UYLIP BOSC COMMENTS
MEETING NO. 1 – DEC. 16, 2009

COMMENTS FROM THE BOSC MEETING NO. 1 REPORT

1. A concern of the BOSC is that there are various hydraulic models of the system generated by various entities. It is understood that TRLIA/MBK have attempted to get the HEC-RAS model "accepted" by the USACE, but it would be prudent to get such a letter from them or at the least get them to say that the MBK HEC-RAS model can be used for the design of the project. (MBK)

RESPONSE: TRLIA requested the Corps to review and comment on the MBK HECRAS Model being used to design repair features for the Upper Yuba South Levee in December of 2008. TRLIA repeated this request as part of the Safety Assurance Review on February 17, 2010. The Corps has not provided a response to the February 17 request. TRLIA believes that the MBK HECRAS Model is the proper one to use for levee repair design. This model gives more conservative design water surface elevations along the Upper Yuba South Levee and there is reasonable probability that these elevations could occur along this reach of the levee. The most significant difference between the MBK and the Corps model in the Upper Yuba is how to address the high ground/training levee between the Yuba Mainstem Channel and the left bank Yuba River levee. MBK has investigated this area in the field and has obtained additional topographic surveys for the high ground/training levee reach. The topography gathered indicates that this reach actually consists of smaller interspersed reaches of high ground and low embankment. FEMA in the past accredited the reach of Training Levee for FEMA mapping purposes and has asked if any agency is willing to certify this levee to FEMA. Without certification FEMA will no longer accredit this levee reach and flood plain maps will be revised accordingly. So far no agency has agreed to provide certification information for the training levee. There is no information that indicates that this levee was built to current engineering standards with current standards of practice. This is not a Sacramento River Flood Control Project Levee and it is unlikely that it was constructed to proper levee standards. Without certification and accreditation of the training levee, FEMA criteria require that the levee reach be removed for purposes of developing base flood (100-year) elevations and flood plains. The MBK Model follows FEMA criteria and removes this levee for the 100-year event and consequently the 100-year event places flood waters against the Upper Yuba South Levee.

For the 200-year event, the training levee reach is modeled differently than for the 100-year event. Because of the lack of construction information, geotechnical information and analysis on this training levee, the levee cannot be assumed reliable for the 200-year event. For levee design purposes, complete removal of a levee is too conservative. The levee is much more likely to breach rather than be completely removed. The MBK Model allows a breach to develop in the low levee reach when it is overtopped by the 200-year flood. This breach degrades to the elevation of the surrounding ground elevation. The Corps hydraulic model allows this low levee reach to overtop without failure. For purposes of reliable design on the UYLIP for the 100-year and 200-year

events, it is TRLIA's position that the breach scenario is the standard for levee design, is conservative and appropriate for the design of the UYLIP.

2. Low points at the Goldfields project levee connection should be filled in for a distance 500 feet upstream of the Goldfields project levee connection. (HDR, MBK)

RESPONSE: Agree. Verification of critical low points will occur and any required modifications of this area will be included in the 90% design package.

TRLIA investigated the presence of low points in the Goldfields near the levee connection. Additional topography was obtained in this area of the Goldfields during the UYLIP design. This topography is shown on Plan sheet C-121 of the 60% Plans. The 200-year water surface elevation at the upstream end of the UYLIP is 93 feet NGVD 29. It would require an elevation of 96 feet NGVD 29 to contain this water surface elevation with 3 feet of freeboard. Review of the topography at the end of the Goldfields on Sheet C-121 indicates one possible low point within 500 feet of the end of the levee. This low point is approximately 40 feet from the end of the levee, approximately 10 feet wide, and has an apparent low elevation of approximately 94 feet NGVD 29. However this low point is located in an area of dense vegetation and a field investigation did not indicate the 2 to 3 foot drop off shown by the aerial topography. Field survey verification will be necessary and accomplished to determine if this low spot actually exists.

3. Analyze and provide an assessment of the possibility for the Yuba River to be "captured" by the Goldfields and be re-routed through the Goldfields by a succession of head cuts such that it would flank the project levee. (MBK)

RESPONSE: Agree.

The Corps of Engineers has concluded that flows from the Goldfields area for a 100 year event will not flank the end of the UYLIP project. An evaluation of the Goldfields was accomplished in 2002 by Tetra Tech for the Corps, *Analysis of Yuba River Surface and Groundwater Flows in the Vicinity of Marysville, California, Tetra Tech Inc. for USACE Sacramento District, June 2002.* This report indicates that the 100 year event does not break out of the Goldfields. The Tetra Tech report indicates a small area of flooding from a 200 year event that needs to be verified. The Corps Yuba Basin General Reevaluation hydraulic evaluations, still in draft, reference the Tetra Tech report and draw similar conclusions. The Corps draft report indicates a 200 year flood area, based on conservative assumptions, that is larger than the area in the Tetra Tech Report. TRLIA has under taken an effort aimed at verifying the 100 year Tetra Tech conclusion for FEMA mapping purposes and to better define the 200 year problem, if there is one. The Corps final report and TRLIA evaluation are expected to be completed later this year.

It needs to be clarified that TRLIA is not the lead agency in the Goldfields evaluation. The Corps along with the Yuba County Water Agency as a local sponsor is evaluating the flood threat from the Goldfields. The UYLIP currently ends at the Goldfields because this is the extent of the RD784 levee system and no specific up river problem has been

identified by the Corps of Engineers. The Corps of Engineers has not identified a 100 year flood flow problem originating from the Goldfields area and has not yet completed their 200 year evaluation.

TRLIA recognizes that the Goldfields hydraulics and river interactions are complicated and stakeholders in the Goldfields are many. The UYLIP is designed to address levee deficiencies from 100 and 200 year flood flows against the Upper Yuba South Levee from Simpson lane to the Goldfields and to terminate at the Goldfields high ground in an effective manner. Correction of the levee deficiencies by the UYLIP remove current 100 year and 200 year flood threats in this reach of levee and improve flood protection to the RD 784 area. The UYLIP cannot address any yet to be identified 200 year flood flow deficiencies in the Goldfields.

4. It is recommended that an agreement be made with the operators of the Goldfields to work outside a defined setback such that any activities would not affect the integrity and efficiency of the project. (MBK)

RESPONSE: See response to number 3. These potential alterations will be the subject of any future Goldfields Project.

5. At a minimum, an "ultimate" modification of the Goldfields should be determined through discussions with the operators and an assessment of this condition on the project should be made. (MBK)

RESPONSE: See response to number 3. These potential alterations will be the subject of any future Goldfields Project.

6. Provide details of the upstream south levee terminus to the BOSC when they are available. (HDR, MBK)

RESPONSE: See Sheet C-121 of the plan set.

7. Exploration appears to be less than recommended by the Corps of Engineers. To rectify it is suggested that in the reach of the levee where a cutoff wall is planned, additional borings could be drilled or, if feasible, CPT's conducted to verify the depth of the impervious stratum. When CPT's are performed, a minimum number should be coupled with drilled borings to provide enough samples to validate the results of the CPT probes. (Kleinfelder)

RESPONSE: Subsurface conditions along the YRSL have been explored during multiple investigations between 1988 and 2009. These investigations have generally resulted in advancement of 110 borings along the 20,159-foot levee alignment. The following table shows the number of borings and their location along the levee.

Distribution of Borings

Boring Location	Number of Borings	Reason for Boring
Levee Crown	47	Levee composition, foundation and subsurface conditions beneath levee
Landside Levee Toe	24	Composition of blanket a levee toe and subsurface conditions adjacent to levee
Waterside of Levee	7	Composition of blanket on waterside
Landside Field – 300 feet from Levee Toe	14	Composition of blanket away from levee
Landside Field – 100 feet from Levee Toe	18	Advanced in area of seepage berm to further investigate blanket composition beneath seepage berm

Boring locations were selected to provide sufficient characterization for project design and to meet the maximum recommended boring spacing of 1,000 feet contained in the USACE, Sacramento District SOP for levee evaluations. Field explorations for the current project were performed in three phases. The first phase of exploration consisted of advancing crown and toe borings for the PIR and occurred in December of 2008 and January of 2009. The second phase consisted of field borings and waterside borings for the GBODR and was performed in July and August of 2009. Since the portion of the project from Station 102+00 to 135+00 was found to not be deficient for slope stability, through seepage, and/or underseepage during the PIR evaluation, field borings were not advanced in this portion of the project. The third phase consisted of sonic borings in the crest and shallow borings in the field to supplement exploration for the GBODR and gather specific subsurface information for design of the cutoff wall and seepage berm elements of the project and was performed in September and October of 2009.

Review of site geologic maps, HEM data, historical mapping, levee geometry and topography, existing borings, and minimum spacing requirements was performed to select the location of each boring. The following steps were used for boring location selection.

1. Geologic mapping review. As discussed in Section 3, geologic mapping focused on identifying elements that may result in seepage pathways beneath the levee such as old channels and buried channels. Where these elements were identified in the geologic mapping, a boring was placed in the area.

2. HEM data. The warmer colors (reds and purples) of the HEM data generally represent coarse-grained sediments (i.e., sand and gravel). And colors between blue and purple (yellow and orange) generally represent intermediate graded materials (i.e., silts and silty/clayey sands). Where so called "hot spots" (red and purple zones) were observed in the HEM data, a boring was placed in the area.

3. Historical mapping. Historical mapping was used to further identify old channel and levee locations. If this mapping indicated an old channel, a boring was placed in the area.

4. Levee geometry and topography. This review was performed to identify areas of likely improvements to correct geometry deficiencies and topographic features that may affect levee performance (i.e. ditches, low areas, and ponds). Since these areas would likely need analysis, borings were placed in these areas to provide subsurface information for the analysis.

5. Existing borings. Existing borings were reviews for applicability to the current project. If a boring did not contain sufficient information (i.e. boring not drilled deep enough, laboratory testing of significantly layers missing) a replacement borings was located.

6. Minimum spacing requirements. After placement of borings to address the above issues, the boring number was checked for minimum USACE criteria. Borings were added as needed to meet this criterion. The exception to this was the location of waterside borings. The purpose of waterside borings is to gather information on the waterside blanket for use in modeling. However, the waterside of the levee was very well characterized by the geologic mapping as containing numerous old channels with the overall appearance of a braided stream environment. It was decided that borings on the waterside would be highly variable and potentially mislead the investigation if a boring encountered fine grained blanket material when the appropriate waterside material should be abandoned channel infilled with coarse grained material. Therefore, waterside borings were advanced in only selected locations.

Based on the above points, it is Kleinfelder's opinion that sufficient information has been gathered for the project design. The discussion presented above and the details relative to the scope of the field investigation have been added to Section 1.1 of the Final GBODR.

8. An attempt should be made to obtain records of the observed levee performance during these earlier flood events that preceded the Oroville Dam/New Bullards Bar Dam construction. The DWR urban levee program may be a ready source of information. (MBK)

RESPONSE: The DWR urban levee program recently completed a Draft Technical Review Memorandum (TRM) for the RD 784 levee system. TRLIA reviewed this report. The TRM accomplished a detailed review of DWR levee integrity records for this reach of levee and included a section on past recorded historical levee problems. None were

noted for the Upper Yuba South Levee. This is to be expected since historically this levee has not had water against it. The high ground/training levee on the south bank of the main stem Yuba River has prevented flows from reaching this stretch of levee. As discussed in the hydraulic analysis, the current analysis makes assumptions that include breaches where they have not historically occurred. These breaches increase the hydraulic loading on the Upper Yuba South Levee which would create seepage problems in this levee should high water reach the levee.

9. A closed form blanket theory analysis should be performed on a cross-section, with the necessary continuous blanket, to verify the finite seepage analyses. (Kleinfelder)

RESPONSE: A closed form blanket theory seepage analysis was performed for the existing conditions represented by the model cross-section at Station 183+50. The model at this location includes a silt levee and a continuous, relatively uniform silt blanket. The results of the seepage analyses indicated the average vertical gradient through the blanket layer (for both the 100-year and 200-year WSEs, respectively) computed by the blanket theory analysis (0.34/0.45) and the SEEP/W analyses (0.39/0.52) correlate well. The respective SEEP/W analyses and results are presented on Plates G-1 and H-1 of the Final GBODR.

10. Sensitivity analyses should be performed to assess the impact of the assumed permeabilities of the subsurface strata on the computed exit gradients reported from the analyses. (Kleinfelder)

RESPONSE: Parametric analyses have been performed for several of the models to assess the sensitivity of the modeled results and computed exit gradients to the input hydraulic properties of the model materials. Selected parametric analyses were presented in the Draft GBODR. Additional parametric analyses are presented in Appendix N of the Final GBDOR. Also refer to additional discussion of parametric modeling added to Section 5 of the Final GBODR.

11. Examine the permeability values determined for the SAFCA Natomas Levee Improvement Project and compare to values used for the UYLIP and use engineering judgment whether the Natomas values are applicable to the UYLIP. (Kleinfelder)

RESPONSE: The Board of Senior Consultants (BOSC) for the Natomas Levee Improvement Program has developed a tabulation of recommended initial permeability values for seepage analyses of levees in the Natomas basin (Draft, dated 01-10-10). Kleinfelder has developed a similar table of values used in BOD reports for the Natomas program. The main difference between the tables is the Kleinfelder table includes a target value and a typical range; the BOSC table does not include a typical range. Kleinfelder used an older version of our table for TRLIA. Permeability values used in the seepage modeling performed for the PIR evaluation of the UYLIP were reviewed and partially revised for the Draft and Final GBODR. This included looking at the age of the deposits and the grain-size distributions of critical materials using results of hydrometer testing. This is similar to the process that the SAFCA Natomas project is using to update and revise permeability values. Therefore, it is our opinion permeability values used for

the GBODR are appropriate for the UYLIP project. Additional discussion of the values of permeability selected for the project is presented in the revised Section 5 of the Final GBODR.

12. Based on information in the "geotechnical "cross-sections", it is indicated that the stability analysis used the same unit weights for dry and saturated conditions. This was unexpected, please explain. (Kleinfelder)

RESPONSE: The values of dry unit weights were presented on the model cross-section plates in error and have been deleted from the revised Plates (4-2 through 4-8) included in the Final GBODR. The stability analyses were performed using saturated unit weights as presented on the plates.

13. Normally rapid drawdown analyses are done using UTEXAS-4. Compare the results of the SLOPE/W analysis with a UTEXAS-4 analysis for at least one rapid drawdown analysis at one section. (Kleinfelder)

RESPONSE: Comparison of SLOPE/W (2007 version) models to UTEXAS-4 models is no longer required by USACE. However, as requested, we have run one model with UTEXAS-4 for the Final GBODR and found the results to correlate well. The factor of safety computed by SLOPE/W for the model at Station 183+50 under rapid drawdown conditions was 1.04 (see Plate K-2/K-2A in the Final GBODR), while the factor of safety computed by UTEXAS-4 for the same model and conditions was 1.10. The results of the UTEXAS-4 modeling are presented in Appendix N of the Final GBDOR.

14. The results of the rapid drawdown analysis for the cross-section at Station 183+50 for the 200-year + 3 feet water surface elevation indicate a factor of safety close to one (1.04). While the shear strength parameters used in the analyses may be conservative, it is prudent to perform a parametric analysis to asses the level of confidence in the computed factor of safety for this section. (Kleinfelder)

RESPONSE: In performing this analysis, a range of strength values were considered. The analysis was performed using the lower of the considered values. A parametric analysis would use higher strength values than those used in the model. Therefore, although the result of the analysis is close to 1.0, which is the allowable value, it is our opinion the analysis for this extreme case is conservative and shows the levee still meets rapid drawdown stability criteria.

15. It is recommended that results of the stability analyses be presented at a better scale to show details of the slip surfaces analyzed. (Kleinfelder)

RESPONSE: Concur. Additional stability analysis Plates have been provided in Appendices I and K to present the SLOPE/W stability analyses at more legible scales.

16. At Station 243+50, post earthquake stability analyses were performed for this section by assigning residual strength for zones that were estimated to have liquefied. The reported yield acceleration for a landside potential sliding surface is 0.06g, which is

less that the PGA value of 0.14g, indicating the potential for some earthquake-induced permanent deformations that need to be estimated. (Kleinfelder)

RESPONSE: We agree that there is a potential for some earthquake-induced permanent deformations. However, our analyses were focused on only qualitative assessments and no effort was done to quantify the deformations. Since the yield acceleration is greater than 15% of the PGA, the section at Station 243+50 will probably not experience large deformations during the design seismic event. For significant deformation to occur, the calculated yield accelerations should be lower than the threshold value of 15% of the PGA. For this site, the PGA varies between 0.13g and 0.14g. Therefore the threshold yield accelerations are 0.0195g and 0.0225g, which are below the yield accelerations calculated for the GBODR. Therefore, it is our opinion that quantification of deformations is not necessary for the level of evaluation performed for this study.

17. Settlement analyses should be conducted to determine the potential for the weight of the seepage berm to further compress existing levee material and the underlying softer foundation layers, causing longitudinal cracking of the levee crest. (Kleinfelder)

RESPONSE: Settlement analyses have been performed for the Final GBODR and are presented in Appendix N of the Final GBDOR. The calculated amount of settlement typically ranged from about 1 to 1/5 inches. This amount of settlement is not significant and not expected to cause significant deformation at the levee seepage berm interface. Please refer to additional discussion of potential post-construction settlement presented in Section 5.5 of the Final GBODR.

18. The BOSC concurs with the use of a “hanging wall” from stations 189+00 to 221+00 but understands that the wall be constructed to maximum depth obtainable by a backhoe as suggested by the Corps of Engineers representative at the meeting. (Kleinfelder)

RESPONSE: Concur. The Final GBODR and Project has been changed to reflect an 80 foot wall depth.

19. A comprehensive justification of the width of the seepage berm and the proposed overlap with the cutoff wall is needed in the GBODR. (Kleinfelder)

RESPONSE: Please refer to revised discussion of seepage analysis results presented in Section 5.2 of Final GBODR.

20. The current datum used in the basis of design report is the NGVD 29 Datum. It is our understanding that surveys are currently planned to develop conversion factors to the NAV 88 Datum. (MBK)

RESPONSE: TRLIA has contracted for studies to provide conversion factors from NGVD 29 to NAV 88 Datum at different parts of the RD 784 levee system. These factors will be used during the FEMA Certification process for the levee system. These

factors will also be included in the O&M Addendum. TRLIA intends to complete plans and specifications using the NGVD 29 Datum.

21. The schedule for degrading the levee for the cutoff wall construction should be drafted in the next few weeks and reviewed by all project participants. Historic river flows and stages, available upstream reservoir storage, and any other pertinent factors should be analyzed to determine the safe starting date for the degrading. The analysis can be updated as runoff evaluations are made in late winter and early spring. (MBK)

RESPONSE: TRLIA will abide by the no work during the flood season restrictions (November 1 to April 15) set forth by the CVFPB Permit. This construction season is established based on the Central Valley climate and historic rain periods. TRLIA will not be able to begin work as early as April 15 in 2010. As the time approaches for TRLIA to award the construction contract, close attention will be paid to the time remaining to the beginning of flood season and excessive levee degradation will not occur. TRLIA will not degrade any more of the levee than can be restored prior to November 1.

22. Consideration should be given to placing the material from degrading the levee directly into the seepage berm and using material from the borrow area to reconstruct the levee. The process would greatly reduce the need for stockpile areas and provide simpler construction, hence should save valuable time and possibly money. (HDR, Kleinfelder)

RESPONSE: Concur. TRLIA will direct contractor to use degraded material that meets seepage berm specifications in the seepage berm and reconstruct levee with borrow material.

23. The BOSC would like to see the status of the Emergency Action Plan (EAP) as well as a list of the participating agencies and their involvement in the EAP. (MBK)

RESPONSE: TRLIA prepared a Flood Plain Management Plan (FPMP) for the Yuba Floodplains as part of the Section 408 approval Process for the Feather Setback Levee. This FPMP was based on the numerous Flood Emergency Plans already developed and adopted by Yuba County. A copy of this FPMP is attached.

24. The Drat GBODR could benefit from a thorough review and editing of a number of inconsistencies. (Kleinfelder)

RESPONSE: Concur. Independent Technical and QC reviews have been performed prior to submittal of Final GBODR.

COMMENTS DURING THE BOSC MEETING

25. TRLIA should develop more information on the duration of flooding against the Upper Yuba South Levee. It should also see what velocity information can be used. The Board cautioned TRLIA to be aware of vertical datum issues. (MBK)

RESPONSE: Hydraulic evaluations are concluding with the new topographic information and a response has not yet been prepared.

26. Kleinfelder will adjust vertical boundary at section 183+50. (Kleinfelder)

RESPONSE: Vertical model boundary conditions for seepage models representing existing and proposed new conditions for model at Station 183+50 have been reviewed and found to be correct. Vertical (elevation) scales on the model cross-section drawing (Plate 4-2) and the seepage/stability analyses have been reviewed and corrected.

27. BOSC suggested that there be a full head boundary on the waterside of the models and based on groundwater levels shown in the borings it was likely that the foundation was saturated. (Kleinfelder)

RESPONSE: Previous seepage analysis was performed for some models during the PIR-level evaluation with the vertical waterside boundary of the models set as a no-flow boundary and a fixed-head boundary condition set to the design WSE was used along the waterside slope of the levee and the waterside ground surface. However, after review of the PIR modeling, all seepage analysis performed for the Draft and Final GBODR was performed with a constant head boundary condition equal to the design WSE applied to the vertical waterside of the models.

28. BOSC suggested additional hydraulic runs to determine approximate frequency of the 200-year +3 foot event. (MBK)

RESPONSE: Hydraulic evaluations are concluding with the new topographic information and a response has not yet been prepared.

COMMENTS FROM DWR

29. (Feb. 2, 2010 email from CR) It appears that the change from the seepage berm to cutoff wall upstream of Station 221+00 is based on tieing the wall into a silt/clay later between elev 20 and 35. Based on their logs, this layer pinches out downstream of the dairy but appears to be continuous in the upstream direction. I suspect that seepage analyses with the cutoff wall will bring the exit gradient at Station 243 to acceptable criteria. I would think, however, they they should take a closer look at Station 221 where the wall raises from elev 0 to elev 25 as this is where the silt/clay layer is less than 10 feet and pinches out immediately downstream. I know they are planning some add'l CPTs but don't know if they plan any at the point where the wall transitions. It may make sense to confirm the silt/clay or extend the deeper wall further upstream to ensure that it ties in.

RESPONSE: Geotechnical borings KB-08-18 (Station 221+00) and KB-08-19 (Station 224+20) both indicate an acceptable silt/clay layer to tie the reduced depth wall into. During construction of the wall, field geologist will verify that the wall is tieing into an appropriate layer and the wall will be deepened in the upstream direction if required.

30. (Feb. 2, 2010 email from CR) I also believe this transition is near the dairy which has a waste ditch directly adjacent to the levee. I seem to recall that under the previous design with seepage berms, they were planning on relocating the ponds. I'm assuming they would still want to relocate the pond.

RESPONSE: Geotechnical evaluation based on field topographic cross sections found that the ponds do not present an excess gradient problem, exit gradients are less than criteria. TRLIA does not plan on touching or relocating the Dairy Waste Ponds.

31. (DOE Feb. 2, 2010 Comment) From Sta.215+00 to Sta 304+00, HEM Differential Resistivity indicates foundation consists of coarse material with high resistivity, while the borings, KB-08-21,26,29,31 encountered fine grained less resistive material. Is that the reason the proposed cutoff wall was terminated at Sta. 215+00?

RESPONSE: After additional evaluation, the TRLIA Project Team selected to extend the slurry wall feature further upstream. The slurry wall now extends to Station 288+00 as reflected in the 60% Plans. Only the final 1700 feet of levee now has a seepage berm. A seepage berm was used in this reach due to the depth of gravels and sands in the foundation.