Value Engineering Proposal

Function of Proposal: To allow longer duration of connectivity between the chute and the main channel.

Existing Situation: When the river drops to approximately 5 feet on the Cape Girardeau gage, the inlet to the chute becomes isolated.

Proposed Change: Lower the elevation of the silt plug by 4 feet, bank to bank.

Advantages: Allows for longer duration connectivity for aquatic organisms to move freely between the chute and the main channel. The lowering of the silt plug would provide for longer duration flows through the chute to lessen the impacts of oxygen stratification and possible anoxic conditions that develop during low water stages.

Disadvantages and possible obstacles: Lowering the silt plug too much may allow increased bed load to be transported into the chute, further degrading habitat by making some portions of the chute shallower. The wing dike above the inlet may need to be modified so the inlet doesn't plug up soon after the modification.

Justification: This action is consistent with the primary goals and objectives of this project; primarily to increase connectivity and lessen the impacts of oxygen stratification.

Cost Savings: This action will slightly increase cost and because of the nature of the wing dike above the inlet, the silt plug may periodically need to be removed.

Implementation Strategy/Timetable: This could be done at any time during the construction phase(s) of the project.

Necessary Coordination: Coordination with the Project Delivery Team is necessary.

Assumptions: That a four-foot deep cut will be adequate to improve water quality and connectivity concerns and not allow excessive bedload into the chute.

Value Engineering Proposal

Function of Proposal: Increase substrate and habitat diversity of existing channel cross-sections and of channel structures (hardpoints, roundpoints) constructed in Schenimann Chute. As described in other proposals, woody structures could also be used to minimize erosion of existing caving banks that are contributing to the siltation of the chute.

Existing Situation: Data is not available to quantitatively compare historic and current amounts of woody material in the Mississippi River, however qualitative observation suggests that there is less woody material now. This may be due to land use changes resulting in less supply of fallen trees and removal of trees from the river system (e.g. at bridges).

Proposed Change: Incorporate woody structures into different phases of the project. See accompanying figures. This could include:

- Selectively anchoring trees into pile dike no. 57.9 to change the flow distribution through this dike and increase scour at desired locations to maintain a continuous low flow channel.
- Incorporating trees into rock structures such as existing hardpoints or roundpoints
- Replacing revetment with trees (see proposal to replace rock revetment with trees).
- Anchoring trees within the chute at desired locations to increase diversity. Trees could be anchored using cables and anchors by placing rock on top of the trees or by placing geotubes on top of the tree.

Advantages: Cost savings will occur where revetment is replaced by trees as described in a proposal. Cost savings might also occur at pile dike 57.9 if trees are used instead of rock. At other locations, cost savings may not be realized, however habitat benefits will increase by incorporating woody structures into project features, thus increasing the benefit/cost ratio.

Disadvantages and possible obstacles: Unless wood is submerged most of the time, decay can occur rather quickly. Trees that typically have the best properties as woody structures, such as high unit weight and great resistance to decay (see table below) also provide the best habitat and timber value, making it difficult to justify using them in a projects like this. Trees must be solidly anchored or weighted down to prevent movement during high water events.

Incorporate Woody Structures into Project

Weights for various woods:		
Species	*Weight per Standard cord (pounds)*	*Weight per cubic foot (green)*
Ash, white	4300	48
Black cherry	4000	45
Black locust	5200	58
Black walnut	5200	58
Boxelder	2900	32
Cottonwood	4400	49
Elm	5000	54
Hackberry	4500	50
Hickory	5700	63
Honeylocust	5500	61
Redcedar	3300	37
Silver maple	4300	45
Red oak	5700	64
White oak	5600	63

Level of Species Resistance to Decay:

High	**Moderate**	*Low*
Black cherry	Honeylocust	Ash
Black locust (exceptionally high)		Aspen
Black walnut		Cottonwood
Cedar		Elm
White oak		Hackberry
		Hickory
		Maple (including Boxelder)
		Oak (red and black species)

Incorporate Woody Structures into Project

Justification: Given the value of habitat associated with chutes on the Middle Mississippi River, anything that can be done to improve habitat is desirable. Woody material can be incorporated into proposed rock structures at little additional cost if the rock is used to anchor the trees.

Cost Savings: As described in the proposal to replace revetment with trees, significant cost savings could be realized by using woody material in this manner. If trees were used instead of rock to modify pile dike 57.9, some cost savings could be achieved. For instance, if 200 feet of the pile dike were to be altered by constructing a stone dike 10 feet above the existing grade, this would require approximately 2200 tons of rock, and at an in-place cost of $30/, this would cost $65,000. Replacing this rock cost with trees wouldn't be without cost, however the costs could probably be cut in half at least, resulting in a savings of $30,000 at pile dike 57.9. At other sites such as the hardpoints, roundpoints, or other locations, adding woody structure will probably increase cost slightly, but the habitat benefits will increase also.

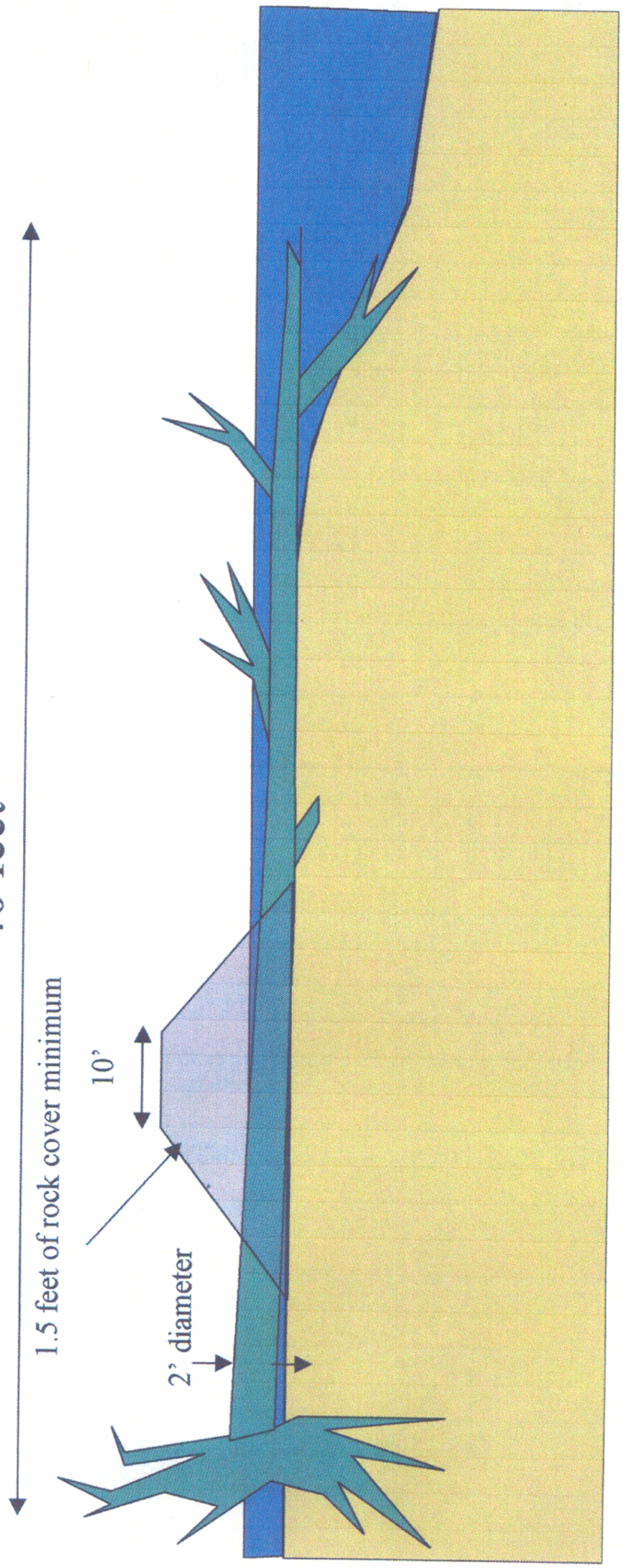
Implementation Strategy/Timetable: As needed.

Necessary Coordination: Original team members and other Environmental Agencies.

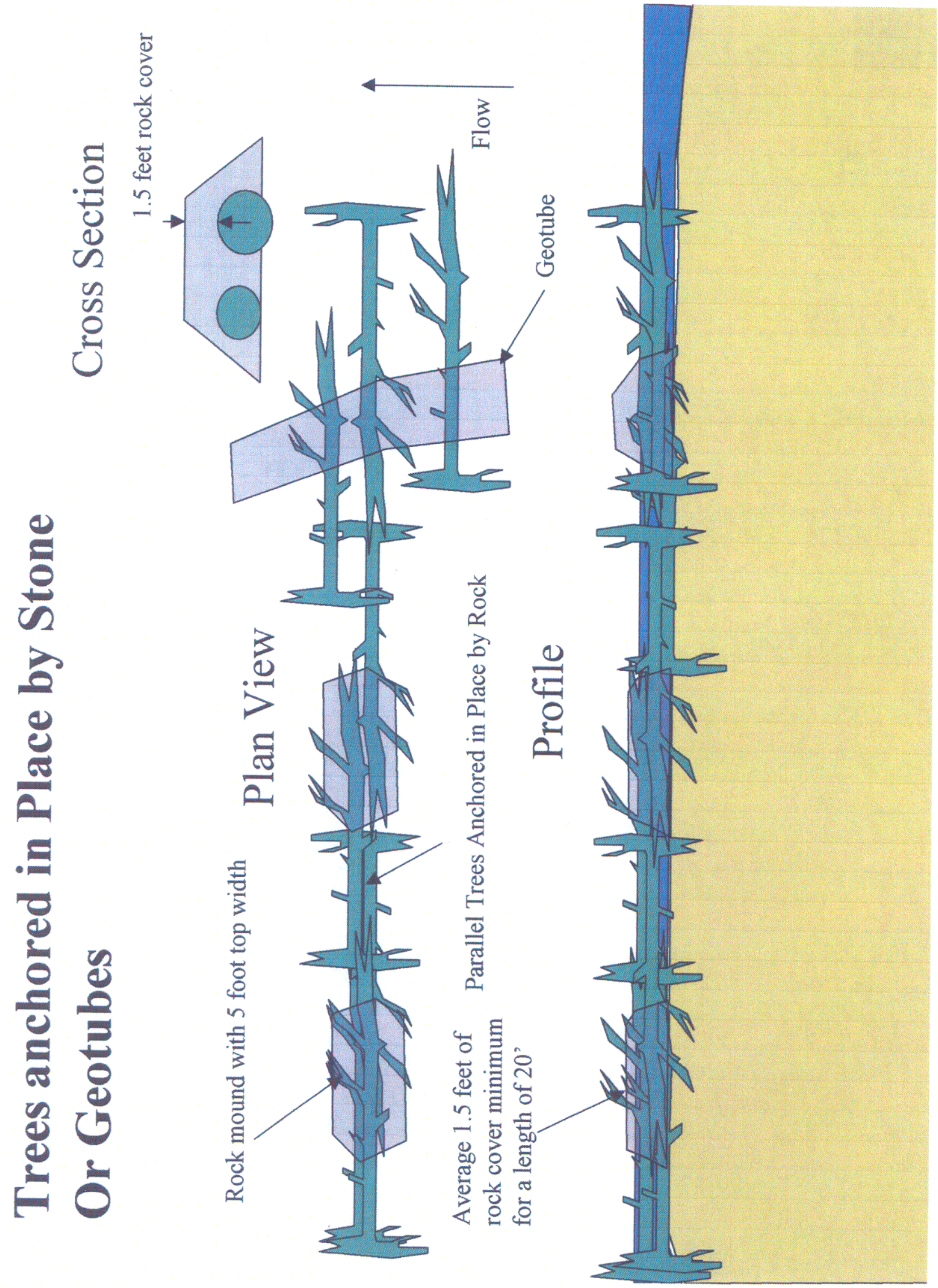
Assumptions: n/a

Incorporate Woody Structures into Project (cont'd)

Tree Incorporated into Hardpoint or Stone Dike



Incorporate Woody Structures into Project (cont'd)



Value Engineering Proposal

Function of Proposal: Minimize erosion of existing caving banks that are contributing to the siltation of the chute.

Existing Situation: Severe bank caving, especially in outside bends of chute.

Proposed Change: Instead of using standard rock revetment, utilize existing trees and construct a revetment system of fallen trees cabled to existing stumps on the high bank. Below is a photo of a tree revetment on an outside bend of the Salt River below Cannon Dam that has been very successful. This photo was taken in 1989, and now the bankline has healed to such an extent that the trees are barely visible.

Advantages: Major cost savings, increasing the presence of woody habitat, and re-establishment of fill (via sediment deposition) in the tree revetment that will encourage the growth of vegetation.

Use of Cable-Anchored Fallen Trees in Lieu of Stone Revetment (cont'd)

Disadvantages and possible obstacles: Not as "time proven" as standard rock revetment. It may be necessary to return and fill in unprotected areas if some trees are destroyed or removed during high-water events. However, high water can also move and/or damage rock revetments, so this factoid in almost a wash.

Justification: Since the criticality of the bank line protection is not necessary to maintain the Navigation Project (as is most tradition revetment jobs on the Mississippi), the use of a tree revetment in the this situation is felt justified.

Cost Savings: The establishment of the tree revetments would be an effort mainly of labor and can probably be designed and constructed for less than $100K in design effort and manpower to construct. This is compared to nearly $1M in the original proposed rock revetment.

Implementation Strategy/Timetable: As needed.

Necessary Coordination: Original team members and other Environmental Agencies.

Assumptions: n/a

Value Engineering Proposal

Title of Proposal: Modify Rock and Wooden Pile Dikes within Schenimann Chute and the Closing Structures at the Head of Schenimann and Dalrymple Chute.

Function of Proposal: The function of this proposal is to increase the flow into and through Schenimann Chute for increased sediment transport, aquatic connectivity and self-maintenance.

Existing Situation: Training structures placed to benefit navigation have created Schenimann Chute. These same structures (rock and wood piling) also create different flow patterns and sediment depositional areas that are directly related to materials used (density, placement angle, height of placement and location).

Proposed Change: Notch rock dike 62.2 and remove a 100 foot section of Pile Dike 57.9 near the right descending bank as well as a 100 foot section of Pile Dikes adjacent to river dike 61.5 and at the confluence of Dalrymple chute. The closing structure below dike 62.5 and dike 59.5 would be notched to allow water at low flows to enter these chutes (unnamed chute above Shenimann and Dalrymple chute).

Advantages: All modifications will increase depth diversity and volume of flow through Schenimann Chute to provide for sediment transport and scour as well as a permanent aquatic connectivity with the Mississippi River during critical low flow periods (November –December). This increased depth diversity will provide access of the deep off-channel habitat within Schenimann Chute to fish that need an overwintering area with little to no current. A permanent connection between the Mississippi River and Schenimann Chute via Dalrymple chute would be created as well as a permanent connection at the southern (downstream) portion of Schenimann Chute.

Disadvantages and possible obstacles: River stages are usually very low during the fish migration period to their winter habitat and construction access can only be accomplished during high flow events. The materials that need to be removed (rock and pile dikes) are not visible at these river stages, plus the desired scour may not be achieved without adding other features. All of the terrestrial area on both sides of the Schenimann Chute is privately owned thus all notches must be configured as to not affect the landowners.

Justification: **Cost Savings**: NA

Implementation Strategy/Timetable: Construction activity must be during high water if using water-based equipment. All locations must be identified with GPS technology during low water stages for proper location of the structure and sections slated for removal. The depth can be adjusted to the river stage at Chester, Illinois and Cape Girardeau, Missouri.

Necessary Coordination: Contractor must develop GPS data with the COE and MDOC. This data must be gathered during low water stages.

Assumptions: The above work can be accomplished in the desired manner and the notch creation will not affect navigation during low flow periods.

Value Engineering Proposal

Function of Proposal: Provide habitat diversity for aquatic and terrestrial wildlife species within the confines of Schenimann Chute.

Existing Situation: Limited habitat for terrestrial wildlife within the Chute and low oxygen content during low flows coupled with high temperatures limit the value of present aquatic habitat.

Proposed Change: Develop mini-island habitat within the chute with a chevron-style structure utilizing rock or wooden pile placement. These island-forming structures will create deep water, shallow sand bar, terrestrial, and abraded channel habitat environs.

Advantages: Landscape diversity will influence the population dynamics and distribution patterns of aquatic and terrestrial flora and fauna within large river systems and scour areas will maintain a connection during low flows between the Mississippi River and develop deep backwater habitat areas within the chute.

Disadvantages and possible obstacles: Existing flow patterns will be altered and create the possibility of increased bank instability. This is a new system design that has not been proven to provide the desired habitat.

Justification: Substrate diversity will provide life requirements for native endemic species.

Cost Savings: NA

Implementation Strategy/Timetable: Island foundation should be completed during the first phase of construction to accumulate sediment from construction disturbance activities.

Necessary Coordination: Contractor, state and federal agencies must have a point of contact during the construction phase so all features are in the proper location and perspective.

Assumptions: That access to the chute is possible for construction activities and high water flows will create the desired features at a reasonable cost.

Value Engineering Proposal

Function of Proposal: Chute width stabilization/restoration, a reduction of diurnal water temperatures and an increase of woody and herbaceous substrate within the chute that may be used by both aquatic and terrestrial wildlife.

Existing Situation: The channel at present is comprised of high banks (15-25 feet in height) that stretch from the bottom of the chute island surface. These banks have a very steep gradient with little or no perennial vegetation and are eroding in several locations.

Proposed Change: In the area downstream of dike 59.8-R, within Schenimann Chute, the width of the chute has doubled as compared to that upstream of dike 59.8-R, thus creating an area of deposition. At this site along the right descending bank a series of short pile dikes (five placed 500 feet apart) driven into the substrate and extending into the chute 100 feet would create an area of deposition with an elevational gradient that would support woody vegetation. This lower level/tier of structures would not restrict flow during high water events but would reduce the channel width during intermediate flows and thus maintain depth diversity.

Advantages: Pile dikes that do not support cross beams reduce the water velocity and provide a mechanism for island creation to begin. As this dike field area increases in elevation, woody vegetation will become established and further reduce velocities, thus increasing the areas development rate. These "bench" (island-like features) will reduce the chute width in this location and the associated increase of water velocity will keep suspended sediment (bedload) moving downstream. The height, density of piling and distance between dikes can be modified to create desired features such as the bench height and growth rate.

Disadvantages and possible obstacles: The existence of the crossover chute (Dalrymple chute) may continue to create an eddy effect and sediment deposition north of the confluence to Schenimman Chute. The technology to drive wooden pile may not be readily available and construction access will only be available during high flows in the Mississippi River. Creating a direct access to the main channel at low water levels via Dalrymple chute would be a desired objective but may be difficult to achieve.

Enhance Multi-stage Chute Flows via the Use of "Benches" (cont'd)

Justification: Increased chute depths in this location would provide access to fish for movement within Schenimann Chute from one deep-water habitat to another that provides the life requirements for overwintering.

Cost Savings: NA

Implementation Strategy/Timetable: During high river stages.

Necessary Coordination: Coordinate with sponsor as to exact location and material availability

Assumptions: All deep-water habitats must be connected during low flows so that fish may access them for their overwintering requirements.

Value Engineering Proposal

Function of Proposal: Enhance flexibility of structure placement and reduce structure costs in areas where dredging is necessary.

Existing Situation: Existing construction of in-channel structures includes wooden pile and rock, both of which are permanent and relatively expensive.

Proposed Change: Investigate use of small dredges and Geotube technology to create in-channel structures that are easily and economically placed, and removable, if necessary.

Advantages: Beneficial use of dredged material; structures may easily be removed and re-established elsewhere.

Disadvantages and possible obstacles: Unknown cost/feasibility. Geotubes may not provide the type of structures desired.

Justification: Current structures are immobile and don't allow for changes in design.

Cost Savings: Unknown at this time.

Implementation Strategy/Timetable: During construction of Schenimann Chute hard points

Assumptions: Geotube technology is available and economical. Small dredge is practical and available.

Value Engineering Proposal

Function of Proposal:

1. Provide a nonerodible boundary between channel subgrade and potentially damaging flow of water, and/or
2. Function similarly to rock dikes and closure structures

Existing Situation:

1. Rip-rap is placed along water bank to provide erosion protection to underlying subgrade, and/or
2. Rip-rap is placed within the channel to deflect water flow and/or provide desired erosion/deposition characteristics.

Proposed Change: Use concrete A-Jacks in lieu of rock riprap for bank erosion protection and/or dike/closure structure material.

Advantages: Per the A-Jack literature, A-Jacks provide an advantage over rock because:

1. Rock may be difficult to obtain
2. The cost of transporting rock can be expensive
3. Poor quality rock can potentially break up and be carried away by water flow
4. Riprap performance is dependent upon the gradation of the material

Disadvantages and possible obstacles:

1. Used as a temporary structure, A-Jacks may not be easier to move/adjust than rock (they are as heavy as rock; they may come apart; care is required to not damage the "blocks"
2. A-Jacks have to assembled
3. Installation has to be monitored to ensure that the A-Jacks do not come apart (they can't be simply dropped off a barge)
4. If a matrix of A-Jacks is desired, more time and care is required to create the matrix (this may be difficult in deep, murky water)
5. Rock may be easier to transport to the site (A-Jacks come from a factory versus a quarry located next to the river)

Justification: Use of this product is not recommended.

Cost Savings: Not known. However, it is assumed that A-Jacks would be more expensive due to additional manufacturing, transportation, and labor that is not required with rock.