APPENDIX A

SOIL VOLUME CALCULATIONS

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The results of the Remedial Investigation (RI) and the Site Characterization component of the Treatability study conducted in November 1996, and the Additional Soil Sampling conducted in 2003 were examined to determine the extent and volume of contaminated media at the Site with concentrations of COCs (acetone, aniline, BTEX, chlorobenzene, alpha-picoline, 2-aminopyridine, and pyridine) and pyridine-based TICs exceeding NYSDEC Soil Cleanup Objectives.

Overburden Thickness

The thickness of the overburden materials in the area of the former lagoons is based on the depth to bedrock for test pits and boreholes completed during the RI, Site Characterization Program, and the 2003 Additional Investigation. Depths are summarized in Table A.1 and are presented on Figure A.1. To determine the average overburden thickness for each lagoon area, the depths to bedrock were averaged for the test pits and boreholes within each lagoon. For locations where bedrock was not encountered, the maximum depth of the borehole or test pit was used if it was deeper than the average bedrock depth determined from other locations within the lagoon area.

The average overburden thickness was estimated to range from 3.7 feet (ft) below ground surface (bgs) for Lagoon 6 to 14.6 ft bgs for Lagoon 3 as summarized in Table A.2.

Area of Former Lagoons

The test pit and borehole results were used to define the approximate area of soils with concentrations of COCs exceeding NYSDEC Soil Cleanup Objectives. The former lagoons and surrounding areas that contain COCs above soil cleanup objectives are presented on Figure A.1. The total area of contaminated soils is estimated to be 135,000 square feet (approximately 3 acres). The area for each former lagoon is summarized in Table A.2.

Volume Estimates

The volume calculations for contaminated soil are based on the average depth to bedrock for each lagoon and the thickness of the distinct black-stained layer observed

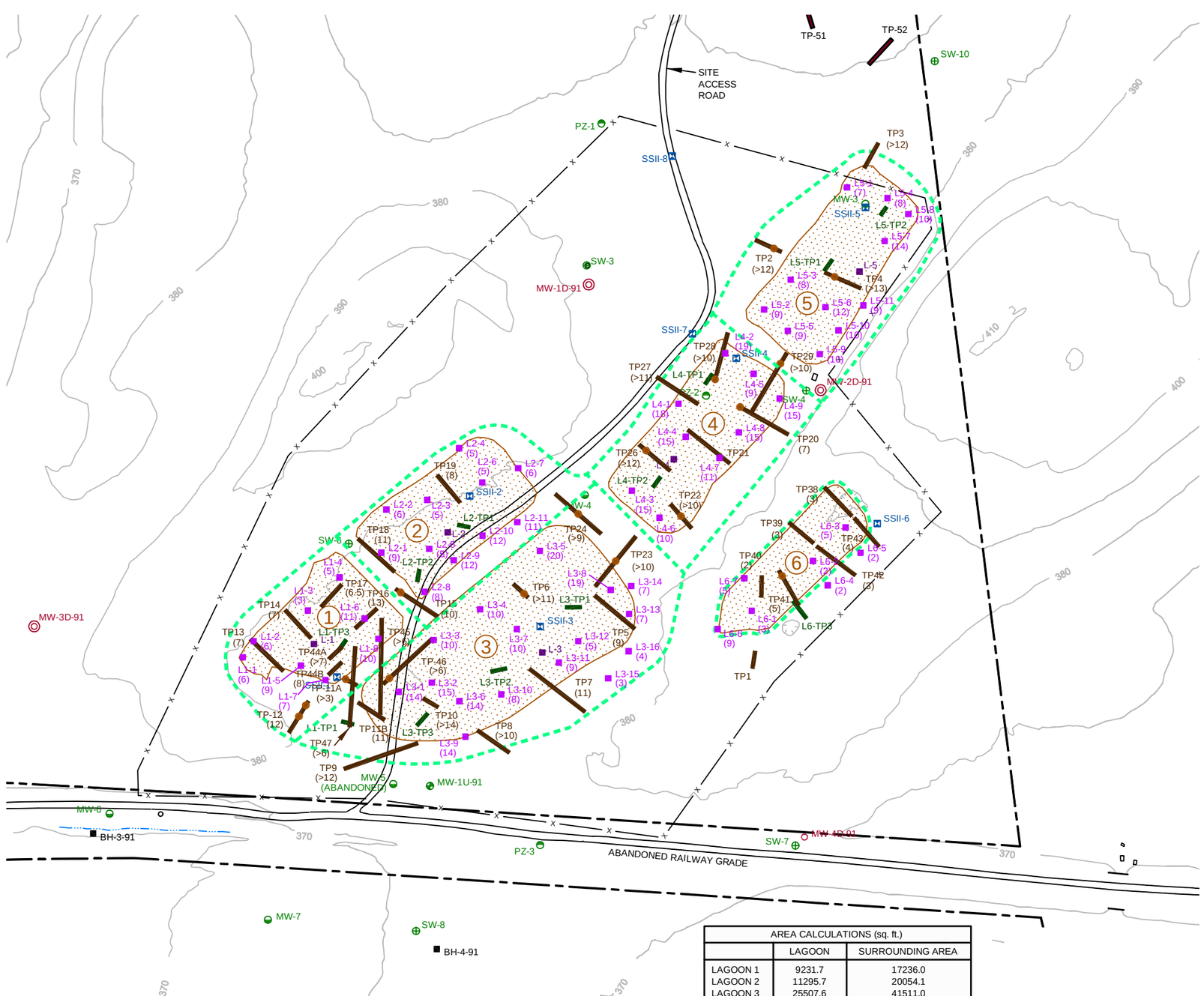
during the completion of test pits. The analytical results for samples collected during the Site Characterization program completed in support of the Treatability Study indicate the upper layer of fill material which occurs above the black-stained fill layers in Lagoons 1 to 5 will, most likely, not require remediation. The thickness of the black-stained layer ranges from approximately 4.6 ft for Lagoon 1 to 10 ft for Lagoon 3 as summarized in Table A.2. The black-stained layer was not encountered in Lagoon 6. The volume of the black-stained contaminated layer is estimated to be approximately 35,000 cubic yards. The total volume of overburden material within the lagoons is estimated to be approximately 56,810 cubic yards as summarized in Table A.2.

A large amount of shale fragments and cobbles were observed in test pits completed within the former lagoons. Based on field observations, it is estimated that approximately 90 percent of Lagoon 6 is comprised of shale fragments that would not require treatment. In addition, it is conservatively estimated that 20 percent of the material in Lagoons 1 to 5 is fragmented shale or cobbles that would be screened out prior to ex situ treatment.

Estimate of Saturated Thickness

In order to estimate the saturated thickness in the area of the former lagoons, historical water levels for wells located in the area of the lagoons were reviewed. The depth to the water table for the months of January, May, June, July, August, and October are presented in Table A.3. The seasonal fluctuations in the water table were estimated by assigning the appropriate wells to each lagoon area as summarized in Table A.4. On average, the water table is estimated to fluctuate from approximately 4 ft bgs to 11 ft bgs for Lagoons 3, 4, and 5. The water table in the area of Lagoons 1, 2, and 6 is estimated to be below the top of bedrock for some of the months where water levels were recorded. The saturated thickness for each lagoon area, based on the depth to bedrock, is estimated as follows:

Lagoon	*Seasonal Saturated Thickness (ft bgs)*
1	0 – 4.5
2	0 – 5.6
3	3.2 – 10.3
4	0.7 – 9.5
5	0 – 6.7
6	0 - 0



LEGEND

- 390 — ELEVATION CONTOUR
- SITE PROPERTY BOUNDARY
- SECURITY FENCE
- AREAS USED FOR SOIL VOLUME CALCULATIONS
- APPROXIMATE LOCATION OF LAGOON (SUPERIMPOSED FROM 06/24/63 AERIAL PHOTOGRAPH)
- 2 — LAGOON IDENTIFICATION NUMBER
- T-1 — OVERBURDEN TEST WELL LOCATION LEGGETTE, BRASHEARS & GRAHAM (1967)
- T-2 — BEDROCK TEST WELL LOCATION LEGGETTE, BRASHEARS & GRAHAM (1967)
- MW-1 — MONITORING WELL LOCATION GROUND/WATER TECHNOLOGY, INC. (1983)
- PZ-1 — PIEZOMETER WELL LOCATION GROUND/WATER TECHNOLOGY, INC. (1983)
- SW-1 — SHALLOW WELL LOCATION C.A. RICH (1985)
- DW-1-95 — DEEP MONITORING WELLS WERE ORIGINALLY INSTALLED BY C.A.RICH (1985) AS OPEN COREHOLES AND WERE CONVERTED BY CRA TO PIEZOMETERS (1995)
- MW-1U-91 — OVERBURDEN WELL LOCATION, CRA (1991,1995 AND 2001)
- MW-6D-95 — BEDROCK WELL LOCATION, CRA (1991,1995 AND 2001)
- MW-1D-01 — CONVERTED BEDROCK MONITORING WELL LOCATION (2001)
- BH-1-91 — BOREHOLE LOCATION, CRA
- SSII-3 — SURFACE SOIL SAMPLE LOCATION, CRA (1995)
- L-5 — SOIL SAMPLE LOCATION, C.A. RICH (1985)
- L4-6 (10) — IN-FIELD SAMPLE LOCATIONS (2003) (MAXIMUM SAMPLE DEPTH IN ft BGS)
- TP41 (5) — TEST PIT AND SAMPLE LOCATION, CRA 1991 (DEPTH TO BEDROCK IN ft BGS)
- L4-TP1 — TEST PIT LOCATION, CRA (1996)
- TP-51 — TEST PIT LOCATION-CURTAIN DRAIN

AREA CALCULATIONS (sq. ft.)		
	LAGOON	SURROUNDING AREA
LAGOON 1	9231.7	17236.0
LAGOON 2	11295.7	20054.1
LAGOON 3	25507.6	41511.0
LAGOON 4	13110.7	22440.0
LAGOON 5	12923.6	24814.1
LAGOON 6	7552.8	8754.6
TOTAL	79622.1	134809.8

figure A.1

AREA OF CONTAMINATED SOIL
FORMER LAGOON SITE
Hamptonburgh, New York

03698-00(032)GN-WA001 JUN 23/2006

TABLE A.1

DETERMINATION OF DEPTH TO BEDROCK AND CONTAMINATED OVERBURDEN
FORMER LAGOON SITE
HAMPTONBURGH, NEW YORK

Lagoon	Sample Location	Depth to Bedrock (ft bgs)		Depth to Top of Black-stained Contaminated Layer (ft bgs)
1	L1-TP1	> 14	[1]	10
1	L1-TP2	5.5	[1]	not encountered
1	L1-TP3	13	[1]	4
1	TP-11A	> 3		0.5
1	TP-12	12	[1]	7
1	TP-13	7	[1]	6
1	TP-14	7	[1]	5
1	TP-16	12.5	[1]	5
1	TP-17	6.5	[1]	6
1	TP-44A	> 7		not encountered
1	TP-44B	8	[1]	not encountered
1	TP-45	> 6		not encountered
1	TP-46	> 6		2
1	TP-47	> 6		not encountered
1	L1-1	6	[2]	NA
1	L1-2	6	[2]	NA
1	L1-3	3	[2]	NA
1	L1-4	5	[2]	NA
1	L1-5	9	[1,2]	NA
1	L1-6	11	[1,2]	NA
1	L1-7	7	[2]	NA
1	L1-8	10	[1,2]	NA
	LAGOON 1 AVERAGE	**9.6**		**5.1**
2	L2-TP1	5	[1]	4
2	L2-TP2	7	[1]	4
2	TP-15	10	[1]	2
2	TP-18	10.5	[1]	4
2	TP-19	8	[1]	6
2	MW-4	> 15	[1]	NA
2	L2-1	9	[1,2]	NA
2	L2-2	6	[2]	NA
2	L2-3	5	[2]	NA
2	L2-4	5	[2]	NA
2	L2-5	5	[2]	NA
2	L2-6	5	[2]	NA
2	L2-7	6	[2]	NA
2	L2-8	8	[2]	NA
2	L2-9	12	[1,2]	NA
2	L2-10	12	[1,2]	NA

TABLE A.1

DETERMINATION OF DEPTH TO BEDROCK AND CONTAMINATED OVERBURDEN
FORMER LAGOON SITE
HAMPTONBURGH, NEW YORK

Lagoon	Sample Location	Depth to Bedrock (ft bgs)	Depth to Top of Black-stained Contaminated Layer (ft bgs)
2	L2-11	11 [1,2]	NA
	LAGOON 2 AVERAGE	**10.0**	**4.0**
3	L3-TP1	> 14 [1]	8
3	L3-TP2	14 [1]	5
3	L3-TP3	> 12	5
3	TP-5	9 [1]	5
3	TP-6	> 11	3
3	TP-7	11 [1]	7
3	TP-8	> 10	3
3	TP-9	> 12	3
3	TP-10	> 13.5	3.5
3	TP-11B	11 [1]	5
3	TP-23	> 10	5
3	TP-24	> 9	3
3	MW-1U-91	20.5 [1]	NA
3	L3-1	14 [1,2]	NA
3	L3-2	15 [1,2]	NA
3	L3-3	10 [2]	NA
3	L3-4	10 [2]	NA
3	L3-5	20 [1,2]	NA
3	L3-6	14 [1,2]	NA
3	L3-7	10 [2]	NA
3	L3-8	19 [1,2]	NA
3	L3-9	14 [1,2]	NA
3	L3-10	8 [2]	NA
3	L3-11	9 [2]	NA
3	L3-12	5 [2]	NA
3	L3-13	7 [2]	NA
3	L3-14	7 [2]	NA
3	L3-15	3 [2]	NA
3	L3-16	4 [2]	NA
	LAGOON 3 AVERAGE	**14.6**	**4.6**
4	L4-TP1	8 [1]	4
4	L4-TP2	> 11 [1]	4
4	TP-20	7 [1]	6
4	TP-22	> 10 [1]	6
4	TP-26	> 12 [1]	4
4	TP-27	> 11 [1]	4

TABLE A.1

DETERMINATION OF DEPTH TO BEDROCK AND CONTAMINATED OVERBURDEN
FORMER LAGOON SITE
HAMPTONBURGH, NEW YORK

Lagoon	Sample Location	Depth to Bedrock (ft bgs)	Depth to Top of Black-stained Contaminated Layer (ft bgs)
4	TP-28	> 10 [1]	4
4	TP-29	> 10 [1]	3
4	L4-1	18 [1,2]	NA
4	L4-2	19 [1,2]	NA
4	L4-3	15 [1,2]	NA
4	L4-4	15 [1,2]	NA
4	L4-5	9 [1,2]	NA
4	L4-6	10 [1,2]	NA
4	L4-7	11 [1,2]	NA
4	L4-8	15 [1,2]	NA
4	L4-9	15 [1,2]	NA
	LAGOON 4 AVERAGE	**12.1**	**4.4**
5	L5-TP1	6 [1]	5
5	L5-TP2	6 [1]	4
5	TP-2	> 12 [1]	4
5	TP-3	> 12 [1]	not encountered
5	TP-4	> 13 [1]	3
5	MW-3	13 [1]	NA
5	MW-2D-91	19 [1]	NA
5	L5-1	7 [1,2]	NA
5	L5-2	9 [1,2]	NA
5	L5-3	8 [1,2]	NA
5	L5-4	8 [1,2]	NA
5	L5-5	9 [1,2]	NA
5	L5-6	12 [1,2]	NA
5	L5-7	14 [1,2]	NA
5	L5-8	10 [1,2]	NA
5	L5-9	10 [1,2]	NA
5	L5-10	9.5 [1,2]	NA
5	L5-11	9 [1,2]	NA
	LAGOON 5 AVERAGE	**10.4**	**4.0**
6	L6-TP1	2 [1]	not encountered
6	L6-TP2	4 [1]	not encountered
6	L6-TP3	5 [1]	not encountered
6	TP-38	3 [1]	not encountered
6	TP-39	3 [1]	not encountered
6	TP-40	2 [1]	not encountered

TABLE A.1

DETERMINATION OF DEPTH TO BEDROCK AND CONTAMINATED OVERBURDEN
FORMER LAGOON SITE
HAMPTONBURGH, NEW YORK

Lagoon	Sample Location	Depth to Bedrock (ft bgs)		Depth to Top of Black-stained Contaminated Layer (ft bgs)
6	L6-TP1	2	[1]	not encountered
6	L6-TP2	4	[1]	not encountered
6	L6-TP3	5	[1]	not encountered
6	TP-38	3	[1]	not encountered
6	TP-39	3	[1]	not encountered
6	TP-40	2	[1]	not encountered
6	TP-41	5	[1]	not encountered
6	TP-42	3	[1]	not encountered
6	TP-43	4	[1]	not encountered
6	L6-1	3	[1,2]	NA
6	L6-2	2	[1,2]	NA
6	L6-3	5	[1,2]	NA
6	L6-4	2	[1,2]	NA
6	L6-5	2	[1,2]	NA
6	L6-6	9	[1,2]	NA
6	L6-7	5	[1,2]	NA
	LAGOON 6 AVERAGE	**3.7**		**NA**

Notes:

1 - Depth used for the calculation of the average depth to bedrock.

Depths were not used for locations where bedrock was not encountered unless the depth was greater than the average depth of bedrock determined from locations where bedrock was encountered.

2 - The depth of bedrock for the boreholes completed in 2003 is assumed based on auger refusal.

TABLE A.2

FORMER LAGOON VOLUME ESTIMATES
FORMER LAGOON SITE
HAMPTONBURGH, NEW YORK

Lagoon	*Estimated Area (sq ft)*	*Average Overburden Thickness (ft)*	*Estimated Overburden Volume (cu yds)*	*Average Depth to Black-Stained Contaminated Layer (ft)*	*Average Thickness of Black-Stained Contaminated Layer (ft)*	*Estimated Volume of Black-Stained Contaminated Layer (cu yds)*
1	17,236	9.6	6,144	5.1	4.6	2,917
2	20,054	10.0	7,390	4.0	6.0	4,419
3	41,511	14.6	22,485	4.6	10.0	15,374
4	22,440	12.1	10,071	4.4	7.7	6,435
5	24,814	10.4	9,522	4.0	6.4	5,846
6	8,755	3.7	1,196	--	--	--
Total	134,810		56,809			34,992

TABLE A.3

HISTORICAL DEPTHS TO WATER WITHIN THE FORMER LAGOON AREA
FORMER LAGOON SITE
HAMPTONBURGH, NEW YORK

	January	May			*June*					
Well ID	*CRA 1/12/1995*	*CRA 5/25/1993*	*CRA 5/21/1993*	*CRA 5/12/1993*	*CRA 6/3/2002*	*CRA 6/20/1995*	*CRA 6/1/1995*	*CRA 6/17/1993*	*CRA 6/10/1993*	*CRA 6/2/1993*
SW-4	3.70	5.85	5.26	3.89	4.22	8.38	7.46	7.69	7.14	6.58
SW-6	--	--	20.43	--	--	--	--	--	--	--
MW-3	4.95	6.53	5.37	4.86	5.75	9.01	8.15	8.35	7.83	7.28
MW-4	4.35	6.31	5.83	4.58	4.73	8.69	7.93	7.75	7.29	6.77
PZ-2	2.58	4.45	3.82	2.60	--	--	6.10	5.95	6.42	5.06
MW-1U-91	5.10	6.54	6.31	5.38	5.77	8.13	7.53	7.75	7.36	6.97
AVERAGE	4.14	5.94	7.84	4.26	5.12	8.55	7.43	7.50	7.21	6.53

Notes:

Reference elevations are based on CRA's survey reference datum. C.A. Rich's datum differs from CRA's.

Depths to water are feet below ground surface.

TABLE A.3

HISTORICAL DEPTHS TO WATER WITHIN THE FORMER LAGOON AREA
FORMER LAGOON SITE
HAMPTONBURGH, NEW YORK

	July		August			October		RANGE	
Well ID	*CRA 7/12/2001*	*CRA 7/24/1995*	*CRA 8/14/1995*	*CRA 8/22/1991*	*CRA 8/23/1991*	*CRA 10/14/1991*	*CRA 10/18/1991*	**LOW**	**HIGH**
SW-4	8.34	10.02	10.20	6.74	7.07	5.93	6.04	3.70	10.20
SW-6	Dry	Dry	Dry	--	--	--	--	20.43	20.43
MW-3	8.95	10.71	11.09	--	--	7.77	7.55	4.86	11.09
MW-4	9.45	10.13	11.44	--	--	7.18	6.91	4.35	11.44
PZ-2	--	7.23	7.24	--	--	5.16	--	2.58	7.24
MW-1U-91	8.05	9.53	9.92	7.84	--	6.61	6.76	5.10	9.92
AVERAGE	8.70	9.52	9.98	7.29	7.07	6.53	6.82	4.14	9.98

Notes:
Reference elevation
Depths to water are

TABLE A.4

HISTORICAL FLUCTUATIONS IN DEPTH TO THE WATER TABLE FOR THE FORMER LAGOONS FORMER LAGOON SITE HAMPTONBURGH, NEW YORK

Lagoon	*Wells in Vicinity of Lagoon*	*Historical Water Table Level [1] (ft bgs)*		*Depth to Bedrock (ft bgs)*	*Saturated Thickness (ft)*
		High	*Low*		
1	MW-1U-91, SW-6	5.1	20.43	9.6	0 - 4.5
2	MW-4, SW-6	4.35	20.43	10.0	0 - 5.6
3	MW-1U-91, MW-4	4.35	11.44	14.6	3.2 - 10.3
4	MW-4, SW-4, PZ-2	2.58	11.44	12.1	0.7 - 9.5
5	MW-3, SW-4	3.7	11.09	10.4	0 - 6.7
6	--	--	--	3.7	0 - 0

Notes:

(1) High and low water table levels were taken from CRA measurements (see Table A.3)