

**IMPIANTO DI RIGOSO – DIGA DI LAGO BALLANO E LAGO VERDE:
SERVIZI DI PROGETTAZIONE**



**RECUPERO DELLA DIGA DI LAGO BALLANO
PROGETTO DEFINITIVO**

 
con la consulenza di 

TITOLO

**RELAZIONE DI CALCOLO
CORPO DIGA – TABULATI CALCOLO**

CODICE OPERA

C732

CODICE ELABORATO

R106-A1

REVISIONE	DATA	NOTE
1	27/06/2023	Prima revisione in seguito all'Istruttoria della DGD del 15/09/2022

Contratto: n° 1401366462

Oggetto: **IMPIANTO DI RIGOSO - DIGA DI LAGO BALLANO E LAGO VERDE:
SERVIZI DI PROGETTAZIONE**

Data contratto: 05 Giugno 2020

Durata: 36 mesi

Cliente: **Enel Green Power S.p.A.**

Gestore del Contratto Ing. Federica Cella

Gestione Tecnica Ing. Luca Dal Canto

ATI: STUDIO SPERI Società di ingegneria S.r.l. (Mandataria)
Frosio Next S.r.l. (Mandante)
Waterways S.r.l. (Consulente)

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Storia del documento

Revisione	Data	Redatto	Verificato	Approvato	Note
1	19/05/2023	Gioele Filippi Federico Bisci	Gianluca Gatto	Giorgio Lupoi	Prima revisione in seguito all'Istruttoria della DGD del 15/09/2022.
0	28/04/2023	Gioele Filippi Federico Bisci	Gianluca Gatto	Giorgio Lupoi	Prima emissione

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Le Società sottolineano inoltre che varie sezioni di questo rapporto si basano su dati forniti da o provenienti da fonti di terze parti. **STUDIO SPERI Società di ingegneria S.r.l. e Frosio Next S.r.l.** non si assumono alcuna responsabilità per perdite o danni subiti dal cliente o da terzi a causa di errori o inesattezze in tali dati da terze parti

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1. INTRODUZIONE

Il presente rapporto ha lo scopo di raccogliere i tabulati di calcolo relativi alle verifiche di sicurezza della diga di Lago Ballano (PR) ed è parte integrante del progetto definitivo di miglioramento sismico e di recupero dello sbarramento, redatto ai sensi della normativa nazionale vigente (MIT19-NTC18 e NTD14).

Questa versione del rapporto risulta essere la prima revisione del documento originario, effettuata in seguito all'Istruttoria della Direzione Generale Dighe (DGD) del 15/09/2022. Per semplicità di trattazione, le parti modificate rispetto alla prima emissione, sono riportate evidenziate in ciano.

Per tutte le informazioni relative al progetto e alle verifiche di sicurezza è possibile far riferimento alla relazione generale (C732-R101) e alla relazione di calcolo (C732-R106).

L'attività di redigere il presente progetto definitivo fa parte di quelle indicate nel contratto di servizi n. 1401366462, tra il gestore dell'impianto, Enel Green Power Italia Srl, e l'Associazione Temporanea d'Impresa (di seguito ATI), composta dalla società mandataria STUDIO SPERI Società di Ingegneria S.r.l e dalla società mandante FROSIO NEXT S.r.l. La progettazione delle opere oggetto del contratto è stata eseguita con il contributo all'ATI della società Waterways S.r.l.

2. TABULATI DI CALCOLO



CADAM3D Version 2.5.11.1 - Report of input data

Project:
 Dam:
 Owner:
 Location:
 Date: 16/03/2022
 Engineer:
 Analysis performed by:

Foundation													
Segment Type	Start point		End point		Radius (m)	Starting Angle (deg.)	Rotation Angle (deg.)	Coefficient A	Coefficient B	Coefficient C	Coefficient D		
	X (m)	Y (m)	X (m)	Y (m)									
1-Linear	0	1326.40000	20.17000	1327.41000									
2-Linear	20.17000	1327.41000	20.17000	1330.89000									
Plane definition	Base failure plane												
	Upstream elevation (m)	Downstream elevation (m)											
Linear regression	.00000	.00000											
Compressive strength (kPa)	Tensile strength (kPa)	Friction angle (deg.)	Material properties of base contact										
			Peak shear strength Cohesion (kPa)	Minimal stress (kPa)	Friction angle (deg.)	Residual shear strength Cohesion (kPa)	Minimal stress (kPa)						
5000.000	0	55.000	0		0	55.000	0		0				
Foundation contour													
Point #	X (m)	Y (m)	Point #	X (m)	Y (m)	Point #	X (m)	Y (m)	Point #	X (m)	Y (m)		
1	0	1326.400	2	20.170	1327.410	3	20.170	1330.890					
Gravity dam													
Segment Type	Start point		End point		Radius (m)	Starting Angle (deg.)	Rotation Angle (deg.)	Coefficient A	Coefficient B	Coefficient C	Coefficient D		
	X (m)	Y (m)	X (m)	Y (m)									
1-Linear	0	1326.40000	0	1330.61000									
2-Linear	0	1330.61000	3.20000	1333.81000									
3-Linear	3.20000	1333.81000	7.69000	1342.80000									
4-Linear	7.69000	1342.80000	7.69000	1343.20000									
5-Linear	7.69000	1343.20000	12.41000	1343.20000									
6-Linear	12.41000	1343.20000	12.41000	1342.80000									
7-Linear	12.41000	1342.80000	20.17000	1330.89000									
Gravity dam width (m)													
1.000													
gravity dam contour													

Point #	X (m)	Y (m)	Point #	X (m)	Y (m)	Point #	X (m)	Y (m)	Point #	X (m)	Y (m)	
1	20.170	1330.890	2	20.170	1327.410	3	0	1326.400	4	0	1330.610	
5	3.200	1333.810	6	7.690	1342.800	7	7.690	1343.200	8	12.410	1343.200	
9	12.410	1342.800	10	20.170	1330.890							
Drainage system												
Gallery number	Gallery name	Gallery state	Position (X) of gallery (m)	Elevation (Y) of gallery (m)	Height (H1) of gallery (m)	Width (L1) of gallery (m)	Ceiling geometry	Presence of U/S gutter	Presence of D/S gutter	Height (H2) of gutters (m)	Width (L2) of gutters (m)	
1	DRAINAGE - 1	Active	1.200	1328.100	2.600	2.000	Round	no	yes	0.200	0.300	
	Drainage above gallery											
	State of drains	Efficiency of drains	Maximum elevation (m)	inclination angle (deg.)	Position (dX) of drains (m)	Spacing (dZ) of drains (m)	Diameter of drains (m)					
	Active	0.350	1343.200	62.700	1.400	4.000	0.100					
	Drainage below gallery											
	State of drains	Efficiency of drains	Maximum elevation (m)	inclination angle (deg.)	Position (dX) of drains (m)	Spacing (dZ) of drains (m)	Diameter of drains (m)					
	Active	0.350	1321.400	-90.000	1.700	4.000	0.100					
Volumes and voids												
Additional masses												
Mass number	Name	Co-ordinate X (m)	Co-ordinate Y (m)	Co-ordinate Z (m)	Mass X (ton)	Mass Y (ton)	Mass Z (ton)	Mass is active	Color			
Materials												
	Gravitational Constant (m/s²)	Unit Mass										
	9.80665	Concrete (kg/m³)	Water (kg/m³)									
		2240.00000	1000.00000									
Material name	Compressive strength (kPa)	Tensile strength (kPa)	Model	Friction angle (deg.)	Peak shear strength Friction angle 2 (deg.)	Cohesion (kPa)	Minimal stress (kPa)	Model	Friction angle (deg.)	Residual shear strength Friction angle 2 (deg.)	Cohesion (kPa)	Minimal stress (kPa)
Base	5000.000	0	Option 2	55.000	N/A	0	0	Option 2	55.000	N/A	0	0
AVG DIGA	5000.000	1300.000	Option 2	45.000	N/A	330.000	0	Option 2	45.000	N/A	330.000	0
lift joints												
Joint number	Material name	U/S point		D/S point		Length	Area	Centroid		Inertia		
		X (m)	Y (m)	X (m)	Y (m)	(m)	(m²)	L (m)	Z (m)	LL (m**4)	ZZ (m**4)	LZ (m**4)
1	AVG DIGA	6.29156	1340.00000	14.23435	1340.00000	7.94279	7.94279	10.26295	0	0.66190	41.75787	0
2	AVG DIGA	5.29267	1338.00000	15.53746	1338.00000	10.24479	10.24479	10.41506	0	0.85373	89.60401	0
3	AVG DIGA	4.29378	1336.00000	16.84056	1336.00000	12.54678	12.54678	10.56717	0	1.04557	164.59463	0
4	AVG DIGA	3.29489	1334.00000	18.14367	1334.00000	14.84877	14.84877	10.71928	0	1.23740	272.82906	0
5	AVG DIGA	1.39000	1332.00000	19.44678	1332.00000	18.05678	18.05678	10.41839	0	1.50473	490.61336	0
6	AVG DIGA	0.39000	1331.00000	20.09833	1331.00000	19.70833	19.70833	10.24416	0	1.64236	637.92287	0
Base	Foundation	0	1326.40000	20.17000	1327.41000	20.19527	20.19527	10.09764	0	1.68294	686.38511	0
Pre-cracking of joints												
Joint	Upstream crack length		Downstream crack length									

number	(m)	(%)	(m)	(%)
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
Base	0	0	0	0

U/S Backfill													
Segment	Start point		End point		Radius	Starting Angle	Rotation	Coefficient	Coefficient	Coefficient	Coefficient		
Type	X (m)	Y (m)	X (m)	Y (m)	(m)	(deg.)	(deg.)	A	B	C	D		
U/S Backfill state		Method in use for static analyses											
Disabled		Earth pressure at rest (Novak, 1996)											
Voluminal weight (kN/m³)	Earth pressure coefficient (K0)	U/S Backfill internal friction angle (deg)	U/S Backfill-concrete friction angle (deg)	Determination of upstream face angle	User defined upstream face angle (deg)	Determination of failure angle	User defined failure angle (deg)						
19.12000	.39820	37.00000	23.00000	Computed	0	Computed	0						
Porosity	Coefficient of permeability m/s	determination of seismic failure angle	User defined seismic failure angle (deg)										
.40000	.001000	Same as internal friction angle			37.00000								

U/S Backfill contour													
Point #	X (m)	Y (m)	Point #	X (m)	Y (m)	Point #	X (m)	Y (m)	Point #	X (m)	Y (m)		

Backfill													
Segment	Start point		End point		Radius	Starting Angle	Rotation	Coefficient	Coefficient	Coefficient	Coefficient		
Type	X (m)	Y (m)	X (m)	Y (m)	(m)	(deg.)	(deg.)	A	B	C	D		
Backfill state		Method in use for static analyses											
Disabled		Earth pressure at rest (Novak, 1996)											
Voluminal weight (kN/m³)	Earth pressure coefficient (K0)	Backfill internal friction angle (deg)	Backfill-concrete friction angle (deg)	Determination of downstream face angle	User defined downstream face angle (deg)	Determination of failure angle	User defined failure angle (deg)						
19.12000	.39820	37.00000	23.00000	Computed	0	Computed	0						
Porosity	Coefficient of permeability m/s	determination of seismic failure angle	User defined seismic failure angle (deg)										
.40000	.001000	Same as internal friction angle			37.00000								

Backfill contour													
Point #	X (m)	Y (m)	Point #	X (m)	Y (m)	Point #	X (m)	Y (m)	Point #	X (m)	Y (m)		

Reservoirs				
Volumetric weight of water	Normal operating level		Flood level	
	Upstream level	Downstream level	Upstream level	Downstream level

(kN/m³)		(m)		(m)		(m)		(m)			
9.80665		1340.00000		1330.89000		1341.20000		1330.89000			
Ice cover						Floating debris					
Usual case		Unusual case				Applied Force (Fd)		Point of application (h1)		Maximum height (h2)	
Load/width (kN/m)		Thickness (m)		Load/width (kN/m)		Thickness (m)		(kN/m)		(m)	
98.00000		0.65000		98.00000		0.65000		0		0	
Silts						Crest overtopping					
Silts elevation (m)		Volumetric weight (kN/m³)		Internal friction angle (deg.)		Assumption for pressure		Upstream percentage (%)		Downstream percentage (%)	
1335.50000		7.00000		25.00000		At rest		0		0	
uplift pressures											
Joint number (m)		Joint elevation (m)		Type of distribution of uplift pressures							
				Normal level		Flood level					
1		1340.00000		USACE 1995		USACE 1995					
2		1338.00000		USACE 1995		USACE 1995					
3		1336.00000		USACE 1995		USACE 1995					
4		1334.00000		USACE 1995		USACE 1995					
5		1332.00000		USACE 1995		USACE 1995					
6		1331.00000		USACE 1995		USACE 1995					
Base		1326.40000		User defined		USACE 1995					
Post-tensioning											
Cable number		Cable name		Cable state		X (m)		Starting point Y (m)		Z (m)	
								Inclination of cable (deg.)		Lowest elevation (m)	
										Tension in cable (kN)	
Applied forces											
Force number		Name		Co-ordinate X (m)		Co-ordinate Y (m)		Co-ordinate Z (m)		Force X (kN)	
										Force Y (kN)	
										Force Z (kN)	
										Force is active	
										Color	
										Combinations	
Seismic data - Seismic coefficient method											
Return period (years)		Peak accelerations		Sustained Accelerations		Water compressibility		Depth limit (m)		Hydrostatic modified by vert. acc.	
		horizontal (g)		vertical (g)		horizontal (g)		vertical (g)		period (sec)	
2500		0.20000		0.05000		0.20000		0.05000		No	
										1.00000	
										No limit	
										No	
Calculation of hydrodynamic pressures in the event of submersion											
Method defining elevation		User-defined elevation (m)		Correction method		Correction of hydrodynamic pressures due to structure face's inclination					
						Angle of U/S face (deg.)		Angle of D/S face (deg.)		X u/s (m)	
Maximum structure elevation		1340.000		Generalized Westergaard		0		0		0	
										Y u/s (m)	
										X d/s (m)	
										Y d/s (m)	
										0	
										0	
										0	
										0	
Analysis options											
Type of analysis											
Nonlinear											
Tensile strength modification in function of the load combination types											
Usual cases				unusual cases				Extreme cases			

Crack initiation:		ft(ini.) = ft(joint)		ft(ini.) = ft(joint)		ft(ini.) = ft(joint)	
Crack propagation:		ft(prop.) = ft(joint)		ft(prop.) = ft(joint)		ft(prop.) = ft(joint)	
Dynamic magnification factor							
1.0							
Modification of uplift pressures upon cracking							
Static analyses		Seismic analyses		Post-seismic analyses			
Modified uplift pressures		Unchanged Uplift in crack		Modified uplift pressures			
Performance indicators							
Performance indicators		Load combinations					
		Usual	Unusual		Extreme		
			No drainage or Ice 150kN/m	Post-seismic	Seismic MDE	Flood	
Stresses - traction							
Lift joints:		0.0 * fc	0.025 * fc	0.033 * fc	0.1 * fc	1.0 * fc	
Rock-concrete contact:		0.0 * fc	0.0 * fc	0.0 * fc	0.1 * fc	1.0 * fc	
Foundation:		0.0 * fc	0.0 * fc	0.0 * fc	0.0 * fc	0.0 * fc	
Stresses - Compression							
Lift joints:		0.25 * fc	0.5 * fc	0.67 * fc	1.0 * fc	1.0 * fc	
Rock-concrete contact:		0.25 * fc	0.5 * fc	0.5 * fc	1.0 * fc	1.0 * fc	
Foundation:		0.25 * fc	0.5 * fc	0.5 * fc	0.67 * fc	0.5 * fc	
Resultant position:		1/3 median	1/2 median	inside section	inside section	inside section	
Sliding Safety Factors:							
Peak SSF without test:		1.15	2.0	2.0	1.15	1.15	
Peak SSF with tests:		1.15	1.5	1.5	1.15	1.15	
Residual SSF:		1.15	1.3	1.1	1.15	1.15	
Uplifting SF:		1.15	1.1	1.1	1.15	1.15	
Load combinations							
#1 Combination: Fondamentale							
Type: N1: Ice - usual							
D	Hu	Hd	I	Fd	U	S	P
1.0	1.3	0.0	1.5	0.0	1.3	1.3	0.0
Active: Yes							
F	Qh	Qv					
0.0	0.0	0.0					
#2 Combination: Massima piena							
Type: E1: Flood							
D	Hu	Hd	I	Fd	U	S	P
1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0
Active: Yes							
F	Qh	Qv					
0.0	0.0	0.0					
#3 Combination: E2A: Seismic event, MDE							
Type: E2: Seismic event, MDE							
D	Hu	Hd	I	Fd	U	S	P
1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0
Active: Yes							
F	Qh	Qv					
0.0	1.0	0.3					
#4 Combination: E2B: Seismic event, MDE							
Type: E2: Seismic event, MDE							
D	Hu	Hd	I	Fd	U	S	P
1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0
Active: Yes							
F	Qh	Qv					
0.0	1.0	-0.3					
#5 Combination: E2C: Seismic event, MDE							
Type: E2: Seismic event, MDE							
D	Hu	Hd	I	Fd	U	S	P
1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0
Active: Yes							
F	Qh	Qv					
0.0	-1.0	0.3					
#6 Combination: E2D: Seismic event, MDE							
Type: E2: Seismic event, MDE							
D	Hu	Hd	I	Fd	U	S	P
1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0
Initial conditions: None							
Active: Yes							
F	Qh	Qv					
0.0	-1.0	-0.3					

#7 Combination: E2E: Seismic event, MDE

Type: E2: Seismic event, MDE

Initial conditions: None

Active: Yes

D	Hu	Hd	I	Fd	U	S	P	F	Qh	Qv
1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.3	1.0

#8 Combination: E2F: Seismic event, MDE

Type: E2: Seismic event, MDE

Initial conditions: None

Active: Yes

D	Hu	Hd	I	Fd	U	S	P	F	Qh	Qv
1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.3	-1.0

#9 Combination: E2G: Seismic event, MDE

Type: E2: Seismic event, MDE

Initial conditions: None

Active: Yes

D	Hu	Hd	I	Fd	U	S	P	F	Qh	Qv
1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	-0.3	1.0

#10 Combination: E2H: Seismic event, MDE

Type: E2: Seismic event, MDE

Initial conditions: None

Active: Yes

D	Hu	Hd	I	Fd	U	S	P	F	Qh	Qv
1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	-0.3	-1.0

#11 Combination: Rara

Type: N1: Ice - usual

Initial conditions: None

Active: Yes

D	Hu	Hd	I	Fd	U	S	P	F	Qh	Qv
1.0	1.0	0.0	1.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0



CADAM3D Version:2.5.11.1 - Computed loads report

Project:
 Dam:
 Owner:
 Location:
 Date: 16/03/2022
 Analyst:
 Verified by:

Volumes and centroids: Structure

Élévation (m)	Volume (m³)	Centroid X (m)	Centroid Y (m)	Centroid Z (m)
1340.0	19.61591	10.15439	1341.44666	0
1338.0	37.80349	10.24476	1340.24925	0
1336.0	60.59505	10.33838	1339.01445	0
1334.0	87.99061	10.43396	1337.75585	0
1332.0	120.81009	10.47492	1336.45482	0
1331.0	139.69264	10.45534	1335.78408	0
Base	222.20880	10.16695	1333.24266	0

Volumes and centroids: Drainage systems

Élévation (m)	Volume (m³)	Centroid X (m)	Centroid Y (m)	Centroid Z (m)
1340.0	0	0	0	0
1338.0	0	0	0	0
1336.0	0	0	0	0
1334.0	0	0	0	0
1332.0	0	0	0	0
1331.0	0	0	0	0
Base	-4.83054	2.21056	1329.28690	0

Loads and moments: Structure

Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Position X (m)	Position Y (m)	Position Z (m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	-430.90063	0				0	0	46.77908
1338.0	0	-830.42527	0				0	0	141.42693
1336.0	0	-1331.08525	0				0	0	304.53809

1334.0	0	-1932.88057	0				0	0	551.49621
1332.0	0	-2653.82267	0				0	0	-150.03840
1331.0	0	-3068.61374	0				0	0	-648.00267
Base	0	-4881.23760	0				0	0	-399.99871
Loads and moments: Drainage systems									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Position X (m)	Position Y (m)	Position Z (m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0				0	0	0
1338.0	0	0	0				0	0	0
1336.0	0	0	0				0	0	0
1334.0	0	0	0				0	0	0
1332.0	0	0	0				0	0	0
1331.0	0	0	0				0	0	0
Base	0	106.11192	0				0	0	-835.57222
Loads and moments: All volumes, voids and masses									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Position X (m)	Position Y (m)	Position Z (m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	-430.90063	0				0	0	46.77908
1338.0	0	-830.42527	0				0	0	141.42693
1336.0	0	-1331.08525	0				0	0	304.53809
1334.0	0	-1932.88057	0				0	0	551.49621
1332.0	0	-2653.82267	0				0	0	-150.03840
1331.0	0	-3068.61374	0				0	0	-648.00267
Base	0	-4775.12568	0				0	0	-1235.57092
Loads and moments: Hydrostatic - operating U/S level - Winter									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Position X (m)	Position Y (m)	Position Z (m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0				0	0	0
1338.0	19.61330	-9.79574	0				.00000	.00000	33.84049
1336.0	78.45320	-39.18297	0				0	0	115.11285
1334.0	176.51970	-88.16167	0				.00000	.00000	213.44342
1332.0	313.81280	-219.77016	0				.00000	.00000	771.67323
1331.0	397.16933	-303.12669	0				.00000	.00000	1159.25817
Base	906.91899	-338.29382	0				.00000	.00000	-1003.00143
Loads and moments: Hydrostatic - operating D/S level - Winter									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Position X (m)	Position Y (m)	Position Z (m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0				0	0	0

1338.0	0	0	0				0	0	0	
1336.0	0	0	0				0	0	0	
1334.0	0	0	0				0	0	0	
1332.0	0	0	0				0	0	0	
1331.0	0	0	0				0	0	0	
Base	-59.38123	0	0				0	0	98.86974	
Loads and moments: Hydrostatic - flood U/S level										
Elevation	Force X	Force Y	Force Z	Position X	Position Y	Position Z	Moment XX (C.G.)	Moment YY (C.G.)	Moment ZZ (C.G.)	
(m)	(kN)	(kN)	(kN)	(m)	(m)	(m)	(kN·m)	(kN·m)	(kN·m)	
1340.0	7.06079	-3.52647	0				.00000	.00000	10.47617	
1338.0	50.21005	-25.07710	0				.00000	.00000	61.53780	
1336.0	132.58591	-66.21921	0				.00000	.00000	128.27725	
1334.0	254.18837	-126.95281	0				0	0	180.32086	
1332.0	415.01743	-280.97806	0				.00000	.00000	729.04177	
1331.0	510.14193	-376.10256	0				.00000	.00000	1108.95387	
Base	1074.02431	-415.85921	0				.00000	.00000	-1579.32167	
Loads and moments: Hydrostatic - flood D/S level										
Elevation	Force X	Force Y	Force Z	Position X	Position Y	Position Z	Moment XX (C.G.)	Moment YY (C.G.)	Moment ZZ (C.G.)	
(m)	(kN)	(kN)	(kN)	(m)	(m)	(m)	(kN·m)	(kN·m)	(kN·m)	
1340.0	0	0	0				0	0	0	
1338.0	0	0	0				0	0	0	
1336.0	0	0	0				0	0	0	
1334.0	0	0	0				0	0	0	
1332.0	0	0	0				0	0	0	
1331.0	0	0	0				0	0	0	
Base	-59.38123	0	0				0	0	98.86974	
Loads and moments: Silts										
Elevation	Force X	Force Y	Force Z	Position X	Position Y	Position Z	Moment XX (C.G.)	Moment YY (C.G.)	Moment ZZ (C.G.)	
(m)	(kN)	(kN)	(kN)	(m)	(m)	(m)	(kN·m)	(kN·m)	(kN·m)	
1340.0	0	0	0				0	0	0	
1338.0	0	0	0				0	0	0	
1336.0	0	0	0				0	0	0	
1334.0	4.54688	-3.93312	0				0	0	25.94538	
1332.0	24.75524	-37.87127	0				.00000	.00000	276.29787	
1331.0	40.92193	-65.87127	0				.00000	.00000	499.69798	
Base	167.34544	-78.68862	0				.00000	.00000	254.28965	
Loads and moments: Uplifts (uncracked) - operating level - winter										
Élévation	Force X	Force Y	Force Z	Normal	Moment XX	Moment YY	Moment ZZ	Moment XX (C.G.)	Moment YY (C.G.)	Moment ZZ (C.G.)

(m)	(kN)	(kN)	(kN)	(kN)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)
1340.0	0	0	0	0	0	0	0	0	0	0
1338.0	0	73.59986	0	73.59986	.00000	0	-524.32342	.00000	0	-147.31603
1336.0	0	176.31781	0	176.31781	.00000	0	-1530.24792	.00000	0	-424.13747
1334.0	0	308.15387	0	308.15387	.00000	0	-3151.29762	.00000	0	-863.44389
1332.0	0	504.64759	0	504.64759	.00000	0	-6293.66517	.00000	0	-1737.51094
1331.0	0	622.57591	0	622.57591	.00000	0	-8485.33413	.00000	0	-2350.36862
Base	-53.46259	1067.66371	0	1069.00143	.00000	.00000	-14661.31982	.00000	.00000	-3866.93265
Loads and moments: Uplifts (uncracked) without drainage										
Élévation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Normal (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0	0
1338.0	0	100.46703	0	100.46703	.00000	0	-686.17552	.00000	0	-171.54388
1336.0	0	246.08377	0	246.08377	.00000	0	-2058.37272	.00000	0	-514.59318
1334.0	0	436.85021	0	436.85021	0	0	-4324.46032	0	0	-1081.11508
1332.0	0	708.30592	0	708.30592	.00000	0	-8526.48083	.00000	0	-2131.62021
1331.0	0	869.72709	0	869.72709	.00000	0	-11427.24512	.00000	0	-2856.81128
Base	-53.46259	1067.66371	0	1069.00143	.00000	.00000	-14661.31982	.00000	.00000	-3866.93265
Loads and moments: Uplifts (uncracked) - flood level										
Élévation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Normal (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	35.42448	0	35.42448	.00000	0	-196.81856	.00000	0	-56.13391
1338.0	0	117.75977	0	117.75977	.00000	0	-838.91748	.00000	0	-235.70565
1336.0	0	229.21316	0	229.21316	.00000	0	-1989.32230	.00000	0	-551.37871
1334.0	0	369.78465	0	369.78465	.00000	0	-3781.55714	.00000	0	-1036.13267
1332.0	0	580.34473	0	580.34473	.00000	0	-7237.71495	.00000	0	-1998.13758
1331.0	0	705.58604	0	705.58604	.00000	0	-9616.71201	.00000	0	-2663.75111
Base	-73.72897	1472.38936	0	1474.23417	.00000	.00000	-17853.71987	.00000	.00000	-2967.44007
Loads and moments: Ice - usual case										
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Position X (m)	Position Y (m)	Position Z (m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)	
1340.0	0	0	0				0	0	0	
1338.0	98.00000	0	0				0	0	-164.15000	
1336.0	98.00000	0	0				0	0	-360.15000	
1334.0	98.00000	0	0				0	0	-556.15000	
1332.0	98.00000	0	0				0	0	-752.15000	
1331.0	98.00000	0	0				0	0	-850.15000	
Base	98.00000	0	0				0	0	-1251.46000	

Loads and moments: Ice - unusual case									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Position X (m)	Position Y (m)	Position Z (m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0				0	0	0
1338.0	98.00000	0	0				0	0	-164.15000
1336.0	98.00000	0	0				0	0	-360.15000
1334.0	98.00000	0	0				0	0	-556.15000
1332.0	98.00000	0	0				0	0	-752.15000
1331.0	98.00000	0	0				0	0	-850.15000
Base	98.00000	0	0				0	0	-1251.46000
Loads and moments: Floating debris									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Position X (m)	Position Y (m)	Position Z (m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0				0	0	0
1338.0	0	0	0				0	0	0
1336.0	0	0	0				0	0	0
1334.0	0	0	0				0	0	0
1332.0	0	0	0				0	0	0
1331.0	0	0	0				0	0	0
Base	0	0	0				0	0	0
Intensity of peak horizontal seismic forces (absolute values): Structure									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	-86.18013	0	0	0	0	124.67318	0	0	124.67318
1338.0	-166.08505	0	0	0	0	373.56719	0	0	373.56719
1336.0	-266.21705	0	0	0	0	802.49811	0	0	802.49811
1334.0	-386.57611	0	0	0	0	1451.92010	0	0	1451.92010
1332.0	-530.76453	0	0	0	0	2364.46066	0	0	2364.46066
1331.0	-613.72275	0	0	0	0	2936.09964	0	0	2936.09964
Base	-976.24752	0	0	0	0	5694.11679	0	0	6187.12178
Intensity of sustained horizontal seismic forces (absolute values): Structure									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	-86.18013	0	0	0	0	124.67318	0	0	124.67318
1338.0	-166.08505	0	0	0	0	373.56719	0	0	373.56719
1336.0	-266.21705	0	0	0	0	802.49811	0	0	802.49811
1334.0	-386.57611	0	0	0	0	1451.92010	0	0	1451.92010
1332.0	-530.76453	0	0	0	0	2364.46066	0	0	2364.46066
1331.0	-613.72275	0	0	0	0	2936.09964	0	0	2936.09964

Base	-976.24752	0	0	0	0	5694.11679	0	0	6187.12178
Intensity of peak horizontal seismic forces (absolute values): Drainage systems									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	0	0	0	0	0	0	0	0	0
1332.0	0	0	0	0	0	0	0	0	0
1331.0	0	0	0	0	0	0	0	0	0
Base	21.22238	0	0	0	0	-39.83228	0	0	-50.54959
Intensity of sustained horizontal seismic forces (absolute values): Drainage systems									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	0	0	0	0	0	0	0	0	0
1332.0	0	0	0	0	0	0	0	0	0
1331.0	0	0	0	0	0	0	0	0	0
Base	21.22238	0	0	0	0	-39.83228	0	0	-50.54959
Intensity of peak horizontal seismic forces (absolute values): All volumes,voids and masses									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	-86.18013	0	0	0	0	124.67318	0	0	124.67318
1338.0	-166.08505	0	0	0	0	373.56719	0	0	373.56719
1336.0	-266.21705	0	0	0	0	802.49811	0	0	802.49811
1334.0	-386.57611	0	0	0	0	1451.92010	0	0	1451.92010
1332.0	-530.76453	0	0	0	0	2364.46066	0	0	2364.46066
1331.0	-613.72275	0	0	0	0	2936.09964	0	0	2936.09964
Base	-955.02514	0	0	0	0	5654.28450	0	0	6136.57220
Intensity of sustained horizontal seismic forces (absolute values): All volumes,voids and masses									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	-86.18013	0	0	0	0	124.67318	0	0	124.67318
1338.0	-166.08505	0	0	0	0	373.56719	0	0	373.56719
1336.0	-266.21705	0	0	0	0	802.49811	0	0	802.49811
1334.0	-386.57611	0	0	0	0	1451.92010	0	0	1451.92010

1332.0	-530.76453	0	0	0	0	2364.46066	0	0	2364.46066
1331.0	-613.72275	0	0	0	0	2936.09964	0	0	2936.09964
Base	-955.02514	0	0	0	0	5654.28450	0	0	6136.57220
Intensity of peak horizontal seismic forces (absolute values): Hydrodynamic (horizontal) - upstream									
Elevation	Force X	Force Y	Force Z	Moment XX	Moment YY	Moment ZZ	Moment XX (C.G.)	Moment YY (C.G.)	Moment ZZ (C.G.)
(m)	(kN)	(kN)	(kN)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	-8.89001	4.44006	0	.00000	.00000	-36.60549	.00000	.00000	-13.86174
1336.0	-25.15325	12.56263	0	.00000	.00000	-107.34794	.00000	.00000	-28.53763
1334.0	-46.21469	23.08164	0	.00000	.00000	-204.17272	.00000	.00000	-32.80567
1332.0	-62.62659	38.38593	0	.00000	.00000	-386.74692	.00000	.00000	-40.18385
1331.0	-71.21775	46.97709	0	.00000	.00000	-509.94126	.00000	.00000	-47.02131
Base	-158.72017	50.46240	0	.00000	.00000	-228.84846	.00000	.00000	360.21852
Intensity of sustained horizontal seismic forces (absolute values): Hydrodynamic (horizontal) - upstream									
Elevation	Force X	Force Y	Force Z	Moment XX	Moment YY	Moment ZZ	Moment XX (C.G.)	Moment YY (C.G.)	Moment ZZ (C.G.)
(m)	(kN)	(kN)	(kN)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	-8.89001	4.44006	0	.00000	.00000	-36.60549	.00000	.00000	-13.86174
1336.0	-25.15325	12.56263	0	.00000	.00000	-107.34794	.00000	.00000	-28.53763
1334.0	-46.21469	23.08164	0	.00000	.00000	-204.17272	.00000	.00000	-32.80567
1332.0	-62.62659	38.38593	0	.00000	.00000	-386.74692	.00000	.00000	-40.18385
1331.0	-71.21775	46.97709	0	.00000	.00000	-509.94126	.00000	.00000	-47.02131
Base	-158.72017	50.46240	0	.00000	.00000	-228.84846	.00000	.00000	360.21852
Intensity of peak horizontal seismic forces (absolute values): Hydrodynamic (horizontal) - downstream									
Elevation	Force X	Force Y	Force Z	Moment XX	Moment YY	Moment ZZ	Moment XX (C.G.)	Moment YY (C.G.)	Moment ZZ (C.G.)
(m)	(kN)	(kN)	(kN)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	0	0	0	0	0	0	0	0	0
1332.0	0	0	0	0	0	0	0	0	0
1331.0	0	0	0	0	0	0	0	0	0
Base	0	0	0	0	0	0	0	0	0
Intensity of sustained horizontal seismic forces (absolute values): Hydrodynamic (horizontal) - downstream									
Elevation	Force X	Force Y	Force Z	Moment XX	Moment YY	Moment ZZ	Moment XX (C.G.)	Moment YY (C.G.)	Moment ZZ (C.G.)
(m)	(kN)	(kN)	(kN)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0

1336.0	0	0	0	0	0	0	0	0	0
1334.0	0	0	0	0	0	0	0	0	0
1332.0	0	0	0	0	0	0	0	0	0
1331.0	0	0	0	0	0	0	0	0	0
Base	0	0	0	0	0	0	0	0	0
Intensity of peak horizontal seismic forces (absolute values): Silts									
Elevation	Force X	Force Y	Force Z	Moment XX	Moment YY	Moment ZZ	Moment XX (C.G.)	Moment YY (C.G.)	Moment ZZ (C.G.)
(m)	(kN)	(kN)	(kN)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	-3.37174	1.68400	0	.00000	.00000	-22.47862	.00000	.00000	-9.97599
1332.0	-9.02359	7.00509	0	.00000	.00000	-103.63952	.00000	.00000	-40.39484
1331.0	-12.46291	10.44441	0	.00000	.00000	-163.59577	.00000	.00000	-60.67486
Base	-52.09153	11.89845	0	.00000	.00000	-105.98783	.00000	.00000	40.31429
Intensity of sustained horizontal seismic forces (absolute values): Silts									
Elevation	Force X	Force Y	Force Z	Moment XX	Moment YY	Moment ZZ	Moment XX (C.G.)	Moment YY (C.G.)	Moment ZZ (C.G.)
(m)	(kN)	(kN)	(kN)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	-3.37174	1.68400	0	.00000	.00000	-22.47862	.00000	.00000	-9.97599
1332.0	-9.02359	7.00509	0	.00000	.00000	-103.63952	.00000	.00000	-40.39484
1331.0	-12.46291	10.44441	0	.00000	.00000	-163.59577	.00000	.00000	-60.67486
Base	-52.09153	11.89845	0	.00000	.00000	-105.98783	.00000	.00000	40.31429
Intensity of peak vertical seismic forces (absolute values): Structure									
Elevation	Force X	Force Y	Force Z	Moment XX	Moment YY	Moment ZZ	Moment XX (C.G.)	Moment YY (C.G.)	Moment ZZ (C.G.)
(m)	(kN)	(kN)	(kN)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)
1340.0	0	-21.54503	0	0	0	87.90281	0	0	2.33895
1338.0	0	-41.52126	0	0	0	219.75958	0	0	7.07135
1336.0	0	-66.55426	0	0	0	432.74777	0	0	15.22690
1334.0	0	-96.64403	0	0	0	745.09752	0	0	27.57481
1332.0	0	-132.69113	0	0	0	1190.48511	0	0	-7.50192
1331.0	0	-153.43069	0	0	0	1479.53110	0	0	-32.40013
Base	0	-244.06188	0	0	0	2441.36412	0	0	-19.99994
Intensity of sustained vertical seismic forces (absolute values): Structure									
Elevation	Force X	Force Y	Force Z	Moment XX	Moment YY	Moment ZZ	Moment XX (C.G.)	Moment YY (C.G.)	Moment ZZ (C.G.)
(m)	(kN)	(kN)	(kN)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)

1340.0	0	-21.54503	0	0	0	87.90281	0	0	2.33895
1338.0	0	-41.52126	0	0	0	219.75958	0	0	7.07135
1336.0	0	-66.55426	0	0	0	432.74777	0	0	15.22690
1334.0	0	-96.64403	0	0	0	745.09752	0	0	27.57481
1332.0	0	-132.69113	0	0	0	1190.48511	0	0	-7.50192
1331.0	0	-153.43069	0	0	0	1479.53110	0	0	-32.40013
Base	0	-244.06188	0	0	0	2441.36412	0	0	-19.99994

Intensity of peak vertical seismic forces (absolute values): Drainage systems

Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	0	0	0	0	0	0	0	0	0
1332.0	0	0	0	0	0	0	0	0	0
1331.0	0	0	0	0	0	0	0	0	0
Base	0	5.30560	0	0	0	-95.28555	0	0	-41.77861

Intensity of sustained vertical seismic forces (absolute values): Drainage systems

Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	0	0	0	0	0	0	0	0	0
1332.0	0	0	0	0	0	0	0	0	0
1331.0	0	0	0	0	0	0	0	0	0
Base	0	5.30560	0	0	0	-95.28555	0	0	-41.77861

Intensity of peak vertical seismic forces (absolute values): All volumes,voids and masses

Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	-21.54503	0	0	0	87.90281	0	0	2.33895
1338.0	0	-41.52126	0	0	0	219.75958	0	0	7.07135
1336.0	0	-66.55426	0	0	0	432.74777	0	0	15.22690
1334.0	0	-96.64403	0	0	0	745.09752	0	0	27.57481
1332.0	0	-132.69113	0	0	0	1190.48511	0	0	-7.50192
1331.0	0	-153.43069	0	0	0	1479.53110	0	0	-32.40013
Base	0	-238.75628	0	0	0	2346.07858	0	0	-61.77855

Intensity of sustained vertical seismic forces (absolute values): All volumes,voids and masses

Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	-21.54503	0	0	0	87.90281	0	0	2.33895
1338.0	0	-41.52126	0	0	0	219.75958	0	0	7.07135
1336.0	0	-66.55426	0	0	0	432.74777	0	0	15.22690
1334.0	0	-96.64403	0	0	0	745.09752	0	0	27.57481
1332.0	0	-132.69113	0	0	0	1190.48511	0	0	-7.50192
1331.0	0	-153.43069	0	0	0	1479.53110	0	0	-32.40013
Base	0	-238.75628	0	0	0	2346.07858	0	0	-61.77855
Intensity of peak vertical seismic forces (absolute values): Hydrodynamic (vertical) - upstream									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	0	0	0	0	0	0	0	0	0
1332.0	0	0	0	0	0	0	0	0	0
1331.0	0	0	0	0	0	0	0	0	0
Base	0	0	0	0	0	0	0	0	0
Intensity of sustained vertical seismic forces (absolute values): Hydrodynamic (vertical) - upstream									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	0	0	0	0	0	0	0	0	0
1332.0	0	0	0	0	0	0	0	0	0
1331.0	0	0	0	0	0	0	0	0	0
Base	0	0	0	0	0	0	0	0	0
Intensity of peak vertical seismic forces (absolute values): Hydrodynamic (vertical) - downstream									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	0	0	0	0	0	0	0	0	0
1332.0	0	0	0	0	0	0	0	0	0
1331.0	0	0	0	0	0	0	0	0	0
Base	0	0	0	0	0	0	0	0	0

Intensity of sustained vertical seismic forces (absolute values): Hydrodynamic (vertical) - downstream

Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	0	0	0	0	0	0	0	0	0
1332.0	0	0	0	0	0	0	0	0	0
1331.0	0	0	0	0	0	0	0	0	0
Base	0	0	0	0	0	0	0	0	0

Intensity of peak vertical seismic forces (absolute values): Silts

Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	0	0	0	0	0	0	0	0	0
1332.0	0	0	0	0	0	0	0	0	0
1331.0	0	0	0	0	0	0	0	0	0
Base	0	0	0	0	0	0	0	0	0

Intensity of sustained vertical seismic forces (absolute values): Silts

Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	0	0	0	0	0	0	0	0	0
1332.0	0	0	0	0	0	0	0	0	0
1331.0	0	0	0	0	0	0	0	0	0
Base	0	0	0	0	0	0	0	0	0



CADAM3D Version 2.5.11.1 - Load Combinations report

Project:

Dam:

Owner:

Location:

Date: 16/03/2022

Engineer:

Analysis performed by:

Fondamentale [1.0*D + 1.3*Hu + 1.3*U + 1.5*I + 1.3*S]

Joint elevation (m)	Cracking at the U/S (% of joint)	Normal U/S stress (kPa)	U/S crack opening length (% of joint)	U/S uplift pressure (kPa)	Cracking at the D/S (% of joint)	Normal D/S stress (kPa)	D/S crack opening length (% of joint)	D/S uplift pressure (kPa)
1340.0	0	-58.69946	0	0	0	-49.80158	0	0
1338.0	0	-58.53782	0	19.61330	0	-87.38615	0	0
1336.0	0	-67.58623	0	39.22660	0	-116.17564	0	0
1334.0	0	-81.48463	0	58.83990	0	-141.02582	0	0
1332.0	0	-89.16905	0	78.45320	0	-169.20650	0	0
1331.0	0	-95.38169	0	88.25985	0	-182.56804	0	0
Base	0	-63.90346	0	133.37044	0	-332.03501	0	0
Joint elevation (m)	Normal load (kN)	Uplift force (kN)	Shear U/S-D/S (kN)	Shear left-right (kN)	Shear total (kN)	Moment ZZ at center (kN·m)	Moment XX at center (kN·m)	Moment YY at center (kN·m)
1340.0	-430.90063	0	0	0	0	46.77908	0	0
1338.0	-747.47992	95.67981	172.49729	0	172.49729	-252.31627	.00000	0
1336.0	-1152.80995	229.21316	248.98916	0	248.98916	-637.41891	.00000	0
1334.0	-1652.00377	400.60003	382.38656	0	382.38656	-1094.00040	.00000	0
1332.0	-2332.71466	656.04187	587.13845	0	587.13845	-2174.66519	.00000	0
1331.0	-2738.96239	809.34869	716.51863	0	716.51863	-2822.06389	.00000	0
Base	-3998.04247	1389.70186	1275.68983	0	1275.68983	-9113.09867	.00000	0
Joint elevation (m)	sliding peak	sliding residual	uplifting	flotation	overturning toward upstream	overturning toward downstream	Resultant position (joint %)	
1340.0	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	48.63321	
1338.0	23.93231	23.93231	8.81231	8.81231	14.66785	4.85470	53.29490	

1336.0	21.25895	21.25895	6.02942	6.02942	9.87633	3.60703	54.40692	
1334.0	17.13475	17.13475	5.12382	5.12382	8.21439	3.26553	54.45980	
1332.0	14.12180	14.12180	4.55574	4.55574	7.34111	3.02857	55.16286	
1331.0	12.89947	12.89947	4.38416	4.38416	7.05943	2.96390	55.22794	
Base	4.47585	4.47585	3.87691	3.87691	6.49473	2.49826	61.28675	
	1.15 (w/o test)	1.15	1.15	1.15			1/3 median	
	1.15 (with test)							
Massima piena [1.0*D + 1.0*Hu + 1.0*U + 1.0*S]								
Joint elevation	Cracking at the U/S	Normal U/S stress	U/S crack opening length	U/S uplift pressure	Cracking at the D/S	Normal D/S stress	D/S crack opening length	D/S uplift pressure
(m)	(% of joint)	(kPa)	(% of joint)	(kPa)	(% of joint)	(kPa)	(% of joint)	(kPa)
1340.0	0	-50.34120	0	11.76798	0	-50.12791	0	0
1338.0	0	-70.13982	0	31.38128	0	-73.88322	0	0
1336.0	0	-88.57994	0	50.99458	0	-97.61783	0	0
1334.0	0	-106.50709	0	70.60788	0	-121.65744	0	0
1332.0	0	-111.45842	0	90.22118	0	-153.51993	0	0
1331.0	0	-116.01742	0	100.02783	0	-168.63396	0	0
Base	0	-109.35979	0	145.13842	0	-272.00948	0	34.12714
Joint elevation	Normal load	Uplift force	Shear U/S-D/S	Shear left-right	Shear total	Moment ZZ at center	Moment XX at center	Moment YY at center
(m)	(kN)	(kN)	(kN)	(kN)	(kN)	(kN·m)	(kN·m)	(kN·m)
1340.0	-399.00261	35.42448	7.06079	0	7.06079	1.12135	.00000	0
1338.0	-737.74260	117.75977	50.21005	0	50.21005	-32.74092	.00000	0
1336.0	-1168.09131	229.21316	132.58591	0	132.58591	-118.56337	.00000	0
1334.0	-1693.98185	369.78465	258.73525	0	258.73525	-278.37022	.00000	0
1332.0	-2392.32726	580.34473	439.77267	0	439.77267	-1142.83634	.00000	0
1331.0	-2805.00153	705.58604	551.06386	0	551.06386	-1703.10193	.00000	0
Base	-3850.92805	1474.23417	976.27097	0	976.27097	-5528.04300	.00000	0
Joint elevation	sliding peak	sliding residual	Safety factors					Resultant position
(m)			uplifting	flotation	overturning toward upstream	overturning toward downstream	(joint %)	
1340.0	427.73186	427.73186	12.26347	12.26347	19.72812	9.05675	49.96462	
1338.0	82.02585	82.02585	7.26481	7.26481	11.37193	5.46560	50.43319	
1336.0	40.03841	40.03841	6.09609	6.09609	9.39922	4.62401	50.80899	
1334.0	25.48581	25.48581	5.58100	5.58100	8.52074	4.25221	51.10668	
1332.0	18.98950	18.98950	5.12225	5.12225	8.01592	3.82631	52.64559	
1331.0	16.89233	16.89233	4.97542	4.97542	7.84136	3.69716	53.08076	
Base	5.63337	5.63337	3.61215	3.61215	4.72631	2.86836	57.10815	

	1.15 (w/o test)	1.15	1.15	1.15				inside section
	1.15 (with test)							
E2A: Seismic event, MDE [1.0*D + 1.0*Hu + 1.0*U + 1.0*S + 1.0*Qh + 0.3*Qv]								
Joint elevation (m)	Cracking at the U/S (% of joint)	Normal U/S stress (kPa)	U/S crack opening length (% of joint)	U/S uplift pressure (kPa)	Cracking at the D/S (% of joint)	Normal D/S stress (kPa)	D/S crack opening length (% of joint)	D/S uplift pressure (kPa)
1340.0	0	-71.43704	0	0	0	-38.69152	0	0
1338.0	0	-97.89530	0	19.61330	0	-53.33039	0	0
1336.0	0	-125.25197	0	39.22660	0	-66.24800	0	0
1334.0	0	-152.50204	0	58.83990	0	-79.30820	0	0
1332.0	0	-159.51939	0	78.45320	0	-106.44535	0	0
1331.0	0	-165.10743	0	88.25985	0	-119.40613	0	0
Base	0	-213.88943	0	133.37044	0	-194.25404	0	0
Joint elevation (m)	Normal load (kN)	Uplift force (kN)	Shear U/S-D/S (kN)	Shear left-right (kN)	Shear total (kN)	Moment ZZ at center (kN·m)	Moment XX at center (kN·m)	Moment YY at center (kN·m)
1340.0	-437.36414	0	-86.18013	0	86.18013	172.15395	0	0
1338.0	-774.63747	73.59986	-155.36177	0	155.36177	389.77824	.00000	0
1336.0	-1201.35405	176.31781	-212.91710	0	212.91710	774.04203	.00000	0
1334.0	-1721.04906	308.15387	-255.09597	0	255.09597	1344.85201	.00000	0
1332.0	-2401.23282	504.64759	-263.84667	0	263.84667	1442.05316	.00000	0
1331.0	-2803.64349	622.57591	-259.31215	0	259.31215	1479.26827	.00000	0
Base	-4121.28419	1069.00143	-351.58741	0	351.58741	667.35610	.00000	0
Joint elevation (m)	sliding peak	sliding residual	uplifting	flotation	overturning toward upstream	overturning toward downstream	Resultant position (joint %)	
1340.0	35.48945	35.48945	100.00000	100.00000	13.55115	100.00000	45.04435	
1338.0	26.74672	26.74672	10.92617	11.52499	6.84542	9.31124	45.08848	
1336.0	25.08860	25.08860	7.36039	7.81357	5.40629	6.43089	44.86475	
1334.0	25.95551	25.95551	6.16957	6.58503	4.78896	5.48151	44.73752	
1332.0	31.68495	31.68495	5.36557	5.75824	4.67126	4.67374	46.67412	
1331.0	35.89262	35.89262	5.12302	5.50330	4.64241	4.43025	47.32284	
Base	16.74066	16.74066	4.46137	4.85527	3.78894	3.88395	49.19818	
	1.15 (w/o test)	1.15	1.15	1.15				inside section
	1.15 (with test)							
E2B: Seismic event, MDE [1.0*D + 1.0*Hu + 1.0*U + 1.0*S + 1.0*Qh - 0.3*Qv]								
Joint elevation	Cracking at the U/S	Normal U/S stress	U/S crack opening length	U/S uplift pressure	Cracking at the D/S	Normal D/S stress	D/S crack opening length	D/S uplift pressure

(m)	(% of joint)	(kPa)	(% of joint)	(kPa)	(% of joint)	(kPa)	(% of joint)	(kPa)
1340.0	0	-69.67606	0	0	0	-37.19748	0	0
1338.0	0	-95.22100	0	19.61330	0	-51.14119	0	0
1336.0	0	-121.72106	0	39.22660	0	-63.41353	0	0
1334.0	0	-148.14668	0	58.83990	0	-75.85330	0	0
1332.0	0	-155.19309	0	78.45320	0	-101.95339	0	0
1331.0	0	-160.73669	0	88.25985	0	-114.43479	0	0
Base	0	-207.35018	0	133.37044	0	-186.62418	0	0
Joint elevation (m)	Normal load (kN)	Uplift force (kN)	Shear U/S-D/S (kN)	Shear left-right (kN)	Shear total (kN)	Moment ZZ at center (kN·m)	Moment XX at center (kN·m)	Moment YY at center (kN·m)
1340.0	-424.43712	0	-86.18013	0	86.18013	170.75058	0	0
1338.0	-749.72471	73.59986	-155.36177	0	155.36177	385.53544	.00000	0
1336.0	-1161.42149	176.31781	-212.91710	0	212.91710	764.90589	.00000	0
1334.0	-1663.06264	308.15387	-255.09597	0	255.09597	1328.30712	.00000	0
1332.0	-2321.61814	504.64759	-263.84667	0	263.84667	1446.55431	.00000	0
1331.0	-2711.58508	622.57591	-259.31215	0	259.31215	1498.70835	.00000	0
Base	-3978.20968	1069.00143	-344.42305	0	344.42305	704.42322	.00000	0
Joint elevation (m)	sliding peak	sliding residual	uplifting	flotation	overturning toward upstream	overturning toward downstream	Resultant position (joint %)	
1340.0	35.33945	35.33945	66.66667	100.00000	11.12330	71.39436	44.93504	
1338.0	26.58636	26.58636	9.28459	11.18650	6.12722	8.15953	44.98051	
1336.0	24.90105	24.90105	6.56112	7.58709	4.93924	5.84976	44.75089	
1334.0	25.72819	25.72819	5.59520	6.39686	4.41735	5.05222	44.62103	
1332.0	31.38320	31.38320	4.93597	5.60047	4.32209	4.36907	46.54933	
1331.0	35.53761	35.53761	4.73483	5.35543	4.30034	4.16032	47.19557	
Base	16.49562	16.49562	4.15184	4.72143	3.55889	3.66024	49.12321	
	1.15 (w/o test)	1.15	1.15	1.15			inside section	
	1.15 (with test)							
E2C: Seismic event, MDE [1.0*D + 1.0*Hu + 1.0*U + 1.0*S - 1.0*Qh + 0.3*Qv]								
Joint elevation (m)	Cracking at the U/S (% of joint)	Normal U/S stress (kPa)	U/S crack opening length (% of joint)	U/S uplift pressure (kPa)	Cracking at the D/S (% of joint)	Normal D/S stress (kPa)	D/S crack opening length (% of joint)	D/S uplift pressure (kPa)
1340.0	0	-47.72287	0	0	0	-62.40569	0	0
1338.0	0	-57.63553	0	19.61330	0	-95.32375	0	0
1336.0	0	-68.25675	0	39.22660	0	-127.24828	0	0
1334.0	0	-79.14512	0	58.83990	0	-159.33656	0	0

1332.0	0	-80.48986	0	78.45320	0	-195.53006	0	0
1331.0	0	-83.55236	0	88.25985	0	-212.61546	0	0
Base	0	-33.49268	0	133.37044	0	-398.53525	0	0
Joint elevation (m)	Normal load (kN)	Uplift force (kN)	Shear U/S-D/S (kN)	Shear left-right (kN)	Shear total (kN)	Moment ZZ at center (kN·m)	Moment XX at center (kN·m)	Moment YY at center (kN·m)
1340.0	-437.36414	0	86.18013	0	86.18013	-77.19241	0	0
1338.0	-783.51760	73.59986	194.58837	0	194.58837	-329.63264	.00000	0
1336.0	-1226.47932	176.31781	369.82350	0	369.82350	-773.87893	.00000	0
1334.0	-1770.58034	308.15387	617.22913	0	617.22913	-1473.42488	.00000	0
1332.0	-2492.01487	504.64759	940.98276	0	940.98276	-3125.71079	.00000	0
1331.0	-2918.48648	622.57591	1135.49466	0	1135.49466	-4177.53865	.00000	0
Base	-4362.46080	1069.00143	1970.93093	0	1970.93093	-12406.85392	.00000	0
Joint elevation (m)	sliding peak	sliding residual	Safety factors uplifting	flotation	overturning toward upstream	overturning toward downstream	Resultant position (joint %)	
1340.0	35.48945	35.48945	100.00000	100.00000	100.00000	14.31284	52.22207	
1338.0	21.40054	21.40054	11.64564	11.64564	19.90849	5.27716	54.10656	
1336.0	14.51210	14.51210	7.95607	7.95607	13.41701	4.10969	55.02899	
1334.0	10.80746	10.80746	6.74577	6.74577	11.26313	3.66694	55.60430	
1332.0	8.98077	8.98077	5.93813	5.93813	10.09111	3.37191	56.94637	
1331.0	8.29791	8.29791	5.68776	5.68776	9.70285	3.28712	57.26295	
Base	3.16106	3.16106	5.07683	5.08087	9.14980	2.58371	64.08252	
	1.15 (w/o test)	1.15	1.15	1.15			inside section	
	1.15 (with test)							
E2D: Seismic event, MDE [1.0*D + 1.0*Hu + 1.0*U + 1.0*S - 1.0*Qh - 0.3*Qv]								
Joint elevation (m)	Cracking at the U/S (% of joint)	Normal U/S stress (kPa)	U/S crack opening length (% of joint)	U/S uplift pressure (kPa)	Cracking at the D/S (% of joint)	Normal D/S stress (kPa)	D/S crack opening length (% of joint)	D/S uplift pressure (kPa)
1340.0	0	-45.96189	0	0	0	-60.91164	0	0
1338.0	0	-54.96123	0	19.61330	0	-93.13455	0	0
1336.0	0	-64.72584	0	39.22660	0	-124.41380	0	0
1334.0	0	-74.78976	0	58.83990	0	-155.88165	0	0
1332.0	0	-76.16356	0	78.45320	0	-191.03810	0	0
1331.0	0	-79.18161	0	88.25985	0	-207.64413	0	0
Base	0	-26.95344	0	133.37044	0	-390.90539	0	0
Joint	Normal	Uplift	Shear	Shear	Shear	Moment ZZ	Moment XX	Moment YY

elevation (m)	load (kN)	force (kN)	U/S-D/S (kN)	left-right (kN)	total (kN)	at center (kN·m)	at center (kN·m)	at center (kN·m)
1340.0	-424.43712	0	86.18013	0	86.18013	-78.59579	0	0
1338.0	-758.60484	73.59986	194.58837	0	194.58837	-333.87545	.00000	0
1336.0	-1186.54676	176.31781	369.82350	0	369.82350	-783.01507	.00000	0
1334.0	-1712.59392	308.15387	617.22913	0	617.22913	-1489.96976	.00000	0
1332.0	-2412.40019	504.64759	940.98276	0	940.98276	-3121.20964	.00000	0
1331.0	-2826.42806	622.57591	1135.49466	0	1135.49466	-4158.09857	.00000	0
Base	-4219.38629	1069.00143	1978.09530	0	1978.09530	-12369.78679	.00000	0
Joint elevation (m)	sliding peak	sliding residual	uplifting	flotation	overturning toward upstream	overturning toward downstream	Resultant position (joint %)	
1340.0	35.33945	35.33945	66.66667	100.00000	71.66009	11.63936	52.33138	
1338.0	21.27252	21.27252	9.81522	11.30715	15.48212	4.83083	54.29602	
1336.0	14.40413	14.40413	7.04505	7.72959	11.24926	3.82804	55.25960	
1334.0	10.71351	10.71351	6.07966	6.55759	9.70723	3.44016	55.85912	
1332.0	8.89616	8.89616	5.43085	5.78037	8.82988	3.18875	57.16528	
1331.0	8.21684	8.21684	5.22735	5.53989	8.53554	3.11709	57.46461	
Base	3.04632	3.04632	4.69603	4.94704	8.16916	2.46177	64.51654	
	1.15 (w/o test)	1.15	1.15	1.15			inside section	
	1.15 (with test)							
E2E: Seismic event, MDE [1.0*D + 1.0*Hu + 1.0*U + 1.0*S + 0.3*Qh + 1.0*Qv]								
Joint elevation (m)	Cracking at the U/S (% of joint)	Normal U/S stress (kPa)	U/S crack opening length (% of joint)	U/S uplift pressure (kPa)	Cracking at the D/S (% of joint)	Normal D/S stress (kPa)	D/S crack opening length (% of joint)	D/S uplift pressure (kPa)
1340.0	0	-65.19156	0	0	0	-48.73454	0	0
1338.0	0	-86.92440	0	19.61330	0	-70.58214	0	0
1336.0	0	-109.42303	0	39.22660	0	-90.90499	0	0
1334.0	0	-131.90837	0	58.83990	0	-111.34885	0	0
1332.0	0	-136.90640	0	78.45320	0	-142.86562	0	0
1331.0	0	-141.66236	0	88.25985	0	-157.82929	0	0
Base	0	-158.37969	0	133.37044	0	-274.65397	0	0
Joint elevation (m)	Normal load (kN)	Uplift force (kN)	Shear U/S-D/S (kN)	Shear left-right (kN)	Shear total (kN)	Moment ZZ at center (kN·m)	Moment XX at center (kN·m)	Moment YY at center (kN·m)
1340.0	-452.44566	0	-25.85404	0	25.85404	86.51999	0	0
1338.0	-806.81040	73.59986	-32.87922	0	32.87922	142.93438	.00000	0
1336.0	-1256.73587	176.31781	-8.95789	0	8.95789	242.92853	.00000	0

1334.0	-1806.03583	308.15387	50.21782	0	50.21782	377.75747	.00000	0
1332.0	-2525.89033	504.64759	157.84363	0	157.84363	-161.91557	.00000	0
1331.0	-2951.24001	622.57591	228.87024	0	228.87024	-523.29424	.00000	0
Base	-4372.61626	1069.00143	452.93558	0	452.93558	-3951.86239	.00000	0
Joint elevation (m)	sliding peak	sliding residual	uplifting	flotation	overturning toward upstream	overturning toward downstream	Resultant position (joint %)	
1340.0	118.88151	118.88151	100.00000	100.00000	46.72811	100.00000	47.59244	
1338.0	127.36281	127.36281	11.76725	11.96212	12.58410	9.15477	48.27073	
1336.0	602.50503	602.50503	7.97851	8.12767	9.14783	6.31085	48.45936	
1334.0	133.54088	133.54088	6.72285	6.86082	7.85006	5.37485	48.59137	
1332.0	53.75337	53.75337	5.87374	6.00526	7.33257	4.59771	50.35500	
1331.0	41.31157	41.31157	5.61274	5.74037	7.16408	4.36566	50.89969	
Base	13.78727	13.78727	4.95534	5.09037	6.19835	3.74199	54.47518	
	1.15 (w/o test)	1.15	1.15	1.15			inside section	
	1.15 (with test)							
E2F: Seismic event, MDE [1.0*D + 1.0*Hu + 1.0*U + 1.0*S + 0.3*Qh - 1.0*Qv]								
Joint elevation (m)	Cracking at the U/S (% of joint)	Normal U/S stress (kPa)	U/S crack opening length (% of joint)	U/S uplift pressure (kPa)	Cracking at the D/S (% of joint)	Normal D/S stress (kPa)	D/S crack opening length (% of joint)	D/S uplift pressure (kPa)
1340.0	0	-59.32162	0	0	0	-43.75438	0	0
1338.0	0	-78.01007	0	19.61330	0	-63.28480	0	0
1336.0	0	-97.65333	0	39.22660	0	-81.45673	0	0
1334.0	0	-117.39050	0	58.83990	0	-99.83251	0	0
1332.0	0	-122.48540	0	78.45320	0	-127.89241	0	0
1331.0	0	-127.09321	0	88.25985	0	-141.25817	0	0
Base	0	-136.58220	0	133.37044	0	-249.22110	0	0
Joint elevation (m)	Normal load (kN)	Uplift force (kN)	Shear U/S-D/S (kN)	Shear left-right (kN)	Shear total (kN)	Moment ZZ at center (kN·m)	Moment XX at center (kN·m)	Moment YY at center (kN·m)
1340.0	-409.35560	0	-25.85404	0	25.85404	81.84209	0	0
1338.0	-723.76787	73.59986	-32.87922	0	32.87922	128.79168	.00000	0
1336.0	-1123.62735	176.31781	-8.95789	0	8.95789	212.47472	.00000	0
1334.0	-1612.74777	308.15387	50.21782	0	50.21782	322.60784	.00000	0
1332.0	-2260.50806	504.64759	157.84363	0	157.84363	-146.91173	.00000	0
1331.0	-2644.37864	622.57591	228.87024	0	228.87024	-458.49398	.00000	0
Base	-3895.70124	1069.00143	476.81680	0	476.81680	-3828.30530	.00000	0

Joint elevation (m)	Safety factors						Resultant position (joint %)	
	sliding peak	sliding residual	uplifting	flotation	overturning toward upstream	overturning toward downstream		
1340.0	117.21484	117.21484	20.00000	100.00000	13.79873	20.42549	47.48289	
1338.0	124.83713	124.83713	7.21510	10.83382	7.50609	6.15563	48.26306	
1336.0	587.64566	587.64566	5.55572	7.37274	6.10148	4.69916	48.49286	
1334.0	129.69189	129.69189	4.91228	6.23358	5.49456	4.15581	48.65284	
1332.0	52.07207	52.07207	4.47260	5.47938	5.25386	3.70730	50.35992	
1331.0	39.97080	39.97080	4.33367	5.24748	5.17769	3.56899	50.87975	
Base	11.66829	11.66829	3.89869	4.64424	4.68197	3.08786	54.86599	
	1.15 (w/o test)	1.15	1.15	1.15			inside section	
	1.15 (with test)							
E2G: Seismic event, MDE [1.0*D + 1.0*Hu + 1.0*U + 1.0*S - 0.3*Qh + 1.0*Qv]								
Joint elevation (m)	Cracking at the U/S (% of joint)	Normal U/S stress (kPa)	U/S crack opening length (% of joint)	U/S uplift pressure (kPa)	Cracking at the D/S (% of joint)	Normal D/S stress (kPa)	D/S crack opening length (% of joint)	D/S uplift pressure (kPa)
1340.0	0	-58.07731	0	0	0	-55.84879	0	0
1338.0	0	-74.84647	0	19.61330	0	-83.18015	0	0
1336.0	0	-92.32447	0	39.22660	0	-109.20507	0	0
1334.0	0	-109.90129	0	58.83990	0	-135.35735	0	0
1332.0	0	-113.19754	0	78.45320	0	-169.59103	0	0
1331.0	0	-117.19584	0	88.25985	0	-185.79209	0	0
Base	0	-104.26067	0	133.37044	0	-335.93834	0	0
Joint elevation (m)	Normal load (kN)	Uplift force (kN)	Shear U/S-D/S (kN)	Shear left-right (kN)	Shear total (kN)	Moment ZZ at center (kN·m)	Moment XX at center (kN·m)	Moment YY at center (kN·m)
1340.0	-452.44566	0	25.85404	0	25.85404	11.71608	0	0
1338.0	-809.47444	73.59986	72.10582	0	72.10582	-72.88889	.00000	0
1336.0	-1264.27346	176.31781	165.86429	0	165.86429	-221.44776	.00000	0
1334.0	-1820.89521	308.15387	311.91535	0	311.91535	-467.72560	.00000	0
1332.0	-2553.12494	504.64759	519.29246	0	519.29246	-1532.24475	.00000	0
1331.0	-2985.69291	622.57591	647.31228	0	647.31228	-2220.33632	.00000	0
Base	-4444.96925	1069.00143	1149.69108	0	1149.69108	-7874.12539	.00000	0
Joint elevation (m)	Safety factors						Resultant position (joint %)	
	sliding peak	sliding residual	uplifting	flotation	overturning toward upstream	overturning toward downstream		
1340.0	118.88151	118.88151	100.00000	100.00000	100.00000	49.35461	49.67398	
1338.0	58.11256	58.11256	11.99832	11.99832	19.36959	7.51340	50.87893	

1336.0	32.58514	32.58514	8.17042	8.17042	12.95462	5.43401	51.39604	
1334.0	21.54748	21.54748	6.90905	6.90905	10.81933	4.70894	51.72988	
1332.0	16.39127	16.39127	6.05922	6.05922	9.72152	4.13867	53.32365	
1331.0	14.65976	14.65976	5.79571	5.79571	9.36069	3.96823	53.77332	
Base	5.52155	5.52155	5.15682	5.15806	8.61576	3.27651	58.77170	
	1.15 (w/o test)	1.15	1.15	1.15			inside section	
	1.15 (with test)							
E2H: Seismic event, MDE [1.0*D + 1.0*Hu + 1.0*U + 1.0*S - 0.3*Qh - 1.0*Qv]								
Joint elevation (m)	Cracking at the U/S (% of joint)	Normal U/S stress (kPa)	U/S crack opening length (% of joint)	U/S uplift pressure (kPa)	Cracking at the D/S (% of joint)	Normal D/S stress (kPa)	D/S crack opening length (% of joint)	D/S uplift pressure (kPa)
1340.0	0	-52.20737	0	0	0	-50.86863	0	0
1338.0	0	-65.93214	0	19.61330	0	-75.88281	0	0
1336.0	0	-80.55477	0	39.22660	0	-99.75681	0	0
1334.0	0	-95.38343	0	58.83990	0	-123.84101	0	0
1332.0	0	-98.77654	0	78.45320	0	-154.61783	0	0
1331.0	0	-102.62669	0	88.25985	0	-169.22097	0	0
Base	0	-82.46317	0	133.37044	0	-310.50546	0	0
Joint elevation (m)	Normal load (kN)	Uplift force (kN)	Shear U/S-D/S (kN)	Shear left-right (kN)	Shear total (kN)	Moment ZZ at center (kN·m)	Moment XX at center (kN·m)	Moment YY at center (kN·m)
1340.0	-409.35560	0	25.85404	0	25.85404	7.03818	0	0
1338.0	-726.43191	73.59986	72.10582	0	72.10582	-87.03158	.00000	0
1336.0	-1131.16493	176.31781	165.86429	0	165.86429	-251.90157	.00000	0
1334.0	-1627.60715	308.15387	311.91535	0	311.91535	-522.87522	.00000	0
1332.0	-2287.74268	504.64759	519.29246	0	519.29246	-1517.24091	.00000	0
1331.0	-2678.83154	622.57591	647.31228	0	647.31228	-2155.53605	.00000	0
Base	-3968.05422	1069.00143	1173.57230	0	1173.57230	-7750.56830	.00000	0
Joint elevation (m)	sliding peak	sliding residual	Safety factors uplifting	flotation	overturning toward upstream	overturning toward downstream	Resultant position (joint %)	
1340.0	117.21484	117.21484	20.00000	100.00000	20.44941	14.03024	49.78354	
1338.0	56.96089	56.96089	7.31015	10.87002	9.74806	5.29976	51.16944	
1336.0	31.78263	31.78263	5.65745	7.41549	7.77706	4.15183	51.77489	
1334.0	20.92780	20.92780	5.02079	6.28180	6.96250	3.71135	52.16350	
1332.0	15.88022	15.88022	4.58952	5.53335	6.50973	3.37839	53.67288	
1331.0	14.18570	14.18570	4.45207	5.30282	6.35815	3.27762	54.08282	
Base	4.82882	4.82882	4.03420	4.71193	6.08865	2.73719	59.67178	

	1.15 (w/o test)	1.15	1.15	1.15	inside section			
	1.15 (with test)							
Rara [1.0*D + 1.0*Hu + 1.0*U + 1.0*I + 1.0*S]								
Joint elevation (m)	Cracking at the U/S (% of joint)	Normal U/S stress (kPa)	U/S crack opening length (% of joint)	U/S uplift pressure (kPa)	Cracking at the D/S (% of joint)	Normal D/S stress (kPa)	D/S crack opening length (% of joint)	D/S uplift pressure (kPa)
1340.0	0	-58.69946	0	0	0	-49.80158	0	0
1338.0	0	-67.04430	0	19.61330	0	-82.61644	0	0
1336.0	0	-81.26208	0	39.22660	0	-109.05773	0	0
1334.0	0	-98.51161	0	58.83990	0	-132.72922	0	0
1332.0	0	-104.00022	0	78.45320	0	-162.58297	0	0
1331.0	0	-109.01203	0	88.25985	0	-176.65762	0	0
Base	0	-102.25348	0	133.37044	0	-311.23304	0	0
Joint elevation (m)	Normal load (kN)	Uplift force (kN)	Shear U/S-D/S (kN)	Shear left-right (kN)	Shear total (kN)	Moment ZZ at center (kN·m)	Moment XX at center (kN·m)	Moment YY at center (kN·m)
1340.0	-430.90063	0	0	0	0	46.77908	0	0
1338.0	-766.62116	73.59986	117.61330	0	117.61330	-136.19860	.00000	0
1336.0	-1193.95040	176.31781	176.45320	0	176.45320	-364.63652	.00000	0
1334.0	-1716.82149	308.15387	279.06658	0	279.06658	-628.70888	.00000	0
1332.0	-2406.81650	504.64759	436.56804	0	436.56804	-1591.72824	.00000	0
1331.0	-2815.03578	622.57591	536.09126	0	536.09126	-2189.56515	.00000	0
Base	-4175.23639	1069.00143	911.13131	0	911.13131	-7102.67535	.00000	0
Joint elevation (m)	sliding peak	sliding residual	Safety factors uplifting	flotation	overturning toward upstream	overturning toward downstream	Resultant position (joint %)	
1340.0	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	48.63321	
1338.0	35.26302	35.26302	11.41607	11.41607	18.68954	6.50600	51.73416	
1336.0	30.23118	30.23118	7.77158	7.77158	12.51769	4.76930	52.43412	
1334.0	23.71089	23.71089	6.57131	6.57131	10.38989	4.26846	52.46623	
1332.0	19.16208	19.16208	5.76930	5.76930	9.27398	3.85814	53.66257	
1331.0	17.38283	17.38283	5.52159	5.52159	8.90821	3.73690	53.94661	
Base	6.54445	6.54445	4.90574	4.90574	8.11123	3.20997	58.42347	
	1.15 (w/o test)	1.15	1.15	1.15			1/3 median	
	1.15 (with test)							



CADAM3D Version 2.5.11.1 - Report of input data

Project:
 Dam:
 Owner:
 Location:
 Date: 16/03/2022
 Engineer:
 Analysis performed by:

Foundation													
Segment Type	Start point		End point		Radius	Starting Angle (deg.)	Rotation Angle (deg.)	Coefficient A	Coefficient B	Coefficient C	Coefficient D		
	X (m)	Y (m)	X (m)	Y (m)	(m)								
1-Linear	0	1326.40000	20.17000	1327.41000									
2-Linear	20.17000	1327.41000	20.17000	1330.89000									
Plane definition	Base failure plane												
	Upstream elevation (m)	Downstream elevation (m)											
Linear regression	.00000	.00000											
Compressive strength (kPa)	Tensile strength (kPa)	Friction angle (deg.)	Peak shear strength		Residual shear strength								
			Cohesion (kPa)	Minimal stress (kPa)	Friction angle (deg.)	Cohesion (kPa)	Minimal stress (kPa)						
5000.000	0	55.000	0	0	55.000	0	0						
Foundation contour													
Point #	X (m)	Y (m)	Point #	X (m)	Y (m)	Point #	X (m)	Y (m)	Point #	X (m)	Y (m)		
1	0	1326.400	2	20.170	1327.410	3	20.170	1330.890					
Gravity dam													
Segment Type	Start point		End point		Radius	Starting Angle (deg.)	Rotation Angle (deg.)	Coefficient A	Coefficient B	Coefficient C	Coefficient D		
	X (m)	Y (m)	X (m)	Y (m)	(m)								
1-Linear	0	1326.40000	0	1330.61000									
2-Linear	0	1330.61000	3.20000	1333.81000									
3-Linear	3.20000	1333.81000	7.69000	1342.80000									
4-Linear	7.69000	1342.80000	7.69000	1343.20000									
5-Linear	7.69000	1343.20000	12.41000	1343.20000									
6-Linear	12.41000	1343.20000	12.41000	1342.80000									
7-Linear	12.41000	1342.80000	20.17000	1330.89000									
Gravity dam width (m)	1.000												
gravity dam contour													
Point #	X (m)	Y (m)	Point #	X (m)	Y (m)	Point #	X (m)	Y (m)	Point #	X (m)	Y (m)		
1	20.170	1330.890	2	20.170	1327.410	3	0	1326.400	4	0	1330.610		

5	3.200	1333.810	6	7.690	1342.800	7	7.690	1343.200	8	12.410	1343.200	
9	12.410	1342.800	10	20.170	1330.890							
Drainage system												
Gallery number	Gallery name	Gallery state	Position (X) of gallery (m)	Elevation (Y) of gallery (m)	Height (H1) of gallery (m)	Width (L1) of gallery (m)	Ceiling geometry	Presence of U/S gutter	Presence of D/S gutter	Height (H2) of gutters (m)	Width (L2) of gutters (m)	
1	DRAINAGE - 1	Active	1.200	1328.100	2.600	2.000	Round	no	yes	0.200	0.300	
Drainage above gallery												
	State of drains	Efficiency of drains	Maximum elevation (m)	inclination angle (deg.)	Position (dX) of drains (m)	Spacing (dZ) of drains (m)	Diameter of drains (m)					
	Active	0.350	1343.200	62.700	1.400	4.000	0.100					
Drainage below gallery												
	State of drains	Efficiency of drains	Maximum elevation (m)	inclination angle (deg.)	Position (dX) of drains (m)	Spacing (dZ) of drains (m)	Diameter of drains (m)					
	Active	0.350	1321.400	-90.000	1.700	4.000	0.100					
Volumes and voids												
Additional masses												
Mass number	Name	Co-ordinate X (m)	Co-ordinate Y (m)	Co-ordinate Z (m)	Mass X (ton)	Mass Y (ton)	Mass Z (ton)	Mass is active	Color			
Materials												
	Gravitational Constant (m/s²)	Concrete (kg/m³)	Water (kg/m³)									
	9.80665	2240.00000	1000.00000									
Material name	Compressive strength (kPa)	Tensile strength (kPa)	Model	Friction angle (deg.)	Peak shear strength Friction angle 2 (deg.)	Cohesion (kPa)	Minimal stress (kPa)	Model	Residual shear strength Friction angle (deg.)	Friction angle 2 (deg.)	Cohesion (kPa)	Minimal stress (kPa)
Base	5000.000	0	Option 2	55.000	N/A	0	0	Option 2	55.000	N/A	0	0
AVG DIGA	5000.000	1000.000	Option 2	45.000	N/A	330.000	0	Option 2	45.000	N/A	330.000	0
lift joints												
Joint number	Material name	U/S point X (m)	Y (m)	D/S point X (m)	Y (m)	Length (m)	Area (m²)	Centroid L (m)	Z (m)	LL (m**4)	Inertia ZZ (m**4)	LZ (m**4)
1	AVG DIGA	6.29156	1340.00000	14.23435	1340.00000	7.94279	7.94279	10.26295	0	0.66190	41.75787	0
2	AVG DIGA	5.29267	1338.00000	15.53746	1338.00000	10.24479	10.24479	10.41506	0	0.85373	89.60401	0
3	AVG DIGA	4.29378	1336.00000	16.84056	1336.00000	12.54678	12.54678	10.56717	0	1.04557	164.59463	0
4	AVG DIGA	3.29489	1334.00000	18.14367	1334.00000	14.84877	14.84877	10.71928	0	1.23740	272.82906	0
5	AVG DIGA	1.39000	1332.00000	19.44678	1332.00000	18.05678	18.05678	10.41839	0	1.50473	490.61336	0
6	AVG DIGA	0.39000	1331.00000	20.09833	1331.00000	19.70833	19.70833	10.24416	0	1.64236	637.92287	0
Base	Foundation	0	1326.40000	20.17000	1327.41000	20.19527	20.19527	10.09764	0	1.68294	686.38511	0
Pre-cracking of joints												
Joint number	Upstream crack length (m) (%)		Downstream crack length (m) (%)									
1	0	0	0	0								
2	0	0	0	0								
3	0	0	0	0								
4	0	0	0	0								
5	0	0	0	0								

6	0	0	0	0
Base	0	0	0	0

U/S Backfill												
Segment Type	Start point		End point		Radius	Starting Angle (deg.)	Rotation Angle (deg.)	Coefficient A	Coefficient B	Coefficient C	Coefficient D	
	X (m)	Y (m)	X (m)	Y (m)	(m)							
U/S Backfill state		Method in use for static analyses										
Disabled		Earth pressure at rest (Novak, 1996)										
Voluminal weight (kN/m³)	Earth pressure coefficient (K0)	U/S Backfill internal friction angle (deg)	U/S Backfill-concrete friction angle (deg)	Determination of upstream face angle	User defined upstream face angle (deg)	Determination of failure angle	User defined failure angle (deg)					
19.12000	.39820	37.00000	23.00000	Computed	0	Computed	0					
Porosity	Coefficient of permeability m/s	determination of seismic failure angle	User defined seismic failure angle (deg)									
.40000	.001000	Same as internal friction angle	37.00000									

U/S Backfill contour											
Point #	X (m)	Y (m)	Point #	X (m)	Y (m)	Point #	X (m)	Y (m)	Point #	X (m)	Y (m)

Backfill												
Segment Type	Start point		End point		Radius	Starting Angle (deg.)	Rotation Angle (deg.)	Coefficient A	Coefficient B	Coefficient C	Coefficient D	
	X (m)	Y (m)	X (m)	Y (m)	(m)							
Backfill state		Method in use for static analyses										
Disabled		Earth pressure at rest (Novak, 1996)										
Voluminal weight (kN/m³)	Earth pressure coefficient (K0)	Backfill internal friction angle (deg)	Backfill-concrete friction angle (deg)	Determination of downstream face angle	User defined downstream face angle (deg)	Determination of failure angle	User defined failure angle (deg)					
19.12000	.39820	37.00000	23.00000	Computed	0	Computed	0					
Porosity	Coefficient of permeability m/s	determination of seismic failure angle	User defined seismic failure angle (deg)									
.40000	.001000	Same as internal friction angle	37.00000									

Backfill contour											
Point #	X (m)	Y (m)	Point #	X (m)	Y (m)	Point #	X (m)	Y (m)	Point #	X (m)	Y (m)

Reservoirs												
Volumetric weight of water (kN/m³)		Normal operating level				Flood level						
		Upstream level (m)		Downstream level (m)		Upstream level (m)		Downstream level (m)				
9.80665		1340.00000		1330.89000		1341.20000		1330.89000				
Ice cover								Floating debris				
Usual case		Unusual case				Applied Force (Fd) (kN/m)		Point of application (h1) (m)		Maximum height (h2) (m)		
Load/width (kN/m)	Thickness (m)	Load/width (kN/m)	Thickness (m)									
98.00000	0.65000	98.00000	0.65000			0		0		0		

Silts				Crest overtopping			
Silts elevation (m)	Volumetric weight (kN/m³)	Internal friction angle (deg.)	Assumption for pressure	Upstream percentage (%)	Downstream percentage (%)		
1335.00000	7.00000	25.00000	At rest		0	0	

uplift pressures			
Joint number (m)	Joint elevation (m)	Type of distribution of uplift pressures	
		Normal level	Flood level
1	1340.00000	USACE 1995	USACE 1995
2	1338.00000	USACE 1995	USACE 1995
3	1336.00000	USACE 1995	USACE 1995
4	1334.00000	USACE 1995	USACE 1995
5	1332.00000	USACE 1995	USACE 1995
6	1331.00000	USACE 1995	USACE 1995
Base	1326.40000	User defined	USACE 1995

Post-tensioning								
Cable number	Cable name	Cable state	X (m)	Starting point Y (m)	Z (m)	Inclination of cable (deg.)	Lowest elevation (m)	Tension in cable (kN)

Applied forces										
Force number	Name	Co-ordinate X (m)	Co-ordinate Y (m)	Co-ordinate Z (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Force is active	Color	Combinations

Seismic data - Seismic coefficient method										
Return period (years)	Peak accelerations		Sustained Accelerations		Water compressibility		Depth limit (m)	Hydrostatic modified by vert. acc.		
	horizontal (g)	vertical (g)	horizontal (g)	vertical (g)	Considered	period (sec)				
2500	0.58000	0.24600	0.58000	0.24600	No	1.00000	No limit	No		

Calculation of hydrodynamic pressures in the event of submersion				Correction of hydrodynamic pressures due to structure face's inclination					
Method defining elevation	User-defined elevation (m)	Correction method	Angle of U/S face (deg.)	Angle of D/S face (deg.)	X u/s (m)	Y u/s (m)	X d/s (m)	Y d/s (m)	
Maximum structure elevation	1340.000	Generalized Westergaard	0	0	0	0	0	0	

Analysis options			
Type of analysis			
Nonlinear			

Tensile strength modification in function of the load combination types			
Usual cases		unusual cases	Extreme cases
Crack initiation:	$ft(ini.) = ft(joint)$	$ft(ini.) = ft(joint)$	$ft(ini.) = ft(joint)$
Crack propagation:	$ft(prop.) = ft(joint)$	$ft(prop.) = ft(joint)$	$ft(prop.) = ft(joint)$

Dynamic magnification factor	
	1.0

Modification of uplift pressures upon cracking		
Static analyses	Seismic analyses	Post-seismic analyses
Modified uplift pressures	Unchanged Uplift in crack	Modified uplift pressures

Performance indicators	
Performance indicators	Load combinations

		Usual	No drainage or Ice 150kN/m	Unusual	Post-seismic	Seismic MDE	Extreme Flood				
Stresses - traction											
	Lift joints:	0.0 * f _c	0.025 * f _c		0.033 * f _c	0.075 * f _c	0.05 * f _c				
	Rock-concrete contact:	0.0 * f _c	0.0 * f _c		0.0 * f _c	0.0 * f _c	0.0 * f _c				
	Foundation:	0.0 * f _c	0.0 * f _c		0.0 * f _c	0.0 * f _c	0.0 * f _c				
Stresses - Compression											
	Lift joints:	0.33 * f _c	0.5 * f _c		0.67 * f _c	0.9 * f _c	0.67 * f _c				
	Rock-concrete contact:	0.25 * f _c	0.5 * f _c		0.5 * f _c	0.67 * f _c	0.5 * f _c				
	Foundation:	0.25 * f _c	0.5 * f _c		0.5 * f _c	0.67 * f _c	0.5 * f _c				
	Resultant position:	1/3 median	1/2 median		inside section	inside section	inside section				
Sliding Safety Factors:											
	Peak SSF without test:	3.0	2.0		2.0	1.3	1.3				
	Peak SSF with tests:	2.0	1.5		1.5	1.1	1.1				
	Residual SSF:	1.5	1.3		1.1	1.0	1.0				
	Uplifting SF:	1.2	1.1		1.1	1.1	1.1				
Load combinations											
#1 Combination: Fondamentale											
	Type: N1: Ice - usual					Initial conditions: None			Active: Yes		
D	Hu	Hd	I	Fd	U	S	P	F	Qh	Qv	
1.0	1.3	0.0	1.5	0.0	1.3	1.3	0.0	0.0	0.0	0.0	
#2 Combination: Rara											
	Type: I2: Ice - unusual					Initial conditions: None			Active: Yes		
D	Hu	Hd	I	Fd	U	S	P	F	Qh	Qv	
1.0	1.0	0.0	1.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	
#3 Combination: Massima piena											
	Type: E1: Flood					Initial conditions: None			Active: Yes		
D	Hu	Hd	I	Fd	U	S	P	F	Qh	Qv	
1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	
#4 Combination: E2A: Seismic event, MDE											
	Type: E2: Seismic event, MDE					Initial conditions: None			Active: Yes		
D	Hu	Hd	I	Fd	U	S	P	F	Qh	Qv	
1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	1.0	0.3	
#5 Combination: E2B: Seismic event, MDE											
	Type: E2: Seismic event, MDE					Initial conditions: None			Active: Yes		
D	Hu	Hd	I	Fd	U	S	P	F	Qh	Qv	
1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	1.0	-0.3	
#6 Combination: E2C: Seismic event, MDE											
	Type: E2: Seismic event, MDE					Initial conditions: None			Active: Yes		
D	Hu	Hd	I	Fd	U	S	P	F	Qh	Qv	
1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	-1.0	0.3	
#7 Combination: E2D: Seismic event, MDE											
	Type: E2: Seismic event, MDE					Initial conditions: None			Active: Yes		
D	Hu	Hd	I	Fd	U	S	P	F	Qh	Qv	
1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	-1.0	-0.3	
#8 Combination: E2E: Seismic event, MDE											
	Type: E2: Seismic event, MDE					Initial conditions: None			Active: Yes		
D	Hu	Hd	I	Fd	U	S	P	F	Qh	Qv	
1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.3	1.0	
#9 Combination: E2F: Seismic event, MDE											
	Type: E2: Seismic event, MDE					Initial conditions: None			Active: Yes		
D	Hu	Hd	I	Fd	U	S	P	F	Qh	Qv	
1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.3	-1.0	
#10 Combination: E2G: Seismic event, MDE											
	Type: E2: Seismic event, MDE					Initial conditions: None			Active: Yes		
D	Hu	Hd	I	Fd	U	S	P	F	Qh	Qv	
1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.3	-1.0	

D	1.0	Hu	1.0	Hd	0.0	I	0.0	Fd	0.0	U	1.0	S	1.0	P	0.0	F	0.0	Qh	-0.3	Qv	1.0
#11 Combination: E2H: Seismic event, MDE																					
Type: E2: Seismic event, MDE										Initial conditions: None					Active: Yes						
D	1.0	Hu	1.0	Hd	0.0	I	0.0	Fd	0.0	U	1.0	S	1.0	P	0.0	F	0.0	Qh	-0.3	Qv	-1.0



CADAM3D Version:2.5.11.1 - Computed loads report

Project:

Dam:

Owner:

Location:

Date: 16/03/2022

Analyst:

Verified by:

Volumes and centroids: Structure

Élévation (m)	Volume (m³)	Centroid X (m)	Centroid Y (m)	Centroid Z (m)
1340.0	19.61591	10.15439	1341.44666	0
1338.0	37.80349	10.24476	1340.24925	0
1336.0	60.59505	10.33838	1339.01445	0
1334.0	87.99061	10.43396	1337.75585	0
1332.0	120.81009	10.47492	1336.45482	0
1331.0	139.69264	10.45534	1335.78408	0
Base	222.20880	10.16695	1333.24266	0

Volumes and centroids: Drainage systems

Élévation (m)	Volume (m³)	Centroid X (m)	Centroid Y (m)	Centroid Z (m)
1340.0	0	0	0	0
1338.0	0	0	0	0
1336.0	0	0	0	0
1334.0	0	0	0	0
1332.0	0	0	0	0
1331.0	0	0	0	0
Base	-4.83054	2.21056	1329.28690	0

Loads and moments: Structure

Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Position X (m)	Position Y (m)	Position Z (m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	-430.90063	0				0	0	46.77908
1338.0	0	-830.42527	0				0	0	141.42693

1336.0	0	-1331.08525	0				0	0	304.53809
1334.0	0	-1932.88057	0				0	0	551.49621
1332.0	0	-2653.82267	0				0	0	-150.03840
1331.0	0	-3068.61374	0				0	0	-648.00267
Base	0	-4881.23760	0				0	0	-399.99871
Loads and moments: Drainage systems									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Position X (m)	Position Y (m)	Position Z (m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0				0	0	0
1338.0	0	0	0				0	0	0
1336.0	0	0	0				0	0	0
1334.0	0	0	0				0	0	0
1332.0	0	0	0				0	0	0
1331.0	0	0	0				0	0	0
Base	0	106.11192	0				0	0	-835.57222
Loads and moments: All volumes, voids and masses									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Position X (m)	Position Y (m)	Position Z (m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	-430.90063	0				0	0	46.77908
1338.0	0	-830.42527	0				0	0	141.42693
1336.0	0	-1331.08525	0				0	0	304.53809
1334.0	0	-1932.88057	0				0	0	551.49621
1332.0	0	-2653.82267	0				0	0	-150.03840
1331.0	0	-3068.61374	0				0	0	-648.00267
Base	0	-4775.12568	0				0	0	-1235.57092
Loads and moments: Hydrostatic - operating U/S level - Winter									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Position X (m)	Position Y (m)	Position Z (m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0				0	0	0
1338.0	19.61330	-9.79574	0				.00000	.00000	33.84049
1336.0	78.45320	-39.18297	0				0	0	115.11285
1334.0	176.51970	-88.16167	0				.00000	.00000	213.44342
1332.0	313.81280	-219.77016	0				.00000	.00000	771.67323
1331.0	397.16933	-303.12669	0				.00000	.00000	1159.25817
Base	906.91899	-338.29382	0				.00000	.00000	-1003.00143
Loads and moments: Hydrostatic - operating D/S level - Winter									
Elevation	Force X	Force Y	Force Z	Position X	Position Y	Position Z	Moment XX (C.G.)	Moment YY (C.G.)	Moment ZZ (C.G.)

(m)	(kN)	(kN)	(kN)	(m)	(m)	(m)	(kN·m)	(kN·m)	(kN·m)
1340.0	0	0	0				0	0	0
1338.0	0	0	0				0	0	0
1336.0	0	0	0				0	0	0
1334.0	0	0	0				0	0	0
1332.0	0	0	0				0	0	0
1331.0	0	0	0				0	0	0
Base	-59.38123	0	0				0	0	98.86974
Loads and moments: Hydrostatic - flood U/S level									
Elevation	Force X	Force Y	Force Z	Position X	Position Y	Position Z	Moment XX (C.G.)	Moment YY (C.G.)	Moment ZZ (C.G.)
(m)	(kN)	(kN)	(kN)	(m)	(m)	(m)	(kN·m)	(kN·m)	(kN·m)
1340.0	7.06079	-3.52647	0				.00000	.00000	10.47617
1338.0	50.21005	-25.07710	0				.00000	.00000	61.53780
1336.0	132.58591	-66.21921	0				.00000	.00000	128.27725
1334.0	254.18837	-126.95281	0				0	0	180.32086
1332.0	415.01743	-280.97806	0				.00000	.00000	729.04177
1331.0	510.14193	-376.10256	0				.00000	.00000	1108.95387
Base	1074.02431	-415.85921	0				.00000	.00000	-1579.32167
Loads and moments: Hydrostatic - flood D/S level									
Elevation	Force X	Force Y	Force Z	Position X	Position Y	Position Z	Moment XX (C.G.)	Moment YY (C.G.)	Moment ZZ (C.G.)
(m)	(kN)	(kN)	(kN)	(m)	(m)	(m)	(kN·m)	(kN·m)	(kN·m)
1340.0	0	0	0				0	0	0
1338.0	0	0	0				0	0	0
1336.0	0	0	0				0	0	0
1334.0	0	0	0				0	0	0
1332.0	0	0	0				0	0	0
1331.0	0	0	0				0	0	0
Base	-59.38123	0	0				0	0	98.86974
Loads and moments: Silts									
Elevation	Force X	Force Y	Force Z	Position X	Position Y	Position Z	Moment XX (C.G.)	Moment YY (C.G.)	Moment ZZ (C.G.)
(m)	(kN)	(kN)	(kN)	(m)	(m)	(m)	(kN·m)	(kN·m)	(kN·m)
1340.0	0	0	0				0	0	0
1338.0	0	0	0				0	0	0
1336.0	0	0	0				0	0	0
1334.0	2.02084	-1.74805	0				0	0	12.01360
1332.0	18.18752	-29.01907	0				.00000	.00000	218.27397
1331.0	32.33338	-53.51907	0				.00000	.00000	418.05490
Base	149.46104	-64.97142	0				.00000	.00000	212.96892

Loads and moments: Uplifts (uncracked) - operating level - winter										
Élévation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Normal (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0	0
1338.0	0	73.59986	0	73.59986	.00000	0	-524.32342	.00000	0	-147.31603
1336.0	0	176.31781	0	176.31781	.00000	0	-1530.24792	.00000	0	-424.13747
1334.0	0	308.15387	0	308.15387	.00000	0	-3151.29762	.00000	0	-863.44389
1332.0	0	504.64759	0	504.64759	.00000	0	-6293.66517	.00000	0	-1737.51094
1331.0	0	622.57591	0	622.57591	.00000	0	-8485.33413	.00000	0	-2350.36862
Base	-53.46259	1067.66371	0	1069.00143	.00000	.00000	-14661.31982	.00000	.00000	-3866.93265
Loads and moments: Uplifts (uncracked) without drainage										
Élévation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Normal (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0	0
1338.0	0	100.46703	0	100.46703	.00000	0	-686.17552	.00000	0	-171.54388
1336.0	0	246.08377	0	246.08377	.00000	0	-2058.37272	.00000	0	-514.59318
1334.0	0	436.85021	0	436.85021	0	0	-4324.46032	0	0	-1081.11508
1332.0	0	708.30592	0	708.30592	.00000	0	-8526.48083	.00000	0	-2131.62021
1331.0	0	869.72709	0	869.72709	.00000	0	-11427.24512	.00000	0	-2856.81128
Base	-53.46259	1067.66371	0	1069.00143	.00000	.00000	-14661.31982	.00000	.00000	-3866.93265
Loads and moments: Uplifts (uncracked) - flood level										
Élévation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Normal (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	35.42448	0	35.42448	.00000	0	-196.81856	.00000	0	-56.13391
1338.0	0	117.75977	0	117.75977	.00000	0	-838.91748	.00000	0	-235.70565
1336.0	0	229.21316	0	229.21316	.00000	0	-1989.32230	.00000	0	-551.37871
1334.0	0	369.78465	0	369.78465	.00000	0	-3781.55714	.00000	0	-1036.13267
1332.0	0	580.34473	0	580.34473	.00000	0	-7237.71495	.00000	0	-1998.13758
1331.0	0	705.58604	0	705.58604	.00000	0	-9616.71201	.00000	0	-2663.75111
Base	-73.72897	1472.38936	0	1474.23417	.00000	.00000	-17853.71987	.00000	.00000	-2967.44007
Loads and moments: Ice - usual case										
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Position X (m)	Position Y (m)	Position Z (m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)	
1340.0	0	0	0				0	0	0	
1338.0	98.00000	0	0				0	0	-164.15000	
1336.0	98.00000	0	0				0	0	-360.15000	
1334.0	98.00000	0	0				0	0	-556.15000	

1332.0	98.00000	0	0				0	0	-752.15000
1331.0	98.00000	0	0				0	0	-850.15000
Base	98.00000	0	0				0	0	-1251.46000
Loads and moments: Ice - unusual case									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Position X (m)	Position Y (m)	Position Z (m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0				0	0	0
1338.0	98.00000	0	0				0	0	-164.15000
1336.0	98.00000	0	0				0	0	-360.15000
1334.0	98.00000	0	0				0	0	-556.15000
1332.0	98.00000	0	0				0	0	-752.15000
1331.0	98.00000	0	0				0	0	-850.15000
Base	98.00000	0	0				0	0	-1251.46000
Loads and moments: Floating debris									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Position X (m)	Position Y (m)	Position Z (m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0				0	0	0
1338.0	0	0	0				0	0	0
1336.0	0	0	0				0	0	0
1334.0	0	0	0				0	0	0
1332.0	0	0	0				0	0	0
1331.0	0	0	0				0	0	0
Base	0	0	0				0	0	0
Intensity of peak horizontal seismic forces (absolute values): Structure									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	-249.92236	0	0	0	0	361.55223	0	0	361.55223
1338.0	-481.64666	0	0	0	0	1083.34484	0	0	1083.34484
1336.0	-772.02944	0	0	0	0	2327.24452	0	0	2327.24452
1334.0	-1121.07073	0	0	0	0	4210.56828	0	0	4210.56828
1332.0	-1539.21715	0	0	0	0	6856.93590	0	0	6856.93590
1331.0	-1779.79597	0	0	0	0	8514.68895	0	0	8514.68895
Base	-2831.11781	0	0	0	0	16512.93868	0	0	17942.65318
Intensity of sustained horizontal seismic forces (absolute values): Structure									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	-249.92236	0	0	0	0	361.55223	0	0	361.55223

1338.0	-481.64666	0	0	0	0	1083.34484	0	0	1083.34484
1336.0	-772.02944	0	0	0	0	2327.24452	0	0	2327.24452
1334.0	-1121.07073	0	0	0	0	4210.56828	0	0	4210.56828
1332.0	-1539.21715	0	0	0	0	6856.93590	0	0	6856.93590
1331.0	-1779.79597	0	0	0	0	8514.68895	0	0	8514.68895
Base	-2831.11781	0	0	0	0	16512.93868	0	0	17942.65318
Intensity of peak horizontal seismic forces (absolute values): Drainage systems									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	0	0	0	0	0	0	0	0	0
1332.0	0	0	0	0	0	0	0	0	0
1331.0	0	0	0	0	0	0	0	0	0
Base	61.54492	0	0	0	0	-115.51362	0	0	-146.59380
Intensity of sustained horizontal seismic forces (absolute values): Drainage systems									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	0	0	0	0	0	0	0	0	0
1332.0	0	0	0	0	0	0	0	0	0
1331.0	0	0	0	0	0	0	0	0	0
Base	61.54492	0	0	0	0	-115.51362	0	0	-146.59380
Intensity of peak horizontal seismic forces (absolute values): All volumes,voids and masses									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	-249.92236	0	0	0	0	361.55223	0	0	361.55223
1338.0	-481.64666	0	0	0	0	1083.34484	0	0	1083.34484
1336.0	-772.02944	0	0	0	0	2327.24452	0	0	2327.24452
1334.0	-1121.07073	0	0	0	0	4210.56828	0	0	4210.56828
1332.0	-1539.21715	0	0	0	0	6856.93590	0	0	6856.93590
1331.0	-1779.79597	0	0	0	0	8514.68895	0	0	8514.68895
Base	-2769.57289	0	0	0	0	16397.42506	0	0	17796.05937
Intensity of sustained horizontal seismic forces (absolute values): All volumes,voids and masses									

Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	-249.92236	0	0	0	0	361.55223	0	0	361.55223
1338.0	-481.64666	0	0	0	0	1083.34484	0	0	1083.34484
1336.0	-772.02944	0	0	0	0	2327.24452	0	0	2327.24452
1334.0	-1121.07073	0	0	0	0	4210.56828	0	0	4210.56828
1332.0	-1539.21715	0	0	0	0	6856.93590	0	0	6856.93590
1331.0	-1779.79597	0	0	0	0	8514.68895	0	0	8514.68895
Base	-2769.57289	0	0	0	0	16397.42506	0	0	17796.05937
Intensity of peak horizontal seismic forces (absolute values): Hydrodynamic (horizontal) - upstream									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	-25.78104	12.87618	0	.00000	.00000	-106.15591	.00000	.00000	-40.19905
1336.0	-72.94442	36.43164	0	.00000	.00000	-311.30903	.00000	.00000	-82.75913
1334.0	-134.02261	66.93676	0	.00000	.00000	-592.10090	.00000	.00000	-95.13643
1332.0	-181.61712	111.31920	0	.00000	.00000	-1121.56605	.00000	.00000	-116.53315
1331.0	-206.53147	136.23355	0	.00000	.00000	-1478.82965	.00000	.00000	-136.36181
Base	-460.28850	146.34096	0	.00000	.00000	-663.66054	.00000	.00000	1044.63370
Intensity of sustained horizontal seismic forces (absolute values): Hydrodynamic (horizontal) - upstream									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	-25.78104	12.87618	0	.00000	.00000	-106.15591	.00000	.00000	-40.19905
1336.0	-72.94442	36.43164	0	.00000	.00000	-311.30903	.00000	.00000	-82.75913
1334.0	-134.02261	66.93676	0	.00000	.00000	-592.10090	.00000	.00000	-95.13643
1332.0	-181.61712	111.31920	0	.00000	.00000	-1121.56605	.00000	.00000	-116.53315
1331.0	-206.53147	136.23355	0	.00000	.00000	-1478.82965	.00000	.00000	-136.36181
Base	-460.28850	146.34096	0	.00000	.00000	-663.66054	.00000	.00000	1044.63370
Intensity of peak horizontal seismic forces (absolute values): Hydrodynamic (horizontal) - downstream									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	0	0	0	0	0	0	0	0	0
1332.0	0	0	0	0	0	0	0	0	0
1331.0	0	0	0	0	0	0	0	0	0

Base	0	0	0	0	0	0	0	0	0	0
Intensity of sustained horizontal seismic forces (absolute values): Hydrodynamic (horizontal) - downstream										
Elevation	Force X	Force Y	Force Z	Moment XX	Moment YY	Moment ZZ	Moment XX (C.G.)	Moment YY (C.G.)	Moment ZZ (C.G.)	
(m)	(kN)	(kN)	(kN)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	
1340.0	0	0	0	0	0	0	0	0	0	
1338.0	0	0	0	0	0	0	0	0	0	
1336.0	0	0	0	0	0	0	0	0	0	
1334.0	0	0	0	0	0	0	0	0	0	
1332.0	0	0	0	0	0	0	0	0	0	
1331.0	0	0	0	0	0	0	0	0	0	
Base	0	0	0	0	0	0	0	0	0	
Intensity of peak horizontal seismic forces (absolute values): Silts										
Elevation	Force X	Force Y	Force Z	Moment XX	Moment YY	Moment ZZ	Moment XX (C.G.)	Moment YY (C.G.)	Moment ZZ (C.G.)	
(m)	(kN)	(kN)	(kN)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	
1340.0	0	0	0	0	0	0	0	0	0	
1338.0	0	0	0	0	0	0	0	0	0	
1336.0	0	0	0	0	0	0	0	0	0	
1334.0	-5.17290	2.58357	0	.00000	.00000	-35.77906	.00000	.00000	-16.59762	
1332.0	-19.32198	15.96023	0	.00000	.00000	-244.83513	.00000	.00000	-100.74000	
1331.0	-28.39000	25.02825	0	.00000	.00000	-405.77616	.00000	.00000	-159.14363	
Base	-135.90365	28.90300	0	.00000	.00000	-268.35474	.00000	.00000	91.76337	
Intensity of sustained horizontal seismic forces (absolute values): Silts										
Elevation	Force X	Force Y	Force Z	Moment XX	Moment YY	Moment ZZ	Moment XX (C.G.)	Moment YY (C.G.)	Moment ZZ (C.G.)	
(m)	(kN)	(kN)	(kN)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	
1340.0	0	0	0	0	0	0	0	0	0	
1338.0	0	0	0	0	0	0	0	0	0	
1336.0	0	0	0	0	0	0	0	0	0	
1334.0	-5.17290	2.58357	0	.00000	.00000	-35.77906	.00000	.00000	-16.59762	
1332.0	-19.32198	15.96023	0	.00000	.00000	-244.83513	.00000	.00000	-100.74000	
1331.0	-28.39000	25.02825	0	.00000	.00000	-405.77616	.00000	.00000	-159.14363	
Base	-135.90365	28.90300	0	.00000	.00000	-268.35474	.00000	.00000	91.76337	
Intensity of peak vertical seismic forces (absolute values): Structure										
Elevation	Force X	Force Y	Force Z	Moment XX	Moment YY	Moment ZZ	Moment XX (C.G.)	Moment YY (C.G.)	Moment ZZ (C.G.)	
(m)	(kN)	(kN)	(kN)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	
1340.0	0	-106.00155	0	0	0	432.48180	0	0	11.50765	
1338.0	0	-204.28462	0	0	0	1081.21714	0	0	34.79103	
1336.0	0	-327.44697	0	0	0	2129.11902	0	0	74.91637	

1334.0	0	-475.48862	0	0	0	3665.87979	0	0	135.66807
1332.0	0	-652.84038	0	0	0	5857.18672	0	0	-36.90945
1331.0	0	-754.87898	0	0	0	7279.29303	0	0	-159.40866
Base	0	-1200.78445	0	0	0	12011.51149	0	0	-98.39968
Intensity of sustained vertical seismic forces (absolute values): Structure									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	-106.00155	0	0	0	432.48180	0	0	11.50765
1338.0	0	-204.28462	0	0	0	1081.21714	0	0	34.79103
1336.0	0	-327.44697	0	0	0	2129.11902	0	0	74.91637
1334.0	0	-475.48862	0	0	0	3665.87979	0	0	135.66807
1332.0	0	-652.84038	0	0	0	5857.18672	0	0	-36.90945
1331.0	0	-754.87898	0	0	0	7279.29303	0	0	-159.40866
Base	0	-1200.78445	0	0	0	12011.51149	0	0	-98.39968
Intensity of peak vertical seismic forces (absolute values): Drainage systems									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	0	0	0	0	0	0	0	0	0
1332.0	0	0	0	0	0	0	0	0	0
1331.0	0	0	0	0	0	0	0	0	0
Base	0	26.10353	0	0	0	-468.80490	0	0	-205.55077
Intensity of sustained vertical seismic forces (absolute values): Drainage systems									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	0	0	0	0	0	0	0	0	0
1332.0	0	0	0	0	0	0	0	0	0
1331.0	0	0	0	0	0	0	0	0	0
Base	0	26.10353	0	0	0	-468.80490	0	0	-205.55077
Intensity of peak vertical seismic forces (absolute values): All volumes,voids and masses									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)

1340.0	0	-106.00155	0	0	0	432.48180	0	0	11.50765
1338.0	0	-204.28462	0	0	0	1081.21714	0	0	34.79103
1336.0	0	-327.44697	0	0	0	2129.11902	0	0	74.91637
1334.0	0	-475.48862	0	0	0	3665.87979	0	0	135.66807
1332.0	0	-652.84038	0	0	0	5857.18672	0	0	-36.90945
1331.0	0	-754.87898	0	0	0	7279.29303	0	0	-159.40866
Base	0	-1174.68092	0	0	0	11542.70659	0	0	-303.95045
Intensity of sustained vertical seismic forces (absolute values): All volumes,voids and masses									
Elevation	Force X	Force Y	Force Z	Moment XX	Moment YY	Moment ZZ	Moment XX (C.G.)	Moment YY (C.G.)	Moment ZZ (C.G.)
(m)	(kN)	(kN)	(kN)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)
1340.0	0	-106.00155	0	0	0	432.48180	0	0	11.50765
1338.0	0	-204.28462	0	0	0	1081.21714	0	0	34.79103
1336.0	0	-327.44697	0	0	0	2129.11902	0	0	74.91637
1334.0	0	-475.48862	0	0	0	3665.87979	0	0	135.66807
1332.0	0	-652.84038	0	0	0	5857.18672	0	0	-36.90945
1331.0	0	-754.87898	0	0	0	7279.29303	0	0	-159.40866
Base	0	-1174.68092	0	0	0	11542.70659	0	0	-303.95045
Intensity of peak vertical seismic forces (absolute values): Hydrodynamic (vertical) - upstream									
Elevation	Force X	Force Y	Force Z	Moment XX	Moment YY	Moment ZZ	Moment XX (C.G.)	Moment YY (C.G.)	Moment ZZ (C.G.)
(m)	(kN)	(kN)	(kN)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	0	0	0	0	0	0	0	0	0
1332.0	0	0	0	0	0	0	0	0	0
1331.0	0	0	0	0	0	0	0	0	0
Base	0	0	0	0	0	0	0	0	0
Intensity of sustained vertical seismic forces (absolute values): Hydrodynamic (vertical) - upstream									
Elevation	Force X	Force Y	Force Z	Moment XX	Moment YY	Moment ZZ	Moment XX (C.G.)	Moment YY (C.G.)	Moment ZZ (C.G.)
(m)	(kN)	(kN)	(kN)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)	(kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	0	0	0	0	0	0	0	0	0
1332.0	0	0	0	0	0	0	0	0	0
1331.0	0	0	0	0	0	0	0	0	0
Base	0	0	0	0	0	0	0	0	0

Intensity of peak vertical seismic forces (absolute values): Hydrodynamic (vertical) - downstream									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	0	0	0	0	0	0	0	0	0
1332.0	0	0	0	0	0	0	0	0	0
1331.0	0	0	0	0	0	0	0	0	0
Base	0	0	0	0	0	0	0	0	0
Intensity of sustained vertical seismic forces (absolute values): Hydrodynamic (vertical) - downstream									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	0	0	0	0	0	0	0	0	0
1332.0	0	0	0	0	0	0	0	0	0
1331.0	0	0	0	0	0	0	0	0	0
Base	0	0	0	0	0	0	0	0	0
Intensity of peak vertical seismic forces (absolute values): Silts									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	0	0	0	0	0	0	0	0	0
1332.0	0	0	0	0	0	0	0	0	0
1331.0	0	0	0	0	0	0	0	0	0
Base	0	0	0	0	0	0	0	0	0
Intensity of sustained vertical seismic forces (absolute values): Silts									
Elevation (m)	Force X (kN)	Force Y (kN)	Force Z (kN)	Moment XX (kN·m)	Moment YY (kN·m)	Moment ZZ (kN·m)	Moment XX (C.G.) (kN·m)	Moment YY (C.G.) (kN·m)	Moment ZZ (C.G.) (kN·m)
1340.0	0	0	0	0	0	0	0	0	0
1338.0	0	0	0	0	0	0	0	0	0
1336.0	0	0	0	0	0	0	0	0	0
1334.0	0	0	0	0	0	0	0	0	0
1332.0	0	0	0	0	0	0	0	0	0

1331.0	0	0	0	0	0	0	0	0	0
Base	0	0	0	0	0	0	0	0	0



CADAM3D Version 2.5.11.1 - Load Combinations report

Project:

Dam:

Owner:

Location:

Date: 16/03/2022

Engineer:

Analysis performed by:

Fondamentale [1.0*D + 1.3*Hu + 1.3*U + 1.5*I + 1.3*S]

Joint elevation (m)	Cracking at the U/S (% of joint)	Normal U/S stress (kPa)	U/S crack opening length (% of joint)	U/S uplift pressure (kPa)	Cracking at the D/S (% of joint)	Normal D/S stress (kPa)	D/S crack opening length (% of joint)	D/S uplift pressure (kPa)
1340.0	0	-58.69946	0	0	0	-49.80158	0	0
1338.0	0	-58.53782	0	19.61330	0	-87.38615	0	0
1336.0	0	-67.58623	0	39.22660	0	-116.17564	0	0
1334.0	0	-80.80047	0	58.83990	0	-141.32737	0	0
1332.0	0	-87.14363	0	78.45320	0	-169.95728	0	0
1331.0	0	-92.92741	0	88.25985	0	-183.39277	0	0
Base	0	-62.17374	0	133.37044	0	-331.88579	0	0

Joint elevation (m)	Normal load (kN)	Uplift force (kN)	Shear U/S-D/S (kN)	Shear left-right (kN)	Shear total (kN)	Moment ZZ at center (kN·m)	Moment XX at center (kN·m)	Moment YY at center (kN·m)
1340.0	-430.90063	0	0	0	0	46.77908	0	0
1338.0	-747.47992	95.67981	172.49729	0	172.49729	-252.31627	.00000	0
1336.0	-1152.80995	229.21316	248.98916	0	248.98916	-637.41891	.00000	0
1334.0	-1649.16318	400.60003	379.10270	0	379.10270	-1112.11173	.00000	0
1332.0	-2321.20680	656.04187	578.60042	0	578.60042	-2250.09626	.00000	0
1331.0	-2722.90453	809.34869	705.35351	0	705.35351	-2928.19990	.00000	0
Base	-3979.06967	1389.70186	1253.36103	0	1253.36103	-9166.81562	.00000	0

Joint elevation (m)	sliding peak	sliding residual	Safety factors uplifting	flotation	overturning toward upstream	overturning toward downstream	Resultant position (joint %)
1340.0	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	48.63321
1338.0	23.93231	23.93231	8.81231	8.81231	14.66785	4.85470	53.29490
1336.0	21.25895	21.25895	6.02942	6.02942	9.87633	3.60703	54.40692
1334.0	17.27569	17.27569	5.11673	5.11673	8.21278	3.25758	54.54145

1332.0	14.31030	14.31030	4.53820	4.53820	7.33334	3.00931	55.36843	
1331.0	13.08089	13.08089	4.36432	4.36432	7.04884	2.94242	55.45655	
Base	4.53397	4.53397	3.86325	3.86325	6.47943	2.48650	61.40742	
	3.0 (w/o test)	1.5	1.2	1.2			1/3 median	
	2.0 (with test)							
Rara [1.0*D + 1.0*Hu + 1.0*U + 1.0*I + 1.0*S]								
Joint elevation (m)	Cracking at the U/S (% of joint)	Normal U/S stress (kPa)	U/S crack opening length (% of joint)	U/S uplift pressure (kPa)	Cracking at the D/S (% of joint)	Normal D/S stress (kPa)	D/S crack opening length (% of joint)	D/S uplift pressure (kPa)
1340.0	0	-58.69946	0	0	0	-49.80158	0	0
1338.0	0	-67.04430	0	19.61330	0	-82.61644	0	0
1336.0	0	-81.26208	0	39.22660	0	-109.05773	0	0
1334.0	0	-97.98534	0	58.83990	0	-132.96118	0	0
1332.0	0	-102.44221	0	78.45320	0	-163.16050	0	0
1331.0	0	-107.12412	0	88.25985	0	-177.29204	0	0
Base	0	-100.92293	0	133.37044	0	-311.11826	0	0
Joint elevation (m)	Normal load (kN)	Uplift force (kN)	Shear U/S-D/S (kN)	Shear left-right (kN)	Shear total (kN)	Moment ZZ at center (kN·m)	Moment XX at center (kN·m)	Moment YY at center (kN·m)
1340.0	-430.90063	0	0	0	0	46.77908	0	0
1338.0	-766.62116	73.59986	117.61330	0	117.61330	-136.19860	.00000	0
1336.0	-1193.95040	176.31781	176.45320	0	176.45320	-364.63652	.00000	0
1334.0	-1714.63642	308.15387	276.54054	0	276.54054	-642.64066	.00000	0
1332.0	-2397.96431	504.64759	430.00032	0	430.00032	-1649.75214	.00000	0
1331.0	-2802.68358	622.57591	527.50270	0	527.50270	-2271.20823	.00000	0
Base	-4160.64193	1069.00143	893.95531	0	893.95531	-7143.99607	.00000	0
Joint elevation (m)	sliding peak	sliding residual	uplifting	flotation	overturning toward upstream	overturning toward downstream	Resultant position (joint %)	
1340.0	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	48.63321	
1338.0	35.26302	35.26302	11.41607	11.41607	18.68954	6.50600	51.73416	
1336.0	30.23118	30.23118	7.77158	7.77158	12.51769	4.76930	52.43412	
1334.0	23.91958	23.91958	6.56422	6.56422	10.38829	4.26033	52.52409	
1332.0	19.43417	19.43417	5.75176	5.75176	9.26621	3.83856	53.81009	
1331.0	17.64244	17.64244	5.50175	5.50175	8.89762	3.71511	54.11181	
Base	6.64688	6.64688	4.89208	4.89208	8.09592	3.19807	58.50220	
	2.0 (w/o test)	1.3	1.1	1.1			1/2 median	
	1.5 (with test)							
Massima piena [1.0*D + 1.0*Hu + 1.0*U + 1.0*S]								

Joint elevation (m)	Cracking at the U/S (% of joint)	Normal U/S stress (kPa)	U/S crack opening length (% of joint)	U/S uplift pressure (kPa)	Cracking at the D/S (% of joint)	Normal D/S stress (kPa)	D/S crack opening length (% of joint)	D/S uplift pressure (kPa)
1340.0	0	-50.34120	0	11.76798	0	-50.12791	0	0
1338.0	0	-70.13982	0	31.38128	0	-73.88322	0	0
1336.0	0	-88.57994	0	50.99458	0	-97.61783	0	0
1334.0	0	-105.98081	0	70.60788	0	-121.88941	0	0
1332.0	0	-109.90040	0	90.22118	0	-154.09745	0	0
1331.0	0	-114.12951	0	100.02783	0	-169.26837	0	0
Base	0	-108.02924	0	145.13842	0	-271.89470	0	34.12714
Joint elevation (m)	Normal load (kN)	Uplift force (kN)	Shear U/S-D/S (kN)	Shear left-right (kN)	Shear total (kN)	Moment ZZ at center (kN·m)	Moment XX at center (kN·m)	Moment YY at center (kN·m)
1340.0	-399.00261	35.42448	7.06079	0	7.06079	1.12135	.00000	0
1338.0	-737.74260	117.75977	50.21005	0	50.21005	-32.74092	.00000	0
1336.0	-1168.09131	229.21316	132.58591	0	132.58591	-118.56337	.00000	0
1334.0	-1691.79678	369.78465	256.20920	0	256.20920	-292.30200	.00000	0
1332.0	-2383.47506	580.34473	433.20495	0	433.20495	-1200.86024	.00000	0
1331.0	-2792.64933	705.58604	542.47531	0	542.47531	-1784.74501	.00000	0
Base	-3836.33359	1474.23417	959.09497	0	959.09497	-5569.36373	.00000	0
Joint elevation (m)	sliding peak	sliding residual	uplifting	flotation	overturning toward upstream	overturning toward downstream	Resultant position (joint %)	
1340.0	427.73186	427.73186	12.26347	12.26347	19.72812	9.05675	49.96462	
1338.0	82.02585	82.02585	7.26481	7.26481	11.37193	5.46560	50.43319	
1336.0	40.03841	40.03841	6.09609	6.09609	9.39922	4.62401	50.80899	
1334.0	25.72855	25.72855	5.57509	5.57509	8.51940	4.24423	51.16357	
1332.0	19.25696	19.25696	5.10700	5.10700	8.00917	3.80725	52.79024	
1331.0	17.13700	17.13700	4.95791	4.95791	7.83202	3.67602	53.24272	
Base	5.71252	5.71252	3.60226	3.60226	4.71741	2.85779	57.18852	
	1.3 (w/o test)	1.0	1.1	1.1			inside section	
	1.1 (with test)							
E2A: Seismic event, MDE [1.0*D + 1.0*Hu + 1.0*U + 1.0*S + 1.0*Qh + 0.3*Qv]								
Joint elevation (m)	Cracking at the U/S (% of joint)	Normal U/S stress (kPa)	U/S crack opening length (% of joint)	U/S uplift pressure (kPa)	Cracking at the D/S (% of joint)	Normal D/S stress (kPa)	D/S crack opening length (% of joint)	D/S uplift pressure (kPa)
1340.0	0	-97.41703	0	0	0	-19.09140	0	0
1338.0	0	-141.38371	0	19.61330	0	-17.72754	0	0
1336.0	0	-186.31801	0	39.22660	0	-13.85332	0	0

1334.0	0	-230.69185	0	58.83990	0	-10.10414	0	0
1332.0	0	-242.06202	0	78.45320	0	-31.13592	0	0
1331.0	0	-249.79014	0	88.25985	0	-41.24269	0	0
Base	0	-396.69737	0	133.37044	0	-15.71122	0	0
Joint elevation (m)	Normal load (kN)	Uplift force (kN)	Shear U/S-D/S (kN)	Shear left-right (kN)	Shear total (kN)	Moment ZZ at center (kN·m)	Moment XX at center (kN·m)	Moment YY at center (kN·m)
1340.0	-462.70109	0	-249.92236	0	249.92236	411.78361	0	0
1338.0	-815.03036	73.59986	-487.81439	0	487.81439	1081.53449	.00000	0
1336.0	-1255.75285	176.31781	-766.52067	0	766.52067	2262.47378	.00000	0
1334.0	-1787.76267	308.15387	-1081.72570	0	1081.72570	4053.04398	.00000	0
1332.0	-2466.53699	504.64759	-1408.15592	0	1408.15592	5730.98778	.00000	0
1331.0	-2867.88547	622.57591	-1585.21474	0	1585.21474	6750.30269	.00000	0
Base	-4164.35175	1069.00143	-2574.33537	0	2574.33537	12948.73524	.00000	0
Joint elevation (m)	sliding peak	sliding residual	Safety factors uplifting	flotation	overturning toward upstream	overturning toward downstream	Resultant position (joint %)	
1340.0	12.33912	12.33912	100.00000	100.00000	4.94351	100.00000	38.79543	
1338.0	8.60124	8.60124	10.42493	12.07380	3.31057	11.02519	37.04720	
1336.0	7.03985	7.03985	6.90250	8.12210	2.77982	7.62657	35.64024	
1334.0	6.18258	6.18258	5.73361	6.80153	2.52664	6.49808	34.73205	
1332.0	5.98320	5.98320	4.90320	5.88764	2.55908	5.44889	37.13228	
1331.0	5.91190	5.91190	4.65877	5.60648	2.58247	5.12605	38.05705	
Base	2.31023	2.31023	3.94211	4.89555	1.99231	4.75129	34.60321	
	1.3 (w/o test)	1.0	1.1	1.1			inside section	
	1.1 (with test)							
E2B: Seismic event, MDE [1.0*D + 1.0*Hu + 1.0*U + 1.0*S + 1.0*Qh - 0.3*Qv]								
Joint elevation (m)	Cracking at the U/S (% of joint)	Normal U/S stress (kPa)	U/S crack opening length (% of joint)	U/S uplift pressure (kPa)	Cracking at the D/S (% of joint)	Normal D/S stress (kPa)	D/S crack opening length (% of joint)	D/S uplift pressure (kPa)
1340.0	0	-88.75299	0	0	0	-11.74068	0	0
1338.0	0	-128.22616	0	19.61330	0	-6.95666	0	0
1336.0	0	-168.94593	0	39.22660	0	.09231	0	0
1334.0	0	-209.26347	0	58.83990	0	6.89398	0	0
1332.0	0	-220.77663	0	78.45320	0	-9.03547	0	0
1331.0	0	-228.28608	0	88.25985	0	-16.78372	0	0
Base	0	-366.00914	0	133.37044	6.36940	.00000	6.36940	0
Joint	Normal	Uplift	Shear	Shear	Shear	Moment ZZ	Moment XX	Moment YY

elevation (m)	load (kN)	force (kN)	U/S-D/S (kN)	left-right (kN)	total (kN)	at center (kN·m)	at center (kN·m)	at center (kN·m)
1340.0	-399.10016	0	-249.92236	0	249.92236	404.87902	0	0
1338.0	-692.45959	73.59986	-487.81439	0	487.81439	1060.65987	.00000	0
1336.0	-1059.28467	176.31781	-766.52067	0	766.52067	2217.52396	.00000	0
1334.0	-1502.46950	308.15387	-1081.72570	0	1081.72570	3971.64314	.00000	0
1332.0	-2074.83277	504.64759	-1408.15592	0	1408.15592	5753.13345	.00000	0
1331.0	-2414.95808	622.57591	-1585.21474	0	1585.21474	6845.94788	.00000	0
Base	-3460.42518	1069.00143	-2539.08670	0	2539.08670	10905.50399	.00000	0
Joint elevation (m)	sliding peak	sliding residual	uplifting	flotation	overturning toward upstream	overturning toward downstream	Resultant position (joint %)	
1340.0	12.08464	12.08464	13.55014	100.00000	3.43626	16.33678	37.22767	
1338.0	8.34998	8.34998	5.68634	10.40844	2.51398	6.42921	35.04871	
1336.0	6.78059	6.78059	4.40624	7.00781	2.18112	5.08617	33.31511	
1334.0	5.77437	5.77437	3.88758	5.87571	2.01778	4.55830	32.19779	
1332.0	5.70503	5.70503	3.50651	5.11145	2.04784	4.04137	34.64389	
1331.0	5.62618	5.62618	3.39033	4.87898	2.06799	3.87215	35.61618	
Base	1.94637	1.94637	2.95792	4.23706	1.66150	3.65244	31.21020	
	1.3 (w/o test)	1.0	1.1	1.1			inside section	
	1.1 (with test)							
E2C: Seismic event, MDE [1.0*D + 1.0*Hu + 1.0*U + 1.0*S - 1.0*Qh + 0.3*Qv]								
Joint elevation (m)	Cracking at the U/S (% of joint)	Normal U/S stress (kPa)	U/S crack opening length (% of joint)	U/S uplift pressure (kPa)	Cracking at the D/S (% of joint)	Normal D/S stress (kPa)	D/S crack opening length (% of joint)	D/S uplift pressure (kPa)
1340.0	0	-28.64594	0	0	0	-87.86249	0	0
1338.0	0	-24.63037	0	19.61330	0	-139.50828	0	0
1336.0	0	-21.03187	0	39.22660	0	-190.75411	0	0
1334.0	0	-16.97577	0	58.83990	0	-242.54777	0	0
1332.0	0	-11.79029	0	78.45320	0	-289.60303	0	0
1331.0	0	-12.22715	0	88.25985	0	-311.53537	0	0
Base	26.29861	.00000	26.29861	133.37044	0	-651.83993	0	0
Joint elevation (m)	Normal load (kN)	Uplift force (kN)	Shear U/S-D/S (kN)	Shear left-right (kN)	Shear total (kN)	Moment ZZ at center (kN·m)	Moment XX at center (kN·m)	Moment YY at center (kN·m)
1340.0	-462.70109	0	249.92236	0	249.92236	-311.32085	0	0
1338.0	-840.78272	73.59986	527.04099	0	527.04099	-1004.75708	.00000	0
1336.0	-1328.61613	176.31781	923.42707	0	923.42707	-2226.49700	.00000	0
1334.0	-1926.80334	308.15387	1438.80677	0	1438.80677	-4144.62446	.00000	0

1332.0	-2721.09585	504.64759	2072.15656	0	2072.15656	-7548.33772	.00000	0
1331.0	-3190.40908	622.57591	2444.22014	0	2444.22014	-9688.06434	.00000	0
Base	-4851.05639	1069.00143	4131.24258	0	4131.24258	-12034.01170	.00000	0
Joint elevation (m)	sliding peak	sliding residual	uplifting	Safety factors flotation	overturning toward upstream	overturning toward downstream	Resultant position (joint %)	
1340.0	12.33912	12.33912	100.00000	100.00000	100.00000	5.22138	58.47100	
1338.0	8.00993	8.00993	12.42370	12.42370	24.12484	3.19916	61.66472	
1336.0	5.92256	5.92256	8.53535	8.53535	16.48657	2.72254	63.35643	
1334.0	4.74483	4.74483	7.25273	7.25273	13.95270	2.50887	64.48629	
1332.0	4.18879	4.18879	6.39207	6.39207	12.39394	2.44420	65.36269	
1331.0	3.96616	3.96616	6.12453	6.12453	11.86691	2.43898	65.40781	
Base	1.67698	1.67698	5.52490	5.53793	11.66775	1.79889	75.43287	
	1.3 (w/o test)	1.0	1.1	1.1			inside section	
	1.1 (with test)							
E2D: Seismic event, MDE [1.0*D + 1.0*Hu + 1.0*U + 1.0*S - 1.0*Qh - 0.3*Qv]								
Joint elevation (m)	Cracking at the U/S (% of joint)	Normal U/S stress (kPa)	U/S crack opening length (% of joint)	U/S uplift pressure (kPa)	Cracking at the D/S (% of joint)	Normal D/S stress (kPa)	D/S crack opening length (% of joint)	D/S uplift pressure (kPa)
1340.0	0	-19.98190	0	0	0	-80.51177	0	0
1338.0	0	-11.47282	0	19.61330	0	-128.73741	0	0
1336.0	0	-3.65979	0	39.22660	0	-176.80849	0	0
1334.0	0	4.45260	0	58.83990	0	-225.54965	0	0
1332.0	0	9.49510	0	78.45320	0	-267.50258	0	0
1331.0	0	9.27692	0	88.25985	0	-287.07639	0	0
Base	38.59616	.00000	38.59616	133.37044	0	-668.85564	0	0
Joint elevation (m)	Normal load (kN)	Uplift force (kN)	Shear U/S-D/S (kN)	Shear left-right (kN)	Shear total (kN)	Moment ZZ at center (kN·m)	Moment XX at center (kN·m)	Moment YY at center (kN·m)
1340.0	-399.10016	0	249.92236	0	249.92236	-318.22544	0	0
1338.0	-718.21195	73.59986	527.04099	0	527.04099	-1025.63170	.00000	0
1336.0	-1132.14795	176.31781	923.42707	0	923.42707	-2271.44682	.00000	0
1334.0	-1641.51017	308.15387	1438.80677	0	1438.80677	-4226.02530	.00000	0
1332.0	-2329.39162	504.64759	2072.15656	0	2072.15656	-7526.19206	.00000	0
1331.0	-2737.48169	622.57591	2444.22014	0	2444.22014	-9592.41915	.00000	0
Base	-4147.12981	1069.00143	4166.49126	0	4166.49126	-8571.19970	.00000	0
Joint elevation	sliding	sliding	uplifting	Safety factors flotation	overturning	overturning	Resultant position	

(m)	peak	residual			toward upstream	toward downstream	(joint %)	
1340.0	12.08464	12.08464	13.55014	100.00000	16.49341	3.57840	60.03875	
1338.0	7.77737	7.77737	6.32461	10.75833	9.82362	2.45318	63.93914	
1336.0	5.70980	5.70980	5.12362	7.42106	8.34767	2.15437	65.99069	
1334.0	4.48062	4.48062	4.64132	6.32692	7.71910	2.01627	67.33796	
1332.0	3.90119	3.90119	4.32533	5.61588	7.21078	1.99728	67.89339	
1331.0	3.69756	3.69756	4.22421	5.39702	7.03032	2.00485	67.77981	
Base	1.42151	1.42151	3.91222	4.87944	7.30023	1.51035	79.53205	
	1.3 (w/o test)	1.0	1.1	1.1			inside section	
	1.1 (with test)							
E2E: Seismic event, MDE [1.0*D + 1.0*Hu + 1.0*U + 1.0*S + 0.3*Qh + 1.0*Qv]								
Joint elevation (m)	Cracking at the U/S (% of joint)	Normal U/S stress (kPa)	U/S crack opening length (% of joint)	U/S uplift pressure (kPa)	Cracking at the D/S (% of joint)	Normal D/S stress (kPa)	D/S crack opening length (% of joint)	D/S uplift pressure (kPa)
1340.0	0	-83.45520	0	0	0	-51.73711	0	0
1338.0	0	-115.87052	0	19.61330	0	-72.91681	0	0
1336.0	0	-148.73529	0	39.22660	0	-92.03849	0	0
1334.0	0	-180.89099	0	58.83990	0	-111.29055	0	0
1332.0	0	-186.29987	0	78.45320	0	-147.38327	0	0
1331.0	0	-191.73117	0	88.25985	0	-164.38060	0	0
Base	0	-251.16870	0	133.37044	0	-266.37284	0	0
Joint elevation (m)	Normal load (kN)	Uplift force (kN)	Shear U/S-D/S (kN)	Shear left-right (kN)	Shear total (kN)	Moment ZZ at center (kN·m)	Moment XX at center (kN·m)	Moment YY at center (kN·m)
1340.0	-536.90218	0	-74.97671	0	74.97671	166.75241	0	0
1338.0	-967.04292	73.59986	-132.61501	0	132.61501	375.68616	.00000	0
1336.0	-1510.46788	176.31781	-175.03896	0	175.03896	743.77547	.00000	0
1334.0	-2169.26894	308.15387	-199.53933	0	199.53933	1278.82767	.00000	0
1332.0	-3012.62086	504.64759	-190.04655	0	190.04655	1057.38724	.00000	0
1331.0	-3509.18402	622.57591	-174.91253	0	174.91253	885.28817	.00000	0
Base	-5225.94604	1069.00143	-268.50655	0	268.50655	-516.74959	.00000	0
Joint elevation (m)	sliding peak	sliding residual	Safety factors		overturning toward upstream	overturning toward downstream	Resultant position (joint %)	
			uplifting	flotation				
1340.0	42.12006	42.12006	100.00000	100.00000	19.12093	100.00000	46.08976	
1338.0	32.78530	32.78530	13.48398	14.13920	9.13959	11.16407	46.20793	
1336.0	32.28370	32.28370	9.06670	9.56673	7.13251	7.67835	46.07538	
1334.0	35.42843	35.42843	7.59332	8.03956	6.27845	6.51656	46.02984	
1332.0	47.20610	47.20610	6.54983	6.96975	6.07086	5.48967	48.05621	

1331.0	57.24537	57.24537	6.23014	6.63656	6.00883	5.17961	48.71994	
Base	27.79606	27.79606	5.45546	5.88862	4.90454	4.56400	50.48963	
	1.3 (w/o test)	1.0	1.1	1.1			inside section	
	1.1 (with test)							
E2F: Seismic event, MDE [1.0*D + 1.0*Hu + 1.0*U + 1.0*S + 0.3*Qh - 1.0*Qv]								
Joint elevation (m)	Cracking at the U/S (% of joint)	Normal U/S stress (kPa)	U/S crack opening length (% of joint)	U/S uplift pressure (kPa)	Cracking at the D/S (% of joint)	Normal D/S stress (kPa)	D/S crack opening length (% of joint)	D/S uplift pressure (kPa)
1340.0	0	-54.57506	0	0	0	-27.23473	0	0
1338.0	0	-72.01202	0	19.61330	0	-37.01391	0	0
1336.0	0	-90.82836	0	39.22660	0	-45.55307	0	0
1334.0	0	-109.46308	0	58.83990	0	-54.63015	0	0
1332.0	0	-115.34857	0	78.45320	0	-73.71510	0	0
1331.0	0	-120.05095	0	88.25985	0	-82.85068	0	0
Base	0	-143.92503	0	133.37044	0	-141.24312	0	0
Joint elevation (m)	Normal load (kN)	Uplift force (kN)	Shear U/S-D/S (kN)	Shear left-right (kN)	Shear total (kN)	Moment ZZ at center (kN·m)	Moment XX at center (kN·m)	Moment YY at center (kN·m)
1340.0	-324.89907	0	-74.97671	0	74.97671	143.73710	0	0
1338.0	-558.47369	73.59986	-132.61501	0	132.61501	306.10411	.00000	0
1336.0	-855.57394	176.31781	-175.03896	0	175.03896	593.94272	.00000	0
1334.0	-1218.29170	308.15387	-199.53933	0	199.53933	1007.49153	.00000	0
1332.0	-1706.94010	504.64759	-190.04655	0	190.04655	1131.20613	.00000	0
1331.0	-1999.42606	622.57591	-174.91253	0	174.91253	1204.10548	.00000	0
Base	-2879.52413	1069.00143	-151.01095	0	151.01095	91.15131	.00000	0
Joint elevation (m)	sliding peak	sliding residual	uplifting	flotation	overturning toward upstream	overturning toward downstream	Resultant position (joint %)	
1340.0	39.29247	39.29247	4.06504	100.00000	3.21374	4.31584	44.43010	
1338.0	29.70443	29.70443	2.98218	8.58797	2.62295	2.97244	44.64988	
1336.0	28.54228	28.54228	2.66230	5.85245	2.40264	2.62905	44.46708	
1334.0	30.66256	30.66256	2.51435	4.95352	2.29566	2.47459	44.43071	
1332.0	40.33578	40.33578	2.42760	4.38244	2.28805	2.36140	46.32985	
1331.0	48.61387	48.61387	2.40229	4.21154	2.29133	2.32618	46.94431	
Base	27.23237	27.23237	2.22734	3.69366	2.12355	2.11309	49.84326	
	1.3 (w/o test)	1.0	1.1	1.1			inside section	
	1.1 (with test)							
E2G: Seismic event, MDE [1.0*D + 1.0*Hu + 1.0*U + 1.0*S - 0.3*Qh + 1.0*Qv]								
Joint elevation (m)	Cracking at the U/S (% of joint)	Normal U/S stress (kPa)	U/S crack opening length (% of joint)	U/S uplift pressure (kPa)	Cracking at the D/S (% of joint)	Normal D/S stress (kPa)	D/S crack opening length (% of joint)	D/S uplift pressure (kPa)

elevation (m)	at the U/S (% of joint)	stress (kPa)	opening length (% of joint)	pressure (kPa)	at the D/S (% of joint)	stress (kPa)	opening length (% of joint)	pressure (kPa)
1340.0	0	-62.82387	0	0	0	-72.36844	0	0
1338.0	0	-80.84452	0	19.61330	0	-109.45104	0	0
1336.0	0	-99.14944	0	39.22660	0	-145.10873	0	0
1334.0	0	-116.77617	0	58.83990	0	-181.02364	0	0
1332.0	0	-117.21835	0	78.45320	0	-224.92340	0	0
1331.0	0	-120.46227	0	88.25985	0	-245.46841	0	0
Base	0	-94.25674	0	133.37044	0	-443.68675	0	0
Joint elevation (m)	Normal load (kN)	Uplift force (kN)	Shear U/S-D/S (kN)	Shear left-right (kN)	Shear total (kN)	Moment ZZ at center (kN·m)	Moment XX at center (kN·m)	Moment YY at center (kN·m)
1340.0	-536.90218	0	74.97671	0	74.97671	-50.17893	0	0
1338.0	-974.76863	73.59986	171.84161	0	171.84161	-250.20131	.00000	0
1336.0	-1532.32687	176.31781	331.94536	0	331.94536	-602.91577	.00000	0
1334.0	-2210.98114	308.15387	556.62041	0	556.62041	-1180.47286	.00000	0
1332.0	-3088.98851	504.64759	854.04720	0	854.04720	-2926.41041	.00000	0
1331.0	-3605.94110	622.57591	1033.91793	0	1033.91793	-4046.22194	.00000	0
Base	-5431.95743	1069.00143	1743.16684	0	1743.16684	-11876.22345	.00000	0
Joint elevation (m)	sliding peak	sliding residual	uplifting	flotation	overturning toward upstream	overturning toward downstream	Resultant position (joint %)	
1340.0	42.12006	42.12006	100.00000	100.00000	100.00000	20.19568	51.17667	
1338.0	25.34630	25.34630	14.24416	14.24416	23.82780	6.80191	52.50545	
1336.0	17.08945	17.08945	9.69071	9.69071	15.97977	5.22007	53.13598	
1334.0	12.77545	12.77545	8.17493	8.17493	13.35294	4.60491	53.59567	
1332.0	10.59394	10.59394	7.12108	7.12108	11.93256	4.14352	55.24661	
1331.0	9.77804	9.77804	6.79197	6.79197	11.45812	4.00613	55.69353	
Base	4.45031	4.45031	6.07695	6.08134	10.63213	3.22651	60.82611	
	1.3 (w/o test)	1.0	1.1	1.1			inside section	
	1.1 (with test)							
E2H: Seismic event, MDE [1.0*D + 1.0*Hu + 1.0*U + 1.0*S - 0.3*Qh - 1.0*Qv]								
Joint elevation (m)	Cracking at the U/S (% of joint)	Normal U/S stress (kPa)	U/S crack opening length (% of joint)	U/S uplift pressure (kPa)	Cracking at the D/S (% of joint)	Normal D/S stress (kPa)	D/S crack opening length (% of joint)	D/S uplift pressure (kPa)
1340.0	0	-33.94373	0	0	0	-47.86606	0	0
1338.0	0	-36.98602	0	19.61330	0	-73.54813	0	0
1336.0	0	-41.24252	0	39.22660	0	-98.62331	0	0
1334.0	0	-45.34825	0	58.83990	0	-124.36324	0	0

1332.0	0	-46.26705	0	78.45320	0	-151.25523	0	0
1331.0	0	-48.78205	0	88.25985	0	-163.93848	0	0
Base	4.25007	.00000	4.25007	133.37044	0	-319.13348	0	0
Joint elevation (m)	Normal load (kN)	Uplift force (kN)	Shear U/S-D/S (kN)	Shear left-right (kN)	Shear total (kN)	Moment ZZ at center (kN·m)	Moment XX at center (kN·m)	Moment YY at center (kN·m)
1340.0	-324.89907	0	74.97671	0	74.97671	-73.19424	0	0
1338.0	-566.19939	73.59986	171.84161	0	171.84161	-319.78337	.00000	0
1336.0	-877.43292	176.31781	331.94536	0	331.94536	-752.74851	.00000	0
1334.0	-1260.00390	308.15387	556.62041	0	556.62041	-1451.80900	.00000	0
1332.0	-1783.30776	504.64759	854.04720	0	854.04720	-2852.59152	.00000	0
1331.0	-2096.18314	622.57591	1033.91793	0	1033.91793	-3727.40463	.00000	0
Base	-3085.53552	1069.00143	1860.66243	0	1860.66243	-9944.14581	.00000	0
Joint elevation (m)	sliding peak	sliding residual	Safety factors uplifting	flotation	overturning toward upstream	overturning toward downstream	Resultant position (joint %)	
1340.0	39.29247	39.29247	4.06504	100.00000	4.32994	3.24996	52.83632	
1338.0	22.96870	22.96870	3.03754	8.69294	3.59406	2.35910	55.51294	
1336.0	15.11656	15.11656	2.74175	5.97643	3.35123	2.11434	56.83760	
1334.0	11.06697	11.06697	2.60788	5.08888	3.24251	2.00139	57.75974	
1332.0	9.06512	9.06512	2.54067	4.53377	3.16614	1.96012	58.85876	
1331.0	8.31781	8.31781	2.52178	4.36695	3.14216	1.95354	59.02251	
Base	2.36830	2.36830	2.37555	3.88637	3.22376	1.64481	68.08336	
	1.3 (w/o test)	1.0	1.1	1.1			inside section	
	1.1 (with test)							