance. The final column on this table lists responses to the proposals by project decision-makers indicating which proposals are to be implemented. Refer to **Section B**, VA proposals for the complete description of each VA recommendation. Sketches, illustrations, cost estimates, and life cycle cost analysis are also included in this section.

# VALUE ANALYSIS SUMMARY OF RECOMMENDATIONS

Table 1

Project: **Buckeye Area Drainage Master Plan**

Location: **Buckeye, AZ**

No.	Idea Description  ilo = in lieu of DS = Design Suggestion	Value Indicator  P = Performance C = Cost	Performance Benefits (+ or -)					Potential Savings  ( ) indicates cost increase	Acceptance  (Implementation in Design)		
			Flood Control	Multi-use Space	Protect Habitat	Protect Cultural resources	Complement Setting			Other	Initial
VA-2	Allow use of BID Rights of Way for both BID and drainage channels. Allows sharing of land to reduce total area required.		+	+		-	+	Less condemnation of property	54,595,400	56,050,900	Yes, The most likely implementation would be through pursuing an IGA for a shared O&M road between the BID canal and ADMP channel on a case-by-case basis.
VA-15	Use hybrid of alternative 1 & 3 ilo alternative 1. (Includes White Tank FRS No. 4 outfall)		+	+	+		+	Easier phased implementation	126,132,800	133,040,000	Yes, VA-15 & VA-16 were synthesized into a new alternative and then refined some more after receiving stakeholder feedback
VA-16	Enhance alternative 1 ilo alternative 3 by adding basins and enlarging planned basins. Also enhance planned basins by adding multi-use features. (Does not include White Tank FRS No. 4 outfall)		+	+			+	Easier phased implementation	217,266,500	234,476,300	Yes, VA-15 & VA-16 were synthesized into a new alternative and then refined some more after receiving stakeholder feedback
VA-17	Accelerate land acquisition process to take advantage of better market prices.								118,000,000	118,000,000	Yes, when possible.
VA-18	Use side slope of 5 1/2 : 1 for channels in lieu of 7 : 1 in site constrained areas						-		25,299,400	25,299,400	Yes, subject to additional guidance & specifications from FCDMC
VA-20	Use single O & M road ilo one on each side of the channel. This allows the landscape buffer to be reduced by 10' on channel side without the O & M road.								42,241,700	44,555,200	Yes, to be implemented on a case-by-case basis as appropriate

# VALUE ANALYSIS SUMMARY OF RECOMMENDATIONS

Table 1

Project: **Buckeye Area Drainage Master Plan**

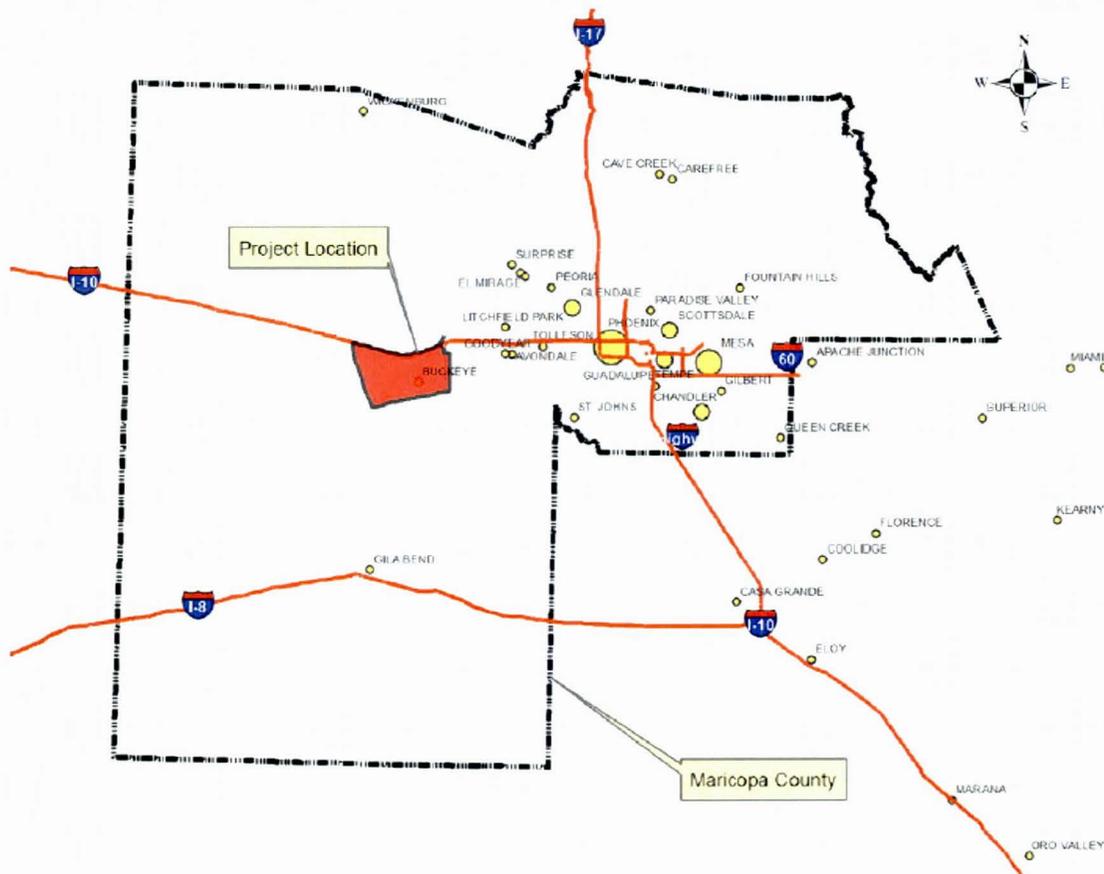
Location: **Buckeye, AZ**

No.	Idea Description  ilo = in lieu of DS = Design Suggestion	Value Indicator  P = Performance C = Cost	Performance Benefits (+ or -)					Other	Potential Savings ( ) indicates cost increase		Acceptance (Implementation in Design)  Yes or No & Reasoning
			Flood Control	Multi-use Space	Protect Habitat	Protect Cultural resources	Complement Setting		Initial	LCC	
VA-22	Give development credits for locating recreational amenities adjacent to flood control facilities			+				Costs vary higher or lower depending on the stakeholder	Design Suggestion		Further consideration required. Not sure if this can/ will be implemented.
VA-23	Consider conc. open channels (alt. 1) for urban and industrial areas. See sketch of cross section and sketch of site location in industrial area. A box culvert (alt. 2), although high in initial cost, could be considered for isolated areas of constrained space. An example application area is the historic rodeo grounds.							Additional access to railroad spurs	10,686,700	10,712,900	Yes, Will be considered on a case-by-case basis. Could "de-couple" channel from multi-use trail in some areas.
VA-25	Include storm drains as part of local improvements (10 year design) and remove storm drains from regional plan.		-						32,824,400	32,824,400	Yes, Storm drains will be removed from plan
VA-27	Optimize Basin - Channel relationship to reduce land cost		+	+					9,009,500	9,563,300	Yes, will work with Town of Buckeye parks to identify optimum size for parks and then develop basin size accordingly with hydrology and channel sizing.

## Project Description

### Study Area

The Buckeye ADMP Study Area is generally bounded by Airport Road on the east, Interstate-10 on the north, the Gila River on the south and the Hassayampa River on the west. The total ADMP and watershed area is approximately one hundred three (103) square miles, which lies within the jurisdictions of unincorporated Maricopa County and the Town of Buckeye. Portions of the study area are under federal and state ownership. The study area is shown on the following map (Figure 1).



**Figure 1, Buckeye ADMP Study Area**

Several distinguishing physical man-made features can be found within the study area boundary. The FCDMC has three Flood Retarding Structures (FRS) that define the north boundary of the study area; Buckeye FRS #1, FRS #2 and FRS #3. These structures primarily run parallel to the I-10 corridor, which is another distinguishing physical feature to the study area. I-10 is a primary interstate connecting Phoenix to Los Angeles. A major state highway, SR-85, bisects the study area from north to south and is currently under construction to be increased in size from a two lane to a four lane divided highway. A less traveled highway, Old United States 80 (US-80), runs along the south boundary north of the Gila River Corridor from SR-85 to the west project boundary. A 1-mile grid of both

paved and dirt roads are evident on the majority of the study area and these often act as delineations of land use or land ownership. Two regional irrigation distribution canals traverse the site from east to west and split the area into thirds. The northern area is bounded by I-10 and the Roosevelt Irrigation District (RID) canal. This area is still mostly desert with large residential communities and commercial sites being developed. The middle area is bounded by the Roosevelt Canal on the north and the Buckeye Water Conservation and Drainage District (BWCDD) Main Canal on the south. Much of this area is beginning to be planned for residential and commercial development. The southern area is bounded by the BWCDD canal on the north and the Gila River on the south. The Arlington irrigation canal traverses through part of this area but does not create as much of a disruption to the natural drainage as the other two canals. This area is also beginning to be planned for residential and commercial development. The Union Pacific Railroad (UPRR) is located just north of the BWCDD Canal and runs east/ west across the project area.

The Buckeye ADMP evaluated existing drainage studies conducted in the Buckeye watershed and the drainage studies performed for others by quantifying the extent of flooding problems and developing alternative solutions to flooding problems. The major objective of the study was to develop a plan to control runoff and prevent flood damage in the watershed. The plan developed and identified preliminary costs, alignments, typical sections, right-of-way requirements, utility conflicts, aesthetic/landscape themes, and potential project implementation partners for the preferred alternative. Through a series of alternatives analysis, the design consultant identified alternative 3 as the preferred alternative. This single preferred alternative was reviewed by the value analysis team.

#### Value-Based Approach

The District has elected to follow a value-based approach to planning within the Buckeye ADMP area. This approach is based on clearly identifying the project objectives as expressed by “end-users” which in this case are the local community stakeholders. The project objectives are supplemented by opportunities to add value to the project as identified during the data collection process. As stated previously, the project objectives are restated as performance criteria, which are then used as a guide in developing storm water management alternatives and as a means to measure the performance, or value, of the various alternatives. The goal of this process is to develop a context-sensitive plan that maximizes the overall value to the community. This is in contrast to an approach that attempts to provide only the basic flood control function at the least cost.

#### Project Goals & Objectives

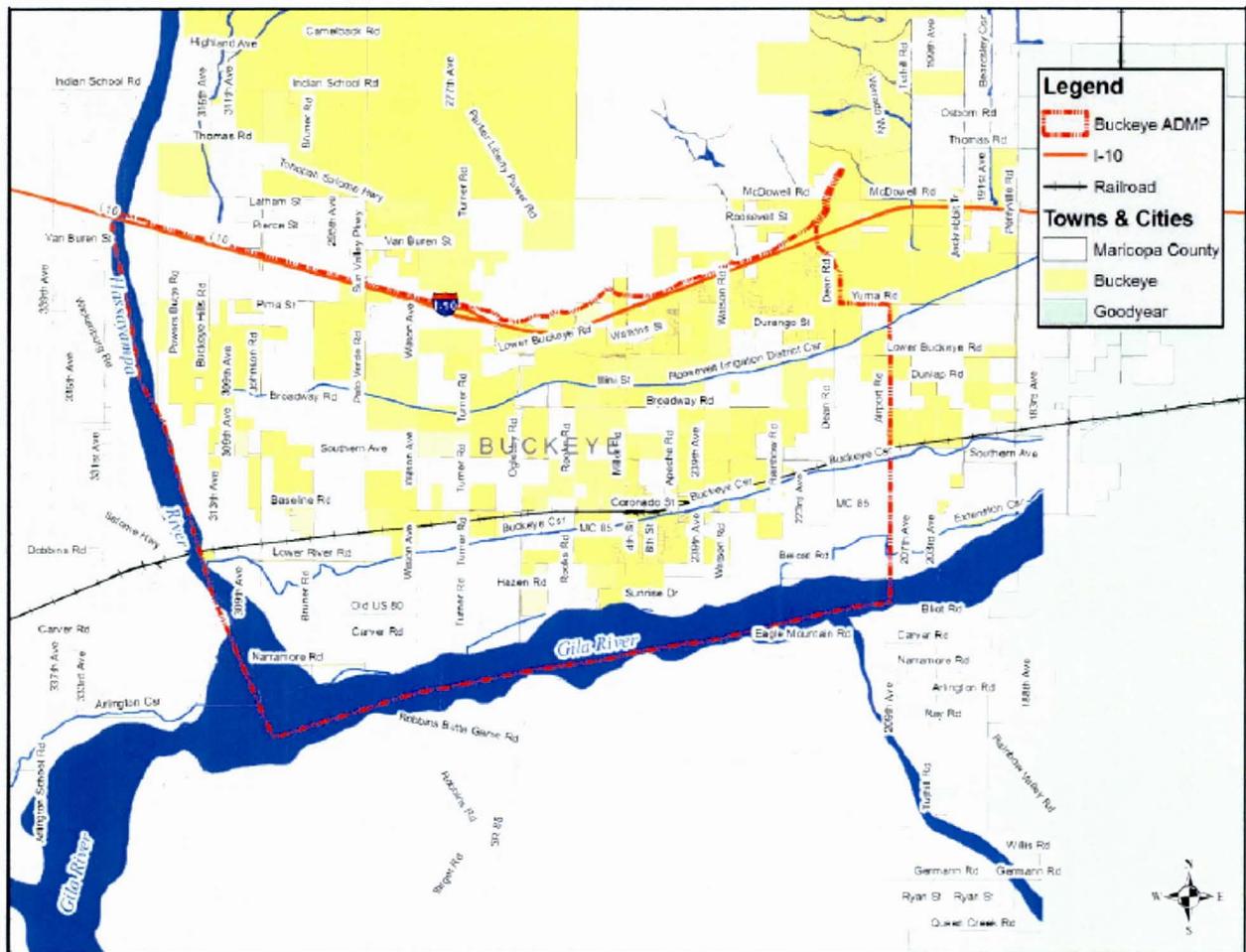
The project goals & objectives expressed by the stakeholders fall into the general categories of flood protection, community enhancement, synergy, and implementation.

The project goals and objectives stated by the stakeholders were synthesized into a set of performance criteria to be used in an evaluation matrix to measure the alternatives according to how well they meet the criteria and thereby add value for the community. The criteria were each assigned a weighting factor from one to five based on how important the

criteria should be considered against the others. The Performance Criteria with the assigned weighting factors are:

- Constructability (3)
- Implementation (1)
- Life Cycle Costs (2)
- Landscape Aesthetics and Land Use Compatibility (4)
- Natural & Cultural Resources (4)
- Public and Political Acceptance (2)
- Safety / Flood Hazard Reduction (5)
- Synergy and Multi-Use (4)

The following **Figure 2** is the Buckeye ADMP site.



**Figure 2, Buckeye ADMP Site**

## Visioning Team Preferred Alternative

### Description

The Visioning Team for this project is made up of Project Team members from the FCDMC and the consultants and Agency Stakeholders representing special interests in the area. The Visioning Team developed the Preliminary plans and evaluated them to select four Proposed Alternatives. The Consultant Team developed the details of the Proposed Alternatives and presented them to the Visioning Team for evaluation. Proposed Alternative 3 was selected to move forward as the Preferred Alternative. There were some suggested modifications to the plan before presenting it to the VA Team.

The Preferred Alternative (**Figure 3**) includes multiple basins as well as a channel alignment along BWCDD Main Canal. The basins could be designed to collect local runoff and bleed it into the main flood control channels or as offline basins to shave the peaks from the flood control channels. This alternative utilizes the Maricopa County Parks and Trail plan for the Buckeye area as a guide for the channel alignments. This alternative receives flow from White Tanks FRS#4 at the RID Canal and crosses the Arizona Nuclear Power Project (ANPP) reclaimed waterline twice. Any body of water, moving or not, is a safety risk and cannot be made 100% safe. To help mitigate safety concerns, this alternative utilizes very flat side-slopes to improve emergency egress and is designed to have a relatively low flow velocity. This option will significantly reduce the flooding potential for the area by intercepting flow north of canals and route it to the west.

### Conceptual Design

Because this option follows the canals, the channels are very flat and in some cases, will have deep cuts to maintain a minimum slope of 0.0005 ft/ft. Additionally, since this options passes through or adjacent to many planned developments, obtaining rights-of-way may be difficult.

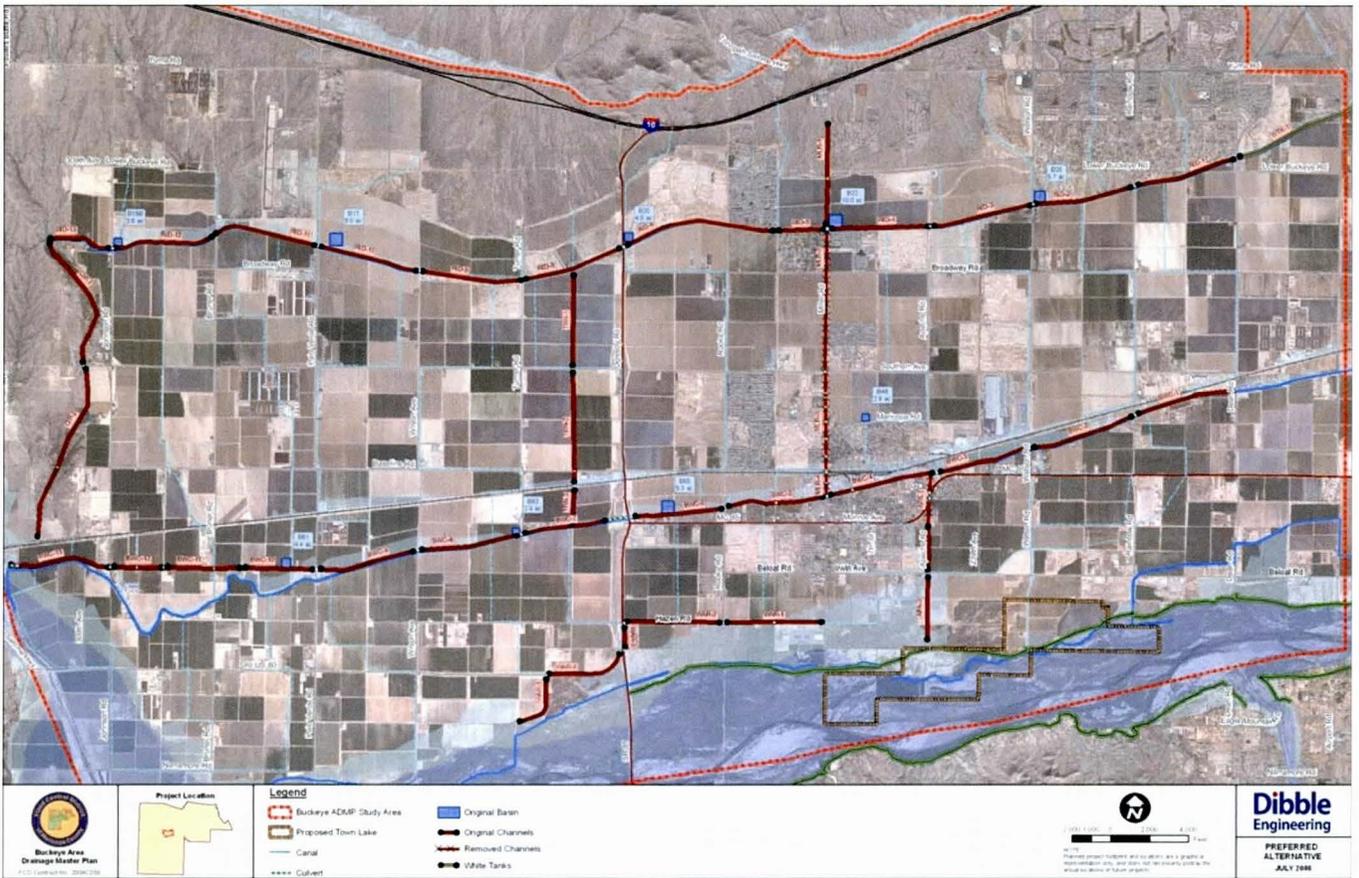
### Advantages

- Provides more basins which can potentially be used for wildlife habitat.
- Includes a concrete box culvert which could be built to create bat habitat.
- Provides a potential opportunity to enhance the wildlife habitat along White Tanks Wash.
- Has fewer outfalls to the Gila River than the other two alternatives, which could impact protected species habitat.
- Provides opportunities for cultural resource interpretation.
- Provides an excellent opportunity for cultural resource interpretation along the canals themselves, which crosscut many of the prehistoric and historic land use categories in the project area.
- Intersects one known hazardous materials site, which is much less than the other Proposed Alternatives.
- The east/west trail alignments coincide with a Multi-Use Foothills/ Wash Trail proposed alignment.

- Portions of the north/south alignment of the primary Maricopa County Trail connection between White Tanks Regional Park and Buckeye Hills Regional Park within the study area is identified for potential recreational multi-use with proposed drainage infrastructure.
- Large Portions of the Miller Road “Gateway” are identified for potential multi-use with drainage infrastructure.
- 3 basin locations coincide with known planned park locations, with a fourth not identified, but could be utilized as a park due to its proximity to development.
- Carries most of the advantages of the other two alternatives combined as it relates to recreation multi-use.
- Provides the most total length of coinciding channel and Maricopa County Trail future alignment at approximately 13.75 miles
- Provides the most total length of coinciding channel and Foothills/ Wash Trail future alignment at approximately 8.75 miles.
- Provides the second most total length of coinciding channel and Town of Buckeye Trails future alignment at approximately 2 miles.
- This alternative provides an excellent reduction in flooding risk by intercepting ponded flow north of the canal and railroad embankments.

### **Disadvantages**

- Projected basin sizes in the southwestern portion of the project area should be larger if to be used as wildlife habitat.
- Does not provide as much diversity in cultural resource interpretation opportunities
- Proposed flood control channels that run along the edge of the Roosevelt Irrigation Canal and the Buckeye Irrigation canal could adversely impact both of these historic cultural resources (mitigation would be required if there is an adverse effect).
- Will require more cultural resources work to implement.
- Has a greater length of proposed channels within areas where the depth to groundwater is less than 50 ft and sometimes as shallow as 8 ft.
- The White Tanks Wash alignment coincides with some of the most unique landscapes in the study area. Care must be taken to maintain the existing character of this area.
- The basin sizes are small in comparison to the size requirements for specific active recreation components.
- This alternative will have channels with flat longitudinal slopes which will require larger channel cross-sections and have difficulty maintaining self-cleansing velocities.
- Additional ROW will need to be acquired at locations with improved parcels which have structures on them.



**Figure 3, Preferred Alternative**

**Value Analysis Objectives**

Following is a summary of the objectives set for this value analysis study:

- Seek “best value” solution (higher performance/ lower life cycle cost)
- Meet goals/ objectives (functions) of project
- Serve as “independent” look at project

**Cost Estimate**

The project cost estimate, prepared by Dibble Engineers, is \$416 million in today’s dollars. The breakdown of cost for alternative 3 is shown as follows:

Channels	\$336,590,348
Culverts	\$25,638,395
Basins	\$20,482,112
Storm Drain	\$32,824,391
Environ. Mitigation	\$332,397
<b>Total</b>	<b>\$415,867,642</b>

Landscaping (included in Channel and Basin cost) \$18,222,106

## VA Team & Agenda

The VA team consisted of members from the Flood Control District of Maricopa County; the Town of Buckeye; Dibble Engineering, design consultant; Evergreen Development, development planning; Stantec Consulting, hydrology; EPG, landscape architects; Oridian, construction specialist & cost estimating; and Kirk Associates. A specialist in value analysis, Stephen J. Kirk Ph.D., FAIA, CVS, LEED™AP of Kirk Associates) led the team's deliberations during the workshop. A list of VA team participants is contained on **Table 2** that follows. See **Figures 4 – 9** for photos of the VA workshop.

The team reviewed the *Proposed Alternatives Analysis Report* and created a function-logic diagram as a part of the workshop. Certain value management analytical tools and methods were used during the 3-day workshop to focus the VA team on the issues, problems and opportunities presented by the Area Drainage Master Plan project. The VA agenda, in conformance with the standards of SAVE International, can be found in **Section C**.



Figure 4, Dibble VA Presentation (Day 1)



Figure 5, VA Team Document Review

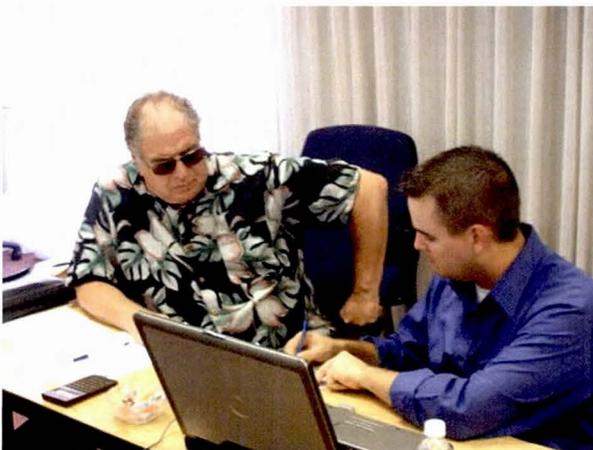


Figure 6, VA Team (Allen & Justin)



Figure 7, VA Team (Valerie & Scott)

# ATTENDANCE

Table 2

Project: **Buckeye Area Drainage Master Plan**  
 Location: **Buckeye, Maricopa, AZ**  
 Date: **July 7 - 9, 2008**

## PARTICIPANTS:

Name/ Title:	Job Function:	Organization/Address:	Phone/ Cell/ e-mail:	Workshop	Presentation
<b>Flood Control District of Maricopa County</b>					
Valerie A. Swick, EIT, CFM	Project Manager/ Professional Hydrologist	Planning & Project Mgt. Division 2801 West Dorango Street Phoenix, AZ 85009	602-506-2929  vas@mail.maricopa.gov	X	X
<b>Buckeye, Arizona</b>					
Michael Manola	Town Representative	Town of Buckeye 90 N Apache Road Buckeye, AZ 85326	623-349-6826  mmanola@buckeyeaz.gov	X	X
<b>Dibble Engineering</b>					
Daniel C. Frank, PE	Project Manager	Dibble Engineering 7500 N Dreamy Draw Dr, Ste 200 Phoenix, AZ 85020	602-957-1155  dan.frank@dibblecorp.com		X
Justin Beeler, PE, CFM	VA Representative	Dibble Engineering 7500 N Dreamy Draw Dr, Ste 200 Phoenix, AZ 85020	602-957-1155  justin.beeler@dibblecorp.com	X	X
Brian J. Fry, PE, CFM Project Manager	Engineering	JE Fuller 1 W Deer Valley Rd, Ste 101 Phoenix, AZ 85027	623-889-0166 ext 307  brian.fry@jefuller.com		X
<b>Value Analysis Team</b>					
Stephen Kirk, PhD, CVS, FAIA, LEED AP, President	VA Facilitator/ Architect	Kirk Associates 1177 Berkshire Road, Suite 100 Grosse Pointe Park, MI 48226	313-823-7330 313-701-2084 (cell) kirkassociates@aol.com	X	X
R. Stuart Barney, PE Senior Project Mgr.	Development Planner	Evergreen Real Estate Developm't 2390 Camelback Rd, #410 Phoenix, AZ 85016	602-567-7131 602-540-1522 (cell) stuart.barney@evergreendev.com	X	X
George V. Sabol, PhD, PE Principal, Water Resources	Hydrologist	Stantec Consulting 8211 South 48th Street Phoenix, AZ 85044	602-438-2200  gsabol@stantec.com	X	X
Scott Peters, RLA, ASLA Director/ Senior Landscape Architect	Landscape Architect	EPG 4141 North 32nd Street, Ste 102 Phoenix, AZ 85018	602-956-4370 602-989-2564 (cell) speters@epgaz.com	X	X
Allen Semer Associate	Construct. Specialist & Cost Estimator	Oridian 2660 N 157th Drive Goodyear, AZ 85395	602-957-3936  jsemer@cox.com	X	X



**Figure 8, VA Team (Stuart & George)**



**Figure 9, VA Team Presentation (Day 3)**

### **Function Logic Diagram**

Function analysis is core to any value study. For this project, the VE team prepared a function logic diagram to help understand the overall purposes of the Buckeye Area Drainage Master Plan. This diagram describes the primary functions of the project that will “prevent flood damage”, by “controlling runoff.” This plan also offers functions to: “create multi-use space, protect existing habitat & cultural resources, and complement the setting.” The function-logic diagram is shown as **Figure 10**.

### **Value Models**

#### Cost Model

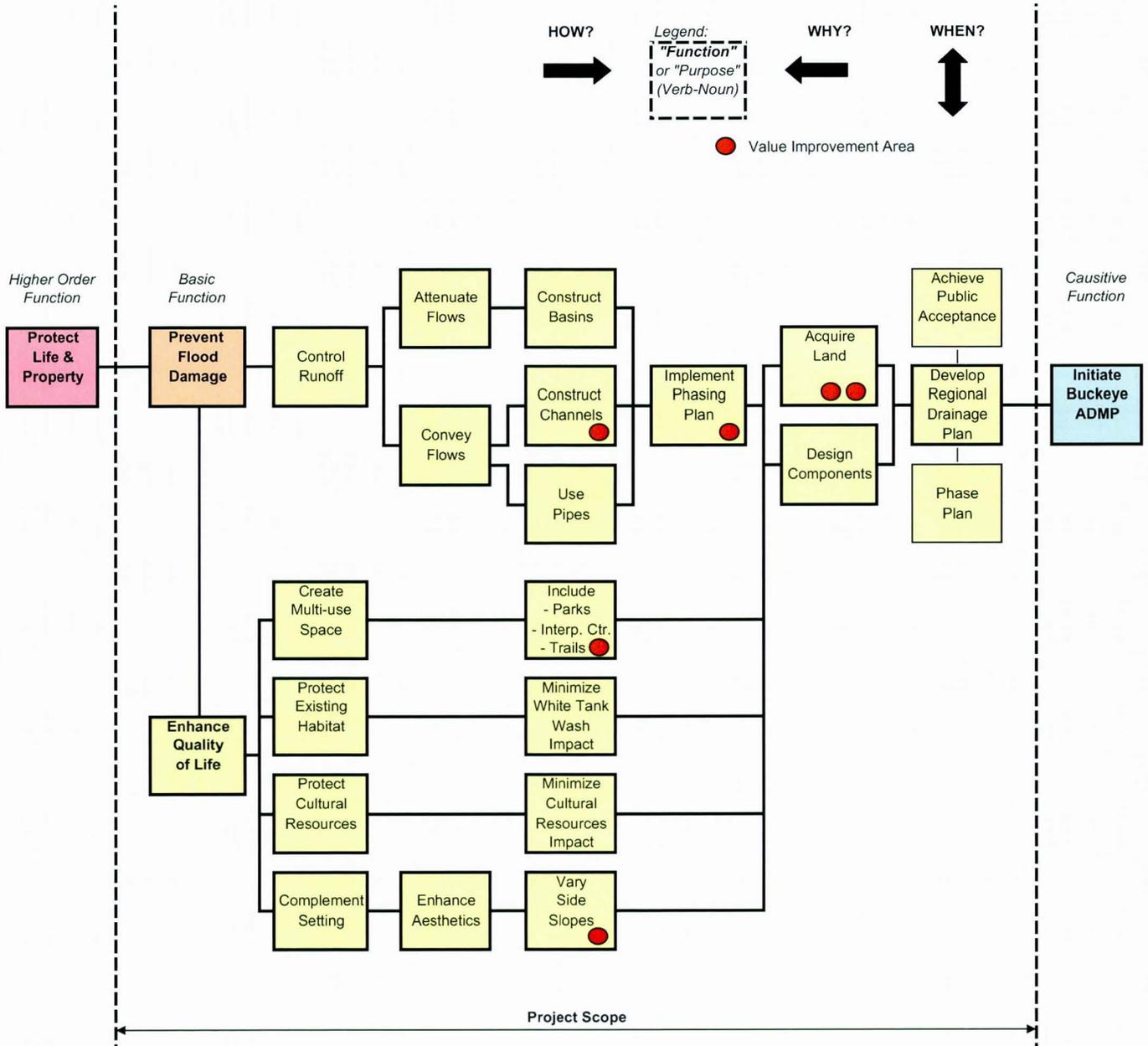
To understand the cost of construction by project components, the cost estimate was organized into a pie chart. This Cost Model is shown as **Figure 11**. Highest costs were the land, channels, storm drains, culverts, basins, and landscaping.

Since the cost of the channels was quite large, this cost was organized into a Pareto Cost Model (highest to lowest cost per mile). It is shown as **Figure 12**.

# Buckeye Area Drainage Master Plan Buckeye, Arizona

Figure 10

## Function Logic Diagram



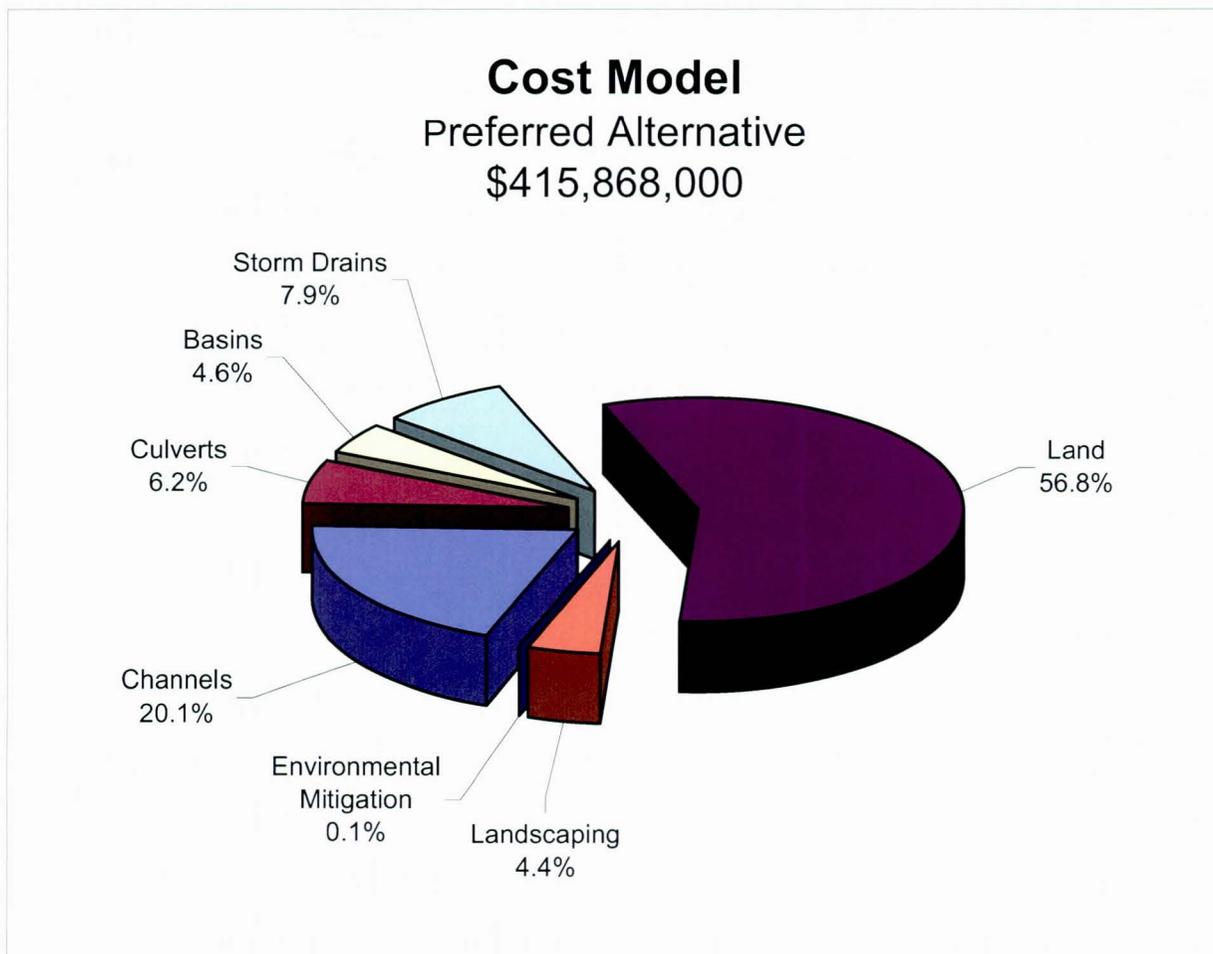
# Cost Model Summary

Figure 11

Buckeye Area Drainage Master Plan, Maricopa County, AZ  
Preferred Alternative

Item	Cost	Landscape	Land	w/o Land & Landscape
Channels	\$336,590,348	\$16,694,127	\$236,309,673	\$83,586,548
Culverts	\$25,638,395	\$0	\$0	\$25,638,395
Basins	\$20,482,112	\$1,527,980	\$0	\$18,954,132
Storm Drains	\$32,824,391	\$0	\$0	\$32,824,391
Environmental Mitigation	\$332,397	\$0	\$0	\$332,397
<b>Total</b>	<b>\$415,867,642</b>	<b>\$18,222,106</b>	<b>\$236,309,673</b>	<b>\$161,335,863</b>

Item	Cost	Percent
Channels	\$83,586,548	20.1%
Culverts	\$25,638,395	6.2%
Basins	\$18,954,132	4.6%
Storm Drains	\$32,824,391	7.9%
Land	\$236,309,673	56.8%
Landscaping	\$18,222,106	4.4%
Environmental Mitigation	\$332,397	0.1%
<b>Total</b>	<b>\$415,867,642</b>	<b>100.0%</b>



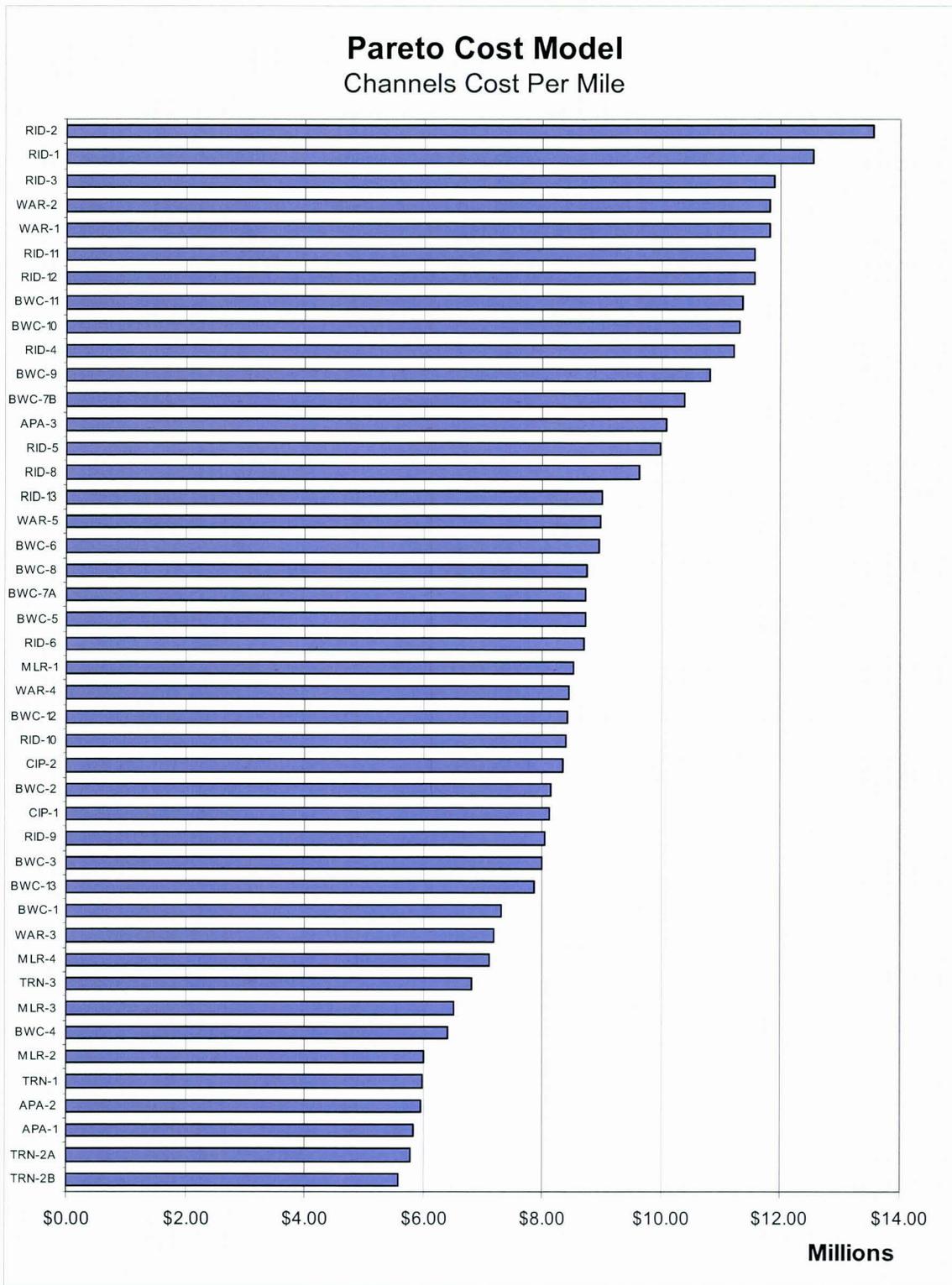


Figure 12, Pareto Cost Model, Channels Cost per Mile

**Section B** contains all VA proposals with a complete description of each VA recommendation. Sketches, cost estimates, and life cycle cost analysis, as appropriate, are also in this section.

**Section C** contains a description of the VA process used in this study. Force field analysis, idea listing, workshop agenda, cost estimate summary, and selected drawings are also contained in this section.

### **Acknowledgements**

It would be a serious oversight to end this Executive Summary without acknowledging the significant contribution made by the well-informed, spirited and cooperative staff of the Flood Control District of Maricopa County; the Town of Buckeye; Dibble Engineering; JE Fuller, Hydrology and Geomorphology,(Brian Fry), Evergreen Development; Stantec Consulting; EPG; Oridian; and Kirk Associates.

**Value Analysis Study  
Buckeye Area Drainage Master Plan**

Flood Control District, Maricopa County, Arizona

July 7 – 9, 2008

**SECTION B: VA RECOMMENDATIONS**

# Value Analysis Recommendation

Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
 Item: Allow use of BID Rights of Way for both of BID and drainage channels

VA No.  
2

Function (verb noun): *Accommodate Drainage Channels*

## Original Design

Build Drainage channel on North side of BID without encroaching the BID canal. APS line is also a potential conflict.

## Proposed Design

With an agreement between the BID/TOB/FCDMC, utilize BID's existing ROW and reconstruct their irrigation canal to the far south side allowing gravity flow and service to their customers while building the drainage channel on the North side & confining it to 169' max ROW, keeping the APS line as horizontal control, and acquiring the extra ROW needed. An increase of basin acreage with offline design would be necessary.

## Advantages and Disadvantages

### Advantages:

- Land acquisition costs are less
- More basin acreage for multi-use
- Less condemnation of property
- 
- 

### Disadvantages:

- Reconstruct BID - cost
- 
- 

### Value Indicator:



## Discussion

Allowing the use of BID's existing ROW could lower costs. Original design criteria used were the averages; D=7' for channels, Top width= 140, ROW 260

## Life Cycle Cost Summary

	<u>Initial Cost</u>	<u>Life Cycle Cost</u>
Original Design	166,903,200	169,513,000
Proposed Design	112,307,800	113,462,100
Potential Savings	54,595,400	56,050,900

# Sketch Worksheet

Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ

VA No.

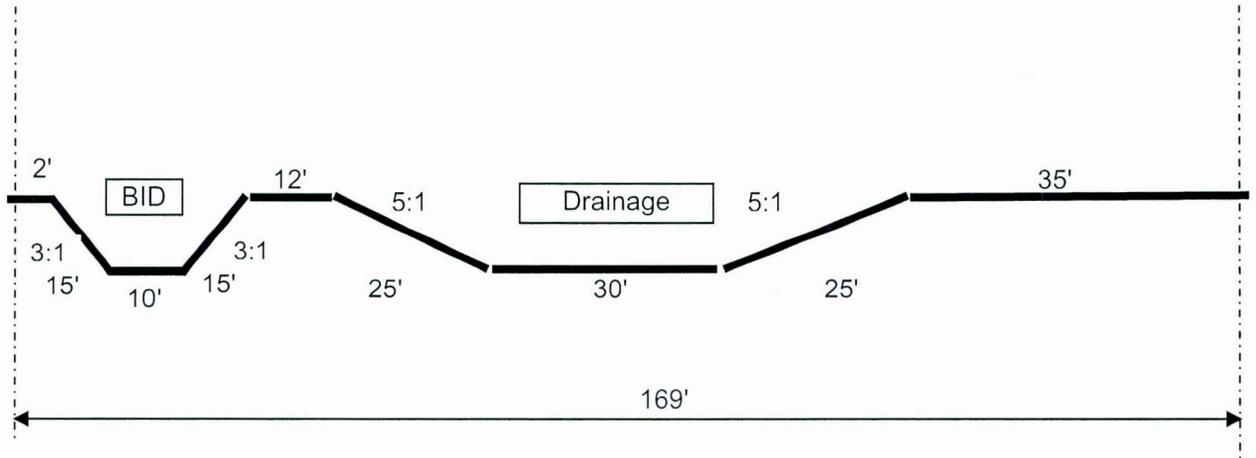
Item: Allow use of BID Rights of Way for both of BID and drainage channels

2

Function (verb noun): Accommodate Drainage Channels

Original Design

Proposed Design



# Cost Worksheet

Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
 Item: Allow use of BID Rights of Way for both of BID and drainage channels

VA No.  
2

Function (verb noun): Accommodate Drainage Channels

<b>Original Design</b>				
	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total</u>
Channel land acquisition (average) = 260' ROW	378	acres	200,000	75,636,364
Channel excavation of ave top width = 140' @ 7' depth	1,642,667	cyd	11	18,069,333
Basin land acquisition	44	acres	200,000	8,800,000
Basin excavation @ 8" depth	425,920	cyd	11	4,685,120
Landscape design	16,473,600	sf	0.23	3,788,928
Landscape construction	16,473,600	sf	0.50	8,236,800
Subtotal				119,216,545
Markup (contingency, GC OH & profit, bond, escalation)	40%			47,686,618
			<b>Total Cost</b>	<b>166,903,200</b>

<b>Proposed Design</b>				
	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total</u>
Channel land acquisition = 90' feet beyond BID	131	acres	200,000	26,181,818
Channel excavation of ave top width = 140' @ 7' depth	563,200	cyd	11	6,195,200
Basin land acquisition	88	acres	200,000	17,600,000
Basin excavation @ 8" depth	1,703,680	cyd	11	18,740,480
Excavation of new BID	234,667	cyd	11	2,581,333
Construct new BID - shotcrete lined- 4"	32,525	cyd	80	2,601,984
BID service reconnects	1	LS	1,000,000	1,000,000
Landscape design @115' width	7,286,400	sf	0.23	1,675,872
Landscape construction	7,286,400	sf	0.50	3,643,200
Subtotal				80,219,888
Markup (contingency, GC OH & profit, bond, escalation)	40%			32,087,955
			<b>Total Cost</b>	<b>112,307,800</b>

**Potential Savings** **Potential Savings 54,595,400**

# LIFE CYCLE COST ANALYSIS (LCCA)

Project/Location: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
 Item: Allow use of BID Rights of Way for both of BID and drainage channels

VA No.  
2

Function (verb noun): Accommodate Drainage Channels

Description:				Original Design		Proposed Design	
Project Life Cycle =	50	Years		Channel land acquisition		Channel land acquisition = 90' feet beyond BID	
Discount Rate =	4.00%			(average) = 260' ROW			
INITIAL COSTS				Est.	PW	Est.	PW
A.	Original Design			166,903,200	166,903,200	0	0
B.	Proposed Design			0	0	112,307,800	112,307,800
C.					0		0
D.					0		0
E.					0		0
F.					0		0
G.					0		0
H.					0		0
I.					0		0
J.					0		0
<b>Total Initial Cost</b>				<b>166,903,200</b>		<b>112,307,800</b>	
<b>Initial Cost PW Savings (Compared to Original Design)</b>						<b>54,595,400</b>	
REPLACEMENT COST/ SALVAGE VALUE							
Description	Year	PW Factor					
A.					0		0
B.					0		0
C.					0		0
D.					0		0
E.					0		0
F.					0		0
G.					0		0
H.					0		0
I.	Salvage Value				0		0
<b>Total Replacement/Salvage Costs</b>				<b>0</b>		<b>0</b>	
ANNUAL COSTS							
Description	Cost/ SF	Escl. %	PWA				
A.	Energy	2.0%	31.684		0		0
B.	Maint, landscape	0.005	31.684	82,368	2,609,767	36,432	1,154,320
C.		0.0%	21.482		0		0
D.		0.0%	21.482		0		0
E.		0.0%	21.482		0		0
F.		0.0%	21.482		0		0
<b>Total Annual Costs (Present Worth)</b>				<b>2,609,800</b>		<b>1,154,300</b>	
<b>Total Life Cycle Costs (Present Worth)</b>				<b>169,513,000</b>		<b>113,462,100</b>	
<b>Life Cycle Savings (Compared to Original Design)</b>						<b>56,050,900</b>	
<b>Total Life Cycle Costs (Annualized)</b>				<b>PP Factor</b>			
				<b>0.0466</b>	<b>7,890,864 Per Year</b>	<b>5,281,683 Per Year</b>	

PW: Present Worth  
 PWA: Present Worth of Annuity  
 PP: Periodic Payment

# Value Analysis Recommendation

**Project:** Buckeye Area Drainage Master Plan, Maricopa County, AZ  
**Item:** Use hybrid site plan of alternative 1 and 3 ilo alternative 3

**VA No.**  
15

**Function (verb noun):** *Control Runoff, Create Multi-Use Space, Complement Setting, Enhance Implementation, Reduce Canal Crossings*

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## Original Design

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Alternative 1 - North-south channels following historic drainage patterns.

Alternative 3 (selected) - East-west channels paralleling canals on upstream side with basins.

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## Proposed Design

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East-west collector channels and basins located along canal to pick up flows and minimize canal crossings with major north-south channels carrying flows to Gila River. Upstream basins attenuate flows to reduce size of north-south channels and size of canal crossing. East-west channels are provided along Southern Ave. and the Union Pacific Railroad to protect Central Buckeye, including the Rodeo Grounds. Flows from White Tanks FRS 4 are picked up at RID canal location.

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## Advantages and Disadvantages

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### Advantages:

- Allows for phased implementation with development
- Protects central Buckeye, including rodeo grounds
- Reduced channel widths
- Provides multi-use opportunities with basins and channels
- Minimizes number of canal crossings (Alt. 1= 5)
- Utilizes historic drainage patterns
- Picks up flows from White Tanks FRS 4
- Basins and channels are consistent with town Parks and Trails Master Plan
- Added protection for railroad
- Avoids existing developments
- Utilizes existing floodplain upstream of canals for multi-use without flood control facility
- Added multi-use opportunities for community (flood control & canals)
- No channel through future airport expansion area
- White Tank Wash is not used for floodwater conveyance as requested by town
- Flows are not discharged into Hassayampa River
- Provides greater opportunity for developers to connect into regional system (shorter reaches)

### Value Indicator:



### Disadvantages:

- Cross RID, BID, Railroad, and APS Palo Verde water line 3 times
- Outfalls into town lake project area
- Potential for not reducing floodplain along BID (specifically between Turner and Palo Verde roads)

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## Discussion

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Provides greater protection to central Buckeye area

Flows from White Tanks FRS No. 4 are picked up at RID

System can be developed as development in Buckeye occurs (phased system)

System allows for multi-use opportunities with trails & parks (larger basins are better suited for park development)

Airport can be expanded without impacting regional system

# Value Analysis Recommendation

Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
 Item: Use hybrid site plan of alternative 1 and 3 ilo alternative 3

VA No.  
15

Function (verb noun): *Control Runoff, Create Multi-Use Space, Complement Setting, Enhance Implementation, Reduce Canal Crossings*

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## Life Cycle Cost Summary

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	<u>Initial Cost</u>	<u>Life Cycle Cost</u>
Original Design	<u>302,650,000</u>	<u>326,623,100</u>
Proposed Design	<u>215,450,000</u>	<u>232,515,900</u>
Base Potential Savings	<u>87,200,000</u>	<u>94,107,200</u>
Additional Savings, O&M Road & Buffer	<u>38,932,800</u>	<u>38,932,800</u>
Total Potential Savings	<u>126,132,800</u>	<u>133,040,000</u>

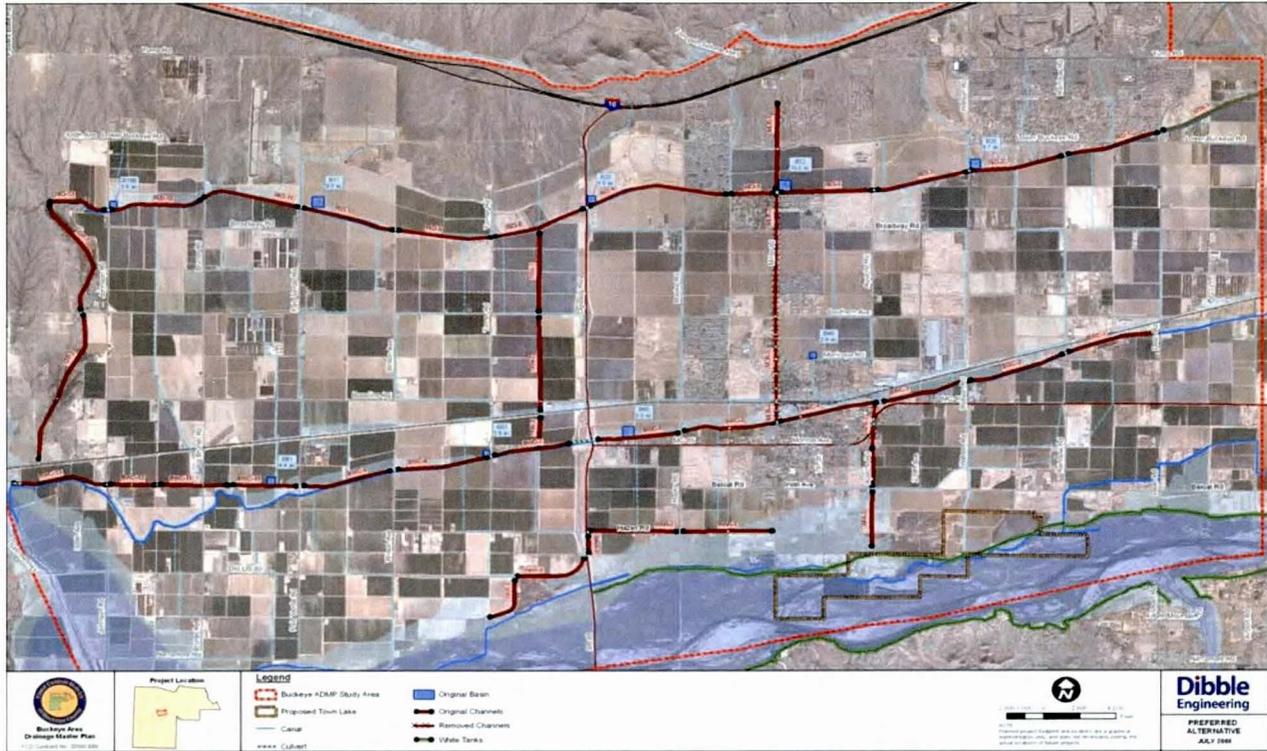
# Sketch Worksheet

Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
 Item: Use hybrid site plan of alternative 1 and 3 ilo alternative 3

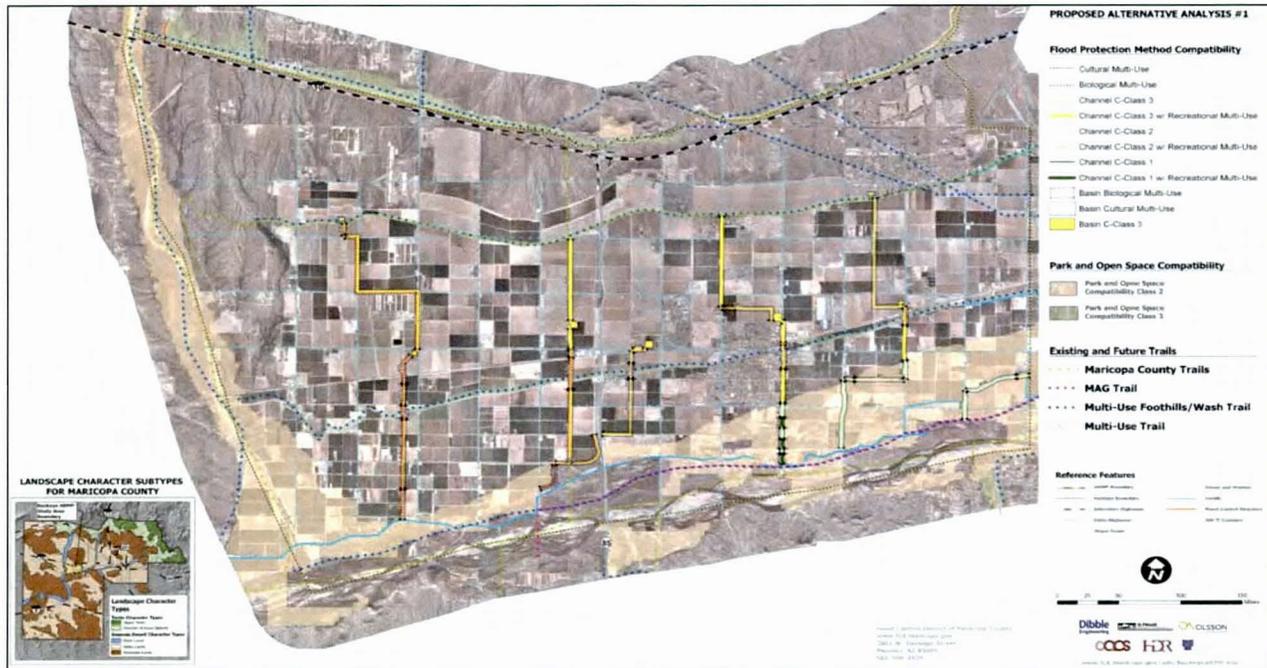
VA No.  
15

■ Original Design      □ Proposed Design

## Alternative 3



## Alternative 1



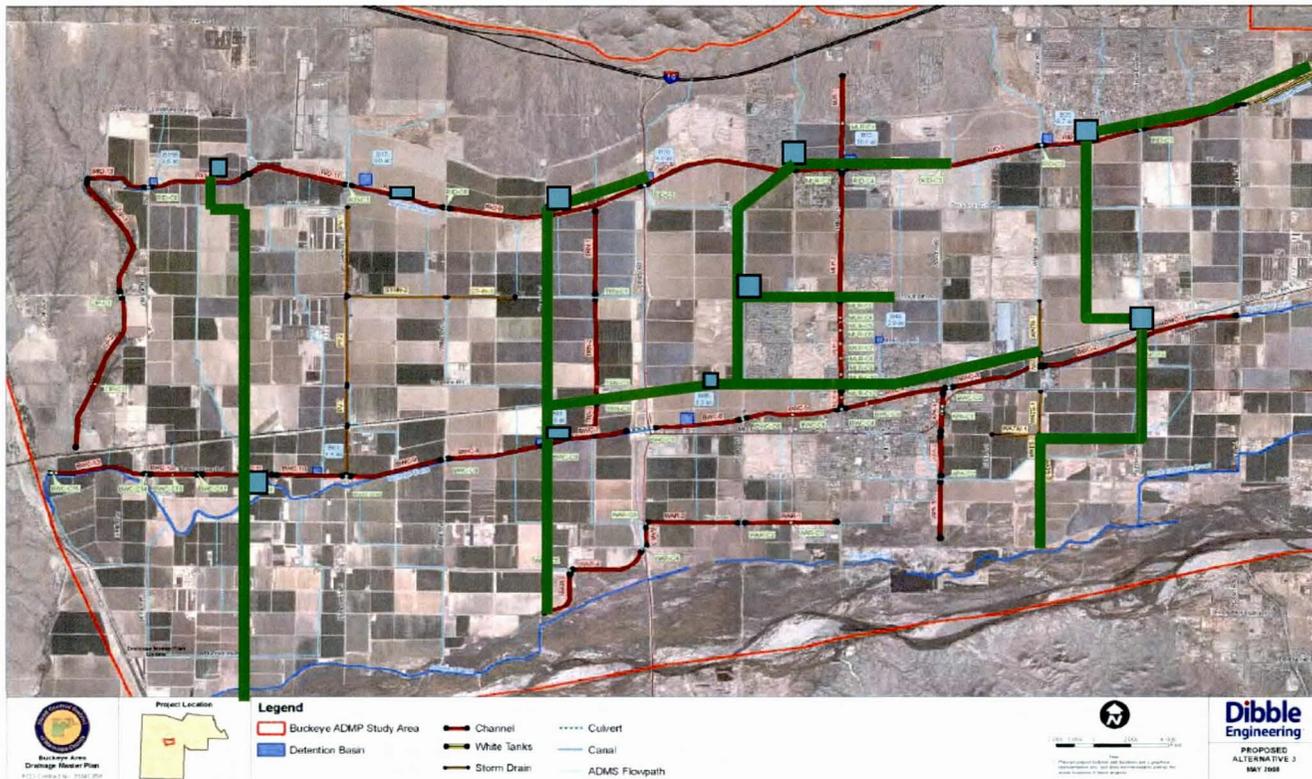
# Sketch Worksheet

Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
 Item: Use hybrid site plan of alternative 1 and 3 ilo alternative 3

VA No.  
15

Function (verb noun): *Control Runoff, Create Multi-Use Space, Complement Setting, Enhance Implementation, Reduce Canal Crossings*

Original Design       Proposed Design



# Cost Worksheet

Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
 Item: Use hybrid site plan of alternative 1 and 3 ilo alternative 3

VA No.  
15

Function (verb noun): *Control Runoff, Create Multi-Use Space, Complement Setting, Enhance Implementation, Reduce Canal Crossings*

<b>Original Design</b>				
	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total</u>
Large Channels (>141')	21	mi	9,000,000	189,000,000
Medium Channels (80'-141')	18	mi	4,000,000	72,000,000
Small Channels (0'-80')	1	mi	2,000,000	2,000,000
X - Large Retention Basins (15-20 ac)	0	ac	6,500,000	0
Large Retention Basins (8-12 ac)	3	ac	3,500,000	10,500,000
Medium Retention Basins (5-7 ac)	1	ac	2,500,000	2,500,000
Small Retention Basins (2-4 ac)	5	ac	1,500,000	7,500,000
Canal Crossings	0	ea	500,000	0
Railroad Crossings	2	ea	250,000	500,000
APS Crossings	1	ea	100,000	100,000
Culvert Crossings	53	ea	350,000	18,550,000
Subtotal				302,650,000
Markup (contingency, GC OH & profit, bond, escalation)	0%			0
			<b>Total Cost</b>	<b>302,650,000</b>

<b>Proposed Design</b>				
	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total</u>
Large channels (>141')	8	mi	9,000,000	67,500,000
Medium channels (80'-141')	18	mi	4,000,000	73,200,000
Small channels (0'-80')	7	mi	2,000,000	14,000,000
X - large retention basins (15-20 ac)	3	ac	6,500,000	19,500,000
Large retention basins (8-12 ac)	4	ac	3,500,000	14,000,000
Medium retention basins (5-7 ac)	2	ac	2,500,000	5,000,000
Small retention basins (2-4 ac)	1	ac	1,500,000	1,500,000
Canal crossings	3	ea	500,000	1,500,000
Railroad Crossings	3	ea	250,000	750,000
APS crossings	3	ea	100,000	300,000
Culvert crossings	52	ea	350,000	18,200,000
Subtotal				215,450,000
Markup (contingency, GC OH & profit, bond, escalation)	0%	Included in items above		0
			<b>Total Cost</b>	<b>215,450,000</b>

## Potential Savings

Potential Savings **87,200,000**

## Cost Worksheet

Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ

VA No.

Item: Use hybrid site plan of alternative 1 and 3 ilo alternative 3

15

Function (verb noun):

*Control Runoff, Create Multi-Use Space, Complement Setting, Enhance Implementation, Reduce Canal Crossings*

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### Proposed Design with Reduced O&M Road and Landscape Buffer

Reduction of one access road (land)	64	ac	200,000.00	12,722,424
Reduction of one access road (construction)	173,184	lf	32.00	5,541,888
reduction of landscape buffer (land)	40	ac	200,000.00	7,951,515
reduction of landscape buffer (construction)	1,731,840	sf	0.92	1,593,293
Subtotal				27,809,120
Markup (contingency, GC OH & profit, bond, escalation)	40%			11,123,648
			<b>Potential Savings</b>	<b>38,932,800</b>

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<b>Potential Savings</b>		<b>Total Potential Savings</b>	<b>126,132,800</b>
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# LIFE CYCLE COST ANALYSIS (LCCA)

Project/Location: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
 Item: Use hybrid site plan of alternative 1 and 3 ilo alternative 3

VA No.  
15

Function (verb noun): *Control Runoff, Create Multi-Use Space, Complement Setting, Enhance Implementation, Reduce Canal Crossings*

Description:			Original Design		Proposed Design	
Project Life Cycle =	50	Years	Alternative 3		Hybrid Alt 1 & 3	
Discount Rate =	4.00%					
<b>INITIAL COSTS</b>		<b>Unit Price</b>	<b>Est.</b>	<b>PW</b>	<b>Est.</b>	<b>PW</b>
A. Alternative 3			302,650,000	302,650,000	0	0
B. Hybrid Alt 1 & 3			0	0	215,450,000	215,450,000
C.				0		0
D.				0		0
E.				0		0
F.				0		0
G.				0		0
H.				0		0
I.				0		0
<b>Total Initial Cost</b>				<b>302,650,000</b>		<b>215,450,000</b>
<b>Initial Cost PW Savings (Compared to Original Design)</b>						<b>87,200,000</b>
<b>REPLACEMENT COST/ SALVAGE VALUE</b>						
<b>Description</b>	<b>Year</b>	<b>PW Factor</b>				
A.				0		0
B.				0		0
C.				0		0
D.				0		0
E.				0		0
F.				0		0
G.				0		0
H.				0		0
I. Salvage Value				0		0
<b>Total Replacement/Salvage Costs</b>				<b>0</b>		<b>0</b>
<b>ANNUAL COSTS</b>						
<b>Description</b>	<b>Escl. %</b>	<b>PWA</b>				
A. Energy	2.0%	31.684		0		0
B. O & M	0.25%	31.684	756,625	23,973,088	538,625	17,065,924
C.	0.0%	21.482		0		0
D.	0.0%	21.482		0		0
E.	0.0%	21.482		0		0
F.	0.0%	21.482		0		0
<b>Total Annual Costs (Present Worth)</b>				<b>23,973,100</b>		<b>17,065,900</b>
<b>Total Life Cycle Costs (Present Worth)</b>				<b>326,623,100</b>		<b>232,515,900</b>
<b>Life Cycle Savings (Compared to Original Design)</b>						<b>94,107,200</b>
<b>Total Life Cycle Costs (Annualized)</b>	<b>PP Factor</b>		<b>15,204,371</b>	<b>Per Year</b>	<b>10,823,662</b>	<b>Per Year</b>
	0.0466					

PW: Present Worth  
 PWA: Present Worth of Annuity  
 PP: Periodic Payment

# Value Analysis Recommendation

**Project:** Buckeye Area Drainage Master Plan, Maricopa County, AZ  
**Item:** Consider other Channel Alignments

**VA No.**  
16

**Function (verb noun):** *Prevent Flood Damage and Create Multi-Use Space*

## Original Design

Alternative 3, the preferred alternative, utilized approximately 37.6 miles of channels. Channels are aligned in an east/west direction and include 9 basins. Alternative 3 also incorporates O&M roads/trails on both sides of channel cross section in addition to significant landscape buffers.

## Proposed Design

Utilize north/south channel alignments as shown by Alternative 1. Approximate length of channels is 24.6 miles. Consider utilizing additional basins north of the RID and enlarge planned basins to enhance attenuate of peak discharge flows. Basin modifications as stated would allow for reduced channel and culvert sizing; and, enhance constructability of crossings of the APS pipeline, BWCDD, Union Pacific Railroad. Also, reduce channel cross section be eliminating one O&M road/trail and reduce landscape buffer adjacent to arterial roads. In order to eliminate one crossing of the APS pipeline, realign channel segments identified by Alternative 1 as R21 and R22 to connect to the south end of segment R25. Also, provide multi-use within planned basins that had been shown without multi-use.

## Advantages and Disadvantages

### Advantages:

- Cost is reduced due to reduction in channel length.
- Cost is reduced due to increased slope of channel.
- Cost is reduced due to reduction of O&M Road/Trail and Landscape Buffer.
- Cost is reduced due to enhance attenuation of peak discharge flows.
- Improved constructability of crossings of the APS Pipeline, Union Pacific Railroad, and BWCDD.
- Facilitates historic discharge into Gila River
- Does not modify historic drainage paths.
- Provides equivalent multi-use opportunities
- Provides north/south trail systems
- Allows for phasing and implementation as development occurs.

### Value Indicator:



### Disadvantages:

- Complexity of crossing APS Pipeline, BWCDD and Union Pacific Railroad

## Discussion

As stated, proposed alternative allows for phasing and implementation as development occurs. This will allow for enhanced partnering with development. Alternative 3 provided for only east/west trail systems; whereas, the proposed alternative provides for north/south trail systems. In the future, the Town of Buckeye could partner with the RID and BWCDD to utilize their channel corridors for trail systems. This would create better trail system connectivity throughout central Buckeye.

## Life Cycle Cost Summary

	<u>Initial Cost</u>	<u>Life Cycle Cost</u>
Original Design	415,000,000	447,872,400
Proposed Design	197,733,500	213,396,100
Potential Savings	217,266,500	234,476,300

# Sketch Worksheet

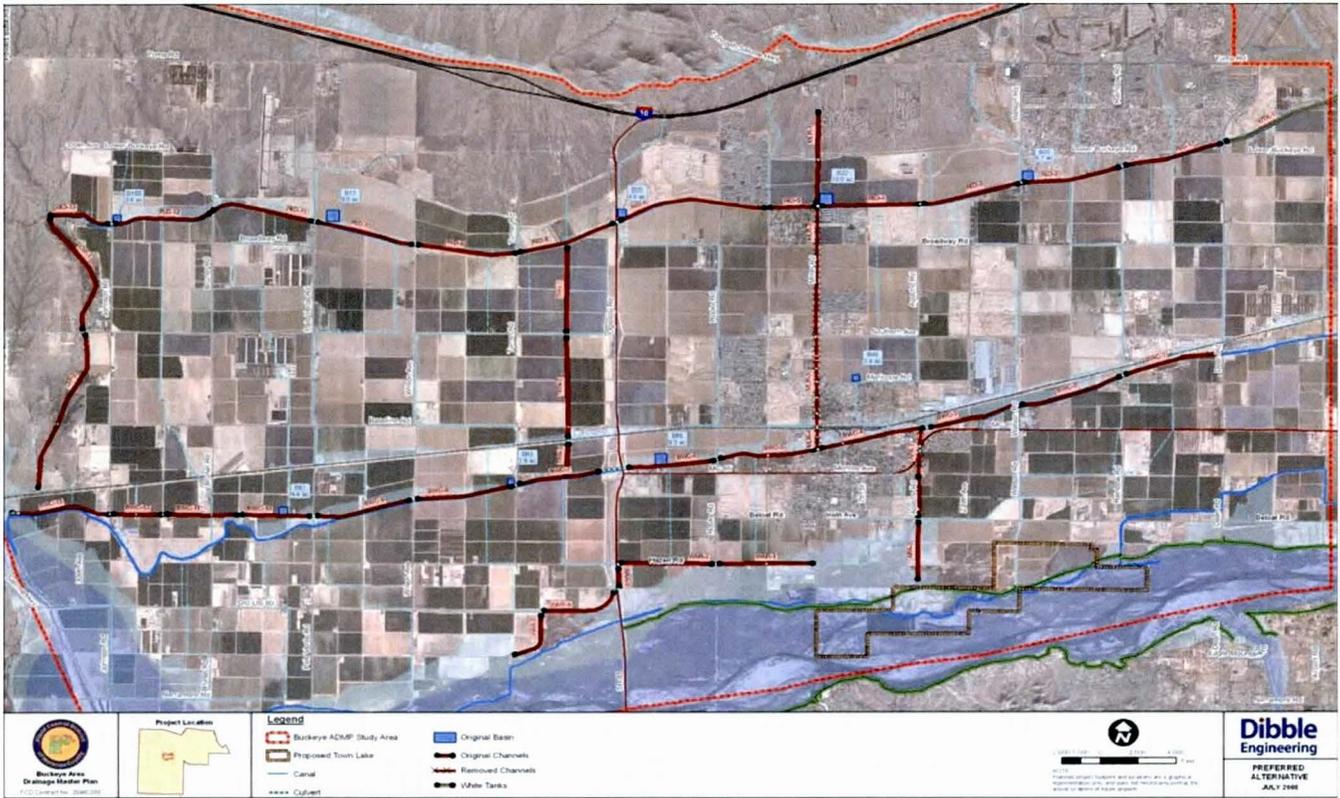
Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
 Item: Consider other Channel Alignments

VA No.  
 16

Function (verb noun): *Prevent Flood Damage and Create Multi-Use Space*

Original Design     
  Proposed Design

Alternate 3: Preferred Alternative





# Sketch Worksheet

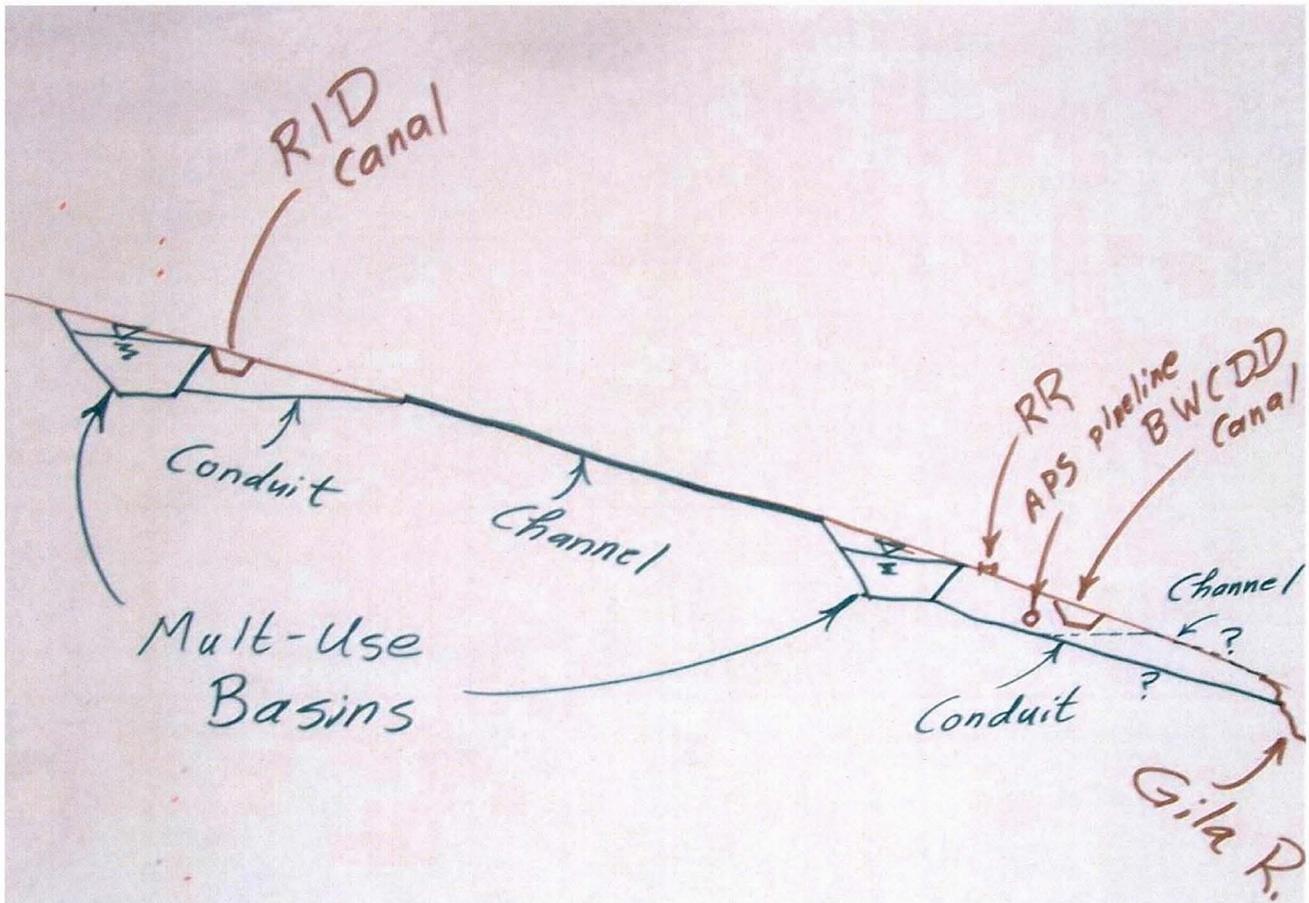
Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
Item: Consider other Channel Alignments

VA No.  
16

Function (verb noun): Prevent Flood Damage and Create Multi-Use Space

Original Design       Proposed Design

Profile of Channel



# Cost Worksheet

Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
 Item: Consider other Channel Alignments

VA No.  
16

Function (verb noun): *Prevent Flood Damage and Create Multi-Use Space*

## Original Design

	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total</u>
Alternative 3 Cost Estimate	1	ea	415,000,000	415,000,000
Subtotal				415,000,000
Markup (contingency, GC OH & profit, bond, escalation)	Already Included in Pricing			
			<b>Total Cost</b>	<b>415,000,000</b>

## Proposed Design

	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total</u>
Alternative 1 cost estimate	1	ea	\$208,000,000	208,000,000
Additional major basins with multi-use	2	ea	\$5,500,000	11,000,000
Add multi-use to planned basins	2	ea	\$1,500,000	3,000,000
Enlarge planned basins	6	ea	\$1,500,000	9,000,000
Estimated additional cost for crossing APS	4	ea	\$1,500,000	6,000,000
Reduction of one access road (land)	(48)	ac	\$200,000	(9,520,000)
Reduction of one access road (construction)	(129,769)	lf	\$32	(4,152,608)
Reduction of landscape buffer (land)	(30)	ac	\$200,000	(6,000,000)
Reduction of landscape buffer (construction)	(1,297,690)	sf	\$0.92	(1,193,875)
Estimated channel cost reduction due to additional basins and planned basin enlargements	(170,000,000)	%	10%	(17,000,000)
Estimated culvert cost reduction due to additional basins and planned basin enlargements	(14,000,000)	%	10%	(1,400,000)
Subtotal				197,733,517
Markup (contingency, GC OH & profit, bond, escalation)	Already Included in Pricing			
			<b>Total Cost</b>	<b>197,733,500</b>

## Potential Savings

Potential Savings 217,266,500

# LIFE CYCLE COST ANALYSIS (LCCA)

Project/Location: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
 Item: Consider other Channel Alignments

VA No.  
16

Function (verb noun): Prevent Flood Damage and Create Multi-Use Space

Description:			Original Design		Proposed Design	
Project Life Cycle = 50 Years			Alternative 3, Preferred Alt.		Modified Alternative 1	
Discount Rate = 4.00%						
<b>INITIAL COSTS</b>			<b>Est.</b>	<b>PW</b>	<b>Est.</b>	<b>PW</b>
A.	Alternative 3, Preferred Alt.		415,000,000	415,000,000	0	0
B.	Modified Alternative 1		0	0	197,733,500	197,733,500
C.				0		0
D.				0		0
E.				0		0
F.				0		0
G.				0		0
H.				0		0
I.				0		0
J.				0		0
<b>Total Initial Cost</b>			<b>415,000,000</b>		<b>197,733,500</b>	
<b>Initial Cost PW Savings (Compared to Original Design)</b>					<b>217,266,500</b>	
<b>REPLACEMENT COST/ SALVAGE VALUE</b>						
	<b>Description</b>	<b>Year</b>	<b>PW Factor</b>			
A.				0		0
B.				0		0
C.				0		0
D.				0		0
E.				0		0
F.				0		0
G.				0		0
H.				0		0
I.	Salvage Value			0		0
<b>Total Replacement/Salvage Costs</b>			<b>0</b>		<b>0</b>	
<b>ANNUAL COSTS</b>						
	<b>Description</b>	<b>Escl. %</b>	<b>PWA</b>			
A.	Energy	2.0%	31.684	0		0
B.	O & M	0.25%	31.684	1,037,500	32,872,399	494,334
C.		0.0%	21.482		0	0
D.		0.0%	21.482		0	0
E.		0.0%	21.482		0	0
F.		0.0%	21.482		0	0
<b>Total Annual Costs (Present Worth)</b>			<b>32,872,400</b>		<b>15,662,600</b>	
<b>Total Life Cycle Costs (Present Worth)</b>			<b>447,872,400</b>		<b>213,396,100</b>	
<b>Life Cycle Savings (Compared to Original Design)</b>					<b>234,476,300</b>	
<b>Total Life Cycle Costs (Annualized)</b>			<b>PP Factor</b>			
			<b>0.0466</b>	<b>20,848,550 Per Year</b>	<b>9,933,631 Per Year</b>	

PW: Present Worth  
 PWA: Present Worth of Annuity  
 PP: Periodic Payment

# Value Analysis Recommendation

Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
 Item: Accelerate Land Acquisition Process

VA No.  
17

Function (verb noun): *Acquire Land*

## Original Design

Master plan is Alternative 3.

## Proposed Design

Accelerate land acquisition process to realize favorable current land costs..

## Advantages and Disadvantages

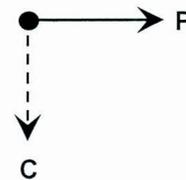
### Advantages:

- Reduce project land cost
- Easier implementation
- 
- 
- 

### Disadvantages:

- Accelerated cash flow
- 
- 

Value Indicator:



## Discussion

Accelerated land acquisition could take advantage of current and future lower land values. Delayed land acquisition would expose the County and Town to increased land pricing.

## Life Cycle Cost Summary

	<u>Initial Cost</u>	<u>Life Cycle Cost</u>
Original Design	236,000,000	236,000,000
Proposed Design	118,000,000	118,000,000
Potential Savings	118,000,000	118,000,000



# Value Analysis Recommendation

Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
 Item: Use side slope of 5 1/2 : 1 for channels in lieu of 7 : 1 in site constrained areas

VA No.  
18

Function (verb noun): *Control Flooding, Create Multi-use Opportunities*

## Original Design

Use 7:1 side slope for all channel design

## Proposed Design

Use side slope of 5 1/2 : 1 for channels in lieu of 7 : 1 for site constrained areas

## Advantages and Disadvantages

### Advantages:

- Reduces channel top width
- Reduces land acquisition cost
- Reduces construction/excavation cost
- Reduces landscape treatment cost
- Increases flow per width

### Disadvantages:

- Increases channel depth
- Reduces area for landscape aesthetics
- 

### Value Indicator:



## Discussion

Reduces total channel cost due to reduction in side slope and channel width  
 Cost savings derived from Channel design spreadsheet

## Life Cycle Cost Summary

	<u>Initial Cost</u>	<u>Life Cycle Cost</u>
Original Design	336,590,348	344,728,748
Proposed Design	311,290,995	318,764,395
Potential Savings	25,299,353	25,964,353
Cost per mile	8,323,289	37 Miles

# Sketch Worksheet

Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
Item: Use side slope of 5 1/2 : 1 for channels in lieu of 7 : 1 in site  
constrained areas

VA No.  
18

Function (verb noun): *Control Flooding, Create Multi-use Opportunities*

Original Design

Proposed Design



# Sketch Worksheet

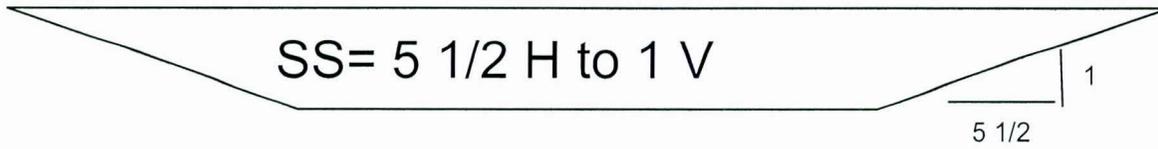
Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
Item: Use side slope of 5 1/2 : 1 for channels in lieu of 7 : 1 in site  
constrained areas

VA No.  
18

Function (verb noun): *Control Flooding, Create Multi-use Opportunities*

Original Design

Proposed Design





# LIFE CYCLE COST ANALYSIS (LCCA)

Project/Location: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
 Item: Use side slope of 5 1/2 : 1 for channels in lieu of 7 : 1 in site constrained areas

VA No.  
18

Function (verb noun): Control Flooding, Create Multi-use Opportunities

Description:				Original Design		Proposed Design	
Project Life Cycle =		50	Years	Channel side slope 7:1		Channel side slope 5 1/2 : 1	
Discount Rate =		4.00%					
<b>INITIAL COSTS</b>				<b>Est.</b>	<b>PW</b>	<b>Est.</b>	<b>PW</b>
A.	Original Design			336,590,348	336,590,348	311,290,995	311,290,995
B.					0		0
C.					0		0
D.					0		0
E.					0		0
F.					0		0
G.					0		0
H.					0		0
I.					0		0
J.					0		0
<b>Total Initial Cost</b>				<b>336,590,348</b>		<b>311,290,995</b>	
<b>Initial Cost PW Savings (Compared to Original Design)</b>						<b>25,299,353</b>	
<b>REPLACEMENT COST/ SALVAGE VALUE</b>							
	Description	Year	PW Factor				
A.					0		0
B.					0		0
C.					0		0
D.					0		0
E.					0		0
F.					0		0
G.					0		0
H.					0		0
I.	Salvage Value				0		0
<b>Total Replacement/Salvage Costs</b>				<b>0</b>		<b>0</b>	
<b>ANNUAL COSTS</b>							
	Description	Cost/SF	Escl. %	PWA			
A.	O & M, landscape	\$ 0.005	2.0%	31.684	256,858	8,138,361	235,873
B.			1.0%	25.876		0	0
C.			0.0%	21.482		0	0
D.			0.0%	21.482		0	0
E.			0.0%	21.482		0	0
F.			0.0%	21.482		0	0
<b>Total Annual Costs (Present Worth)</b>				<b>8,138,400</b>		<b>7,473,400</b>	
<b>Total Life Cycle Costs (Present Worth)</b>				<b>344,728,748</b>		<b>318,764,395</b>	
<b>Life Cycle Savings (Compared to Original Design)</b>						<b>25,964,353</b>	
<b>Total Life Cycle Costs (Annualized)</b>			<b>PP Factor</b>				
			<b>0.0466</b>	<b>16,047,192</b>	<b>Per Year</b>	<b>14,838,546</b>	<b>Per Year</b>

PW: Present Worth  
 PWA: Present Worth of Annuity  
 PP: Periodic Payment

# Value Analysis Recommendation

Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
 Item: Use one O & M road ilo two along channel right of way

VA No.  
20

Function (verb noun): *Control Runoff, Create Multi-use Space, Complement Setting*

## Original Design

Current design:  
 O & M road on both sides of channel, 16' wide

## Proposed Design

VA team recommends the following:  
 O & M road on one side of channel, 16' wide  
 Landscape buffer reduced by 10' on channel side without the O & M road

## Advantages and Disadvantages

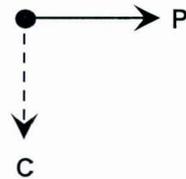
### Advantages:

- Reduces land acquisition cost
- Less O & M cost
- Improves opportunity to implement plan
- Reduced impact to adjacent land owners
- 

### Disadvantages:

- Loss of some open space
- 
- 

### Value Indicator:



## Discussion

This VA proposal adds value to Flood Control District & other stakeholders by reducing the cost to the project and thereby increasing the feasibility of implementation while still allowing for multiuse and aesthetic treatment of the channel.

## Life Cycle Cost Summary

	<u>Initial Cost</u>	<u>Life Cycle Cost</u>
Original Design	162,386,300	168,835,200
Proposed Design	120,144,600	124,280,000
Potential Savings	42,241,700	44,555,200

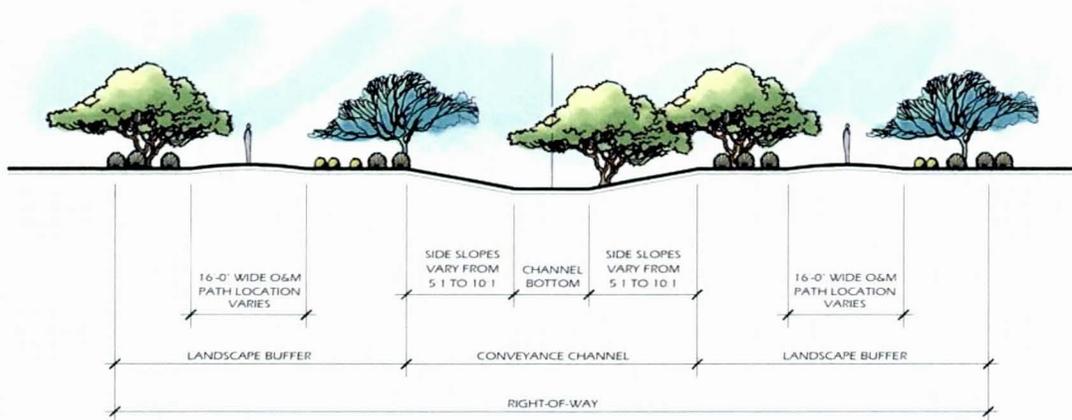
# Sketch Worksheet

Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
 Item: Use one O & M road ilo two along channel right of way

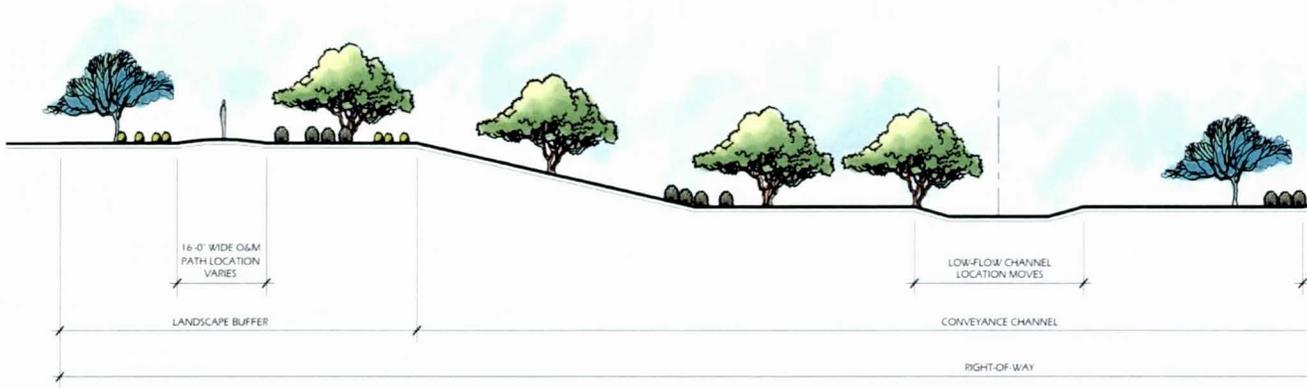
VA No.  
20

Function (verb noun): *Control Runoff, Create Multi-use Space, Complement Setting*

Original Design       Proposed Design



**TYPICAL SECTION - SMALL REGIONAL CHANNEL (40'-80' CHANNEL WIDTH) NOT TO SCALE**



**TYPICAL SECTION - LARGE REGIONAL CHANNEL (150'+ CHANNEL WIDTH)**



# LIFE CYCLE COST ANALYSIS (LCCA)

Project/Location: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
 Item: Use one O & M road ilo two along channel right of way

VA No.  
20

Function (verb noun): Control Runoff, Create Multi-use Space, Complement Setting

Description:				Original Design		Proposed Design	
Project Life Cycle =	50	Years		O&M road on each side of channel		O&M road on one side of channel	
Discount Rate =	4.00%						
INITIAL COSTS				Est.	PW	Est.	PW
A.	O&M road on each side of channel			162,386,300	162,386,300	0	0
B.	O&M road on one side of channel			0	0	120,144,600	120,144,600
C.					0		0
D.					0		0
E.					0		0
F.					0		0
G.					0		0
H.					0		0
I.					0		0
<b>Total Initial Cost</b>				<b>162,386,300</b>		<b>120,144,600</b>	
<b>Initial Cost PW Savings (Compared to Original Design)</b>						<b>42,241,700</b>	
REPLACEMENT COST/ SALVAGE VALUE							
Description	Year	PW Factor					
A.					0		0
B.					0		0
C.					0		0
D.					0		0
E.					0		0
F.					0		0
G.					0		0
H.					0		0
I.	Salvage Value				0		0
<b>Total Replacement/Salvage Costs</b>				<b>0</b>		<b>0</b>	
ANNUAL COSTS							
Description	% of Initial Cost/SF	Escl. %	PWA				
A.	O & M, road 1.0%	2.0%	31.684	126,436	4,006,024	63,218	2,003,012
B.	O & M, landscape \$0.005	2.0%	31.684	77,101	2,442,893	67,300	2,132,356
C.		0.0%	21.482		0		0
D.		0.0%	21.482		0		0
E.		0.0%	21.482		0		0
<b>Total Annual Costs (Present Worth)</b>				<b>6,448,900</b>		<b>4,135,400</b>	
<b>Total Life Cycle Costs (Present Worth)</b>				<b>168,835,200</b>		<b>124,280,000</b>	
<b>Life Cycle Savings (Compared to Original Design)</b>						<b>44,555,200</b>	
<b>Total Life Cycle Costs (Annualized)</b>				<b>7,859,312 Per Year</b>		<b>5,785,259 Per Year</b>	

PW: Present Worth  
 PWA: Present Worth of Annuity  
 PP: Periodic Payment

# Value Analysis Recommendation

**Project:** Buckeye Area Drainage Master Plan, Maricopa County, AZ  
**Item:** Give development credits for locating recreational amenities adjacent to flood control facilities

VA No.  
22

**Function (verb noun):** *Create Multi-Use Recreational Facilities*

## Original Design

Recreational facilities associated with a subdivision or other development are often located internal to the development and don't connect to or face the flood control facilities. They are often viewed as a local subdivision amenity and not a regional amenity.

## Proposed Design

Give development credits (higher densities, credits for higher subdivision amenities, etc.) for locating recreational and open space amenities (e.g., trails, parks, tot lots, open space, retention basins) associated with subdivision adjacent to regional flood control facilities. Develop the amenities as regional use facilities.

## Advantages and Disadvantages

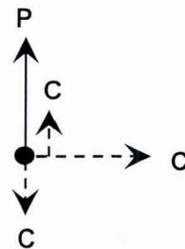
### Advantages:

- Facilitates multi-use of flood control facilities
- Provides greater regional recreation and open space connectivity
- Provides larger open space corridors/areas
- Regional facilities are implemented with development
- Town may not have to purchase land for regional community amenity

### Disadvantages:

- Areas for retention are still required internal to development
- 
- 

### Value Indicator:



## Discussion

Recreational facilities are not duplicated between subdivision and regional facilities creating a cost savings to the community (Town would still need to build regional amenities that are outside scope of subdivision amenities). Potentially greater regional community connectivity. HOA O&M costs may be reduced if Town takes over maintenance of regional facilities.

## Life Cycle Cost Summary

	<u>Initial Cost</u>	<u>Life Cycle Cost</u>
Original Design	_____	_____
Proposed Design	<u>Design Suggestion</u>	_____
Potential Savings	_____	_____

# Value Analysis Recommendation

Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
 Item: Channel Profile Options

VA No.  
23

Function (verb noun): *Control Runoff, Create Multi-use Space, Complement Setting*

## Original Design

The original design includes a landscaped drainage channel. See sketch.

## Proposed Design

Consider conc. open channels (alt. 1) for urban and industrial areas. See sketch of cross section and sketch of site location in industrial area.

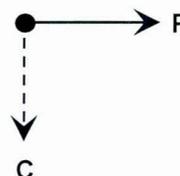
A box culvert (alt. 2), although high in initial cost, could be considered for isolated areas of constrained space. An example application area is the historic rodeo grounds. See sketch.

## Advantages and Disadvantages

### Advantages of Alt. 1:

- Reduces land acquisition cost
- Less O & M cost
- Improves opportunity to implement plan
- Reduced impact to adjacent land owners
- Additional access to railroad spurs

### Value Indicator:



### Disadvantages of Alt. 1:

- Loss of aesthetics
- Loss of multi-use
- 

## Discussion

This VA proposal adds value to Flood Control District & other stakeholders by reducing the cost to the project and thereby increasing the feasibility of implementation. It doesn't allow for multiuse and aesthetic treatment of the channel.

## Life Cycle Cost Summary

	<u>Initial Cost</u>	<u>Life Cycle Cost</u>
Original Design	36,917,760	37,533,360
Proposed Design, Alt. 1	26,231,040	26,820,440
Potential Savings	10,686,720	10,712,920

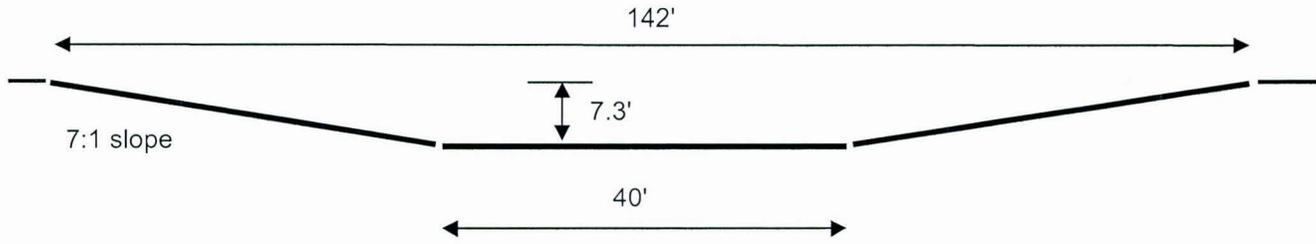
# Sketch Worksheet

Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
Item: Channel Profile Options

VA No.  
23

Function (verb noun): *Control Runoff, Create Multi-use Space, Complement Setting*

Original Design       Proposed Design



Landscaped Drainage Channel

# Sketch Worksheet

Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ

VA No.

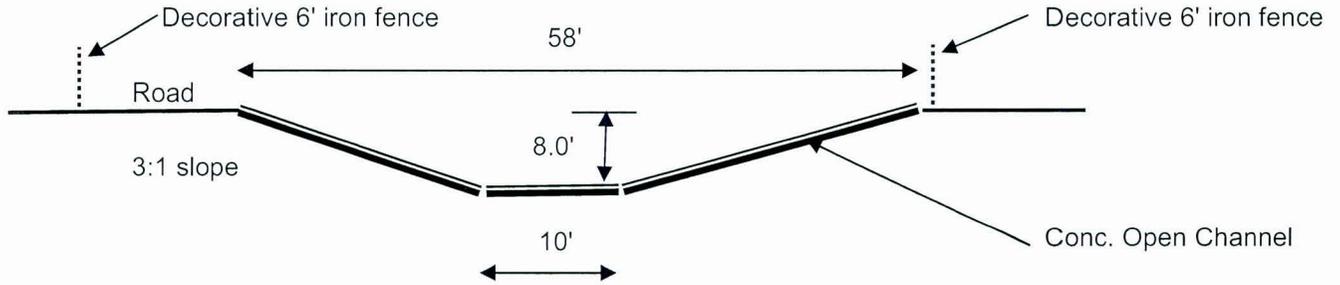
Item: Channel Profile Options

23

Function (verb noun): *Control Runoff, Create Multi-use Space, Complement Setting*

Original Design

Proposed Design



Concrete Open Channel

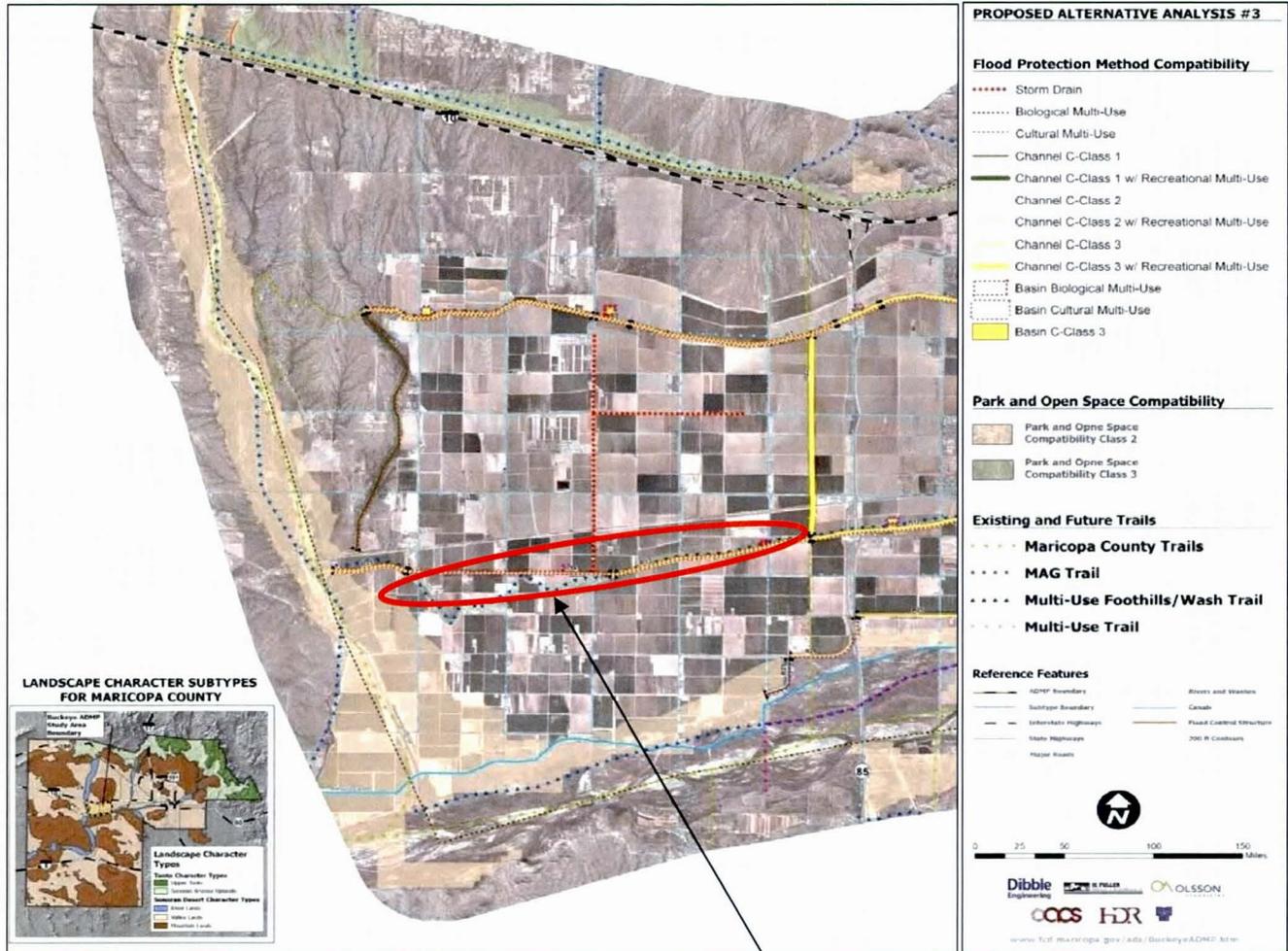
# Sketch Worksheet

Project: **Buckeye Area Drainage Master Plan, Maricopa County, AZ**  
 Item: **Channel Profile Options**

**VA No.**  
**23**

Function (verb noun): **Control Runoff, Create Multi-use Space, Complement Setting**

Original Design       Proposed Design



Conc. Open Channel  
 In Industrial Area

# Sketch Worksheet

Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ

VA No.

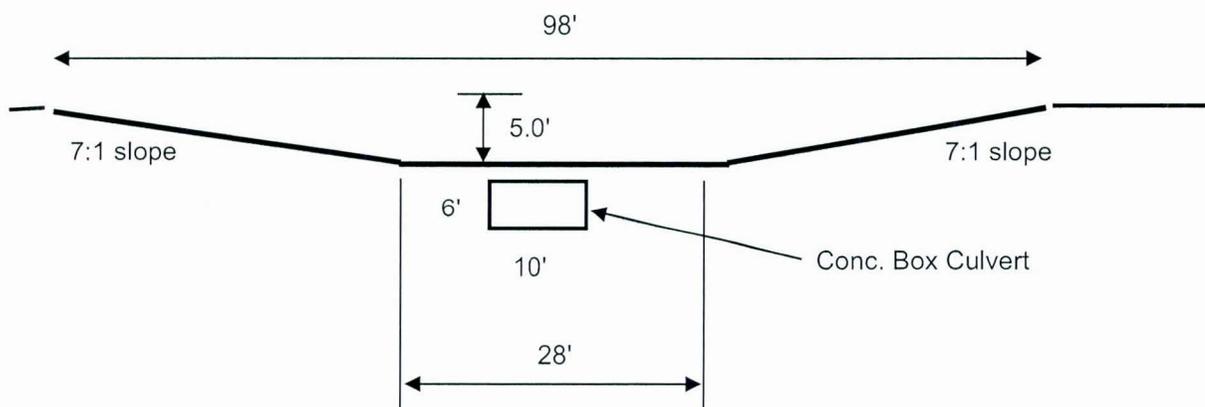
Item: Channel Profile Options

23

Function (verb noun): *Control Runoff, Create Multi-use Space, Complement Setting*

Original Design

Proposed Design



Box Culvert & Landscaped Channel

# Cost Worksheet

Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
 Item: Channel Profile Options

VA No.  
23

Function (verb noun): *Control Runoff, Create Multi-use Space, Complement Setting*

## Original Design

	Quantity	Unit	Unit Cost	Total
Excavation	24.60	CY	11.00	271
Earth hauling	24.60	CY	5.00	123
Landscaping	160	SF	0.23	37
Land acquisition cost (landscape area)	142	SF	4.60	653
Subtotal				1,084
Markup (contingency, GC OH & profit, bond, escalation)	40%			433
			<b>Total Cost per LF</b>	<b>1,520</b>
			Cost per Mile	8,025,600

## Alt. 1 Design: Conc. Open Channel

	Quantity	Unit	Unit Cost	Total
Excavation	10.07	CY	11.00	111
Earth hauling	10.07	CY	5.00	50
Landscaping	0	SF	0.23	0
Land acquisition cost (landscape area)	58	SF	4.60	267
Concrete, 8" & reinforcing	62	SF	3.72	231
Decorative iron fence, 6' high, both sides	2	LF	56.00	112
Subtotal				771
Markup (contingency, GC OH & profit, bond, escalation)	40%			308
			<b>Total Cost per LF</b>	<b>1,080</b>
			Cost per Mile	5,702,400

## Alt. 2 Design: Conc. Box Culvert

	Quantity	Unit	Unit Cost	Total
Excavation, box culvert	4.15	CY	11.00	46
Excavation, open channel	11.67	CY	11.00	128
Earth hauling	14.31	CY	5.00	72
Landscaping	110	SF	0.23	25
Land acquisition cost (landscape area)	98	SF	4.60	451
Conc. box culvert	32	SF	30.00	960
Subtotal				1,682
Markup (contingency, GC OH & profit, bond, escalation)	40%			673
			<b>Total Cost per LF</b>	<b>2,350</b>
			Cost per Mile	12,408,000

## Potential Savings for Alt. 1

**Potential Savings** **400**  
 Cost Savings per Mile 2,112,000

### Using Alternative 1:

Area south of UPRR & north of Buckeye canal 4.6 Miles 2,112,000 **9,715,200**  
 (See sketch)

# LIFE CYCLE COST ANALYSIS (LCCA)

Project/Location: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
 Item: Channel Profile Options

VA No.  
23

Function (verb noun): Control Runoff, Create Multi-use Space, Complement Setting

Description:				Original Design		Proposed Design	
Project Life Cycle = 50 Years				7:1 slope channel		Conc. open channel	
Discount Rate = 4.00%							
<b>INITIAL COSTS</b>				<b>Est.</b>	<b>PW</b>	<b>Est.</b>	<b>PW</b>
A.	Original Design	LF 24,288	Unit Price \$1,520	36,917,760	36,917,760	0	0
B.	Alt. 1 Design: Conc. Open Channel	24,288	\$1,080	0	0	26,231,040	26,231,040
C.					0		0
D.					0		0
E.					0		0
F.					0		0
G.					0		0
H.					0		0
I.					0		0
J.					0		0
<b>Total Initial Cost</b>				<b>36,917,760</b>		<b>26,231,040</b>	
<b>Initial Cost PW Savings (Compared to Original Design)</b>						<b>10,686,720</b>	
<b>REPLACEMENT COST/ SALVAGE VALUE</b>							
Description		Year	PW Factor				
A.	Conc. Channel Renovation	5% 25	0.3751		0	1,311,552	491,985
B.					0		0
C.					0		0
D.					0		0
E.					0		0
F.					0		0
G.					0		0
H.					0		0
I.	Salvage Value				0		0
<b>Total Replacement/Salvage Costs</b>				<b>0</b>		<b>492,000</b>	
<b>ANNUAL COSTS</b>							
Description		Cost/SF	Escl. %	PWA			
A.	Maint., Landscape	\$0.0050	2.0%	31.684	19,430	615,637	0
B.	Maint., Conc. Chan.	\$0.0025	1.0%	25.876		0	3,765 97,412
C.			0.0%	21.482		0	0
D.			0.0%	21.482		0	0
E.			0.0%	21.482		0	0
F.			0.0%	21.482		0	0
<b>Total Annual Costs (Present Worth)</b>				<b>615,600</b>		<b>97,400</b>	
<b>Total Life Cycle Costs (Present Worth)</b>				<b>37,533,360</b>		<b>26,820,440</b>	
<b>Life Cycle Savings (Compared to Original Design)</b>						<b>10,712,920</b>	
<b>Total Life Cycle Costs (Annualized)</b>				<b>1,747,185 Per Year</b>		<b>1,248,497 Per Year</b>	

PW: Present Worth  
 PWA: Present Worth of Annuity  
 PP: Periodic Payment

# Value Analysis Recommendation

**Project:** Buckeye Area Drainage Master Plan, Maricopa County, AZ  
**Item:** Include storm drains as part of local improvements and remove from regional master plan

VA No.  
25

**Function (verb noun):** *Convey Storm Water*

## Original Design

Three storm drain systems were originally planned for Alternative 3.

## Proposed Design

Storm drains should be part of local improvements (10 year design). Remove storm drains from regional master plan.

## Advantages and Disadvantages

### Advantages:

- Removes cost of storm drains from Alternative 3
- 
- 
- 
- 

### Value Indicator:



### Disadvantages:

- Removes small north-south conveyance from west portion of project area
- 
- 

## Discussion

Storm drains will be added to street infrastructure as site development occurs. Storm drains for local drainage shouldn't be part of regional plan.

## Life Cycle Cost Summary

	<u>Initial Cost</u>	<u>Life Cycle Cost</u>
Original Design	<u>32,824,400</u>	<u>32,824,400</u>
Proposed Design	<u>0</u>	<u>0</u>
Potential Savings	<u>32,824,400</u>	<u>32,824,400</u>

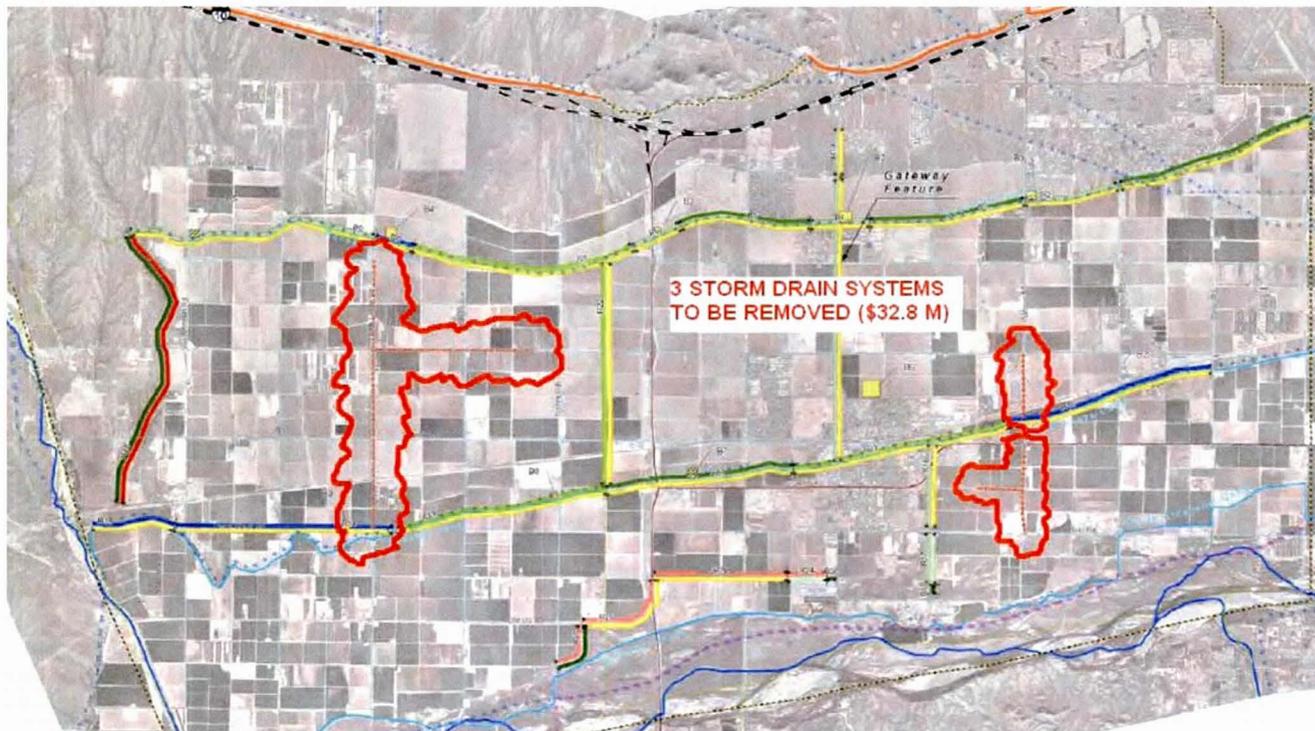
# Sketch Worksheet

Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
Item: Include storm drains as part of local improvements and remove from regional master plan

VA No.  
25

Function (verb noun): Convey Storm Water

Original Design       Proposed Design





# Value Analysis Recommendation

Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
 Item: Optimize Basin - Channel relationship to reduce land cost

VA No.  
 27  
 (also 8)

Function (verb noun): *Control Flows*

## Original Design

Basins take only offsite flow. Basins at 7:1 side slope.

## Proposed Design

Basin volume doubled to decrease discharge into channel. Assume channel top width will be reduced by approximately 10%. Also, reducing basin side slope from 7:1 to 5:1.

## Advantages and Disadvantages

### Advantages:

- Providing more recreation area in basins
- Reducing channel top width (by approx 10%)
- Overall reduction in land acquisition and landscaping
- 
- 

### Value Indicator:



### Disadvantages:

- Increase land acquisition for basins
- 
- 

## Discussion

Increases recreation area in basins and reduces channel size

## Life Cycle Cost Summary

	<u>Initial Cost</u>	<u>Life Cycle Cost</u>
Original Design	357,072,500	365,210,900
Proposed Design	348,063,000	355,647,600
Potential Savings	9,009,500	9,563,300

# Sketch Worksheet

Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
Item: Optimize Basin - Channel relationship to reduce land cost

VA No.  
27

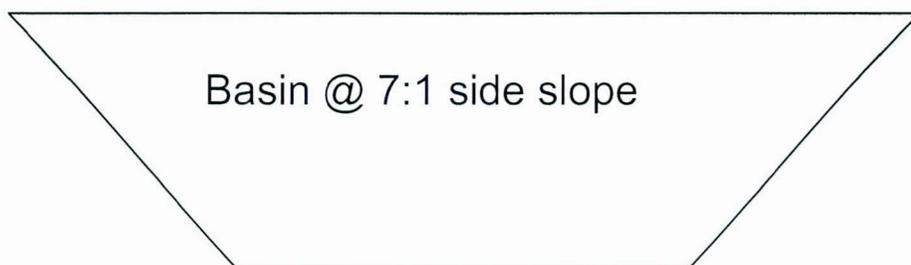
Function (verb noun): *Control Flows*

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Original Design

Proposed Design



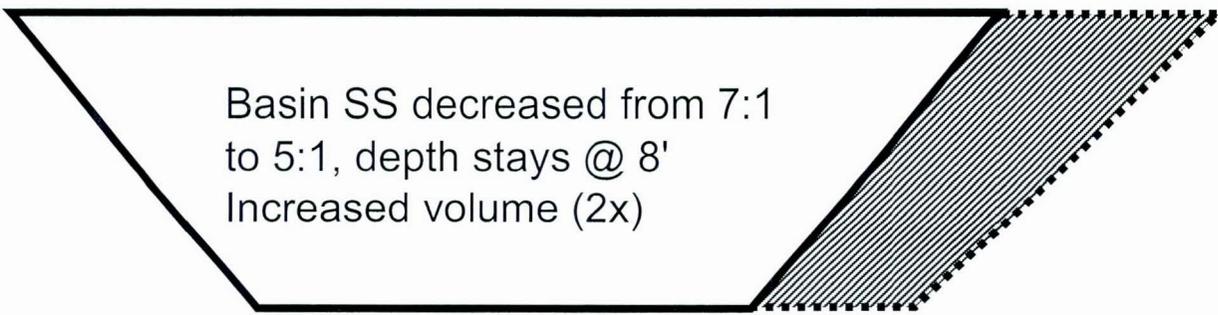
# Sketch Worksheet

Project: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
Item: Optimize Basin - Channel relationship to reduce land cost

VA No.  
27

Function (verb noun): *Control Flows*

Original Design       Proposed Design





# LIFE CYCLE COST ANALYSIS (LCCA)

Project/Location: Buckeye Area Drainage Master Plan, Maricopa County, AZ  
 Item: Optimize Basin - Channel relationship to reduce land cost

VA No.  
27

Function (verb noun): Control Flows

Description:				Original Design		Proposed Design	
Project Life Cycle =		50	Years	Channel & basin cost		Channel cost (10% reduction to top width)	
Discount Rate =		4.00%					
<b>INITIAL COSTS</b>				<b>Est.</b>	<b>PW</b>	<b>Est.</b>	<b>PW</b>
A.	Original Design			357,072,500	357,072,500	0	0
B.	Proposed Design			0	0	348,063,000	348,063,000
C.					0		0
D.					0		0
E.					0		0
F.					0		0
G.					0		0
H.					0		0
I.					0		0
J.					0		0
<b>Total Initial Cost</b>				<b>357,072,500</b>		<b>348,063,000</b>	
<b>Initial Cost PW Savings (Compared to Original Design)</b>						<b>9,009,500</b>	
<b>REPLACEMENT COST/ SALVAGE VALUE</b>							
	Description	Year	PW Factor				
A.					0		0
B.					0		0
C.					0		0
D.					0		0
E.					0		0
F.					0		0
G.					0		0
H.					0		0
I.	Salvage Value				0		0
<b>Total Replacement/Salvage Costs</b>				<b>0</b>		<b>0</b>	
<b>ANNUAL COSTS</b>							
	Description	Escl. %	PWA				
A.	O & M, Landscape \$ 0.005	2.0%	31.684	256,858	8,138,361	239,382	7,584,622
B.		1.0%	25.876		0		0
C.		0.0%	21.482		0		0
D.		0.0%	21.482		0		0
E.		0.0%	21.482		0		0
F.		0.0%	21.482		0		0
<b>Total Annual Costs (Present Worth)</b>				<b>8,138,400</b>		<b>7,584,600</b>	
<b>Total Life Cycle Costs (Present Worth)</b>				<b>365,210,900</b>		<b>355,647,600</b>	
<b>Life Cycle Savings (Compared to Original Design)</b>						<b>9,563,300</b>	
<b>Total Life Cycle Costs (Annualized)</b>			<b>PP Factor</b>	<b>17,000,641</b>	<b>Per Year</b>	<b>16,555,467</b>	<b>Per Year</b>
			<b>0.0466</b>				

PW: Present Worth  
 PWA: Present Worth of Annuity  
 PP: Periodic Payment

**Value Analysis Study  
Buckeye Area Drainage Master Plan**

Flood Control District, Maricopa County, Arizona

July 7 – 9, 2008

**SECTION C: VALUE ANALYSIS PROCESS**

# VALUE ANALYSIS PROCESS

## INTRODUCTION

Value Analysis (VA), also known as Value Management (VM) and Value Engineering (VE), is an organized, creative process, which focuses attention on the requirements of a project for the purpose of achieving essential functions and attendant benefits at the lowest, total costs for materials, equipment, staffing, energy usage, facilities, professional services, maintenance, etc. over the life of the project. In other words, value analysis is a systematic approach to obtain optimum **value** for money spent. As a result of thorough investigation, using experienced, multi-disciplined teams, value and economy are improved by the study of alternate systems, concepts, materials, methods and procedures.

A Certified Value Specialist (CVS) guides a value analysis study. Experience has shown that project studies performed by a person or team with little or no value analysis leadership will tend to steer in the direction of a superficial review and concentrate on errors made by others. A VA study, on the other hand, focuses on both reducing the total cost of ownership and improving overall performance. Application of the VA methodology and coordination of the activities before and after the study also significantly increase the probability the recommendations will be implemented.

This approach has been successfully applied to projects of all types and magnitudes and allows value analysis teams to be responsive to clients by producing practical results. The VM approach also encourages participation of the clients in the study in order to take advantage of their experience and knowledge. Multi-disciplined teams, using a value analysis job plan, analyze the functions of the buildings, products or processes under study, identify high cost areas, ascertain the benefits sought and propose alternatives to those planned or currently being used.

A value analysis job plan is organized into three distinct parts: (1) Pre-Study Preparation, (2) Study Workshop Phase, and (3) Post-Study Implementation.

## PRE-STUDY PREPARATION

The success of a VA study is largely dependent on proper preparation and coordination. Information and documents are furnished by the client and distributed to the team to enable them to prepare for their role in the study. All participants are briefed on the project and their responsibility prior to the study. The pre-study activities include the following tasks:

- Identification of context of the value analysis study.
- Review of project documentation and distribution of information to team members. The VA team relies on the client for the completeness and organization of the material to be used.
- Finalization of team and team assignments.
- Preparation of analytic models, as appropriate.
- Finalization of arrangements for workshop.

Each VA study is designed in response to the goals of the client. The analytic models developed prior to the workshop are consistent with these goals and are based on the information provided to the study team. While not every model is used for every study, it is important the team have sufficient data to develop at least a few of the analytic models to ensure a measure of thoroughness and perspective.

## **STUDY WORKSHOP PHASE**

During the workshop portion of a VA study, a Study Plan is followed which usually includes specific phases to ensure a thoughtful, professional analysis.

### **Information Phase**

At the beginning of a value analysis study, it is important to understand the background and decisions that have influenced the development of the client's goals. For this reason, the client normally describes the history and scope of the project.

### **Function Phase**

The functions of the project are the controlling elements in the overall value analysis approach. Explicitly identifying the functions that drive the project is essential to the team because it forces the participants to think in terms of the purposes for the project and the desired results and costs associated with those functions.

### **Creativity Phase**

This step in a VA study involves the listing of creative ideas. During this portion of a workshop, the value analysis team thinks of as many ways as possible to provide the necessary functions, keeping in mind the benefits important to the client and, at the same time, the need to reduce costs in a responsible manner. During this creative session, judgment about the ideas is not permitted.

### **Evaluation Phase**

All of the information created up to this point must undergo careful consideration. The value analysis team assesses the ideas stemming from the creativity session to test, first, whether the creativity session addressed the problem areas, opportunities and functions identified earlier and, second, whether the specific strategies generated during the creativity session can be, at least in a preliminary fashion, linked with them.

### **Development Phase**

The development phase includes preparing sketches, engineering calculations, cost estimates and life cycle cost analyses to verify the idea adds value to the project. The results of this effort are then used to prepare a presentation.

## Recommendation Phase

The last phase of the value analysis study involves the presentation of recommendations. The team carefully reviews the recommendations before they are formally presented, generally on the last day of the workshop. The recommendations, the rationale that went into the development of each proposal and a summary of the cost savings are presented at this time so that the client can begin an evaluation of the value analysis recommendations prior to the receipt of the report itself.

## POST-STUDY PROCEDURES

The post-study portion of a value engineering study includes the preparation of a report describing the activities undertaken during the study and incorporating the recommendations stemming from the workshop. This post-study effort may require follow-up to resolve questions remaining from the study. Either the VA team leader or an appropriate team member may work directly with the client to further implementation strategies.

## SUPPORTING DOCUMENTS

Following is supporting documentation associated with this VA workshop:

- Force Field Analysis (best features and features of concern)
- Creative Ideas
- Workshop Agenda

## Force Field Analysis

Following is a listing of the current project design “best features” and “features of concern” as identified by the VA team. The VE team then brainstormed ideas to address the features of concern regarding the current design.

### Best Features of Preferred Alternative:

- Leaving Hassayampa River alone from BID south
- Connectivity of trails & flows east to west
- Incorporation of basins to provide multi-use functions
- Protection of RID and Buckeye canal by channels
- Avoids crossing Buckeye, railroad, Roosevelt, pipeline fiber line
- Funding for landowners
- Multi-use opportunities in plan
- Many active participants (stakeholders) involved in project planning
- Helps define future growth development potential

- Simplified discharge into Gila River
- Keeps land available along railroad
- Potential to enhance wildlife in White Tank Wash

Features of Concern:

- High cost of master plan development
- Potential problems with irrigation company
- Large land acquisition amount/ complexity/ cost
- Changes historical drainage from north – south to east – west orientation which duplicates drainage requirements with developers
- Very difficult to phase
- Amount of development north of RID
- Right of way constraints in downtown (rodeo grounds)
- Constructability – existing canal is higher than the proposed flood channel
- Drainage is shown going through the proposed new lake
- Cost of hauling earth long distances (fuel cost)
- Multi-use overkill (town has other plans)
- Flat profile (length-wise) slopes
- High ground water near Gila
- Channel conflict with Buckeye airport
- Doesn't protect the railroad
- Potential flooding problems in the SW area of the master plan (heavy local flood protection planning required)
- 404 permit concerns on White Tank wash
- Uncertainty of White Tank wash designation (i.e. ground water re-charge versus storm water conveyance)
- Relationship of White Tank No. 4 outlet
- Need for regional flood control solution
- Land availability for west wing development north of RID

## Creative Ideas

The VA team generated over 40 creative ideas during the "brainstorming" portion of the workshop (**Figure 13**). These ideas were discussed by the team and 10 were selected for development into VA proposals. Idea evaluation criteria included:

- **Performance Benefits**
  - Constructability
  - Implementation
  - Landscape Architecture/ Land Use Compatibility
  - Natural & Cultural Resources
  - Public/ Political Acceptance
  - Safety/ Flood Hazard Reduction
  - Synergy/ Multi-use
- **Cost Savings**
  - Initial Construction Cost
  - Maintenance Cost
  - Life Cycle Cost

# CREATIVE IDEAS/ EVALUATION

Figure 13

## Brainstorming

Project: **Buckeye Area Drainage Master Plan**  
 Location: **Buckeye, AZ**

**Bold** = Ideas developed into proposals  
 Key: DS = Design Suggestion; ilo = in lieu of  
 Numbers indicate evaluation dots (votes)

No.	Description:	Cost Savings	Performance
VA-1	Use north - south drainage between Roosevelt Canal and Buckeye Canal		
<b>VA-2</b>	<b>Allow use of BID Rights of Way for both BID and drainage channels. Allows sharing of land to reduce total area required.</b>	2	3
VA-3	Siphon BID at drainage crossing		
VA-4	Provide channel and retaining basins near Southern Avenue alignment ilo BID		
VA-5	Verify location of national security fiber optic line to determine if in planning area		
VA-6	Use concrete lined channel sections to reduce right of way (land savings)	1	
VA-7	Upsize basins to reduce channel width (land savings)	1	
VA-8	Optimize basin and channel relationship to reduce land cost (see VA-27)	1	2
VA-9	Phase project in reasonable cost increments	1	1
VA-10	Partner with development to create multi-use areas		1
VA-11	Coincide implementation of flood control plan with development plan. Grow out from central Buckeye. (see VA-16)		4
VA-12	Replace open channels with buried conduits (see VA-23)		
VA-13	Upgrade existing (local) drainage plan and omit from regional drainage plan (see VA-15 & VA-16)		
VA-14	Use alternative 1 concept in area east of Watson Road		
<b>VA-15</b>	<b>Use hybrid of alternative 1 &amp; 3 ilo alternative 1. (Includes White Tank FRS No. 4 outfall)</b>	1	4
<b>VA-16</b>	<b>Enhance alternative 1 ilo alternative 3 by adding basins and enlarging planned basins. Also enhance planned basins by adding multi-use features. (Does not include White Tank FRS No. 4 outfall)</b>	1	6
VA-17	Accelerate land acquisition process to take advantage of better market prices.	1	1
<b>VA-18</b>	<b>Use side slope of 5 1/2 : 1 for channels in lieu of 7 : 1 in site constrained areas</b>	1	3
VA-19	Partner with canal company to utilize access road on south side (see VA-20)	1	
<b>VA-20</b>	<b>Use single O &amp; M road ilo one on each side of the channel. This allows the landscape buffer to be reduced by 10' on channel side without the O &amp; M road.</b>	1	3
VA-21	Locate multi-purpose space out of channel at nodes of activity		2

# CREATIVE IDEAS/ EVALUATION

Figure 13

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No.	Description:	Cost Savings	Performance
<b>VA-22</b>	<b>Give development credits for locating recreational amenities adjacent to flood control facilities</b>		<b>3</b>
<b>VA-23</b>	<b>Consider conc. open channels (alt. 1) for urban and industrial areas. See sketch of cross section and sketch of site location in industrial area. A box culvert (alt. 2), although high in initial cost, could be considered for isolated areas of constrained space. An example application area is the historic rodeo grounds.</b>	<b>1</b>	<b>5</b>
VA-24	Not used		
<b>VA-25</b>	<b>Include storm drains as part of local improvements (10 year design) and remove storm drains from regional plan.</b>	<b>1</b>	<b>2</b>
VA-26	Meet flood control needs first and accommodate recreation needs within flood control cost		
<b>VA-27</b>	<b>Optimize Basin - Channel relationship to reduce land cost</b>	<b>1</b>	<b>5</b>
VA-28	Consider "desert greenbelt" approach like Scottsdale (see VA-16)		<b>2</b>
VA-29	Move north - south, optimize basins & channels (see VA-15 & VA-16)		
VA-30	Add more aesthetics/ multi-use space to alternative 1 like alternative 3 (see VA-16)		<b>2</b>
VA-31	Increase cost per crossing from \$100,000 to \$1 to \$2 million for alternative 1, estimating adjustment		
VA-32	Protect and preserve historic rodeo grounds as part of plan. Consider channel with smaller storm drain.		
VA-33	Modify drainage to avoid new proposed lake		
VA-34	Further study to determine if "wicking" will occur at existing canal versus proposed flood channel. May require more distance separation.		
VA-35	Revise cost estimate to reflect cost of excavation and hauling earth away at \$15 - \$20 per CY ilo \$11 per CY (also include fine grading)		<b>1</b>
VA-36	Protect railroad from flooding (locate channel along southern side, or north - south channels to avoid flooding over time)		
VA-37	Investigate options for White Tanks #4 outlet. Consider north - south channel from White Tanks #4 to BID or Gila River		<b>1</b>
VA-38	Use stormwater as opportunity for creating wetlands		<b>1</b>
VA-39	Combine run-off with proposed lake (portion as demonstration area)		<b>1</b>
VA-40	Use existing outfalls, requires upgrading		<b>2</b>

# CREATIVE IDEAS/ EVALUATION

Figure 13

## Brainstorming

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No.	Description:	Cost Savings	Performance
VA-41	See Dibble ideas in design presentation		
VA-42	Design culverts for by-pass of water through railroad line		2

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## Buckeye Area Drainage Master Plan

### VALUE ANALYSIS WORKSHOP

#### THREE DAY AGENDA

July 7 – 9, 2008

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#### Day 1, Monday July 7th

8:00 a.m.    **INTRODUCTION TO WORKSHOP/INFORMATION PHASE**  
(VA Team Leader Steve Kirk, CVS)  
Welcome & Opening Remarks  
Team Member Introductions  
Objectives of Workshop  
Workshop Organization & Agenda

#### **INFORMATION PHASE:**

8:15            **VALUE ANALYSIS PROCESS BRIEFING**  
(Steve Kirk)

8:45            **PROJECT BRIEFING**  
(Dibble, Flood Control District)  
Project Background  
Project Goals and Objectives  
Proposed Alternatives  
Evaluation of Proposed Alternatives  
Recommended Alternatives

10:00          **BREAK**

10:15          **COST & OTHER VALUE MODELS**  
(Dibble)  
Project Budget Review and Confirmation  
Performance Criteria

#### **FUNCTION ANALYSIS PHASE**

11:00 pm    **FUNCTION ANALYSIS**  
  
Definition of Function Analysis  
Function Analysis Questions  
Function / Cost / Worth Analysis

- Noon      **LUNCH**
- 1:00 pm    **FUNCTION ANALYSIS (continued)**  
 FAST Diagramming  
 Identification of High Cost / Worth Relationships
- 4:00        **FORCE FIELD ANALYSIS**  
 Best Project Features  
 Weakest Features  
 Ideas for Value Enhancement
- 4:30        **SUMMARY OF FORCE FIELD FINDINGS**
- 5:00        **ADJOURN**

**Day 2, Tuesday July 8th**

**CREATIVITY PHASE**

- 8:00 a.m.    Brainstorm Ideas to Meet Functions (Project Objectives)  
 Identify High Cost Elements for Value Enhancement  
 Brainstorm Large Variety of Ideas  
 Generate Ideas for Basic Function(s)  
 Think of Ideal Solutions

**EVALUATION PHASE**

- 10:30        Discuss Idea Advantages & Disadvantages  
 Evaluate Ideas by Comparison  
 Rank Ideas for Further Investigation

- 12:00        **LUNCH**

- 1:00 p.m.    **SUMMARIZE IDEAS FOR DEVELOPMENT**

**DEVELOPMENT PHASE**

- 1:30        **PROPOSAL DEVELOPMENT**  
 Team Member Proposal Development Assignments  
 Prepare Design Alternatives  
 Cost Estimate of Alternatives  
 Sketches of Alternatives  
 Weighted Evaluation, Using Performance Model

- 5:30        **ADJOURN**

**Day 3, Wednesday July 9th**

8:00 a.m. **PROPOSAL DEVELOPMENT (Concurrent, as required)**

Cost Estimate of Alternatives  
Sketches of Alternatives  
Life Cycle Cost Calculations  
Written Proposals (Present, Proposed, Discussion)

12:00 **LUNCH**

12:30 p.m. **PROPOSAL DEVELOPMENT (Continued)**

**RECOMMENDATION PHASE**

3:00 **PRESENTATION**

Opening Remarks  
Summary of VA Process (Steps, Models, Function Analysis, etc.)  
VA Proposals & Performance Improvements/ Cost Savings  
Comments & Discussion  
Next Steps (VA Implementation Plan)  
Closing Remarks

5:00 **ADJOURN/CELEBRATION!**