Analysis of Delta Levees Compliance of HMP and PL84-99 Design Geometry

Transmittal Document

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This document is a transmittal document concerning a delivery of analysis files from California Department of Water Resources to the Delta Stewardship Council. Enclosed with this transmittal document are various documents which comprise the analysis of the Delta levees level of compliance with HMP & PL84-99 design geometries. The documents include a disclaimer document, a document explaining some analysis assumptions and limitations, a master analysis Excel spreadsheet, and various digital map products. The purpose of this transmittal document is to explain the contents of the various enclosed files.

The transmittal concerns the version of this analysis dated 12/13/2011. As it is anticipated that this analysis will be updated in the future as new information is received, it is critical to note the version of the analysis when considering the interpretation of the levee conditions.

Disclaimer Document

Readers shall read the contents of the disclaimer document and agree to the conditions described therein prior to opening, copying, or otherwise using any of the other files.

Assumptions & Limitations Document

Readers will greatly benefit in their interpretation of the results and appropriate uses of this analysis if they read the Assumptions & Limitations document. The document details many of the critical analysis assumptions and allows users to better understand the accuracy of the analysis, the issues involved, and for considering Delta levee geometry assessments in general.

Master Analysis Spreadsheet

The master analysis spreadsheet, version dated 2011.12.12, represents the consolidated analysis of Delta levee achievement of HMP and PL84-99 design geometries. The analysis included in this spreadsheet includes analysis of Delta levee design compliance as conducted by both DWR and the respective Delta local maintaining agency (LMA) engineers. The spreadsheet includes individual worksheets for each Delta LMA, with individual records for each analyzed cross section within the respective LMA. The interval between consolidated analysis cross sections is generally 1000 feet. The information includes separate results from DWR and the LMA engineers, as well as secondary classifications, as explained below. The information from the individual LMA compliance maps is based upon the information in these individual LMA worksheets.

The spreadsheet also includes a summary worksheet which compiled the headline information from each LMA into a Delta-wide format. The information in the Delta-wide compliance maps is based upon the information in this summary worksheet.

For the individual LMA worksheets displaying the analysis results by cross section, please use the following field description/data dictionary:

RD Name: the commonly used shorthand region name for the LMA, generally an island or tract.

Station: a modified label of the LMA levee station marker corresponding to where the analysis was conducted. LMA engineers and surveyors conventionally use, for example, "1+00" and "35+00" to designate a location 100 and 3500 feet, respectively, from a starting reference point on an island's levee system. However, in a few cases other distance measurement units were utilized. To avoid confusion, we conflated the "+00" conventions to hundreds of feet and standardized the entire system accordingly.

Classification From LIDAR Analysis: DWR conducted an entire-Delta analysis of the Delta levee system's achievement of design geometry using the 2007-08 LIDAR dataset. That analysis was conducted at 50 foot intervals. The values for this field represent the LIDAR-based analysis result sub-sampled at the appropriate 1000-foot cross section used for this consolidated analysis.

Recent Construction: If DWR is aware of any recent (2008-2011) construction activities on LMA levees at specific cross sections, it is indicated here.

Planned Construction: If DWR is aware of any levee construction projects that are planned to occur for an LMA's levees, it is indicated here. The levees flagged as such are generally projects approved for funding by DWR's recent Special Projects PSPs.

Date of Recent RD Survey: LMA engineers and surveyors conduct their own survey work and, if cost-shared by DWR's Delta Levees Program, generally submit copies of those surveys. If DWR has in its possession such a survey at the respective cross section, it is indicated here by the date of the most recent survey in DWR files. For a survey to qualify for this project, the cross section survey must be supplied at the specific LMA levee station identified for each record. A profile survey, by itself, is not considered sufficient, since the side slopes must be analyzed along with the freeboard. Furthermore, cross section surveys between LMA levee stations used in this analysis are not included here. The cross section surveys have to be more or less right at the indicated LMA levee station.

Classification From RD Survey: For the LMA engineer-supplied surveys submitted, if it can be determined what level of design geometry (HMP or PL84-99) is achieved by the levee cross section, it is included here. In many cases, the LMA engineer-supplied surveys include a template showing the design prism on the cross section. In such cases, DWR simply scored the compliance as compared to those design prisms. In some cases, generally because of file resolution, cross section survey submittal quality, or age, it was not possible to determine the design geometry compliance. In such cases, the value stated is "indeterminate".

Classification After RD/LIDAR: The values in this field represent the initial consolidated classification for each levee cross section. The "consolidation" refers to looking at both the DWR/LIDAR-based classification and the LMA engineer survey-derived classification. In all cases, if there is a valid RD

engineer survey-derived classification available from 2005 or more recent, that is the classification that is used. If there is not, the DWR/LIDAR-based classification is used.

Classification After Removing LIDAR Exceptions: As discussed in more detail in the companion document outlining assumptions and limitations of use, the LIDAR analysis suffers from some drawbacks. In the case of more serious drawbacks related to presence of excessive vegetation, excessive structures, or errors in the LIDAR-derived levee centerline, such cross sections were omitted from further analysis. This modification only affects cross sections classified by LIDAR, and not those as determined from LMA engineer-supplied surveys.

Classifications With HMP Subdivided: Due to some of the accuracy issues inherent in using LIDAR data, the "Below HMP" classification was divided into two categories. "Minimally Below HMP" is distinct from "Below HMP" for LIDAR-based analysis cross sections which had minimum freeboard amounts less than one foot in deficit as determined from a more involved levee profile analysis. The levee profile analysis evaluated levee freeboard anywhere from halfway before the previous cross section location, through the cross section itself, to halfway towards the next cross section down the levee. For example, if considering station 1000, the analysis analyzed the entire levee from station 500 to 1500. If, say, the minimum freeboard from HMP design height was .5 feet, the levee is considered to be "Minimally Below HMP". If the minimum freeboard is more than a foot in deficit of achieving HMP, the section is considered to be "Below HMP." **Critically, the values in this field are what were used to generate the final individual LMA levee system compliance maps.**

Final Source: The values in this field indicate whether the final classification is derived from the DWR/LIDAR-based analysis, or whether they are from LMA engineer-supplied surveys. If nothing is indicated, there is no final classification for the respective cross section, and the cross section was excluded from any further analysis.

Island Summary: The mini-table shown after Island Summary indicates the counted number of analyzed sections meeting each design geometry criteria. It should be noted that a higher level of classification should still be interpreted as meeting a lower design geometry standard. In effect, this means that a cross section meeting PL84-99 should also be considered to actually meet HMP as well, since the PL84-99 standard is a larger and wider levee than is the HMP standard.

For the worksheet titled "Summary", which displays summarized headline results per LMA for the entire Delta, please use the following field description/data dictionary:

The information shown in this worksheet consists of essentially the same information repeated in three different ways. It includes the results of the consolidated classification analysis for each LMA, first presented as the raw information for the cross sections shown in the individual LMA worksheets, then converted into mileage, and then converted as a percentage of the LMA's total analyzed levee mileage.

At the bottom of the page, the totals are summed for the entire Delta, and displayed as above.

The following fields indicate the following:

"Below HMP": As described above, if a levee is below HMP on the LMA engineer-supplied survey, or is below HMP according to the LIDAR analysis and more than one foot of freeboard in deficit to HMP crown elevation somewhere along the profile line running through the levee cross section, it is considered to be "Below HMP".

"Minimally Below HMP": As described above, if a levee is below HMP according to the LIDAR analysis but has less than one foot of freeboard deficit compared to HMP crown elevation somewhere along the profile line running through the levee cross section, it is considered to be "Minimally Below HMP".

"HMP But Below PL84-99": If a levee meets the HMP design geometry criteria, but not the PL84-99 design geometry criteria, it is tallied in the fields for "HMP But Below PL84-99".

"PL84-99": If a levee meets the PL84-99 design geometry criteria, it is tallied in the fields for "PL84-99". Note that a levee that meets PL84-99 also meets HMP.

In the case of the last section indicating percent as a fraction of LMA analyzed mileage, an additional field occurs:

"Combined Below HMP": If a levee is either "Below HMP" or "Minimally Below HMP", it is tallied as "Combined Below HMP". The existence of this field is for the user to make their own decision about whether or not to evaluate the results in the context of LIDAR-derived uncertainty towards meeting the HMP design geometry criteria.

One other important point to note is that because we removed some cross sections for this analysis, the analyzed levee system mileage is frequently less than the total levee system length for any given LMA. Do not use the levee system lengths shown here as the total actual LMA levee system length. Also, the removal of sections can also alter the proportion of a levee meeting the various design geometry classifications.

Digital Map Products

Two types of digital map products are provided as part of this transmittal in .pdf format. Maps of the data for the levee system for each analyzed LMA are included. The individual island maps show the results of the consolidated analysis plotted along the LMA levee profile line, with colors corresponding to the final classification. If a portion of the LMA levee profile is missing, that is due to the fact that the record for that cross section was left unclassified according to reasons outlined above. The maps show the information collected about known recent and planned levee construction projects plotted adjacent to the LMA levee profile line. The analysis results are also indicated in tabular format for reference.

The other type of digital map products are the two maps showing overall summarized compliance with the PL84-99 geometry and with HMP geometry. The colors relate to the percentage of each LMA's levee system that achieves the respective standard design geometry. For the map with the HMP geometry, additional information is provided on the percentage of LMA levee system that is either "Below HMP" or "Minimally Below HMP", as differentiated above.