



**SR 26/US 80 Widening from  
Bull River to the Lazaretto Creek**  
Chatham County, Georgia

**Value Engineering Study Report**

December 2003

**Design Consultant**  
Georgia Department of Transportation

**Value Engineering Consultant**

December 4, 2003

Ms. Lisa L. Myers  
Design Review Engineer Manager  
State of Georgia Department of Transportation  
General Office  
No. 2 Capitol Square, Room 266  
Atlanta, Georgia 30334-1002

re: Project Number HPP-STP-064-1 (41)  
US 80/SR 26 Widening from Bull River to  
Lazaretto Creek in Chatham County, Georgia  
Value Engineering Study Report

Dear Ms. Myers:

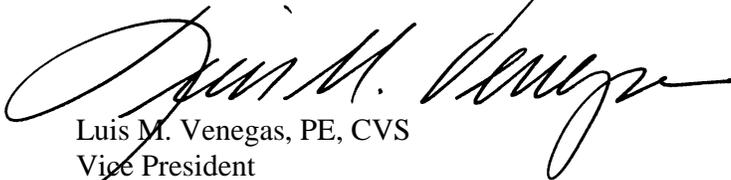
Lewis & Zimmerman Associates, Inc. is pleased to submit 17 copies and one electronic copy of the referenced report.

The alternatives and design suggestion addressed during this VE effort identify opportunities to improve the value of the project in terms of potential capital cost reductions, more efficient evacuation of Tybee Island during emergency conditions by reduction of a known bottleneck, improving safety, protecting the Diamondback Terrapin, improving constructibility, and improving service.

We wish to take this opportunity to thank you and the State of Georgia Department of Transportation participants for your efforts to assist the VE team generating new, creative solutions for this project. We look forward to working with you on future assignments and stand ready to provide additional value engineering services.

Sincerely yours,

LEWIS & ZIMMERMAN ASSOCIATES, INC.



Luis M. Venegas, PE, CVS  
Vice President

Attachments

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## EXECUTIVE SUMMARY

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### INTRODUCTION

This Value Engineering (VE) Study Report summarizes the events of the VE study conducted by Lewis & Zimmerman Associates, Inc. (LZA) for the State of Georgia Department of Transportation (GDOT), Atlanta, Georgia. The subject of the study was the **SR 26/US 80 Widening** from Bull River to the Lazaretto Creek, **Project HPP-STP-064-1 (41)**. The project is located in Chatham County, Georgia and is being designed by GDOT.

### PROJECT DESCRIPTION

The proposed widening will provide two-3.3-meter (m) lanes in each direction separated by a 7.2 m raised grassed median, 3.0 m bicycle shoulders, and 4:1 slopes. The typical section between Bull River and Lazaretto Creek will have the same features as described above for 6:1 front and back slopes separated by a 0.6m flat bottom ditch, and a gravity wall to prevent Diamondback Terrapins from entering the roadway. In addition, Sabal Palm trees will be planted two meters behind the gravity wall. The two new lanes will be constructed at a minimum elevation of 2.7m. Although SR 26/US 80 has experienced flooding at high tides, raising the grade to meet the worst-case storm would not be practical or cost effective since all of Tybee Island would be flooded during even the least severe hurricane. Raising the existing roadway 0.3 m does allow more time for residents to evacuate. The existing bridges over Bull River and Lazaretto Creek will be widened and new parallel bridges will be constructed. In addition, a bike lane/path may be provided on the Bull River Bridge which will tie to the Georgia Rails to Trails Bikeway. The roadway will remain open to traffic during construction.

The current probable cost of construction has been identified at \$80,560,073 as noted on GDOT's *Preliminary Cost Estimate, Urban Design Office* dated September 17, 2003 and includes \$8,000,000 for right-of-way purchases. As such, construction is earmarked at \$72,560,073 and includes engineering and construction contingencies of 10.25% and a two-year inflation rate at 10.00%.

### CONCERNS AND OBJECTIVES

Numerous design objectives were expressed by the design team that included: (1) improve emergency evacuation route from Tybee Island, (2) correct/prevent settlement of existing roadway as the current profile elevation is in very close proximity, if not within, the spring tides, (3) provide access to McQueen's Island Trail, (4) complete the last section of SR 26/US 80 as a four-lane facility, (5) provide access to Old Highway 80 and associated fishing pier and boat ramp, (6) provide access to Fort Pulaski National Monument on McQueen's Island, (7) preserve wildlife – specifically the Diamondback Terrapin, (8) accommodate several environmental issues that include wetland mitigation, oyster bed preservation, and visual preclusion of marshes and lowland vistas and (9) preserve the Sabal Palm trees which were planted as a tribute to World War I veterans.

The priority of these objectives was not determined; however, the VE team deemed the environmental sensitivity of the area to be very important. Although the Diamondback Terrapin is not yet on the endangered list, its inclusion on the "Watch List" of potential endangerment is serious enough to warrant

some permanent means of protection. Minimizing wetland encroachments and disturbances was considered to be important enough to minimize the typical section were possible. However, the visual impacts associated with the driving public of the marshes and lowland vistas were not considered to be as important as other concerns. The preponderance of the using public lives on Tybee Island; as such, their primary concern is getting to and from the mainland through McQueen's Island as quickly as possible. Tourists would be more attuned to the vistas, which could still be appreciated even with an elevated structure, guardrails, or other safety measures.

Two other major concerns were determined to warrant further investigation: (1) the proposed high profile of the new roadway facility and (2) expansion of the existing bridges. The proposed profile for the new roadway was derived from the elevation of the existing roadway on Tybee Island: 2.7m. Any higher profile would prove to be useless as neither roadway facility is designed to preclude flooding, even from a Category 1 hurricane. The current roadway elevation on McQueen's Island is affected by spring tides and water has been known to migrate onto the shoulder and with sufficient wind, splash onto the driving surfaces. This however, has not been of sufficient severity to leave the residences of Tybee Island stranded through an impassable roadway. So it may be possible to reduce this profile elevation closer to existing grade.

The proposed widening of SR 26/US 80 mandates the widening of the two existing bridges, one at Bull River and the other at Lazaretto Creek. Upon closer review, the two existing bridges' geometry, radius of curvature, elevations, and construction preclude a physical expansion or widening. Total replacement appears to be the only alternative. Although an increase in the project's overall cost would occur, the two bridges are approaching the end of their useful lives at 45 years for Lazaretto Creek and 35 years for Bull River and replacements are deemed an added value to the overall project.

Finally, it was noted during the Information Phase of the VE study that costs associated with the purchase of rights-of-way and mitigation cannot be verified as the backup information and data is not available.

Therefore, in order to accomplish the project's goals in an expeditious and cost-effective manner, and assist in ameliorating the concern noted, GDOT engaged this VE study. The objective of the effort was to identify opportunities that would improve the value of the project in terms of potential capital cost reductions, more efficient evacuation of Tybee Island during emergency conditions by reduction of a known bottleneck, improve safety, assure wildlife preservation of the Diamondback Terrapin, improve constructibility, and improve level of service.

## **HIGHLIGHTS OF THE STUDY**

The project is a relatively straightforward concept to interconnect two existing four-lane facilities with a new four-lane roadway by widening the existing two-lane roadway on McQueen's Island.

Listed below are some of the more salient ideas resulting from the brainstorming session. They are provided here as a sampling of the contents of the report.

### *Bridges (B)*

As previously noted, the bridges over Lazaretto Creek and Bull River are rapidly approaching the end of their useful lives at 45 years and 35 years, respectively. Alternatives B-3 and B-4 were combined to present the added value associated with two new sets of bridges resulting in an initial cost increase of over \$10,000,000. However, taking into account future replacements and on-going maintenance of older

structures, recurring cost savings over a 50-year period could total nearly \$24,000,000, resulting a net present worth life cycle savings of almost \$13,600,000.

As stated in Alternative B-1, it appears the geometry of the existing bridges will not permit easy widening on one side. However, it may be possible to widen the bridges with one new lane on each side of the existing bridges and retain the existing bridges as the “center” two lanes after widening. This situation will facilitate constructing the new bridge widening from the existing bridges but results in adding almost \$8,000,000.

If the design speed limit were reduced from 90 kilometers per hour (km/h) to 72 km/h, then saving approaching \$2,200,000 could be attained by reducing the new bridges’ widths as noted on Alternative B-7.

#### *Earthwork (EW)*

A concern the VE team encountered on this project was the apparent high profile. Raising the entire roadway by 2.7 m results in over 190,000 cubic meters (m<sup>3</sup>) of in-place embankment and 300,000 m<sup>3</sup> in surcharge material—all having to be imported. Much of this profile can be eliminated if the proposed roadway improvements were to be accomplished at or near existing grade. This could save over \$9,900,000 as noted on Alternatives EW-7 and BP-8. In a similar manner, merely lowering the profile could see initial savings of almost \$1,900,000 as indicated on Alternative EW-1.

The current design calls for using Wick drains as a means of dewatering the proposed project “bed” on both the new areas and beneath the existing roadway section. Since the existing section is already dewatered, eliminating the Wick drains on this section will save \$3,300,000 per Alternative EW-9. After consultation with GDOT’s Office of Materials and Research, it was determined elimination of the proposed use of geogrid material and using a single layer of high grade filter material in lieu of two layers of thinner filter fabric could work on the project. Alternatives EW-10 and EW-11 developed these ideas and estimate initial savings of about \$1,400,000 and \$1,300,000, respectively.

#### *Concrete Work (CW)*

The project documents indicated the use of a raised concrete median for the entire length of the project which is approximately ±9 kilometers. During the information phase of the study it was noted by the users that the intended composition of the median was to be grass to improve the new roadway’s appearance and to be inkeeping with McQueen’s Island’s general environment. Therefore, Alternative CW-1 minimizes the use of the raised concrete median to those areas that are required for safety, i.e. turning movements, bridges, etc., and denotes savings of about \$3,000,000.

#### *Base and Paving (BP)*

Building on previous ideas, Alternative BP-6 adapted the concept of providing two new “evacuation” lanes on each side of the existing roadway at grade and incorporating the proposed bicycle lanes on these “evacuation” lanes. Savings for this concept is an eye-opening \$28,000,000 and acknowledges a lower profile that would be prone to the same spring tidal effects being experienced today. However, these tidal effects will be further from the drivable surfaces and the wildlife barriers would, to some extent, ameliorate the effects by acting as mini-dams for water intrusion.

### *Miscellaneous (M)*

As an alternate concept to accommodate the diamondback terrapin, Alternative M-8 suggests having interested parties create a wildlife sanctuary for the diamondback terrapin thereby assuring their survivability and eliminating the costs associated with the wildlife barriers from the project.

Alternative M-1 would slip-form the wildlife barriers and initially save about \$1,000,000. Alternative M-2 could save almost \$1,800,000 if gabions were used for the wildlife barriers. In either case, the barriers are not eliminated.

*Summary of Potential Cost Savings* worksheets follow this section indicating all of the alternatives and design suggestions developed by the VE team. Some of the alternatives are mutually exclusive or interrelated so that addition of all project cost savings does not equal total savings for the project. A full listing of all of the ideas can be found in the Value Analysis and Conclusions section of this report as *Creative Idea Listing* worksheets.

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## STUDY RESULTS

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### INTRODUCTION

The results are the major feature of a value engineering study since they represent the benefits that can be realized on the project by the owner, users and designer. The results will directly affect the project design and will require coordination among the designer, the user and the owner to determine the ultimate acceptance of each alternative.

The creative ideas are organized according to the order in which they were originally generated by the VE team during their function analysis creative sessions. The following prefixes in the alternative numbers are used to designate the project element being addressed:

<b>B</b>	=	<b>Bridges</b>
<b>EW</b>	=	<b>Earthwork</b>
<b>CW</b>	=	<b>Concrete Work</b>
<b>BP</b>	=	<b>Base and Paving</b>
<b>M</b>	=	<b>Miscellaneous</b>

### RESULTS OF THE STUDY

The VE team generated 48 ideas for change during the Function Analysis and Creative Ideas phases of the VE Job Plan. The evaluation of these ideas was based upon their potential for capital cost savings, probability of acceptance, availability of information to properly develop an idea, compliance with perceived quality, adherence to universally accepted standards and procedures, life cycle cost efficiency, safety, maintainability, constructibility and soundness of the idea.

Of the 48 ideas generated, 28 were sufficiently rated to warrant further investigation. Continued research and development of these ideas yielded 23 alternatives for change with an impact on project costs and one design suggestion that will enhance the value of the project in terms of capital cost, durability, and expected life. All of these alternatives and design suggestions are presented in detail following this narrative. However, due to the large quantity of highly rated ideas, not all of them were able to be developed. As such, these have been listed on the *Summary of Potential Cost Savings* worksheets as italicized alternatives for review and possible development by others.

### EVALUATION OF ALTERNATIVES

Once the aforementioned ideas are developed, it is important to consider each part of an individual alternative on its own merit. There is a tendency to disregard an alternative because of concern about one portion of it. Separate consideration should be given to each of the areas within an alternative that are acceptable and those parts should be considered in the final design, even if the entire alternative is not implemented.

Cost is the primary basis of comparison for alternative designs. To ensure that costs are comparable within the alternatives proposed by the VE team, the designer's cost estimates, where possible, is to be used as the pricing basis. Where appropriate, the impact of energy costs, replacement costs, and effect on operations and maintenance should be shown within each alternative.

Some of the alternatives are interrelated, so acceptance of one may preclude the acceptance of another. The reader should evaluate those alternatives carefully to select the ideas with the greatest beneficial impact to the project.



# SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: <b>US 80/SR 26 WIDENING</b> <b>BULL RIVER TO LAZARETTO CREEK</b> <i>Preliminary Design Development</i>						
PRESENT WORTH OF COST SAVINGS						
ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	INITIAL COST SAVINGS	RECURRING COST SAVINGS	TOTAL PW LCC SAVINGS
<b>BRIDGES (B)</b>						
B-1	Shift alignment to allow widen bridges on both sides with existing in the middle	\$24,240,238	\$32,170,997	(\$7,930,759)		(\$7,930,759)
B-2	Use prestressed concrete beams for main span of Lazaretto Creek	\$3,865,102	\$3,269,001	\$596,101		\$596,101
B-3/B-4	Construct new bridges and remove existing bridges at Lazaretto Creek and Bull River	\$23,302,599	\$33,890,993	(\$10,588,394)	\$24,147,157	\$13,558,763
B-7	Lower design speed to reduce bridge width	\$21,246,707	\$19,041,086	\$2,205,621		\$2,205,621
<b>EARTHWORK (EW)</b>						
EW-1	Lower the profile	\$4,609,183	\$2,752,594	\$1,856,589		\$1,856,589
EW-3	Lower design speed and minimize median	\$4,424,142	\$3,952,618	\$471,524		\$471,524
EW-4	Use mechanically stabilized embankment walls	\$4,495,940	\$10,290,924	(\$5,794,984)		(\$5,794,984)
EW-5	Use 4:1 slopes in lieu of 6:1 slopes	\$70,899	\$0	\$70,899		\$70,899
EW-7/BP-8	Provide roadway improvements at existing grade	\$13,771,278	\$3,846,681	\$9,924,597		\$9,924,597
EW-9	Minimize the quantity of Wick drains	\$8,213,075	\$4,927,845	\$3,285,230		\$3,285,230
EW-10	Eliminate the geogrid material	\$1,443,000	\$0	\$1,443,000		\$1,443,000
EW-11	Use a single layer of higher grade filter fabric in lieu of two layers	\$5,411,250	\$4,058,438	\$1,352,812		\$1,352,812
<b>CONCRETE WORK (CW)</b>						
CW-1	Minimize the use of raised concrete median	\$3,458,384	\$550,286	\$2,908,098		\$2,908,098
CW-3	Eliminate temporary concrete barriers	\$638,650	\$0	\$638,650		\$638,650
<b>BASE AND PAVING (BP)</b>						
BP-4	Construct separate bicycle facility	\$4,111,595	\$4,052,080	\$59,515		\$59,515
BP-5	Use existing McQueen's Island Trail as bicycle facility - connect to existing facility at ends of project	\$509,838	\$0	\$509,838		\$509,838
BP-6	Add evacuation lanes on each side of existing roadway at grade and incorporate bicycle lanes on evacuation lanes	\$31,011,852	\$2,893,718	\$28,118,134		\$28,118,134

# VALUE ENGINEERING ALTERNATIVE



PROJECT: **US 80/SR 26 WIDENING**  
**BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

ALTERNATIVE NO.:  
**B-1**

DESCRIPTION: **SHIFT ALIGNMENT TO WIDEN BRIDGES ON BOTH SIDES**  
**WITH EXISTING IN THE MIDDLE**

SHEET NO.: 1 of 4

**ORIGINAL DESIGN:** (Sketch attached)

In the original design, the bridges at Lazaretto Creek and Bull River require that portions of the widened structure be built on either side of the existing bridges. It uses the existing bridges in the eastbound travel lane. The design is not developed at this time, but would likely match existing; widening would be needed without question.

**ALTERNATIVE:** (Sketch attached)

The alternative design shifts the alignment 6.6 meters (m) from the original proposed position. The existing bridges will now be a portion of the median. The existing post and rail side barriers would be removed and replaced with raised medians. The work would be done from the deck level. Staging traffic would require a temporary barrier to be added during stage construction. This would still allow for two 3.7 m lanes and no shoulders. The widening for the main spans of Lazaretto could be prestressed concrete.

**ADVANTAGES:**

- More economical
- Takes advantage of existing assets
- Uses existing structure

**DISADVANTAGES:**

- Involves redesign of the alignment to shift the centerline

**DISCUSSION:**

The typical approach to this project would be to widen the existing bridges to accommodate the increase in shoulder widths for the new roadway section. This would involve widening the existing bridge on both sides; see original sketch. This Alternative uses the existing bridges, but in the median where its low sufficiency rating would not be taxed by vehicular traffic. Two longitudinal joints would be required to isolate the structure.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
<b>ORIGINAL DESIGN</b>	\$ 24,240,238	—	\$ 24,240,238
<b>ALTERNATIVE</b>	\$ 32,170,997	—	\$ 32,170,997
<b>SAVINGS</b>	\$ (7,930,759)	—	\$ (7,930,759)

# VALUE ENGINEERING ALTERNATIVE



PROJECT: **US 80/SR 26 WIDENING**  
**BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

ALTERNATIVE NO.:

**B-2**

DESCRIPTION: **USE PRESTRESSED BEAMS FOR MAIN SPAN OF**  
**LAZARETTO CREEK**

SHEET NO.: 1 of 7

**ORIGINAL DESIGN:** (Sketch attached)

Though no drawings are available, standard procedure for the widened portion would be to match “in kind” the existing superstructure. The approach spans for Lazaretto Creek and Bull River bridges are prestressed concrete (PSC) beams. The main span for the Lazaretto Creek bridge is a three-span variable depth plate girder. The spans are 35.6 m – 46.9 m – 35.6 m. Structural steel is the least desirable from a cost and maintenance standpoint. At the time of construction in 1958, long span prestressed beams solutions were not used a result of prevailing concrete strength capabilities, fabrication and construction technologies.

**ALTERNATIVE:**

Today, spans of this length are achievable using prestressed beams either as a simple span or made continuous through post-tensioning. The proximity of the navigable channel and the open, rural nature of the area allow the opportunity to haul longer concrete units to the site.

**ADVANTAGES:**

- More economical
- Shorter fabrication time
- Common practice
- Industry standard for these spans and location

**DISADVANTAGES:**

- Constructability considerations - crane size and location
- Hauling concerns must be considered but can be mitigated by special hauling equipment
- May require raising grade to accommodate increased depth

**DISCUSSION:**

The main and flanker spans of the channel crossing for this bridge is a three span continuous unit with spans of 35.6 m – 46.9 m – 35.6 m. The center unit is generally considered out of the range of a simple prestressed beam, mostly because of the difficulty in hauling a girder of this length. However, it is possible to fabricate a girder this long and transport it by barge if necessary. Haunched continuous girders would allow spans in excess of 61m for the main span. However, a conventional simple span beam approximately 1.88 m deep would work.

Per Paul Liles: Use 861.11/m<sup>2</sup> (\$80/Square Foot (SF)) for steel superstructure and \$645.83/m<sup>2</sup> (\$60/sf) for PSC beams superstructure.

*Note: This alternative can be used with Alternative B-1.*

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
<b>ORIGINAL DESIGN</b>	\$ 3,865,102	—	\$ 3,865,102
<b>ALTERNATIVE</b>	\$ 3,269,001	—	\$ 3,269,001

<b>SAVINGS</b>	\$ 596,101	—	\$ 596,101
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# VALUE ENGINEERING ALTERNATIVE



<b>PROJECT:</b>	<b>US 80/SR 26 WIDENING BULL RIVER TO LAZARETTO CREEK</b> <i>Preliminary Design Development</i>	<b>ALTERNATIVE NO.:</b> <b>B-3/B-4</b>
<b>DESCRIPTION:</b>	<b>CONSTRUCT NEW BRIDGES AND REMOVE EXISTING BRIDGES AT LAZARETTO CREEK AND BULL RIVER</b>	<b>SHEET NO.:</b> 1 of 3

**ORIGINAL DESIGN:**

The original design considered using the existing bridges and widening them. The existing bridges would be in future travel lanes. Their crowned cross sections would have to be adjusted to match by hydraulics, demolition of the superstructures, and recasting a deck overlay. This overlay would have to adjust from the existing 3.175 millimeter (mm)/0.3408 m (1/8 inch/foot) cross slope to a 2% cross slope deep overlay.

**ALTERNATIVE:**

Remove the existing bridges and construct new bridges.

**ADVANTAGES:**

- Longer service life
- Feasible alternative
- Existing bridges are nearing the end of their useful lives

**DISADVANTAGES:**

- Higher initial cost
- Redesign effort

**DISCUSSION:**

The existing cross section for this bridge is normal crown with 3.175 mm/0.3408 m cross slope. The new cross section places this bridge offset from the centerline and increases the cross slope to 2%. The existing bridge has a sufficiency rating of 53. It is not advisable to widen this bridge. Achieving the cross slope would mean a deck overlay and/or differential jacking, neither of which is very accepted.

<b>COST SUMMARY</b>	<b>INITIAL COST</b>	<b>PRESENT WORTH RECURRING COSTS</b>	<b>PRESENT WORTH LIFE-CYCLE COST</b>
<b>ORIGINAL DESIGN</b>	\$ 23,302,599	\$ 27,193,524	\$ 50,496,123

<b>ALTERNATIVE</b>	\$ 33,890,993	\$ 3,046,367	\$ 36,937,360
<b>SAVINGS</b>	\$ (10,588,394)	\$ 24,147,157	\$ 13,558,763

# VALUE ENGINEERING ALTERNATIVE



PROJECT:	<b>US 80/SR 26 WIDENING BULL RIVER TO LAZARETTO CREEK <i>Preliminary Design Development</i></b>	ALTERNATIVE NO.:	<b>B-7</b>
DESCRIPTION:	<b>LOWER DESIGN SPEED TO REDUCE BRIDGE WIDTH</b>	SHEET NO.:	1 of 4

**ORIGINAL DESIGN:** (Sketch attached)

The current design is based on a design speed of 90 kilometers per hour (km/h).

**ALTERNATIVE:** (Sketch attached)

Reduce the design speed to 72 km/h.

**ADVANTAGES:**

- Matches adjacent project's design speeds
- Lower cost
- Improves safety
- Improves line of sight
- Improves drivability

**DISADVANTAGES:**

- Increased travel time (less than two minutes)
- Safety compromised
- Increase driver frustration as expectation of a widened road is higher speed

**DISCUSSION:**

Lowering the design speed of the project will allow the 6 m median to be reduced to 1.83 m; a net difference of 4.17 m.

<b>COST SUMMARY</b>	<b>INITIAL COST</b>	<b>PRESENT WORTH RECURRING COSTS</b>	<b>PRESENT WORTH LIFE-CYCLE COST</b>
<b>ORIGINAL DESIGN</b>	\$ 21,246,707	—	\$ 21,246,707

<b>ALTERNATIVE</b>	<b>\$ 19,041,086</b>	<b>—</b>	<b>\$ 19,041,086</b>
<b>SAVINGS</b>	<b>\$ 2,205,621</b>	<b>—</b>	<b>\$ 2,205,621</b>

# VALUE ENGINEERING ALTERNATIVE



PROJECT: **US 80/SR 26 WIDENING**  
**BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

ALTERNATIVE NO.:  
**EW-1**

DESCRIPTION: **LOWER THE PROFILE**

SHEET NO.: 1 of 4

**ORIGINAL DESIGN:**

Keep the proposed typical section in the current plans.

**ALTERNATIVE:** (Sketch attached)

Lower the roadway profile 0.30 m from design elevation 2.7 m to 2.4 m. As a second Alternative “B,” consider also reducing the entire section, including the barrier.

**ADVANTAGES:**

- Reduces earthwork quantity
- Reduces surcharge/reduce surcharge duration
- Eliminates/minimizes earthwork over existing roadway

**DISADVANTAGES:**

- Does not provide as much
- Flood/evacuation protection only with Alt. B
- Might require additional asphalt over existing roadway

**DISCUSSION:**

The project need of providing additional time to evacuate is still met with a smaller earthwork requirement. While cost saving were not calculated, it may also be feasible to lower the entire section as noted on the sketch as Alt. B. However, this will reduce the flood protection.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 4,609,183	—	\$ 4,609,183
ALTERNATIVE	\$ 2,752,594	—	\$ 2,752,594
SAVINGS	\$ 1,856,589	—	\$ 1,856,589

# VALUE ENGINEERING ALTERNATIVE



PROJECT: **US 80/SR 26 WIDENING**  
**BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

ALTERNATIVE NO.:  
**EW-3**

DESCRIPTION: **LOWER DESIGN SPEED AND MINIMIZE MEDIAN**

SHEET NO.: 1 of 5

**ORIGINAL DESIGN:**

The current typical section provides a 6 m raised median for a 90 km/h design speed.

**ALTERNATIVE:** (Sketch attached)

Reduce the design speed to 72 km/h and use a narrower median with a concrete barrier.

**ADVANTAGES:**

- Reduces earthwork
- Reduces roadway template
- Reduces wetlands effects
- Reduces limit of disturbance
- Eliminates curb and gutter
- Improves safety—no head-on collisions

**DISADVANTAGES:**

- Reduces design speed
- Open feel of barrier-less design is compromised (however, the drivers visual vista is not)
- Will still need to provide left turn lanes at several locations in the project (assume 10%)

**DISCUSSION:**

Reducing the design speed and providing a reduced-width median with barrier will save the project about \$471,524 and still provide an improved safety design. All earthwork and geotechnical quantities will be reduced. A secondary benefit of this reduction will also be reduced environmental affects/wetlands disturbance. This argument can help offset the visual impacts. While there is no left shoulder, there will be a right shoulder for the full length of the project. With the barrier and narrower median, the accident rate might actually increase. However, the severity (fatalities) will decrease and head-on collisions will be eliminated (not guaranteed with even the 6 m median 72 km/h posted speed limit at project interfaces).

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
<b>ORIGINAL DESIGN</b>	\$ 4,424,142	—	\$ 4,424,142
<b>ALTERNATIVE</b>	\$ 3,952,618	—	\$ 3,952,618

SAVINGS	\$ 471,524	—	\$ 471,524
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# VALUE ENGINEERING ALTERNATIVE



PROJECT: **US 80/SR 26 WIDENING**  
**BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

ALTERNATIVE NO.:  
**EW-4**

DESCRIPTION: **BUILD EDGE WALLS ON OUTSIDE SHOULDERS**

SHEET NO.: 1 of 8

**ORIGINAL DESIGN:** (Sketch attached)

The current design does not call for the use of edge walls. The project does provide for a continuous wildlife barrier on the outside shoulders to preclude diamond back terrapins from crossing the roadway and being killed by motorists.

**ALTERNATIVE:** (Sketch attached)

Provide edge walls at outside edge of shoulders of the project. These walls will also serve as the wildlife barriers.

**ADVANTAGES:**

- Smaller footprint
- Reduces environmental impacts (5.0 hectares)
- Still prevents wildlife crossings
- Improves safety

**DISADVANTAGES:**

- Adds initial costs
- Could have an adverse effect on vistas of marshes and large expanses of McQueen's Island

**DISCUSSION:**

This alternative replaces side embankments with mechanically-stabilized earth (MSE) walls and Jersey Barriers. The use of walls provide better protection for the diamond back terrapin while improving driving safety.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 4,495,940	—	\$ 4,495,940
ALTERNATIVE	\$ 10,290,924	—	\$ 10,290,924

<b>SAVINGS</b>	\$ (5,794,984)	—	\$ (5,794,984)
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# VALUE ENGINEERING ALTERNATIVE



**PROJECT:** US 80/SR 26 WIDENING  
**BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

ALTERNATIVE NO.:  
**EW-5**

**DESCRIPTION:** USE 4:1 SIDE SLOPES INSTEAD OF 6:1 SLOPES

SHEET NO.: 1 of 4

**ORIGINAL DESIGN:** (Sketch attached)

The original design uses 6:1 fore slopes and back slopes in the area where the wildlife barrier is proposed: Station (STA) 6+092 to STA 8 + 701.

**ALTERNATIVE:** (Sketch attached)

The alternative proposes 4:1 fore slopes and back slopes.

**ADVANTAGES:**

- Reduces earthwork
- Saves cost
- Common practice where appropriate
- Same basic geometry throughout the project
- Facilitates construction

**DISADVANTAGES:**

- 4:1 slopes less desirable for a 90 km/h facility

**DISCUSSION:**

This alternative proposes the use of 4:1 side slopes in the area where the wildlife barrier is proposed. This is consistent with the slopes proposed in areas without wildlife barriers.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
<b>ORIGINAL DESIGN</b>	\$ 70,899	—	\$ 70,899
<b>ALTERNATIVE</b>	\$ 0	—	\$ 0

<b>SAVINGS</b>	\$	<b>70,899</b>	—	\$	<b>70,899</b>
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# VALUE ENGINEERING ALTERNATIVE



PROJECT:	<b>US 80/SR 26 WIDENING BULL RIVER TO LAZARETTO CREEK <i>Preliminary Design Development</i></b>	ALTERNATIVE NO.:	<b>EW-7/BP-8</b>
DESCRIPTION:	<b>PROVIDE ROADWAY IMPROVEMENTS AT EXISTING GRADE</b>	SHEET NO.:	1 of 4

**ORIGINAL DESIGN:** (Sketch attached)

The current design raises/constructs the new roadway at 2.7 m.

**ALTERNATIVE:** (Sketch attached)

Provide full roadway improvements at existing roadway grade of 1.50 m to 1.80 m and resurface existing road. Use environmental barrier as seawall to keep away spring tides.

**ADVANTAGES:**

- Minimizes earthwork
- Use existing roadway
- Reduces environmental/wetlands impacts
- Preserve openness

**DISADVANTAGES:**

- Drainage system through the wall will have to be developed
- Lower elevation does not meet 2.7 m

**DISCUSSION:**

This alternate provides the same improvements as the original project. However, at the existing grade, the significant amounts of earthwork are minimized. This not only reduces the earthwork but also provides secondary benefits such as reduced wetlands effects, better staging option, easier construction techniques; all not readily included in the reduced costs. It also maintains the same “open” feel as existing conditions. While the design elevation of 2.7 m is not provided, there are still four lanes for evacuating the island.

Keep wildlife barrier as is which will act as seawall in keeping spring tides from edge of travel lanes.

<b>COST SUMMARY</b>	<b>INITIAL COST</b>	<b>PRESENT WORTH RECURRING COSTS</b>	<b>PRESENT WORTH LIFE-CYCLE COST</b>
<b>ORIGINAL DESIGN</b>	\$ <b>13,771,278</b>	—	\$ <b>13,771,278</b>

<b>ALTERNATIVE</b>	\$ 3,846,681	—	\$ 3,846,681
<b>SAVINGS</b>	\$ 9,924,597	—	\$ 9,924,597

# VALUE ENGINEERING ALTERNATIVE



PROJECT: **US 80/SR 26 WIDENING**  
**BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

ALTERNATIVE NO.:  
**EW-9**

DESCRIPTION: **MINIMIZE THE QUANTITY OF WICK DRAINS**

SHEET NO.: 1 of 2

**ORIGINAL DESIGN:**

Wick drains are to be used in both stages of construction while the surcharge is consolidating the embankment. This applies to the proposed westbound lanes (Stage 1) embankment on natural ground and to the proposed eastbound lanes (Stage 2) embankment on the existing roadway embankment.

**ALTERNATIVE:**

Wick drains are to be used during Stage 1 only.

**ADVANTAGES:**

- Reduces cost
- Reduces construction time
- Facilitate construction

**DISADVANTAGES:**

- None apparent

**DISCUSSION:**

In meeting with Tom Scruggs of the Office of Materials and Research, it was determined that Wick drains would not be necessary where proposed embankment is being placed on the existing roadway embankment.

<b>COST SUMMARY</b>	<b>INITIAL COST</b>	<b>PRESENT WORTH RECURRING COSTS</b>	<b>PRESENT WORTH LIFE-CYCLE COST</b>
<b>ORIGINAL DESIGN</b>	\$ 8,213,075	—	\$ 8,213,075

<b>ALTERNATIVE</b>	\$ 4,927,845	—	\$ 4,927,845
<b>SAVINGS</b>	\$ 3,285,230	—	\$ 3,285,230

# VALUE ENGINEERING ALTERNATIVE



PROJECT: **US 80/SR 26 WIDENING**  
**BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

ALTERNATIVE NO.:  
**EW-10**

DESCRIPTION: **ELIMINATE THE GEOGRID**

SHEET NO.: 1 of 2

**ORIGINAL DESIGN:**

The current design calls for the use of a large quantity of Geogrid in the proposed embankment.

**ALTERNATIVE:**

Eliminate the use of Geogrid.

**ADVANTAGES:**

- Reduces cost
- Easier to construct
- Not needed

**DISADVANTAGES:**

- None apparent

**DISCUSSION:**

This alternative calls for the elimination of Geogrid from the preliminary construction cost estimate. In discussions with Tom Scruggs of the Office of Materials and Research, it was determined that the need for this item is not included in the Geotechnical Report.

<b>COST SUMMARY</b>	<b>INITIAL COST</b>	<b>PRESENT WORTH RECURRING COSTS</b>	<b>PRESENT WORTH LIFE-CYCLE COST</b>
<b>ORIGINAL DESIGN</b>	\$ 1,443,000	—	\$ 1,443,000

<b>ALTERNATIVE</b>	\$	<b>0</b>	—	\$	<b>0</b>
<b>SAVINGS</b>	\$	<b>1,443,000</b>	—	\$	<b>1,443,000</b>

# VALUE ENGINEERING ALTERNATIVE



PROJECT: **US 80/SR 26 WIDENING**  
**BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

ALTERNATIVE NO.:  
**EW-11**

DESCRIPTION: **USE A SINGLE LAYER OF HIGH GRADE FILTER FABRIC**

SHEET NO.: 1 of 2

**ORIGINAL DESIGN:**

The current design calls for the use of two layers of lower grade filter fabric in the construction of the proposed embankment.

**ALTERNATIVE:**

Use a single layer of a higher grade filter fabric.

**ADVANTAGES:**

- Reduces cost
- Better constructibility

**DISADVANTAGES:**

- None apparent

**DISCUSSION:**

In the meeting with Tom Scruggs of the Office of Materials and Research, it was suggested that a single layer of higher quality filter fabric could adequately replace the two layers of a lower quality filter fabric that are called for in the Geotechnical Report.

<b>COST SUMMARY</b>	<b>INITIAL COST</b>	<b>PRESENT WORTH RECURRING COSTS</b>	<b>PRESENT WORTH LIFE-CYCLE COST</b>
<b>ORIGINAL DESIGN</b>	<b>\$ 5,411,250</b>	<b>—</b>	<b>\$ 5,411,250</b>
<b>ALTERNATIVE</b>	<b>\$ 4,058,438</b>	<b>—</b>	<b>\$ 4,058,438</b>
<b>SAVINGS</b>	<b>\$ 1,352,812</b>	<b>—</b>	<b>\$ 1,352,812</b>

# VALUE ENGINEERING ALTERNATIVE



PROJECT: **US 80/SR 26 WIDENING**  
**BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

ALTERNATIVE NO.:  
**CW-1**

DESCRIPTION: **MINIMIZE THE USE OF RAISED CONCRETE MEDIAN**

SHEET NO.: 1 of 4

**ORIGINAL DESIGN:**

The current design calls for the use of curb and gutter with a raised median.

**ALTERNATIVE:** (Sketch attached)

Eliminate the raised median, eliminate the curb and gutter, and provide alternate material for median e.g., grass.

**ADVANTAGES:**

- Reduces cost
- More attractive/natural median
- Provides pull-off area for disabled vehicles

**DISADVANTAGES:**

- Does not provide as much positive delineation as curbing
- Maintenance/cut grass
- Pavement/grass interface

**DISCUSSION:**

Revising the median from a raised concrete median to a flush, grassed median eliminates significant concrete work, maintains the same median distance, and provides a more attractive, natural landscape.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 3,458,384	—	\$ 3,458,384
ALTERNATIVE	\$ 550,286	—	\$ 550,286
SAVINGS	\$ 2,908,098	—	\$ 2,908,098

# VALUE ENGINEERING ALTERNATIVE



PROJECT: **US 80/SR 26 WIDENING**  
**BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

ALTERNATIVE NO.:  
**CW-3**

DESCRIPTION: **ELIMINATE TEMPORARY CONCRETE BARRIER**

SHEET NO.: 1 of 2

**ORIGINAL DESIGN:**

The current design uses concrete barriers for roadside protection.

**ALTERNATIVE:**

Eliminate the use of concrete barrier. Plan/stage construction to eliminate or minimize need for barrier.

**ADVANTAGES:**

- Reduces cost
- Requires no storage/staging area
- Accidents can increase with the use of the barrier
- No protection at ends
- Do not have to move it from stage to stage

**DISADVANTAGES:**

- Potential liability
- Perceived loss of safety for workers

**DISCUSSION:**

The area is flat, level, and open, with no significant driveways or access points. The barrier may not be warranted. Develop the plans/staging of construction to try to eliminate the need for concrete barrier. Construct side slopes at 4:1 and far enough from the edge of travel way to maintain a safe roadway, no worse than existing. This will eliminate the handling and storage of the barrier. No protection at the ends of the barrier is needed.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 638,650	—	\$ 638,650
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS	\$ 638,650	—	\$ 638,650



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **US 80/SR 26 WIDENING**  
**BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

ALTERNATIVE NO.:  
**BP-4**

DESCRIPTION: **CONSTRUCT SEPARATE BICYCLE FACILITY**

SHEET NO.: 1 of 4

**ORIGINAL DESIGN:**

The current design is part of the Georgia Rails to Trails Bikeway System and incorporates a bicycle shoulder intact on the proposed typical section.

**ALTERNATIVE:** (Sketch attached)

Eliminate bicycle lane on roadway shoulder, pave a 0.6 m shoulder, maintain graded shoulder and construct a 2.4 m bike lane.

**ADVANTAGES:**

- Reduces pavement
- Separates bike facility
- Improves safety for bikers

**DISADVANTAGES:**

- Needs to provide a crossing back to original trail

**DISCUSSION:**

This is a safety improvement that will separate the bicycles from 90 km/h traffic and reduces the pavement quantity of the bike lane/shoulder.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 4,111,595	—	\$ 4,111,595
ALTERNATIVE	\$ 4,052,080	—	\$ 4,052,080
SAVINGS	\$ 59,515	—	\$ 59,515

# VALUE ENGINEERING ALTERNATIVE



PROJECT: **US 80/SR 26 WIDENING  
BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

ALTERNATIVE NO.:  
**BP-5**

DESCRIPTION: **USE EXISTING MCQUEEN'S ISLAND TRAIL AS  
BICYCLE FACILITY—CONNECT TO THE EXISTING  
FACILITY AT THE ENDS OF THE PROJECT**

SHEET NO.: 1 of 4

**ORIGINAL DESIGN:** (Sketch attached)

The current design is part of the Georgia Rails to Trails Bikeway System and incorporates a bicycle shoulder intact on the proposed typical section.

**ALTERNATIVE:**

Use the existing McQueen's Island Trail for the facility's bike lane and reduce the shoulder pavement to 0.6 m from 3 m at STA 6+300 to 11+100, 4,800 m.

**ADVANTAGES:**

- Reduces cost/pavement
- Uses existing facility
- Eliminates redundancy

**DISADVANTAGES:**

- Requires coordination with agency running existing trail
- Requires connectivity to road facility
- Vary shoulder width within project

**DISCUSSION:**

Since an existing bicycle facility is contiguous to the road there is no reason to provide a separate bike lane for a portion of the new facility; try to use what is there and eliminate the redundancy.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 509,838	—	\$ 509,838
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS	\$ 509,838	—	\$ 509,838

# VALUE ENGINEERING ALTERNATIVE



PROJECT: **US 80/SR 26 WIDENING**  
**BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

ALTERNATIVE NO.:  
**BP-6**

DESCRIPTION: **ADD EVACUATION LANES ON EACH SIDE OF THE**  
**EXISTING ROADWAY AT GRADE AND INCORPORATE**  
**BICYCLE LANES ON EVACUATION LANES**

SHEET NO.: 1 of 4

## ORIGINAL DESIGN:

The current design calls for a four-lane divided rural roadway with raised concrete median at elevation 2.7 m.

## ALTERNATIVE: (Sketch attached)

Widen the existing roadway with full depth, 3.7 m wide shoulders at existing elevation. Environmental barriers can remain as this will keep water out and incorporate bicycle path on this shoulder.

## ADVANTAGES:

- Provides four evacuation lanes
- Provides bicycle lanes
- Improves flooding control—keeps edge of water further away from the travel edge
- Reduces earthwork substantially
- Earthwork/embankment construction is a minor issue
- Reduces wetlands/environmental impacts
- Preserve openness/visual vistas

## DISADVANTAGES:

- No additional capacity
- Roadway elevation not at desired elevation of 2.7 m
- Median safety issue is not resolved, although we maintain existing condition

## DISCUSSION:

This alternative will drastically change the proposed project. However, it does provide the additional lanes during evacuation as well as a bicycle facility, without changing the existing roadway median. The fatality rate is still lower than the state average.

The water that approaches the current shoulder will be further away from the travel way ensuring a safer roadway.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 31,011,852	—	\$ 31,011,852
ALTERNATIVE	\$ 2,893,718	—	\$ 2,893,718
SAVINGS	\$ 28,118,134	—	\$ 28,118,134



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **US 80/SR 26 WIDENING**  
**BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

ALTERNATIVE NO.:  
**M-1**

DESCRIPTION: **USE SLIP FORMS FOR WILDLIFE BARRIERS**

SHEET NO.: 1 of 3

## ORIGINAL DESIGN:

A 0.61-m cast-in-place gravity wall wildlife barrier is noted on the current design documents.

## ALTERNATIVE:

Slip form the wildlife barrier in lieu of using cast-in-place concrete gravity walls.

## ADVANTAGES:

- Reduces construction time
- Facilitates construction
- Reduces labor costs

## DISADVANTAGES:

- None apparent

## DISCUSSION:

This alternative investigates the use of slip forms for construction of the wildlife barrier. Not different than slip forming Jersey Barriers on a smaller scale.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 2,951,489	—	\$ 2,951,489
ALTERNATIVE	\$ 1,932,979	—	\$ 1,932,979
SAVINGS	\$ 1,018,510	—	\$ 1,018,510

# VALUE ENGINEERING ALTERNATIVE



PROJECT: **US 80/SR 26 WIDENING**  
**BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

ALTERNATIVE NO.:  
**M-2**

DESCRIPTION: **USE GABIONS FOR WILDLIFE BARRIER**

SHEET NO.: 1 of 4

## ORIGINAL DESIGN:

A 0.61-m cast-in-place gravity wall wildlife barrier is noted on the current design documents.

## ALTERNATIVE: (Sketch attached)

Use gabions for wildlife barrier.

## ADVANTAGES:

- Reduces cost
- Easier to place
- Common practice for lakeside erosion control

## DISADVANTAGES:

- May require additional maintenance cost
- Could become inadvertent trash collectors

## DISCUSSION:

This alternative involves the use of gabions as the wildlife barrier. This system has a lower unit cost than the gravity walls shown in the concept report.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 2,951,489	—	\$ 2,951,489
ALTERNATIVE	\$ 1,164,472	—	\$ 1,164,472
SAVINGS	\$ 1,787,017	—	\$ 1,787,017

# VALUE ENGINEERING ALTERNATIVE



PROJECT: **US 80/SR 26 WIDENING**  
**BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

ALTERNATIVE NO.:  
**M-8**

DESCRIPTION: **CREATE A WILDLIFE SANCTUARY**

SHEET NO.: 1 of 2

**ORIGINAL DESIGN:**

The current project calls for the use of a concrete wildlife barrier on both sides of the new roadway to preclude Diamondback Terrapins from climbing onto the roadway. The barrier is a solid two-foot gravity wall with the vertical surface facing the marshes on both sides of the roadway. The cost of this wildlife barrier is indicated to be \$2,951,489 including all markups.

**ALTERNATIVE:**

Through an interested third party, create a Diamondback Terrapin sanctuary to promote the study, breeding and promulgation of this wildlife species that could potentially become endangered in the near future.

**ADVANTAGES:**

- Eliminates the need for the project to bear the cost of a wildlife barrier
- Improves motor vehicle safety by creating side gentler slopes and no hard surface at the toe
- Reduces maintenance costs associated with the wildlife barrier
- Potential to increase the Diamondback Terrapin population and remove it from the "Watch List"
- Eliminates potential of the wildlife barrier acting as a trash receptacle

**DISADVANTAGES:**

- Continued inadvertent killing of Diamondback Terrapins on the roadway
- May be difficult to find an interested party to take on this endeavor

**DISCUSSION:**

Although the Diamondback Terrapin is not yet on the endangered list, its inclusion on the "Watch List" of potential endangerment is serious enough to warrant some means of protection. However, other protection means should be explored that do not involve the expenditure of monies earmarked for road construction. The almost \$3,000,000 may be better used to increase vehicular safety along this stretch of SR 26/US 80. The Diamondback Terrapin does not generally represent a safety hazard on the road.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
<b>ORIGINAL DESIGN</b>	\$ 2,951,489	—	\$ 2,951,489
<b>ALTERNATIVE</b>	\$ 0	—	\$ 0
<b>SAVINGS</b>	\$ 2,951,489	—	\$ 2,951,489

# VALUE ENGINEERING ALTERNATIVE



PROJECT: **US 80/SR 26 WIDENING**  
**BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

ALTERNATIVE NO.:  
**M-10**

DESCRIPTION: **INCREASE THE NUMBER OF SABAL PALM TREES**

SHEET NO.: 1 of 3

**ORIGINAL DESIGN:**

The current design calls for the use of Sabal Palm Trees spaced at 40 m on both sides of the roadway.

**ALTERNATIVE:**

Reduce the spacing between the trees to 15 m.

**ADVANTAGES:**

- More appealing appearance
- Create an arbor drive
- Enhances the driving experience

**DISADVANTAGES:**

- Increases initial cost

**DISCUSSION:**

The Sabal Palm Trees as shown in the concept report are spaced approximately 40 m apart and are being planted to replace trees that have died or been stolen over the years. The additional trees will also help Savannah and Tybee Island continue to honor the veterans of World War I, the original intent of the Sabal Palms on McQueen's Island. Placing the trees closer together would enhance the visual aspects of the roadway. It was decided that a spacing of 15 m would achieve that enhancement.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 182,299	—	\$ 182,299
ALTERNATIVE	\$ 503,126	—	\$ 503,126
SAVINGS	\$ (320,827)	—	\$ (320,827)

# VALUE ENGINEERING ALTERNATIVE



PROJECT: **US 80/SR 26 WIDENING**  
**BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

ALTERNATIVE NO.:  
**M-12**

DESCRIPTION: **HAVE ANOTHER ENTITY PAY FOR THE SABAL PALM TREES**

SHEET NO.: 1 of 2

## ORIGINAL DESIGN:

Replacement Sabal Palm Trees are included in the project.

## ALTERNATIVE:

Exclude the Sabal Palm Trees from the project budget and have them paid for by others.

## ADVANTAGES:

- Reduces initial cost
- Facilitates construction
- Involves local citizen groups

## DISADVANTAGES:

- No assurance Sabal Palms would ever be purchased
- Could result in a tree-less drive

## DISCUSSION:

The Sabal Palm Trees included in the project offer no benefit to safety, capacity, etc. They do benefit Tybee Island as a tourist trade enhancement and continued tribute to veterans of World War I. With that in mind, having a local entity bear the cost of the trees seems reasonable.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 182,299	—	\$ 182,299
ALTERNATIVE	\$ 0	—	\$ 0

<b>SAVINGS</b>	\$	<b>182,299</b>	—	\$	<b>182,299</b>
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# VALUE ENGINEERING ALTERNATIVE



**PROJECT:** US 80/SR 26 WIDENING  
**BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

**ALTERNATIVE NO.:**  
**M-13**

**DESCRIPTION:** REUSE/RELOCATE EXISTING SABAL PALM TREES

**SHEET NO.:** 1 of 2

**ORIGINAL DESIGN:**

The current project documents indicate the Sabal Palm Trees are to be replaced.

**ALTERNATIVE:**

Reuse/relocate the existing trees to avoid damage during construction and replant immediately to avoid their premature death.

**ADVANTAGES:**

- Reduces cost
- Reduces the number of new trees
- Common practice

**DISADVANTAGES:**

- Uncertainty of survivability of mature trees

**DISCUSSION:**

There are a number of existing Sabal Palm Trees that could be relocated for use with the proposed roadway.

<b>COST SUMMARY</b>	<b>INITIAL COST</b>	<b>PRESENT WORTH RECURRING COSTS</b>	<b>PRESENT WORTH LIFE-CYCLE COST</b>
<b>ORIGINAL DESIGN</b>	\$ 182,299	—	\$ 182,299
<b>ALTERNATIVE</b>	\$ 120,250	—	\$ 120,250

SAVINGS	\$	62,049	—	\$	62,049
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# VALUE ENGINEERING ALTERNATIVE



PROJECT: **US 80/SR 26 WIDENING**  
**BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

ALTERNATIVE NO.:  
**M-14**

DESCRIPTION: **USE DREDGE SPOIL FOR EMBANKMENT MATERIAL**

SHEET NO.: 1 of 3

**ORIGINAL DESIGN:**

No specification is given for the source of borrow embankment.

**ALTERNATIVE:** (Sketch attached)

Obtain the borrow embankment from dredge spoil from the Savannah River.

**ADVANTAGES:**

- Reduces cost
- Helps maintain the Savannah River ship channel

**DISADVANTAGES:**

- Coordination with another agency (Corps of Engineers)

**DISCUSSION:**

This alternative suggests the use of dredged material for the roadway embankment. The proximity of the Savannah River to this project would make a hydraulically-placed embankment cost effective. If the material that is encountered in the periodic maintenance dredging that takes place on the Savannah River is suitable for roadway embankment, it could be stockpiled somewhere near the project and used when road construction begins. It is, however, likely that this material contains a high percentage of silt and could not be used for embankment. If this is the case, the river could be dredged to a depth in excess of the normal channel depth. It is much more likely that the material at this depth is acceptable roadway embankment material. As an example, if the Savannah River was dredged to an elevation of -14.6 m mean sea level (msc) (-48 msc, approximately 3 m below the customary -11.6 m msc depth for ship channels) approximately 1.9 km of channel dredging would be needed to provide the estimated quantity of borrow and surcharge.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE			

**DESIGN SUGGESTION**

<b>SAVINGS</b>	
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## **PROJECT DESCRIPTION**

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### **BACKGROUND**

State Route (SR) 26/Unites States Route (US) 80 from Bull River to Lazaretto Creek is a rural principal arterial in Chatham County, Georgia. The corridor serves as the only roadway access to Tybee Island. Tybee Island serves as the Savannah metropolitan area's primary beach access. Tybee Island has an ever-fluctuating year-round population, with additional tourist and seasonal populations during peak months. The existing roadway is a two-lane undivided rural section. The section proposed for improvement has passing lanes that cover approximately 25% of the section. The corridor includes a low-level bridge crossing the Bull River (length being 1077 meters (m)) and a high-level bridge crossing Lazaretto Creek (length being 439m). The SR 26/US 80 corridor is also the only hurricane evacuation route for Tybee Island. Improvements to this portion of SR 26/US 80 are included in the year 2025 Regional Transportation Plan adopted by the Chatham Urban Transportation Study (CUTS) Policy Committee in 1999 and in the CUTS Transportation Improvement Program. At its present elevation, the spring tide approaches the edge of the travel way on this section of SR 26/US 80.

### **Logical Termini**

The termini for this project are logical because the project can stand on its own. The proposed project will provide lane continuity by linking two four-lane segments as SR 26/US 80 is four-lanes east and west of the project corridor.

### **Travel Demand and Operational Conditions**

Design Traffic provided by the Office of Environment/Location indicates this section of SR 26/US 80 will carry 14,000 Average Annual Daily Traffic (AADT) in the year 2010. In 2030 the corridor will carry 24,500 AADT. Based upon the Base Year traffic, this segment of SR 26/US 80 will be operating at a level of service (LOS) D in the year 2010. If the highway is not widened, the LOS for the year 2030 will fall to E. Widening SR 26/US 80 from Bull River to Lazaretto Creek would improve the LOS to A for the year 2010 and to LOS B for the year 2030.

### **Economic and Land Use Considerations**

Tybee Island is heavily developed and denser development is now occurring and will continue into the future. The project corridor is mostly undeveloped, consisting almost entirely of salt marshes. The only developed property in the project corridor is the entrance to Fort Pulaski National Monument, the adjacent McQueen's Island Trail, and an entrance to a boat ramp on the Lazaretto Creek.

### **Safety**

The table below summarizes the accident rate per 100 million miles traveled and the corresponding statewide average for a similar facility - Rural Principal Arterial on the National Highway System.

	1995		1996		1997	
	US 80	State	US 80	State	US 80	State
Total accidents	13	-	8	-	14	-
Accident rate	71	140	47	148	74	134
Injuries	10	-	3	-	11	-
Injury rate	55	53	18	55	58	94
Fatalities	0	-	0	-	0	-
Fatality rate	0	2.67	0	2.94	0	2.36

In the twelve year period between 1988 and 2000, this section of US 80 experienced twelve fatalities.

Hurricane evacuation is the primary safety concern that the project addresses. The existing SR 26/US 80 roadbed is only 1.5m above sea level. Major portions of the roadway shoulders are flooded during spring tide conditions. This low elevation makes hurricane evacuation for Tybee Island a major concern. The proposed project will provide an improved hurricane evacuation route by increasing the number of lanes on which to evacuate and by increasing the elevation of the roadway to 2.7m, only 0.3m below the highest ground elevation on Tybee Island.

### **Need and Purpose**

This project is needed to provide an adequate hurricane evacuation route and to satisfactorily accommodate existing and future traffic demands, while decreasing the roadway's susceptibility to flooding. The addition of bicycle lanes in the corridor will provide an additional benefit.

### **PROJECT DESCRIPTION**

The existing roadway consists of two lanes, one in each direction. The existing structures are (1) a 1,077 m x 9.1 m bridge over Bull River with a sufficiency rating of 61.0 and (2) a 439 m x 8.5 m bridge over Lazaretto Creek with a sufficiency rating of 51.0. The posted speed and the design speed are 90 kilometer per hour.

The proposed widening will provide two 3.3 m lanes in each direction separated by a 7.2 m raised grassed median, 3.0 m bicycle shoulders and 4:1 slopes. The typical section between Bull River and Lazaretto Creek will have the same features as described above for 6:1 front and back slopes separated by a 0.6 m flat bottom ditch, and a gravity wall to prevent Diamondback Terrapins from entering the roadway. In addition, Sabal Palm trees will be planted two meters behind the gravity wall. The Office of Materials and Research has approved the use of the gravity wall. The two new lanes will be constructed at a minimum elevation of 2.7 m. Although SR 26/US 80 has experienced flooding at high tides, raising the grade to meet the worst case storm would not be practical or cost effective since all of Tybee Island would be flooded during even the least severe of hurricanes. Therefore, raising the existing roadway 0.3 m would allow more time for residents to evacuate. The existing bridges over Bull River and Lazaretto Creek will be widened and new parallel bridges will be constructed. In addition, a bike lane/path may be provided on the Bull River Bridge which will tie to the Georgia Rails to Trails Bikeway. The roadway will remain open to traffic during construction.

## **Cost Data**

The current probable cost of construction has been identified at \$80,560,073 as noted on the State of Georgia Department of Transportation's *Preliminary Cost Estimate, Urban Design Office* dated September 17, 2003 and includes \$8,000,000 for Right-of-Way purchases. As such, construction is earmarked at \$72,560,073 and includes engineering and construction contingencies of 10.25% and a two year inflation rate at 10.00%.

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## VALUE ANALYSIS AND CONCLUSIONS

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### GENERAL

This section describes the value analysis procedure used during the value engineering study. It is followed by separate narratives and conclusions concerning:

- Value Engineering Workshop Participants
- Economic Data
- Cost Estimate Summary and Cost Histograms
- Function Analysis
- Creative Idea Listing and Judgment of Ideas

A systematic approach was used in the VE study and the key procedures involved were organized into three distinct parts: 1) preparation; 2) VE workshop; and 3) post-study. A Task Flow Diagram that outlines each of the procedures included in the VE study is attached for reference.

### PREPARATION EFFORT

Pre-study preparation for the VE effort consisted of scheduling study participants and tasks; gathering necessary background information on the facility; and compiling project data into a cost model and graphic cost histogram. Information relating to the design, construction, and operation of the facility is important as it forms the basis of comparison for the study effort. Information relating to funding, project planning operating needs, systems evaluations, basis of cost, soil conditions, and construction of the facility was also a part of the analysis.

### VALUE ENGINEERING WORKSHOP EFFORT

The VE workshop was a three-day effort (see attached agenda). During the workshop, the VE job plan was followed. The job plan guided the search for high cost areas in the project and included procedures for developing alternative solutions for consideration. It includes six phases:

- Information Phase
- Function Identification and Analysis Phase
- Creative Phase
- Evaluation Phase
- Development Phase
- Presentation Phase (*Not conducted*)

## Information Phase

At the beginning of the study, the conditions and decisions that have influenced the development of the project must be reviewed and understood. For this reason, the development manager presented information about the project to the VE team on first day of the session. Following the presentation, the VE team discussed the project using the following documents:

- *Half-Size and Full Size Preliminary Design Submittal Drawings* entitled Plan and Profile of proposed **US 80/SR 26 Widening, Bull River to Lazaretto Creek, HPP-STP-064-1 (41), Chatham County, P.I. No. 522490**, prepared by the Department of Transportation, State of Georgia, dated November 3, 2003;
- Interdepartment Correspondence with *Project Concept Report* for the **STP-064-1 (41), Chatham County, SR 26/US 80 Widening from Bull River to Lazaretto Creek, P.I. No. 52249** dated August 13, 1993;
- Interdepartment Correspondence with *Revised Project Concept Report* for **STP-064-1 (41), Chatham County, US 80 from Bull River to Lazaretto Creek, P.I. No. 52249** dated November 10, 1998;
- Interdepartment Correspondence with *Revised Project Concept Report Approval* the **STP-064-1 (41) Chatham County, P.I. No. 52249** dated December 22, 1998;
- Interdepartment Correspondence with *Revised Project Concept Report* for **STP-064-1 (41), Chatham County, P.I. No. 522490, SR 26/US 80 fm W of Bull River to E of Lazaretto Creek**, dated September 15, 2003 containing the following attachments: (1) Overall Schematic Site Plan; (2) Preliminary Cost Estimate; (3) Need and Purpose Statement; (4) Chatham County, 1988 – 2001 SR 26, ML 27.50 – 32.49 Yearly Accident, Injury, and Fatality Table; (5) Four Proposed Typical Sections and Sabal Palm Detail;
- *Summary of Wetlands Impact Table* for **HPP-STP-064-1(41), US 80/SR 26 - Bull River to Lazaretto Creek, P.I. 522490**, dated November 12, 2003;
- *Magazine Article* from TR News 227 July – August 2003 entitled: “Ecopassage Reduces Roadkills, Barrier and Underpass in Florida Preserve Animal Lives”;
- *Critter Crossings – Linking Habitats and Reducing Roadkill Article* from the U.S. Department of Transportation, Federal highway Administration entitled: “Amphibian-Retile Wall and Culverts,” dated February 23, 2001 containing Typical Sections, Detail Sheet, Guardrail Detail and General Notes:
- *White Paper* entitled: “Possible Use of Barriers to reduce Wildlife Mortality on US 441 at Paynes Prairie [Florida] prepared by R. Franz, undated;
- *Letter* from the Georgia Department of Transportation’s State Urban Design Engineer to The Georgia Conservatory responding to questions regarding **HPP-STP-064-1(41), Chatham County, SR 26/US 80 from Bull River to Lazaretto Creek Widening, P.I. No. 522490** dated July 26, 2002;
- *Letter* from the Mayor, City of Tybee Island to the Governor of the State of Georgia requesting Governor’s assistance in finding a way to fund the **widening of SR 26/US 80** in Chatham County dated May 23, 2203;
- *Practical Alternative Report* for **STP-064-1(41) Chatham County, US 80/SR 26 Widening from Bull River to Lazaretto Creek Widening, P.I. No. 522490** dated December 11, 1998, 2002;
- *Comparison of Tidal Elevations with Existing Pavement Elevations Table* for **522490-SR26-US80 fm Bull River to Lazaretto Creek** dated July 25, 2002;

- *Tidal Datum and Their Impactions*, NOAA Special Publication NOS CO-OPS 1 dated June 2000;
- *Mean Sea Levels Data for the Fort Pulaski Tidal Station* prepared by the Georgia Department of Transportation's Urban Design Office dated July 25, 2002;
- *Half Size Drawings* of Bridge Over Lazaretto Creek, STA 574 + 87.01 to STA 589 + 22.89, Chatham County, F.064-1(6) dated August 1958; and
- *Half Size Drawings* of Bridge Over Tybee River [now called the Bull River], STA 416 + 93 to STA 452 + 27, Chatham County, F.064-1(8) dated February 1965.

### **Function Identification and Analysis Phase**

Based on historical and background data, a cost model and graphic function analysis were developed for this project by major construction elements. They were used to distribute costs by project element; serve as a basis for alternative functional categorization; and to assign worth to the categories, where worth is the least cost to provide the required function, as determined by the VE team. The VE team identified the functions of the various project elements and subsystems by using random function generation techniques resulting in the attached Random Function Analysis worksheet and Function Analysis Systems Technique (F.A.S.T.) diagram.

### **Creative Phase**

This VE study phase involved the creation and listing of ideas. Creative idea worksheets were organized by project element. During this phase, the VE team developed as many ideas as possible to provide the necessary functions within the project at a lower cost to the owner, or to improve the quality of the project. Judgment of the ideas was restricted at this point. The VE team was looking for a large quantity of ideas and association of ideas.

The Georgia Department of Transportation (GDOT) representatives may wish to review the creative list since it may contain ideas that can be further evaluated for potential use in the design.

### **Evaluation Phase**

During this phase of the workshop, the VE team judged the ideas generated during the creative phase. Advantages and disadvantages of each idea were discussed to find the best ideas for development. Ideas found to be irrelevant or not worthy of additional study were discarded. Those that represented the greatest potential for cost savings or improvement to the project were then developed further.

The VE team would like to develop all ideas, but time constraints usually limit the number that can be developed. Therefore, each idea was compared with the present schematic design concepts, in terms of how well it met the design intent. Advantages and disadvantages were discussed, and each team member rated the ideas on a scale of zero to five, with the best ideas rated five. Total scores were summed for each idea and only highly-rated ideas were developed into alternatives. In cases where there was little cost impact, but an improvement to the project was anticipated, the designation DS, for design suggestion, was used. The design team should review this listing for possible incorporation of ideas into the project.

The creative listing was re-evaluated frequently during the process of developing alternatives. As the relationship between creative ideas became more clearly defined, their importance and ratings may have changed, or they may have been combined into a single alternative. For these reasons, some of the originally high-rated items may not have been developed into alternatives.

### **Development Phase**

During the development phase, each highly rated idea was expanded into a workable solution. The development consisted of a description of the alternative, life cycle cost comparisons, where applicable, and a descriptive evaluation of the advantages and disadvantages of the proposed alternatives. Each alternative was written with a brief narrative to compare the original design to the proposed change. Sketches and design calculations, where appropriate, were also prepared in this part of the study. The VE alternatives are included in the section entitled *Study Results*.

### **Presentation Phase**

The last phase of the VE study would have been to present the findings of the study; however GDOT now conducts the presentation internally upon receipt of the report. The VE alternatives were screened by the VE team before draft copies of the *Summary of Potential Cost Savings* worksheets were provided to GDOT representatives. The VE alternatives were arranged in the same order as the idea listing sheets to facilitate cross-referencing.

### **POST-WORKSHOP EFFORT**

The post-study portion of the VE study includes the preparation of this Value Engineering Study Report. Personnel from GDOT will analyze each alternative and prepare a short response, recommending either incorporating the alternative into the project, offering modifications before implementation, or presenting reasons for rejection. Lewis & Zimmerman Associates, Inc. is available at your convenience as you review the alternatives. Please do not hesitate to call on us for clarification or further information as you consider an implementation approach.

# VALUE ENGINEERING STUDY AGENDA

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Lewis & Zimmerman Associates, Inc. (LZA) will conduct a 24-hour VE Study on the **United States Route (US) 80/State Road (SR) 26 Widening from Bull River to Lazaretto Creek, Project No. HPP-STP-064(41), PI No. 522490** located in Chatham County, Georgia. It is expected the owner, the Georgia Department of Transportation (GDOT) will be available to make a formal presentation concerning the project at the beginning of the workshop and be available to answer questions during the VE study effort.

## VE Study Agenda

The VE study will follow the outline described below and be conducted November 12 - 14, 2003. The first two days will be carried out in the Urban Design Conference Room, Room 352 and the last day will be held in the Planning Conference Room, Room 344; both in GDOT's General Office located at No. 2 Capitol Square Street, Atlanta, Georgia 30334. The point-of-contact is Ms. Lisa L. Myers, Design Review Engineer Manager, who can be reached at 404-651-7468.

### Wednesday, November 12<sup>th</sup>

9:00 am - 9:15 am                      **General Introduction of all Parties and review of the VE Process**

9:15 am - 11:15 am                    **Owner's/Designer's Presentation**

GDOT is to present information concerning the project including, but not necessarily limited to: rationale for design; criteria for specific areas of study, project constraints and the reasons for design decisions.

11:00 am - 12:00 noon                **Commence Function Analysis Phase**

The VE team will continue their familiarization with the cost models and project data for each area of study. The cost model(s) will be refined, as necessary; define the function of each project element or system in the cost model, select the primary or basic functions, and determine the worth, or least cost, to provide the function. Cost/worth or value index ratios will be calculated, and high cost/low worth areas for study identified. In addition, the VE team will continue defining the function of each element/system to gain a thorough understanding of the project's needs and requirements.

12:00 noon - 1:00 pm                **Lunch**

1:00 pm - 5:00 pm                    **Conclude the Function Analysis Phase and Commence the Creative Phase**

The VE team will conduct a brainstorming session and list as many ideas as possible for consideration. The aim is to obtain a large quantity of ideas through free association, by eliminating roadblocks to creativity and deferring judgment.

## **Thursday, November 13<sup>th</sup>**

9:00 am - 10:00 am                      **Conclude Creative Phase and Complete Evaluation/Analytical Phase**

The VE team will analyze the ideas listed in the creative phase and select the best ideas for further development.

10:00 am - 12:00 noon                  **Development Phase**

VE team will develop creative ideas into alternate design solutions. Initial and life cycle cost estimates comparing original and proposed alternatives will be prepared. Selected alternatives for change will be developed and supported with sketches, calculations and written substantiation.

12:00 noon - 1:00 pm                  **Lunch**

1:00 pm - 5:00 pm                      **Continue Development Phase**

## **Friday, November 14<sup>th</sup>**

9:00 am - 12:00 am                      **Continue Development Phase**

12:00 noon - 1:00 pm                  **Lunch**

1:00 pm - 4:00 pm                      **Conclude Development Phase and Commence Summary Worksheets**

Upon completion of the Development Phase, the VE facilitator will commence preparation of the summary worksheets based on the alternatives developed by the VE team. The summary work sheets form the basis of the informal oral presentation.

4:00 – 5:00 pm                          **Finalize Summary Worksheets**

The VE team will provide draft copies of the *Summary of Potential Cost Savings* worksheets to GDOT representatives and be available to clarify any points.

# VALUE ENGINEERING STUDY

## PARTICIPANTS



PROJECT: **US 80/SR 26 WIDENING**  
**BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

DATE:  
**November 12 – 14, 2003**

NAME & E-MAIL (PLEASE PRINT)	ORGANIZATION/TITLE	PHONE/FAX
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James (Mag) Magnus, CPESC  em: <a href="mailto:james.magnus@dot.state.ga.us">james.magnus@dot.state.ga.us</a>	GDOT, Office of Construction  Assistant State Construction Engineer	ph: 404-656-5306  fx: 404-656-3507
Jerry Milligan  em: <a href="mailto:jmilligan@dot.state.ga.us">jmilligan@dot.state.ga.us</a>	GDOT, General Office (GO)  Right-of-Way	ph: 404-463-2575  fx: 404-651-5209
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Scott Zehngraff  em: <a href="mailto:scott.zehngraff@dot.state.ga.us">scott.zehngraff@dot.state.ga.us</a>	GDOT, Office of Traffic and Safety Design  Safety	ph: 404-635-8127  fx: 404-635-8116
Darryl D. VanMeter, PE  em: <a href="mailto:darryl.vanmeter@dot.state.ga.us">darryl.vanmeter@dot.state.ga.us</a>	GDOT, Office of Urban Design  Design Group Manager	ph: 404-656-5447  fx: 404-657-7921
Lisa Westberry  em: <a href="mailto:lisa.westberry@dot.state.ga.us">lisa.westberry@dot.state.ga.us</a>	GDOT, OEL  Ecologist	ph: 404-699-4422  fx: 404-699-4440
Vince Wilson  em: <a href="mailto:vince.wilson@dot.state.ga.us">vince.wilson@dot.state.ga.us</a>	GDOT, GO  Bridge Design	ph: 404-656-5302  fx: 404-651-7076



## VALUE ENGINEERING WORKSHOP PARTICIPANTS

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The VE team was organized to provide specific expertise on the unique project elements involved. Team members consisted of a multidisciplinary group with professional design experience and a working knowledge of VE procedures. The VE team included the following professionals:

Larry F. Cook, PE	Transportation Engineer	HNTB
Gregory C. Grant, PE	Structural Engineer	HNTB
George A. Obaranec, PE	Civil / Roadway Engineer	Delon Hampton & Associates, Chartered
Luis M. Venegas, PE, CVS-Life	VE Facilitator	Lewis & Zimmerman Associates, Inc.

### OWNER'S/DESIGNER'S PRESENTATION

Representatives from the State of Georgia Department of Transportation (GDOT) administration and design team presented an overview of the project on Wednesday, November 12, 2003. The purpose of this meeting, in addition to being an integral part of the Information Gathering Phase of the VE Study, was to bring the VE team “up-to-speed” regarding the overall project. Additionally, the meeting afforded the design team the opportunity to highlight in greater detail, those areas of the project requiring additional or special attention.

### VALUE ENGINEERING TEAM'S FINAL PRESENTATION

The VE team did not conduct a final, oral presentation on Friday, November 14, 2003 to GDOT. However, copies of the draft *Summary of Potential Cost Savings* worksheets were provided for interim use by GDOT personnel.

A copy of the meeting participants is attached for reference.

## ECONOMIC DATA

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The VE team developed economic criteria used for evaluation with information gathered from the State of Georgia Department of Transportation. To express costs in a meaningful manner, the VE team alternatives are presented on the basis of discounted present worth. Criteria for planning project period interest rates are based on the following parameters:

Year of Analysis:	2003
Construction Start Up:	2008 (Per Engineer Service Let Status for 522490-HPP-STP-0641-1 (41))
Construction Duration:	±36 Months
Economic Planning Life:	35 years starting in 2008 pavements
Economic Planning Life:	50 years starting in 2008 bridges
Discount Rate/Interest:	5.10% (U.S. OMB Circular A-94)
Inflation/Escalation Rate:	5.00% (GDOT)
Uniform Present Worth (UPW) Factor:	16.1696 for 35 years 17.9774 for 50 years
Cost of Power:	\$0.07/kWhr (kilowatt hour) (assumed)
Operation and Maintenance Costs ( <i>Industry Norms</i> ):	
Equipment - With Many Moving Parts	5.00%-5.50%+ of Capital Cost
Equipment - With Minimal Moving Parts	3.50%-4.00% of Capital Cost
Equipment - Electronic	3.00% of Capital Cost
Structural	1.00%-2.00% (or less) of Capital Cost
Overall Composite Mark-Up:	20.25% (1.2025)
(Composed of: Engineering and Construction at 10.25% and Inflation at 10.00%)	

## **COST ESTIMATE SUMMARY AND COST HISTOGRAMS**

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The VE team prepared various cost models for the project that are included on the following this page. The cost models are arranged in the Pareto Charting/Cost Histogram format to aid in identifying high cost areas and are based on a reasonable facsimile developed by the VE team of the *Preliminary Cost Estimate, Urban Design Office* prepared by the Georgia Department of Transportation dated September 17, 2003. As can be expected, judgments at this stage of the study are based on experience and intuition rather than facts, which are not uncovered until well along in the analysis of function. As a result of these qualified hypotheses, there appears to be a potential for initial savings in the following areas:

### **DESIGNER'S COST ESTIMATE**

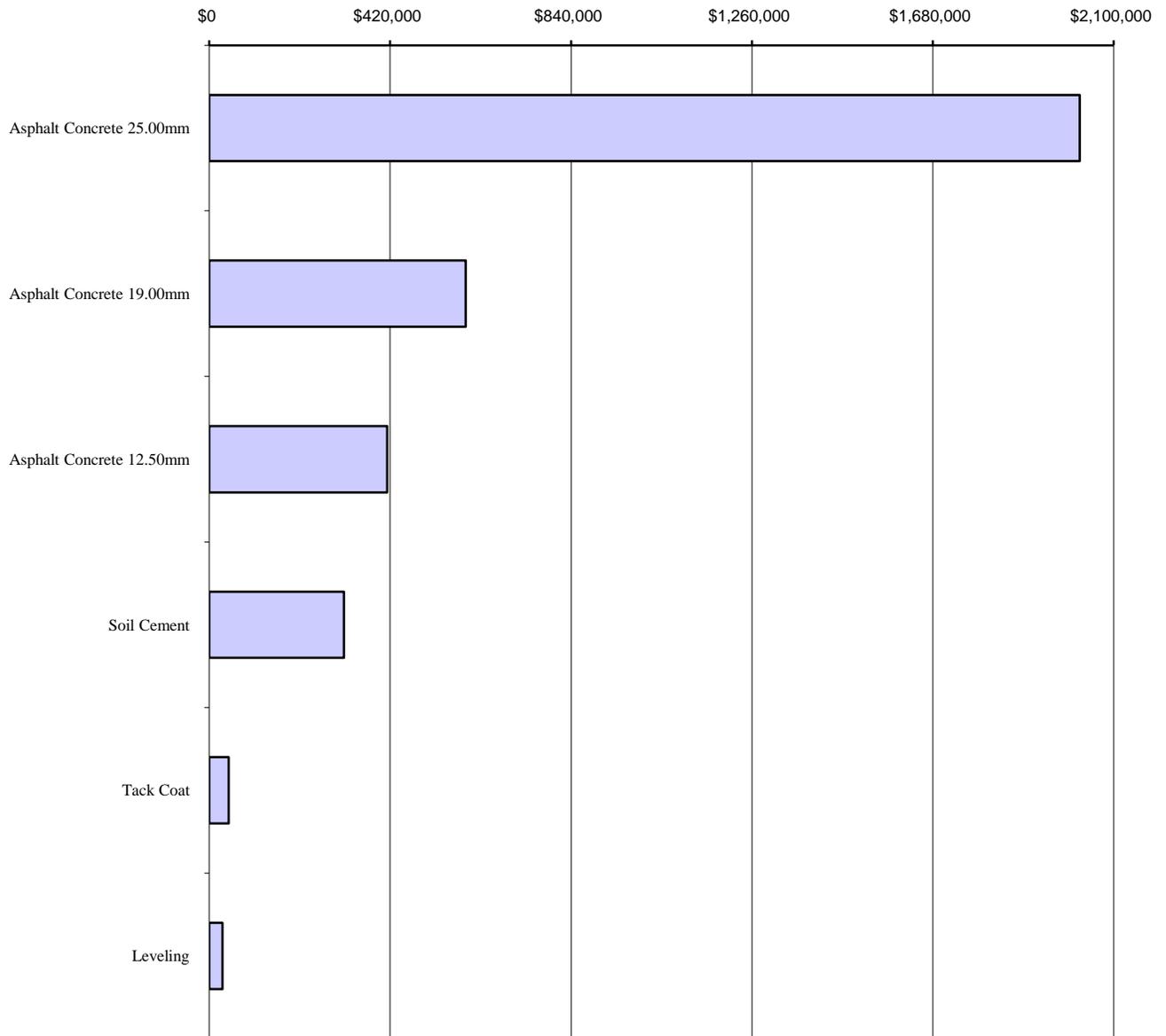
The VE team realizes this is a preliminary design development submittal and as such, the cost estimate should be relatively complete with some omissions, incompleteness, assumptions and minimal "lump sum" items. Such has been the case with sufficient information and detail to permit a proper VE analysis.

# COST HISTOGRAM



PROJECT: US 80 / SR 26 WIDENING  
 BULL RIVER TO LAZARETTO CREEK  
 Preliminary Design Development

BASE AND PAVING	COST	PERCENT	CUM. PERCENT
Asphalt Concrete 25.00mm	2,021,038	59.11%	59.11%
Asphalt Concrete 19.00mm	595,881	17.43%	76.54%
Asphalt Concrete 12.50mm	413,284	12.09%	88.62%
Soil Cement	312,990	9.15%	97.78%
Tack Coat	45,142	1.32%	99.10%
Leveling	30,872	0.90%	100.00%
<b>Subtotal</b>	<b>3,419,207</b>	<b>100.00%</b>	
E&C at 10.25%	350,469		
Inflation at 10.00%	341,921		
<b>TOTAL</b>	<b>\$ 4,111,596</b>	Comp Markup:	20.25%



Costs in graph are not marked-up.

## FUNCTION ANALYSIS

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A function analysis was performed to: (1) define the requirements for each project element, and (2) to ensure a complete and thorough understanding by the VE team of the basic function(s) needed to attain a given requirement. A *Random Function Analysis* worksheet for the project is attached. This part of the function analysis stimulated the VE team members to think in terms of the areas in which to channel their creative idea development.

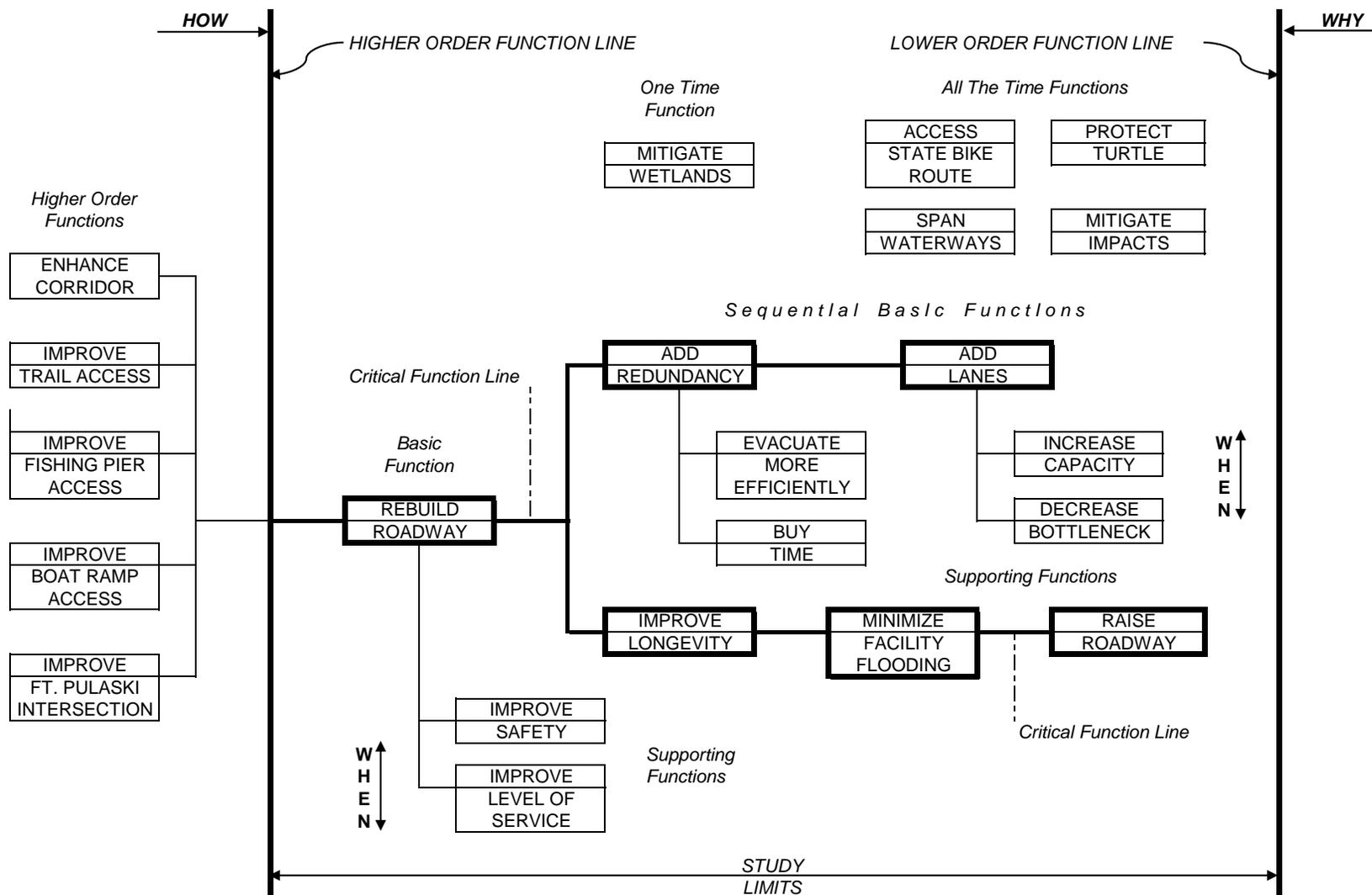
Function Analysis is a means of evaluating a project to see if the expenditures actually perform the requirements of the project, or if there are disproportionate amounts of money spent on support functions. These elements add cost to the final product, but have a relatively low worth to the basic function.

In addition to the random function analysis, the VE Facilitator worked with members of the study team to develop a Function Analysis System Technique (F.A.S.T.) diagram. The F.A.S.T. diagram was used to show the flow of function within the project. It helps to confirm the project is addressing those issues that have been voiced by the owner as being important. The diagram was generated by asking the key question: "What is the most important function to be accomplished by this phase?" The answer is characterized by a verb/noun pair. In turn, another question is asked: "Why?" The answer is again listed in a verb/noun pair, and the process continued from left to right. If the result is a true F.A.S.T. diagram, the flow of functions from right to left will answer the question "Why?" No F.A.S.T. diagram is ever completed. The readers of this report may wish to challenge themselves to see how far they can carry the construction of the F.A.S.T. diagram.

This F.A.S.T. diagram notes the critical function path and identifies the project's basic function as: **REBUILD/ROADWAY** by **ADDING/REDUNDANCY** and **IMPROVING/LONGEVITY** and is included at the end of this section of the report.



FUNCTION ANALYSIS SYSTEMS TECHNIQUE (F. A. S. T.)  
**US 80 / SR 26 WIDENING**  
**BULL RIVER TO LAZARETTO CREEK**  
 Georgia Department of Transportation, District 1  
 Chatham County, Georgia



## CREATIVE IDEA LISTING AND JUDGMENT OF IDEAS

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During the creative phase, numerous ideas, alternative proposals and/or recommendations were generated using conventional brainstorming techniques as recorded on the following pages.

These ideas were then discussed and the advantages/disadvantages of each listed. The VE design team compared each of the ideas with the concept solution determining whether it improved value, was equal in value, or lessened the value of the solution.

The ideas were then ranked on a scale of one to five on how well the VE design team believed the idea met necessary criteria and program needs. The higher rated ideas were then developed into formal alternatives and included in the VE workshop. Some ideas were judged to have minimal cost impacts on the project but provided enhancements in the form of improved operations, efficiency, constructibility or potential to save unknown or hidden costs. These were given the designation "DS" which indicates a design suggestions. This designation is also used when an idea is difficult to price but improves the functionality of the project or system, and is deemed to be of significant value to the owner, user, operator or designer.

Typically, all ideas rated four or above are included in the Study Report. When this is not the case, an idea was combined with another related idea or discarded, as a result of additional research that indicated the concept as not being cost-effective or technically feasible.

All readers are encouraged to review the *Creative Idea Listing and Evaluation* worksheets since they may suggest additional ideas that can be applied to the design.

# CREATIVE IDEA LISTING



PROJECT: **US 80/SR 26 WIDENING**  
**BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

SHEET NO.: 1 of 3

NO.	IDEA DESCRIPTION	RATING
	<b>BRIDGES (B)</b>	
B-1	Shift alignment in order to widen existing bridges on one side only	5
B-2	Use prestressed concrete beams for main spans	4
B-3	Use two new bridges at Lazaretto Creek	4
B-4	Use two new bridges at Bull River	4
B-5	Do not build new bridges	1
B-6	Eliminate median in bridges	3
B-7	Lower design speed to reduce bridge width	4
B-8	Bridge the entire length of the project, i.e. a viaduct	1
B-9	Grade separate the Fort Pulaski intersection	1
B-10	Grade separate the Queen's Island Trail access	1
B-11	Grade separate the Old Highway 80 access	1
B-12	Use new double deck bridges at Lazaretto Creek and Bull River	1
	<b>EARTHWORK (EW)</b>	
EW-1	Lower the overall profile	4
EW-2	Use flowable fill in lieu of in place embankment	3
EW-3	Lower the design speed to reduce overall roadway template	5
EW-4	Use mechanically stabilized earth (MSE) walls	4
EW-5	Use 4:1 slopes in lieu 6:1 slopes	4
EW-6	Eliminate the 6:1 back slope	4
EW-7	Construct edge walls and match existing profile (Same as Alternative BP-8)	5
EW-8	Use Geogrid reinforcing for steeper slopes	4
EW-9	Minimize the quantity if wick drains	4
EW-10	Eliminate geogrid material	4
EW-11	Use a single layer of higher grade filter fabric in lieu of two layers	4

**Rating: 1→2 = Not to be Developed; 3→4 = Varying Degrees of Development Potential; 5 = Most likely to be Developed;**  
**DS = Design Suggestion; ABD = Already Being Done**

# CREATIVE IDEA LISTING



PROJECT: **US 80/SR 26 WIDENING**  
**BULL RIVER TO LAZARETTO CREEK**  
*Preliminary Design Development*

SHEET NO.: 2 of 3

NO.	IDEA DESCRIPTION	RATING
	<b>CONCRETE WORK (CW)</b> (Continued)	
CW-1	Minimize the use of raised concrete median	4
CW-2	Use alternate material for raised median's curb and gutter	3
CW-3	Eliminate temporary barriers	4
	<b>BASE AND PAVING (BP)</b>	
BP-1	Realign roadway further south	1
BP-2	Use rigid in lieu of flexible pavement	1
BP-3	Use 25mm thick asphalt base in lieu of soil cement	2
BP-4	Use a dedicated bicycle lane off the roadway – outside the roadway template	4
BP-5	Minimize the length of the bicycle lane – beyond Queen's Island Trail	4
BP-6	Add evacuation lanes on each side of existing roadway – incorporate bicycle lane on evaluation lanes	4
BP-7	Do nothing – status quo	1
BP-8	Add turtle/wildlife barrier to act as a mini-seawall at current profile – could still add two lanes (Same as Alternative EW-7)	5
	<b>MISCELLANEOUS (M)</b>	
M-1	Use a slip formed curb for wildlife barrier	4
M-2	Use gabions in lieu of a concrete wildlife barrier	4
M-3	Eliminate the wildlife barrier	1
M-4	Use sheet piling for the wildlife barrier	3
M-5	Use a gravel berm for the wildlife barrier	2
M-6	Use riprap for the wildlife barrier	3
M-7	Create wildlife crossings	2
M-8	Create a wildlife sanctuary	4
M-9	Eliminate the Sabal Palm trees	1
M-10	Increase the number of Sabal Palm trees on the project	4
M-11	Use hedges in lieu of Sabal Pam trees	3

**Rating:** 1→2 = Not to be Developed; 3→4 = Varying Degrees of Development Potential; 5 = Most likely to be Developed;  
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