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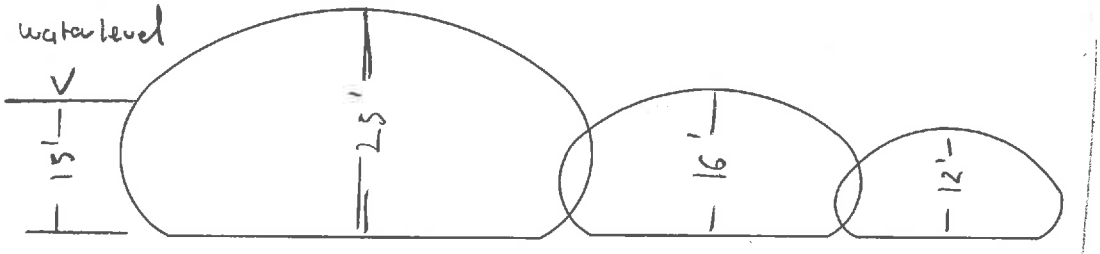
JOB California Aqueduct Canal Liner Repair
ELEMENT Aquadam Stability Calculation
SHEET NO. 1 OF 3
CALCULATED BY PMG DATE Feb 26 2018
CHECKED BY RAO JN KWE 1801

This calculation is for the stability of (3) Aquadams in the following configuration



The factor of safety against overturn for a single 25' high dam is 3.4

The factor of safety against sliding for all three dams in the configuration shown is 3.57

REGISTERED PROFESSIONAL ENGINEER
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Feb 26 2018
CIVIL
STATE OF CALIFORNIA

Aquadam Stability Calculation
California Aquaduct Canal Liner and Embankment Repair

Whitchurch engineering job no. KWE1801
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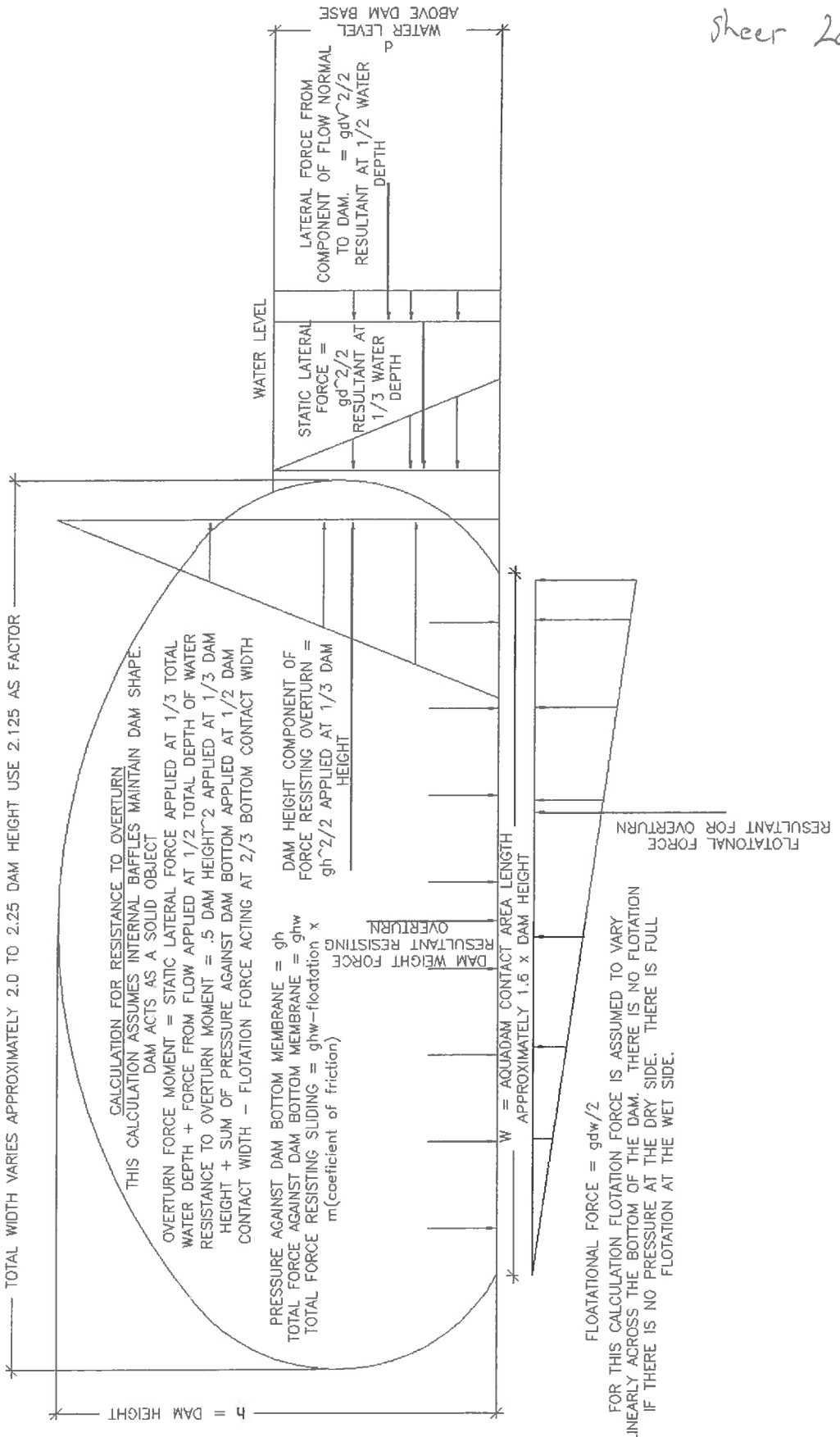
Sheer 2 of 3



Aquadam Stability Calculation

California Aquaduct Canal Liner and Embankment Repair

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This calculation assumes the Aqua Dam flotational forces act across the dam contact width. The bottom of the canal is at elevation 198'. The water level shown on the drawings is elevation 229.5'. We have been instructed that the water level will be reduced to, and to calculate the water depth as 15'. The primary dam height will be 25'. A secondary dam height 16' and a third dam height 12'. The top of the embankment is elevation 231'. As any movement of the dam will remove slime from the concrete surface, the coefficient of friction is estimated at the lower range of rubber on wet concrete.

Single dam		
Dam height, h	25 feet	7.6 Meters
height of retained water, d	15 feet	4.6 Meters
Temp of water in dam and being retained assumed similar	68 deg F	20 deg C
Density of water, g	62.3 lbs/cuft	998.0 Kg/cuMeter
flow rate normal to dam, v	0 feet/second	0.0 Meters/Second
Coeficient of friction, m	0.3	0.3
Contact width across bottom of dam approximately , w	40 feet	12.2 Meters
Lateral force from flow = dgv^2/(2*Gc)	0 lbs/ft dam length	0.0 N/M dam length
Lateral force from static height = gd^2/2	7,009 lbs/ft dam length	1575.6 N/M dam length
Total lateral force	7,009 lbs/ft dam length	1575.6 N/M dam length
Resistance to sliding		
Total pressure acting on interior dam membrane contact width, = ghw	62,300 lbs/ft dam length	14005.6 N/M dam length
Flotation force from static height = gdw/2	18,690 lbs/ft dam length	4201.7 N/M dam length
Net gravitational force creating friction = ghw – gdw/2	43,610 lbs/ft dam length	9803.9 N/M dam length
Frictional force resisting lateral movement	13,083 lbs/ft dam length	2941.2 N/M dam length
Factor of safety against lateral displacement	1.87	1.87
Resistance to overturn		
Moment imparted by static depth = .3333*d*gd^2/2	35,040 ftlbs/ft dam length	7877.4 N/M dam length
Moment imparted by flow = .5*d*dgv^2/2	0 ftlbs/ft dam length	0.0 N/M dam length
Moment imparted by flotation = .5*w*gdw/2	373,800 ftlbs/ft dam length	84033.6 N/M dam length
Sum of overturn moments	408,840 ftlbs/ft dam length	91911.0 N/M dam length
Resisting lateral moment dam height water weight = .3333h*gh^2/2	162,223 ftlbs/ft dam length	36469.3 N/M dam length
Resisting vertical moment dam width water weight = .5w*ghw	1246000 ftlbs/ft dam length	280112.0 N/M dam length
Sum of resisting moments	1,408,223 ftlbs/ft dam length	316581.3 N/M dam length
Factor of safety against overturn = resisting moment/overturn moment	3.4	3.4
Lateral force resistance with second dam as back up		
Second dam height, h	16 feet	4.9 Meters
Second dam contact width across bottom of dam, w	25.6 feet	7.8 Meters
Frictional force resisting lateral movement = ghwm	7655 lbs/ft dam length	1721.0 N/M dam length
Combined frictional force resisting lateral force	20738 lbs/ft dam length	4662.2 N/M dam length
Combined factor of safety against sliding	2.96	2.96
Lateral force resistance with third dam as back up		
Third dam height	12 feet	3.7 Meters
Third dam contact width across bottom	19.2 feet	5.9 Meters
Frictional force resisting lateral movement = ghwm	4306 lbs/ft dam length	968.1 N/M dam length
Combined frictional force resisting lateral force	25045 lbs/ft dam length	5630.3 N/M dam length
Combined factor of safety against sliding	3.57	3.57