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Dr. John Kirlin, Executive Director
Delta Vision
650 Capitol Mall
Sacramento, CA 95814

Subject: Costs to Improve Delta Levees to the PL 84-99 Standard

Dear Dr. Kirlin:

As we have discussed previously, described below are the costs associated with rehabilitation of Delta levees to the PL 84-99 standard. In addition to general information, we are also providing details regarding a specific levee recently rehabilitated to the PL 84-99 standard.

A distinction should be made between which levees in the Delta require PL 84-99 rehabilitation, and which do not. Generally, project levees that are components of the Federal flood control projects along the Sacramento and San Joaquin River systems exceed PL 84-99 requirements. These levees constitute 431 miles of the 1,066 miles of Delta levees, or 40%. Therefore, the other 635 miles (60%) of non-project levees are subject to PL 84-99 rehabilitation.

In order to meet the PL 84-99 standard, work generally involves raising the existing levees between 0.5 and 1 foot. In addition, the work requires stabilization of the levee based on levee height, flood elevation, and foundation conditions. This stabilization consists of building a large berm at the landside toe of the levee and flattening the landside slope. A benefit of the PL 84-99 section is that it not only stabilizes the levee against static failure under flood conditions; it also provides subsidence mitigation by covering peat with a toe berm.

We have performed several quantity and cost estimates for reclamation districts to attain the PL-99 standard. These quantity and cost estimates were based on detailed surveys, giving them very high accuracy. In general, we have found that the levees in the Delta require between 10 and 32 cut cubic yards of fill material per lineal foot. The key to rehabilitation is the availability of levee material. The closer the borrow source is, the cheaper the material. Also, the design needs to balance the desired material and its availability.

Attached as Table 1 are bid results for fill material over the past year. Note that on-island borrow sources produce a much lower cost. Considering the general conversion factor between tons and cut yards, imported fill can be in the neighborhood of three times the cost of on-island material.

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Case Study: Bouldin Island

An 8,500 foot section of Bouldin Island was recently rehabilitated to the PL 84-99 standard. This site was chosen because it has shown signs of weakness in the past and is also located along the south side of Bouldin Island, where the peat depth exceeds 30 feet. A typical cross-section showing the levee rehabilitation design is attached as Plate 1. Note that the design calls for a 21 foot wide crown width. This width exceeds the PL 84-99 minimum of 16 feet. This larger width, in addition to, over building the crown elevation 0.5 feet above the PL 84-99 minimum allows for future maintenance of the levee to maintain the PL 84-99 height.

The Bouldin Island project required 246,585 cut cubic yards of material, or about 29 yards per lineal foot. The cost of the project was kept low due to the fact that local borrow was available. The total price of $1,162,534 included excavation, hauling and placement of fill material, mobilization and demobilization of equipment, clearing and grubbing, recycling of existing gravel, and importation of additional gravel. Extrapolated over 635 miles of non-project levee, this levee rehabilitation cost of $137 per lineal foot would total $459,334,000. Assuming imported fill at three times the cost of local borrow, the total cost would be $1,378,200,000 for all non-project levees.

In addition to construction costs, the work included engineering. Engineering tasks included geotechnical exploration, analysis and development of design parameters, detailed pre-project and post-project surveys of the levees and borrow pits, competitive bid contract plans and specifications, construction inspection and testing, contract administration, and project coordination. These engineering costs equated to about 20% of the construction costs. The same level of effort would be required for an import fill project, so it is not straightforward to standardize engineering cost as a percentage of construction.

This example illustrates the rehabilitation costs of a relatively large levee, with relatively weak foundation conditions. Therefore, we feel the range of $459 million to $1.4 billion is adequate to encompass the cost to rehabilitate all 635 miles of non-project levees to the PL 84-99 standard. Further study regarding location of borrow material for individual reclamation districts would narrow the total cost range.

We hope this provides useful information. If you have questions, or require additional information, please call me at (916) 456-4400.

Sincerely,
MBK ENGINEERS

Gilbert Cosio, Jr.

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2526/JOHN KIRLIN 2008-04-16.DOC

cc: Dr. Raymond Seed, Member, Delta Vision Blue Ribbon Task Force

TABLE 1

LEVEE FILL BID PRICES 2007-08

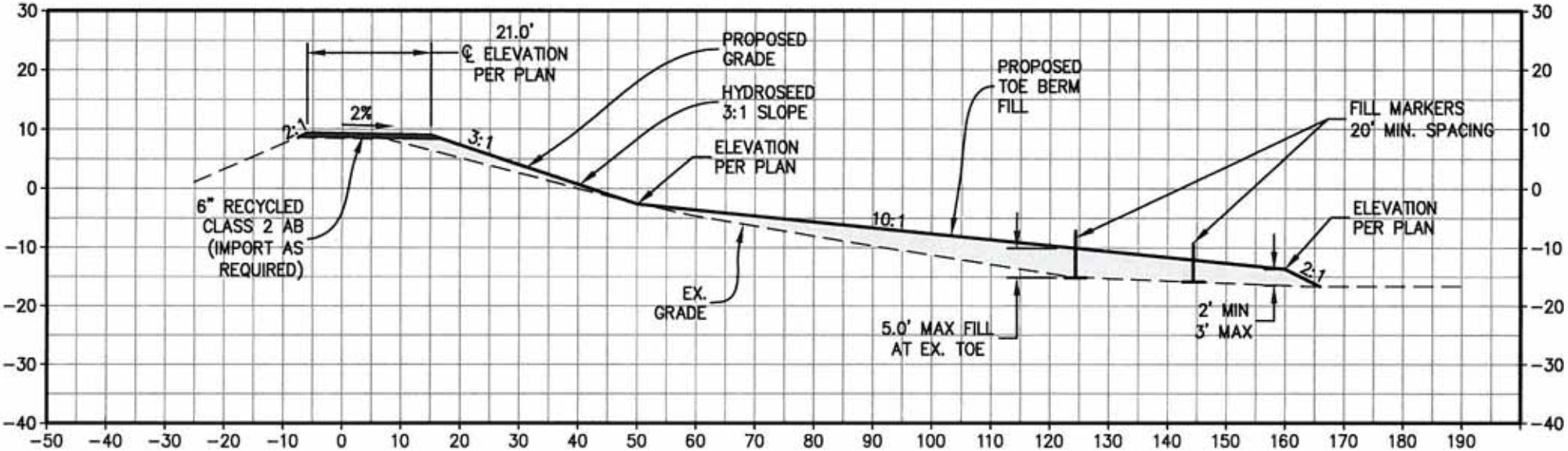
					On-Island Borrow Material			Imported Borrow Material		
Bid Date	Reclamation District	Engineer	Special Notes	Contractor	Total Cut CY	Total Cost	Net Cost/CY	Total Tons	Total Cost	Net Cost/Ton
3/19/07	Mandeville Island	KSN	1, 4, 5	Dutra/Asta				204000	$2,688,720	$13.18
5/15/07	Orwood	Rosten	1	Asta				10400	$111,696	$10.74
5/23/07	Wright-Elmwood	KSN	1, 4	Robert Burns				900	$7,065	$7.85
8/15/07	Bouldin Island	MBK	1, 3, 4	Teichert	167300	$689,035	$4.12			
8/24/07	Upper Jones Tract	Rosten	1	Asta				14000	$93,800	$6.70
8/30/07	King Island	MBK	1, 3	Asta				42632	$308,813	$7.24
9/17/07	Lower Jones Tract	KSN	1, 4	Robert Burns				14650	$160,564	$10.96
10/5/07	Empire Tract	MBK	1, 3	Ford				20155	$162,901	$8.08
10/29/07	Lower Jones Tract	KSN	1, 3	Robert Burns				14735	$109,776	$7.45
10/29/07	Lower Jones Tract	KSN	1, 3	Robert Burns				15680	$118,384	$7.55
2/21/08	Orwood	Rosten	1	Cal-Neva				16000	$127,360	$7.96
3/10/08	Holland Tract	MBK	1, 3, 4	Teichert	200000	$887,655	$4.44			
3/17/08	Twitchell Island	KSN	1, 2	Top Grade				112080	$1,385,886	$12.37
3/31/08	Brack Tract	MBK	1, 3	Asta				11376	$103,229	$9.07
4/15/08	Webb Tract	MBK	1, 3, 4	Teichert	150000	$739,850	$4.93			

ODD BALL BID - IMPORT FILL MEASURED BY CUT YARD

8/15/07	Jersey Island	Milani	1, 3, 4	DeSilva Gates	45000	$752,105	$16.71

Special Notes

1. Total Cost includes unit cost of fill, and other costs associated with project that can be attributed to fill such as mobilization/demobilizaton, clearing and grubbing, etc.
2. Set back levee. Total Cost includes keyway excavation and recompaction, and grid fabric.
3. PL-99 toe berm, or full section
4. Crown fill
5. Imported by barge



1 TYPICAL SECTION - BOULDIN ISLAND

SCALE: N.T.S.

NOTES:

1.) SECTION APPLIED OVER 8,500 L.F.
2.) FILL REQUIRED = 30 C.Y. / L.F. BASED ON FINAL QUANTITIES (ROUNDED)

PLATE 1