TILENGA PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Volume VI(b)

Submitted to:
National Environment Management Authority

May 2018

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Due to the size of the appendices, for the printed version of the ESIA they have been split into 2 volumes (6a and 6b) as follows:

ESIA VOLUME 6a:

Appendix A: NEMA Approval for Scoping Report and Project Proponents Response

Appendix B: Key Project Component Fact Sheets

Appendix C: Early Works Project Brief (PB) Executive Summary and Enabling Infrastructure Geotechnical surveys PB Executive Summary

Appendix D: A3 copy of key figures

Appendix E: Additional Project Description material

Appendix F: CIA VEC Summary Report

Appendix G: Stakeholder Engagement Plan and supporting information

Appendix H: Air Quality supporting information

Appendix I: Noise and Vibration supporting information

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Appendix J: Soils and Geology supporting information

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Appendix L: Surface Water supporting information

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TILENGA PROJECT ESIA - APPENDIX J: Soils and Geology

May 2018

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Appendix J Soils and Geology

J.1 Summary of Soil Samples

Location ID	Sample ID	Date	Sample Interval (cm below ground)	Description
S1	S1-170611-T1	11 June 2017	0 - 5	Characterise soil quality in vicinity of natural oil seep
	S1-170611-B1		5- 20	
S2	S2-170611-T1	11 June 2017	0 - 5	Characterise soil quality in vicinity of natural oil seep
	S2-170611-B1		5- 20	
S3	S3-170611-T1	11 June 2017	0 - 5	Define background soil quality and gather data to evaluate erosion risk near proposed well pad JBR-02 and flowline in MFNP north of Nile River
	S3-170611-B1		5- 20	
S4	S4-170611-T1	11 June 2017	0 - 5	Define background soil quality and gather data to evaluate erosion risk near proposed Industrial Area
	S4-170611-B1		5- 20	
S5	S5-170611-T1	11 June 2017	0 - 5	Define background soil quality and gather data to evaluate erosion risk near proposed well pad NSO-03 and flowline in LA-2 near Ngwedo Village
	S5-170611-B1		5- 20	
S6	S6-170610-T1	10 June 2017	0 - 5	Define background soil quality and gather data to evaluate erosion risk near proposed well pad KW-02 and flowline near Kisansya Village
	S6-170610-B1		5- 20	
S7	S7-170611-T1	11 June 2017	0 - 5	Define background soil quality and gather data to evaluate erosion risk near proposed well pad NSO-04 and flowline in uncultivated area south of Ngwedo Village
	S7-170611-B1		5- 20	
S8	S8-170611-T1	11 June 2017	0 - 5	Define background soil quality and gather data to evaluate erosion risk near proposed well pad KGG-04 and flow line near edge of cultivated area
	S8-170611-B1		5- 20	
S9	S9-170611-T1	11 June 2017	0 - 5	Define background soil quality and gather data to evaluate erosion risk near proposed well pad KGG-06 and flowline
	S9-170611-B1		5- 20	
S10	S10-170612-T1	12 June 2017	0 - 5	Define background soil quality and gather data to evaluate erosion risk near proposed Industrial Area
	S10-170612-B1		5- 20	
S11	S11-170611-T1	11 June 2017	0 - 5	Define background soil quality and gather data to evaluate pollution runoff and erosion risk from proposed Industrial Area
	S11-170611-B1		5- 20	
S12	S12-170611-T1	11 June 2017	0 - 5	Define background soil quality and gather data to evaluate pollution run-on to Industrial Area
	S12-170611-B1		5- 20	
S13	S13-170611-T1	11 June 2017	0 - 5	Define background soil quality and gather data to evaluate erosion risk near proposed production well pad NSO-01 and flowline
	S13-170611-B1		5- 20	
S14	S14-170611-T1	11 June 2017	0 - 5	Define background soil quality and gather

Location ID	Sample ID	Date	Sample Interval (cm below ground)	Description
	S14-170611-B1		5- 20	data to evaluate erosion risk near proposed production well pad KGG-03 and flowline
S15	S15-170610-T1	10 June 2017	0 - 5	Define background soil quality and gather data to evaluate erosion risk near proposed production well pad KW-01 and flowline
	S15-170610-T1		5- 20	

J.2 Seismic Events near Project Area 2000 - 2017

Date of the event	Coordinates of the epicentre (UTM Zone 36N)		Depth of the earthquake starting point (km)	Magnitude (Mb)
	Easting (m)	Northings (m)		
2/25/2017	290450	156231	10	4.7
2/18/2017	246886	161237	10	4.2
11/24/2015	285980	160891	10	4.2
9/12/2015	128584	43966	18.36	4.5
7/17/2015	196511	129058	10.08	4.4
6/29/2015	303261	305013	10	4.5
10/31/2014	165488	54434	10	4.5
9/21/2014	193222	83415	10	4.4
10/8/2013	229694	168866	24.95	4.6
8/5/2013	253389	183442	10	4.1
8/5/2013	282937	180469	10	4.7
8/5/2013	282703	180215	9.93	4.6
7/30/2013	184972	49246	15.3	4.4
7/3/2013	257227	171226	10	5.1
7/3/2013	274814	171098	11.2	4.4
7/3/2013	265686	170001	10.1	5.7
7/2/2013	267140	177631	10	5.2
4/20/2013	262677	166354	10	4.8
10/2/2012	165142	52907	10	4.4
3/15/2011	303214	193079	10	5
1/17/2011	251667	176984	10	4.8
12/27/2010	537166	19343	10	4.5
12/12/2010	129281	89018	10	4.9
10/8/2010	227913	137404	26.2	4.6
10/18/2009	182193	62306	10	4.9
7/30/2009	221349	142942	10	4.6
8/26/2008	267677	251404	10	4.4
5/11/2008	120451	52928	10	4.4
6/15/2007	259028	190138	24	5.9
4/29/2007	254264	208285	10	4.5
2/21/2007	245004	190708	10	0
2/19/2007	250573	193577	19	5.6
5/29/2006	178729	37960	23.9	4.9
4/27/2006	172490	36855	10	4.4
4/27/2006	174718	37408	10	5.2
3/13/2005	152985	21032	10	4.5
12/13/2004	184880	85766	18.7	4.8
12/13/2004	185094	71933	20	4.3
6/7/2004	335807	377148	4.2	3.7
3/18/2004	322166	231542	30	4.7
2/5/2004	216305	105883	10	4.8
11/2/2003	184751	52345	10	3.8
5/3/2003	128590	56688	10	4.5
1/19/2003	160159	101723	10	4.5
8/10/2002	428679	367208	10	4
1/27/2002	134405	85803	10	4.7
6/29/2001	162906	32320	10	5.3
1/31/2001	109637	51604	27.7	4.9
10/23/2000	232063	166828	21.2	4.8

Date of the event	Coordinates of the epicentre (UTM Zone 36N)		Depth of the earthquake starting point (km)	Magnitude (Mb)
	Easting (m)	Northings (m)		
2/25/2017	290450	156231	10	4.7
2/18/2017	246886	161237	10	4.2
11/24/2015	285980	160891	10	4.2
9/12/2015	128584	43966	18.36	4.5
7/17/2015	196511	129058	10.08	4.4
6/29/2015	303261	305013	10	4.5
10/31/2014	165488	54434	10	4.5
9/21/2014	193222	83415	10	4.4
10/8/2013	229694	168866	24.95	4.6
8/5/2013	253389	183442	10	4.1
8/5/2013	282937	180469	10	4.7
8/5/2013	282703	180215	9.93	4.6
7/30/2013	184972	49246	15.3	4.4
7/3/2013	257227	171226	10	5.1
7/3/2013	274814	171098	11.2	4.4
7/3/2013	265686	170001	10.1	5.7
7/2/2013	267140	177631	10	5.2
4/20/2013	262677	166354	10	4.8
10/2/2012	165142	52907	10	4.4
3/15/2011	303214	193079	10	5
1/17/2011	251667	176984	10	4.8
12/27/2010	537166	19343	10	4.5
12/12/2010	129281	89018	10	4.9
10/8/2010	227913	137404	26.2	4.6
10/18/2009	182193	62306	10	4.9
7/30/2009	221349	142942	10	4.6
8/26/2008	267677	251404	10	4.4
5/11/2008	120451	52928	10	4.4
6/15/2007	259028	190138	24	5.9
4/29/2007	254264	208285	10	4.5
2/21/2007	245004	190708	10	0
2/19/2007	250573	193577	19	5.6
5/29/2006	178729	37960	23.9	4.9
4/27/2006	172490	36855	10	4.4
4/27/2006	174718	37408	10	5.2
3/13/2005	152985	21032	10	4.5
12/13/2004	184880	85766	18.7	4.8
12/13/2004	185094	71933	20	4.3
6/7/2004	335807	377148	4.2	3.7
3/18/2004	322166	231542	30	4.7
2/5/2004	216305	105883	10	4.8
11/2/2003	184751	52345	10	3.8
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1/19/2003	160159	101723	10	4.5
8/10/2002	428679	367208	10	4
1/27/2002	134405	85803	10	4.7
6/29/2001	162906	32320	10	5.3
1/31/2001	109637	51604	27.7	4.9
10/23/2000	232063	166828	21.2	4.8

J.3 Soils Laboratory Results

AECOM Uganda

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-- KAMPALA
UGANDA

Certificate of analysis

Date: 12-Jul-2017

Please find enclosed the analytical results of the test carried out for the project.

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Your project name	AECOM Uganda
Your order number	Soils
Samples received on	03-Jul-2017

This Certificate of Analysis shall not be reproduced except in full, without written approval of the laboratory. Interpretations and opinions are outside the scope of our accreditation, and all results relate only to samples supplied.

Soil samples will be stored for a period of 4 weeks and water samples for a period of 2 weeks after receipt of the samples at our laboratory. Without any additional request, samples will be disposed when the above mentioned periods have expired. If you require Eurofins Analytico to store the samples for a longer period, please complete this page and return it to Eurofins Analytico at least one businessday before the period is due to expire.
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Storage period:
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Yours sincerely,

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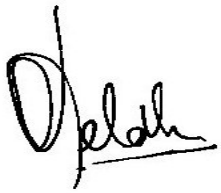

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Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	1/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	1	2	3	4	5
	Sample Pre-treatment						
Q	Cryogenic grinding		Executed	Executed	Executed	Executed	Executed
	Characteristics						
Q	Dry matter	% (w/w)	99.3	98.2	99.5	98.5	99.8
Q	Moisture residue	% (w/w)	0.7	1.8	0.5	1.5	0.2
Q	Total Organic Carbon (TOC)	g/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Organic matter	% (w/w) dm	0.9	<0.7	0.7	0.7	0.9
Q	Residue on ignition	% (w/w) dm	98.8	98.9	99.0	98.9	98.8
Q	Carbonates (CaC03)	g/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Fraction < 2000 µm	% (w/w) dm	97.1	96.5	96.1	95.4	95.5
Q	Fraction < 63 µm	% (w/w) dm	12.5	14.4	14.4	16.3	14.0
Q	Fraction < 45 µm	% (w/w) dm	9.1	10.3	9.5	12.2	9.5
Q	Fraction < 16 µm	% (w/w) dm	6.4	7.8	5.7	8.3	5.6
Q	Fraction < 2 µm	% (w/w) dm	4.9	6.2	3.7	5.9	3.8
	Metals						
Q	Arsenic (As)	mg/kg dm	<4.0	<4.0	<4.0	<4.0	<4.0
Q	Cadmium (Cd)	mg/kg dm	<0.30	<0.30	<0.30	<0.30	<0.30
Q	Chromium (Cr)	mg/kg dm	<15	17	<15	<15	19
Q	Copper (Cu)	mg/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Mercury (Hg)	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Nickel (Ni)	mg/kg dm	<3.0	<3.0	<3.0	<3.0	<3.0
Q	Lead (Pb)	mg/kg dm	<13	<13	<13	<13	<13
Q	Zinc (Zn)	mg/kg dm	<17	<17	<17	<17	<17
Q	Antimony (Sb)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0
Q	Barium (Ba)	mg/kg dm	34	<15	16	15	25
Q	Cobalt (Co)	mg/kg dm	4.7	4.5	3.5	4.4	3.7
Q	Molybdenum (Mo)	mg/kg dm	<1.5	<1.5	<1.5	<1.5	<1.5
	Selenium (Se)	mg/kg dm	0.95	0.82	0.80	0.96	<0.70
Q	Tin (Sn)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
Q	Vanadium (V)	mg/kg dm	<10	<10	<10	10	<10
Q	Beryllium (Be)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0

No.	Sample description	Date sampling	Sample nr.
1	S8-170611-T1	11-Jun-2017	9612056
2	S8-170611-B1	11-Jun-2017	9612079
3	S9-170611-T1	11-Jun-2017	9612080
4	S9-170611-B1	11-Jun-2017	9612081
5	S5-170611-T1	11-Jun-2017	9612082

Q: Dutch Accreditation Council (RvA) accredited test
A: AP04 accredited test
S: AS3000 recognized test
V: VLAREL recognized test
M: MCERTS accredited

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Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	2/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	1	2	3	4	5
Q	Calcium (Ca)	mg/kg dm	100	63	180	150	230
Q	Potassium (K)	mg/kg dm	220	190	250	250	200
Q	Magnesium (Mg)	mg/kg dm	100	98	150	160	130
Q	Sodium (Na)	mg/kg dm	31	19	<10	17	59
Q	Phosphorus total (P)	g/kg dm	0.075	0.065	0.078	0.072	0.080
Q	Phosphorus total (P04)	g/kg dm	0.23	0.20	0.24	0.22	0.24
Q	Phosphorus total (P205)	g/kg dm	0.17	0.15	0.18	0.16	0.18
	Mono Aromatic Hydrocarbons						
Q	Benzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Toluene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Ethylbenzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	o-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	m,p-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Xylenes (sum)	mg/kg dm	<0.10	<0.10	<0.10	<0.10	<0.10
Q	BTEX (sum)	mg/kg dm	<0.25	<0.25	<0.25	<0.25	<0.25
	Petroleum Hydrocarbons						
	EPH (C10-C12)	mg/kg dm	<3.0	<3.0	<3.0	<3.0	<3.0
	EPH (C12-C16)	mg/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
	EPH (C16-C21)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
	EPH (C21-C30)	mg/kg dm	<12	<12	<12	<12	<12
	EPH (C30-C35)	mg/kg dm	<6.0	<6.0	<6.0	6.3	<6.0
	EPH (C35-C40)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
Q	EPH Sum (C10-C40)	mg/kg dm	<38	<38	<38	<38	<38
	Physical and chemical analyses						
	Measuring temperature (pH)	°C	20	21	21	20	21
Q	Acidity (pH-CaCl2)		5.3	4.7	5.3	4.7	5.6
	Inorganic Compounds						
	Nitrite (N02-N)	mg/kg dm	<0.20	<0.20	<0.20	<0.20	<0.20
	Nitrite (N02)	mg/kg dm	<0.60	<0.60	<0.60	<0.60	<0.60
	Nitrate (N03-N)	mg/kg dm	<2.0	<2.0	<2.0	<2.0	<2.0

No.	Sample description	Date sampling	Sample nr.
1	S8-170611-T1	11-Jun-2017	9612056
2	S8-170611-B1	11-Jun-2017	9612079
3	S9-170611-T1	11-Jun-2017	9612080
4	S9-170611-B1	11-Jun-2017	9612081
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Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	3/18
Sample matrix	Soil, Sediment		

Analysis	Unit	1	2	3	4	5
Nitrate (N03)	mg/kg dm	<9.0	<9.0	<9.0	<9.0	<9.0

No.	Sample description	Date sampling	Sample nr.
1	S8-170611-T1	11-Jun-2017	9612056
2	S8-170611-B1	11-Jun-2017	9612079
3	S9-170611-T1	11-Jun-2017	9612080
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Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	4/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	6	7	8	9	10
	Sample Pre-treatment						
Q	Cryogenic grinding		Executed	Executed	Executed	Executed	Executed
	Characteristics						
Q	Dry matter	% (w/w)	99.0	99.5	98.4	99.7	98.5
Q	Moisture residue	% (w/w)	1.0	0.5	1.6	0.3	1.5
Q	Total Organic Carbon (TOC)	g/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Organic matter	% (w/w) dm	0.7	0.8	0.7	<0.7	<0.7
Q	Residue on ignition	% (w/w) dm	98.9	98.9	98.9	99.0	99.0
Q	Carbonates (CaC03)	g/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Fraction < 2000 µm	% (w/w) dm	97.2	94.2	95.9	98.5	96.4
Q	Fraction < 63 µm	% (w/w) dm	15.9	20.4	20.8	11.0	12.3
Q	Fraction < 45 µm	% (w/w) dm	11.3	11.4	14.0	8.7	9.5
Q	Fraction < 16 µm	% (w/w) dm	7.4	5.5	8.1	5.3	7.2
Q	Fraction < 2 µm	% (w/w) dm	5.6	3.9	5.9	3.7	5.6
	Metals						
Q	Arsenic (As)	mg/kg dm	<4.0	<4.0	<4.0	<4.0	<4.0
Q	Cadmium (Cd)	mg/kg dm	<0.30	<0.30	<0.30	<0.30	<0.30
Q	Chromium (Cr)	mg/kg dm	15	<15	<15	18	17
Q	Copper (Cu)	mg/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Mercury (Hg)	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Nickel (Ni)	mg/kg dm	<3.0	<3.0	<3.0	<3.0	<3.0
Q	Lead (Pb)	mg/kg dm	<13	<13	<13	<13	<13
Q	Zinc (Zn)	mg/kg dm	<17	<17	<17	<17	<17
Q	Antimony (Sb)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0
Q	Barium (Ba)	mg/kg dm	16	16	<15	<15	<15
Q	Cobalt (Co)	mg/kg dm	4.3	1.8	2.4	3.1	3.4
Q	Molybdenum (Mo)	mg/kg dm	<1.5	<1.5	<1.5	<1.5	<1.5
	Selenium (Se)	mg/kg dm	<0.70	0.91	<0.70	0.95	<0.70
Q	Tin (Sn)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
Q	Vanadium (V)	mg/kg dm	<10	<10	<10	12	12
Q	Beryllium (Be)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0

No.	Sample description	Date sampling	Sample nr.
6	S5-170611-B1	11-Jun-2017	9612083
7	S7-170611-T1	11-Jun-2017	9612084
8	S7-170611-B1	11-Jun-2017	9612085
9	S10-170611-T1	11-Jun-2017	9612086
10	S10-170611-B1	11-Jun-2017	9612087

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BIC: BNPANL2A
KvK/CoC No. 09088623
BTW/VAT No. NL 8043.14.883.B01

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Certificate of analysis

Your project number	NGSB2017003401	Certificate number/Version	2017086572/2
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	5/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	6	7	8	9	10
Q	Calcium (Ca)	mg/kg dm	220	160	240	130	100
Q	Potassium (K)	mg/kg dm	230	210	310	160	160
Q	Magnesium (Mg)	mg/kg dm	120	110	140	84	96
Q	Sodium (Na)	mg/kg dm	42	19	50	27	62
Q	Phosphorus total (P)	g/kg dm	0.065	0.067	0.071	0.061	0.052
Q	Phosphorus total (P04)	g/kg dm	0.20	0.21	0.22	0.19	0.16
Q	Phosphorus total (P205)	g/kg dm	0.15	0.15	0.16	0.14	0.12
	Mono Aromatic Hydrocarbons						
Q	Benzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Toluene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Ethylbenzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	o-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	m,p-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Xylenes (sum)	mg/kg dm	<0.10	<0.10	<0.10	<0.10	<0.10
Q	BTEX (sum)	mg/kg dm	<0.25	<0.25	<0.25	<0.25	<0.25
	Petroleum Hydrocarbons						
	EPH (C10-C12)	mg/kg dm	<3.0	<3.0	<3.0	<3.0	<3.0
	EPH (C12-C16)	mg/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
	EPH (C16-C21)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
	EPH (C21-C30)	mg/kg dm	<12	<12	<12	<12	<12
	EPH (C30-C35)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
	EPH (C35-C40)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
Q	EPH Sum (C10-C40)	mg/kg dm	<38	<38	<38	<38	<38
	Physical and chemical analyses						
	Measuring temperature (pH)	°C	21	20	22	21	21
Q	Acidity (pH-CaCl2)		5.1	4.9	4.6	5.8	4.8
	Inorganic Compounds						
	Nitrite (N02-N)	mg/kg dm	<0.20	<0.20	<0.20	<0.20	<0.20
	Nitrite (N02)	mg/kg dm	<0.60	<0.60	<0.60	<0.60	<0.60
	Nitrate (N03-N)	mg/kg dm	<2.0	<2.0	<2.0	<2.0	<2.0

No.	Sample description	Date sampling	Sample nr.
6	S5-170611-B1	11-Jun-2017	9612083
7	S7-170611-T1	11-Jun-2017	9612084
8	S7-170611-B1	11-Jun-2017	9612085
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Certificate of analysis

Your project number	NGSB2017003401	Certificate number/Version	2017086572/2
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	6/18
Sample matrix	Soil, Sediment		

Analysis	Unit	6	7	8	9	10
Nitrate (N03)	mg/kg dm	<9.0	<9.0	<9.0	<9.0	<9.0

No.	Sample description	Date sampling	Sample nr.
6	S5-170611-B1	11-Jun-2017	9612083
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Your project number	NGSB2017003401	Certificate number/Version	2017086572/2
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	7/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	11	12	13	14	15
	Sample Pre-treatment						
Q	Cryogenic grinding		Executed	Executed	Executed	Executed	Executed
	Characteristics						
Q	Dry matter	% (w/w)	99.6	98.7	90.4	91.2	100.0
Q	Moisture residue	% (w/w)	0.4	1.3	9.6	8.8	<0.1
Q	Total Organic Carbon (TOC)	g/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Organic matter	% (w/w) dm	0.8	0.8	1.3	2.0	1.0
Q	Residue on ignition	% (w/w) dm	99.0	98.9	98.2	97.4	98.8
Q	Carbonates (CaC03)	g/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Fraction < 2000 µm	% (w/w) dm	95.0	92.2	96.6	94.2	97.5
Q	Fraction < 63 µm	% (w/w) dm	14.3	17.4	14.0	68.8	11.5
Q	Fraction < 45 µm	% (w/w) dm	8.8	11.5	10.5	12.0	9.0
Q	Fraction < 16 µm	% (w/w) dm	4.4	6.8	8.6	10.1	6.7
Q	Fraction < 2 µm	% (w/w) dm	2.5	4.7	7.3	9.0	4.2
	Metals						
Q	Arsenic (As)	mg/kg dm	<4.0	<4.0	<4.0	<4.0	<4.0
Q	Cadmium (Cd)	mg/kg dm	<0.30	<0.30	<0.30	<0.30	<0.30
Q	Chromium (Cr)	mg/kg dm	<15	<15	<15	<15	<15
Q	Copper (Cu)	mg/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Mercury (Hg)	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Nickel (Ni)	mg/kg dm	<3.0	<3.0	3.8	5.4	<3.0
Q	Lead (Pb)	mg/kg dm	<13	<13	<13	<13	<13
Q	Zinc (Zn)	mg/kg dm	<17	<17	<17	<17	<17
Q	Antimony (Sb)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0
Q	Barium (Ba)	mg/kg dm	<15	<15	20	25	22
Q	Cobalt (Co)	mg/kg dm	2.7	3.2	3.2	4.1	4.6
Q	Molybdenum (Mo)	mg/kg dm	<1.5	<1.5	<1.5	<1.5	<1.5
	Selenium (Se)	mg/kg dm	0.96	1.1	1.1	1.4	<0.70
Q	Tin (Sn)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
Q	Vanadium (V)	mg/kg dm	<10	11	13	20	<10
Q	Beryllium (Be)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0

No.	Sample description	Date sampling	Sample nr.
11	S11-170611-T1	11-Jun-2017	9612088
12	S11-170611-B1	11-Jun-2017	9612089
13	S3-170611-T1	11-Jun-2017	9612090
14	S3-170611-B1	11-Jun-2017	9612091
15	S4-170611-T1	11-Jun-2017	9612092

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Certificate of analysis

Your project number	NGSB2017003401	Certificate number/Version	2017086572/2
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	8/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	11	12	13	14	15
Q	Calcium (Ca)	mg/kg dm	130	100	350	360	280
Q	Potassium (K)	mg/kg dm	190	230	490	450	210
Q	Magnesium (Mg)	mg/kg dm	120	140	250	340	160
Q	Sodium (Na)	mg/kg dm	25	30	32	37	51
Q	Phosphorus total (P)	g/kg dm	0.060	0.055	0.098	0.11	0.11
Q	Phosphorus total (P04)	g/kg dm	0.18	0.17	0.30	0.33	0.35
Q	Phosphorus total (P205)	g/kg dm	0.14	0.13	0.23	0.25	0.26
	Mono Aromatic Hydrocarbons						
Q	Benzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Toluene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Ethylbenzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	o-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	m,p-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Xylenes (sum)	mg/kg dm	<0.10	<0.10	<0.10	<0.10	<0.10
Q	BTEX (sum)	mg/kg dm	<0.25	<0.25	<0.25	<0.25	<0.25
	Petroleum Hydrocarbons						
	EPH (C10-C12)	mg/kg dm	<3.0	<3.0	<3.0	<3.0	<3.0
	EPH (C12-C16)	mg/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
	EPH (C16-C21)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
	EPH (C21-C30)	mg/kg dm	<12	<12	<12	<12	<12
	EPH (C30-C35)	mg/kg dm	<6.0	<6.0	<6.0	13	<6.0
	EPH (C35-C40)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
Q	EPH Sum (C10-C40)	mg/kg dm	<38	<38	<38	<38	<38
	Physical and chemical analyses						
	Measuring temperature (pH)	°C	21	22	21	21	21
Q	Acidity (pH-CaCl2)		4.9	4.5	5.8	4.6	5.6
	Inorganic Compounds						
	Nitrite (N02-N)	mg/kg dm	<0.20	<0.20	<0.20	<0.20	<0.20
	Nitrite (N02)	mg/kg dm	<0.60	<0.60	<0.60	<0.60	<0.60
	Nitrate (N03-N)	mg/kg dm	<2.0	<2.0	<2.0	<2.0	<2.0

No.	Sample description	Date sampling	Sample nr.
11	S11-170611-T1	11-Jun-2017	9612088
12	S11-170611-B1	11-Jun-2017	9612089
13	S3-170611-T1	11-Jun-2017	9612090
14	S3-170611-B1	11-Jun-2017	9612091
15	S4-170611-T1	11-Jun-2017	9612092

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Certificate of analysis

Your project number	NGSB2017003401	Certificate number/Version	2017086572/2
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	9/18
Sample matrix	Soil, Sediment		

Analysis	Unit	11	12	13	14	15
Nitrate (N03)	mg/kg dm	<9.0	<9.0	<9.0	<9.0	<9.0

No.	Sample description	Date sampling	Sample nr.
11	S11-170611-T1	11-Jun-2017	9612088
12	S11-170611-B1	11-Jun-2017	9612089
13	S3-170611-T1	11-Jun-2017	9612090
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Certificate of analysis

Your project number	NGSB2017003401	Certificate number/Version	2017086572/2
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	10/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	16	17	18	19	20
	Sample Pre-treatment						
Q	Cryogenic grinding		Executed	Executed	Executed	Executed	Executed
	Characteristics						
Q	Dry matter	% (w/w)	99.3	97.6	96.9	99.7	98.3
Q	Moisture residue	% (w/w)	0.7	2.4	3.1	0.3	1.7
Q	Total Organic Carbon (TOC)	g/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Organic matter	% (w/w) dm	0.7	1.1	0.8	<0.7	<0.7
Q	Residue on ignition	% (w/w) dm	99.0	98.5	98.6	98.9	98.9
Q	Carbonates (CaC03)	g/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Fraction < 2000 µm	% (w/w) dm	97.6	95.7	96.3	95.2	98.8
Q	Fraction < 63 µm	% (w/w) dm	11.5	12.5	16.1	12.2	11.5
Q	Fraction < 45 µm	% (w/w) dm	9.2	9.0	12.9	8.4	9.5
Q	Fraction < 16 µm	% (w/w) dm	6.8	6.6	10.2	6.8	7.7
Q	Fraction < 2 µm	% (w/w) dm	4.6	5.1	8.4	5.7	6.3
	Metals						
Q	Arsenic (As)	mg/kg dm	<4.0	<4.0	<4.0	<4.0	<4.0
Q	Cadmium (Cd)	mg/kg dm	<0.30	<0.30	<0.30	<0.30	<0.30
Q	Chromium (Cr)	mg/kg dm	<15	<15	<15	<15	<15
Q	Copper (Cu)	mg/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Mercury (Hg)	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Nickel (Ni)	mg/kg dm	<3.0	<3.0	3.1	<3.0	<3.0
Q	Lead (Pb)	mg/kg dm	<13	<13	<13	<13	<13
Q	Zinc (Zn)	mg/kg dm	<17	<17	<17	<17	<17
Q	Antimony (Sb)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0
Q	Barium (Ba)	mg/kg dm	26	15	<15	<15	<15
Q	Cobalt (Co)	mg/kg dm	4.7	5.4	6.1	5.7	6.1
Q	Molybdenum (Mo)	mg/kg dm	<1.5	<1.5	<1.5	<1.5	<1.5
	Selenium (Se)	mg/kg dm	<0.70	1.5	1.6	<0.70	<0.70
Q	Tin (Sn)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
Q	Vanadium (V)	mg/kg dm	<10	<10	12	<10	12
Q	Beryllium (Be)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0

No.	Sample description	Date sampling	Sample nr.
16	S4-170611-B1	11-Jun-2017	9612093
17	S14-170611-T1	11-Jun-2017	9612094
18	S14-170611-B1	11-Jun-2017	9612095
19	S13-170611-T1	11-Jun-2017	9612096
20	S13-170611-B1	11-Jun-2017	9612097

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Certificate of analysis

Your project number	NGSB2017003401	Certificate number/Version	2017086572/2
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	11/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	16	17	18	19	20
Q	Calcium (Ca)	mg/kg dm	290	320	240	230	140
Q	Potassium (K)	mg/kg dm	180	220	210	160	150
Q	Magnesium (Mg)	mg/kg dm	130	140	140	85	80
Q	Sodium (Na)	mg/kg dm	50	36	24	39	76
Q	Phosphorus total (P)	g/kg dm	0.092	0.090	0.070	0.081	0.078
Q	Phosphorus total (P04)	g/kg dm	0.28	0.28	0.22	0.25	0.24
Q	Phosphorus total (P205)	g/kg dm	0.21	0.21	0.16	0.19	0.18
	Mono Aromatic Hydrocarbons						
Q	Benzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Toluene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Ethylbenzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	o-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	m,p-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Xylenes (sum)	mg/kg dm	<0.10	<0.10	<0.10	<0.10	<0.10
Q	BTEX (sum)	mg/kg dm	<0.25	<0.25	<0.25	<0.25	<0.25
	Petroleum Hydrocarbons						
	EPH (C10-C12)	mg/kg dm	<3.0	<3.0	<3.0	<3.0	<3.0
	EPH (C12-C16)	mg/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
	EPH (C16-C21)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
	EPH (C21-C30)	mg/kg dm	<12	<12	<12	<12	<12
	EPH (C30-C35)	mg/kg dm	6.2	<6.0	<6.0	<6.0	<6.0
	EPH (C35-C40)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
Q	EPH Sum (C10-C40)	mg/kg dm	<38	<38	<38	<38	<38
	Physical and chemical analyses						
	Measuring temperature (pH)	°C	20	21	21	21	22
Q	Acidity (pH-CaCl2)		5.3	6.2 [1)]	5.4	5.4	4.7
	Inorganic Compounds						
	Nitrite (N02-N)	mg/kg dm	<0.20	<0.20	<0.20	<0.20	<0.20
	Nitrite (N02)	mg/kg dm	<0.60	<0.60	<0.60	<0.60	<0.60
	Nitrate (N03-N)	mg/kg dm	<2.0	<2.0	<2.0	<2.0	<2.0

No.	Sample description	Date sampling	Sample nr.
16	S4-170611-B1	11-Jun-2017	9612093
17	S14-170611-T1	11-Jun-2017	9612094
18	S14-170611-B1	11-Jun-2017	9612095
19	S13-170611-T1	11-Jun-2017	9612096
20	S13-170611-B1	11-Jun-2017	9612097

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BNP Paribas S.A. 227 9245 25
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BIC: BNPANL2A
KvK/CoC No. 09088623
BTW/VAT No. NL 8043.14.883.B01

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Sampled by		Page	12/18
Sample matrix	Soil, Sediment		

Analysis	Unit	16	17	18	19	20
Nitrate (N03)	mg/kg dm	<9.0	<9.0	<9.0	<9.0	<9.0

No.	Sample description	Date sampling	Sample nr.
16	S4-170611-B1	11-Jun-2017	9612093
17	S14-170611-T1	11-Jun-2017	9612094
18	S14-170611-B1	11-Jun-2017	9612095
19	S13-170611-T1	11-Jun-2017	9612096
20	S13-170611-B1	11-Jun-2017	9612097

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		Annex	A,B,C,D
Sampled by		Page	13/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	21	22	23	24	25
	Sample Pre-treatment						
Q	Cryogenic grinding		Executed	Executed	Executed	Executed	Executed
	Characteristics						
Q	Dry matter	% (w/w)	92.2	91.1	96.2	93.0	99.8
Q	Moisture residue	% (w/w)	7.8	8.9	3.8	7.0	0.2
Q	Total Organic Carbon (TOC)	g/kg dm	21	9.2	6.7	<5.0	<5.0
Q	Organic matter	% (w/w) dm	5.0	3.9	2.7	2.2	<0.7
Q	Residue on ignition	% (w/w) dm	93.3	94.5	96.4	95.7	99.0
Q	Carbonates (CaC03)	g/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Fraction < 2000 µm	% (w/w) dm	91.7	87.8	87.9	100.0	96.3
Q	Fraction < 63 µm	% (w/w) dm	31.8	30.9	23.3	40.2	15.7
Q	Fraction < 45 µm	% (w/w) dm	30.0	28.6	18.9	36.4	10.7
Q	Fraction < 16 µm	% (w/w) dm	27.6	25.7	15.8	33.3	5.9
Q	Fraction < 2 µm	% (w/w) dm	24.5	23.0	13.7	30.2	3.9
	Metals						
Q	Arsenic (As)	mg/kg dm	<4.0	<4.0	<4.0	<4.0	<4.0
Q	Cadmium (Cd)	mg/kg dm	<0.30	<0.30	<0.30	<0.30	<0.30
Q	Chromium (Cr)	mg/kg dm	42	47	50	88	<15
Q	Copper (Cu)	mg/kg dm	12	13	12	20	<5.0
Q	Mercury (Hg)	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Nickel (Ni)	mg/kg dm	16	17	15	27	<3.0
Q	Lead (Pb)	mg/kg dm	<13	<13	<13	<13	<13
Q	Zinc (Zn)	mg/kg dm	30	28	<17	25	<17
Q	Antimony (Sb)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0
Q	Barium (Ba)	mg/kg dm	110	110	140	200	<15
Q	Cobalt (Co)	mg/kg dm	8.8	9.4	13	21	3.0
Q	Molybdenum (Mo)	mg/kg dm	<1.5	<1.5	<1.5	<1.5	<1.5
	Selenium (Se)	mg/kg dm	3.3	3.8	<0.70	4.0	0.86
Q	Tin (Sn)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
Q	Vanadium (V)	mg/kg dm	41	43	42	70	<10
Q	Beryllium (Be)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0

No.	Sample description	Date sampling	Sample nr.
21	S1-170611-T1	11-Jun-2017	9612098
22	S1-170611-B1	11-Jun-2017	9612099
23	S2-170611-T1	11-Jun-2017	9612100
24	S2-170611-B1	11-Jun-2017	9612101
25	SFD-170611-T1	11-Jun-2017	9612102

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		Annex	A,B,C,D
Sampled by		Page	14/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	21	22	23	24	25
Q	Calcium (Ca)	mg/kg dm	2800	2300	1400	1200	120
Q	Potassium (K)	mg/kg dm	560	470	1200	1600	190
Q	Magnesium (Mg)	mg/kg dm	1600	1600	1300	2200	120
Q	Sodium (Na)	mg/kg dm	68	73	52	89	23
Q	Phosphorus total (P)	g/kg dm	0.23	0.13	0.15	0.11	0.058
Q	Phosphorus total (P04)	g/kg dm	0.70	0.41	0.46	0.32	0.18
Q	Phosphorus total (P205)	g/kg dm	0.52	0.30	0.34	0.24	0.13
	Mono Aromatic Hydrocarbons						
Q	Benzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Toluene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Ethylbenzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	o-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	m,p-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Xylenes (sum)	mg/kg dm	<0.10	<0.10	<0.10	<0.10	<0.10
Q	BTEX (sum)	mg/kg dm	<0.25	<0.25	<0.25	<0.25	<0.25
	Petroleum Hydrocarbons						
	EPH (C10-C12)	mg/kg dm	<3.0	<3.0	<3.0	<3.0	<3.0
	EPH (C12-C16)	mg/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
	EPH (C16-C21)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
	EPH (C21-C30)	mg/kg dm	<12	<12	<12	<12	<12
	EPH (C30-C35)	mg/kg dm	18	9.8	6.1	<6.0	<6.0
	EPH (C35-C40)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
Q	EPH Sum (C10-C40)	mg/kg dm	<38	<38	<38	<38	<38
	Physical and chemical analyses						
	Measuring temperature (pH)	°C	21	21	21	20	21
Q	Acidity (pH-CaCl2)		5.2	5.0	5.7	4.8	5.1
	Inorganic Compounds						
	Nitrite (N02-N)	mg/kg dm	<0.20	<0.20	<0.20	<0.20	<0.20
	Nitrite (N02)	mg/kg dm	<0.60	<0.60	<0.60	<0.60	<0.60
	Nitrate (N03-N)	mg/kg dm	<2.0	<2.0	<2.0	<2.0	<2.0

No.	Sample description	Date sampling	Sample nr.
21	S1-170611-T1	11-Jun-2017	9612098
22	S1-170611-B1	11-Jun-2017	9612099
23	S2-170611-T1	11-Jun-2017	9612100
24	S2-170611-B1	11-Jun-2017	9612101
25	SFD-170611-T1	11-Jun-2017	9612102

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Your order number	Soils	Report date	12-Jul-2017/11:00
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Sampled by		Page	15/18
Sample matrix	Soil, Sediment		

Analysis	Unit	21	22	23	24	25
Nitrate (N03)	mg/kg dm	<9.0	<9.0	<9.0	<9.0	<9.0

No.	Sample description	Date sampling	Sample nr.
21	S1-170611-T1	11-Jun-2017	9612098
22	S1-170611-B1	11-Jun-2017	9612099
23	S2-170611-T1	11-Jun-2017	9612100
24	S2-170611-B1	11-Jun-2017	9612101
25	SFD-170611-T1	11-Jun-2017	9612102

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Sampled by		Page	16/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	26
	Sample Pre-treatment		
Q	Cryogenic grinding		Executed
	Characteristics		
Q	Dry matter	% (w/w)	98.8
Q	Moisture residue	% (w/w)	1.2
Q	Total Organic Carbon (TOC)	g/kg dm	<5.0
Q	Organic matter	% (w/w) dm	<0.7
Q	Residue on ignition	% (w/w) dm	99.0
Q	Carbonates (CaCO3)	g/kg dm	<5.0
Q	Fraction < 2000 µm	% (w/w) dm	97.0
Q	Fraction < 63 µm	% (w/w) dm	16.8
Q	Fraction < 45 µm	% (w/w) dm	12.6
Q	Fraction < 16 µm	% (w/w) dm	8.0
Q	Fraction < 2 µm	% (w/w) dm	5.8
	Metals		
Q	Arsenic (As)	mg/kg dm	<4.0
Q	Cadmium (Cd)	mg/kg dm	<0.30
Q	Chromium (Cr)	mg/kg dm	<15
Q	Copper (Cu)	mg/kg dm	<5.0
Q	Mercury (Hg)	mg/kg dm	<0.050
Q	Nickel (Ni)	mg/kg dm	<3.0
Q	Lead (Pb)	mg/kg dm	<13
Q	Zinc (Zn)	mg/kg dm	<17
Q	Antimony (Sb)	mg/kg dm	<1.0
Q	Barium (Ba)	mg/kg dm	<15
Q	Cobalt (Co)	mg/kg dm	3.2
Q	Molybdenum (Mo)	mg/kg dm	<1.5
	Selenium (Se)	mg/kg dm	1.2
Q	Tin (Sn)	mg/kg dm	<6.0
Q	Vanadium (V)	mg/kg dm	11
Q	Beryllium (Be)	mg/kg dm	<1.0

No.	Sample description	Date sampling	Sample nr.
26	SFD-170611-B1	11-Jun-2017	9612103

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Sampled by		Page	17/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	26
Q	Calcium (Ca)	mg/kg dm	89
Q	Potassium (K)	mg/kg dm	210
Q	Magnesium (Mg)	mg/kg dm	130
Q	Sodium (Na)	mg/kg dm	22
Q	Phosphorus total (P)	g/kg dm	0.051
Q	Phosphorus total (P04)	g/kg dm	0.16
Q	Phosphorus total (P205)	g/kg dm	0.12
	Mono Aromatic Hydrocarbons		
Q	Benzene	mg/kg dm	<0.050
Q	Toluene	mg/kg dm	<0.050
Q	Ethylbenzene	mg/kg dm	<0.050
Q	o-Xylene	mg/kg dm	<0.050
Q	m,p-Xylene	mg/kg dm	<0.050
Q	Xylenes (sum)	mg/kg dm	<0.10
Q	BTEX (sum)	mg/kg dm	<0.25
	Petroleum Hydrocarbons		
	EPH (C10-C12)	mg/kg dm	<3.0
	EPH (C12-C16)	mg/kg dm	<5.0
	EPH (C16-C21)	mg/kg dm	<6.0
	EPH (C21-C30)	mg/kg dm	<12
	EPH (C30-C35)	mg/kg dm	<6.0
	EPH (C35-C40)	mg/kg dm	<6.0
Q	EPH Sum (C10-C40)	mg/kg dm	<38
	Physical and chemical analyses		
	Measuring temperature (pH)	°C	22
Q	Acidity (pH-CaCl2)		4.7
	Inorganic Compounds		
	Nitrite (N02-N)	mg/kg dm	<0.20
	Nitrite (N02)	mg/kg dm	<0.60
	Nitrate (N03-N)	mg/kg dm	<2.0

No.	Sample description	Date sampling	Sample nr.
26	SFD-170611-B1	11-Jun-2017	9612103

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		Annex	A,B,C,D
Sampled by		Page	18/18
Sample matrix	Soil, Sediment		

Analysis	Unit	26
Nitrate (NO3)	mg/kg dm	<9.0

No.	Sample description	Date sampling	Sample nr.
26	SFD-170611-B1	11-Jun-2017	9612103

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Annex (A) concerning subsample information referring to certificate of analysis 2017086572/2

Sample nr.	Drill-#	Description	From	To	Barcode	Sample description
9612056					0520038264	S8-170611-T1
9612056					0520038261	
9612079					0520038255	S8-170611-B1
9612079					0520038256	
9612080					0520038260	S9-170611-T1
9612080					0520038263	
9612081					0520038262	S9-170611-B1
9612081					0520038265	
9612082					0520077696	S5-170611-T1
9612082					0520077709	
9612083					0520077698	S5-170611-B1
9612083					0520077587	
9612084					0520027839	S7-170611-T1
9612084					0520027842	
9612085					0520027577	S7-170611-B1
9612085					0520027586	
9612086					0520038268	S10-170611-T1
9612086					0520038271	
9612087					0520077593	S10-170611-B1
9612087					0520077596	
9612088					0520077594	S11-170611-T1
9612088					0520077679	
9612089					0520077667	S11-170611-B1
9612089					0520077689	
9612090					0520038225	S3-170611-T1
9612090					0520038231	
9612091					0520038224	S3-170611-B1
9612091					0520038226	
9612092					0520077590	S4-170611-T1
9612092					0520077597	
9612093					0520077595	S4-170611-B1
9612093					0520077599	
9612094					0520038259	S14-170611-T1
9612094					0520039482	
9612095					0520038257	S14-170611-B1

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Annex (A) concerning subsample information referring to certificate of analysis 2017086572/2

Sample nr.	Drill-#	Description	From	To	Barcode	Sample description
9612095					0520038258	S14-170611-B1
9612096					0520038253	S13-170611-T1
9612096					0520039501	
9612097					0520038254	S13-170611-B1
9612097					0520039480	
9612098					0520038221	S1-170611-T1
9612098					0520077692	
9612099					0520038220	S1-170611-B1
9612099					0520038219	
9612100					0520038230	S2-170611-T1
9612100					0520077588	
9612101					0520077706	S2-170611-B1
9612101					0520077708	
9612102					0520077682	SFD-170611-T1
9612102					0520077684	
9612103					0520077681	SFD-170611-B1
9612103					0520077688	

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Annex (B) concerning remarks referring to certificate of analysis 2017086572/2

General remark referring to certificate of analysis

This certificate replaces previous published certificate(s) with lower version numbers.

Remark 1)

Measuring value not stabel (pH/EC/Redox)

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Annex (C): method references belonging to certificate of analysis 2017086572/2

Analysis	Method	Technique	Method reference
Cryogenic Milling (max 250 g)	W0106	Crushing	I.a.w. NVN 7313
Dry matter	W0104	Gravimetry	In accordance with NEN-EN 15934 & CMA 2/II/A.1
Moisture residue	W6110	Gravimetry	In house method
Organic matter (loss of ignition)	W0109	Gravimetry	Cf. NEN 5754
TOC	W0594	Element analysis	I.a.w. ISO 10694
Calcite (CaC03)	W0177	Volumetric	Equivalent to NEN-EN-ISO 10693
Grainsize < 2000 µm	W0105	Sieving	I.a.w. NEN 5753
Grainsize < 63 µm	W0105	Sieving	I.a.w. NEN 5753
Grainsize < 45 Âµm (Sedimentation)	W0173	Sedimentation	I.a.w. NEN 5753
Grainsize < 16 µm (sedimentation)	W0173	Sedimentation	I.a.w. NEN 5753
Grainsize < 2 µm (clay) sedimentation	W0173	Sedimentation	I.a.w. NEN 5753
Metalen Royal degree	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
Calcium (Ca)	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
Potassium (K)	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
Magnesium (Mg)	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
Sodium (Na)	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
P	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
Aromatics (BTEX)	W0254	HS-GC/MS	In accordance with NEN-ISO 22155
EPH (C10-C40)	W0202	GC/FID	Eq. NEN-EN-ISO 16703
Acidity (pH-CaCl2)	W0524	Potentiometry	In accordance with NEN-ISO 10390
Nitrite	W0566	Spectrometry	In house method
Nitrate	W0566	Spectrometry	In house method

Additional information about the applied methods as well as the classification of the accuracy, are listed in our supplement: "Specification of methods of analyses", version June 2016.

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Annex (D) remarks concerning the sampling and preservation period 2017086572/2

Non compliance(s) of the criteria is(are) observed that may have influenced the accuracy of the test results of samples mentioned below.

	Sample nr.
The temperature of the samples received at the laboratory, exceded the limit.	9612056
	9612079
	9612080
	9612081
	9612082
	9612083
	9612084
	9612085
	9612086
	9612087
	9612088
	9612089
	9612090
	9612091
	9612092
	9612093
	9612094
	9612095
	9612096
	9612097
	9612098
	9612099
	9612100
	9612101
	9612102
	9612103

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Annex (D) remarks concerning the sampling and preservation period 2017086572/2

Non compliance(s) of the criteria is(are) observed that may have influenced the accuracy of the test results of samples mentioned below.

Analysis	Sample nr.
The preservation term for this parameter has been expired.	
Volatiles (HS weight)	9612056
	9612079
	9612080
	9612081
	9612082
	9612083
	9612084
	9612085
	9612086
	9612087
	9612088
	9612089
	9612090
	9612091
	9612092
	9612093
	9612094
	9612095
	9612096
	9612097
	9612098
	9612099
	9612100
	9612101
	9612102
	9612103
Voorbeh NC Sp	9612056
	9612079
	9612080
	9612081
	9612082
	9612083
	9612084
	9612085
	9612086
	9612087
	9612088
	9612089
	9612090
	9612091
	9612092
	9612093

Annex (D) remarks concerning the sampling and preservation period 2017086572/2

Non compliance(s) of the criteria is(are) observed that may have influenced the accuracy of the test results of samples mentioned below.

	9612094
	9612095
	9612096
	9612097
	9612098
	9612099
	9612100
	9612101
	9612102
	9612103
Pretreatment TPH	9612056
	9612079
	9612080
	9612081
	9612082
	9612083
	9612084
	9612085
	9612086
	9612087
	9612088
	9612089
	9612090
	9612091
	9612092
	9612093
	9612094
	9612095
	9612096
	9612097
	9612098
	9612099
	9612100
	9612101
	9612102
	9612103

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AECOM Uganda

Rwenzori Towers, 5th Floor, Nakasero ---
-- KAMPALA
UGANDA

Certificate of analysis

Date: 12-Jul-2017

Please find enclosed the analytical results of the test carried out for the project.

Certificate number/Version	2017086646/3
Your project number	NGSB2017003401-3
Your project name	AECOM Uganda
Your order number	Soils and Sediments
Samples received on	03-Jul-2017

This Certificate of Analysis shall not be reproduced except in full, without written approval of the laboratory. Interpretations and opinions are outside the scope of our accreditation, and all results relate only to samples supplied.

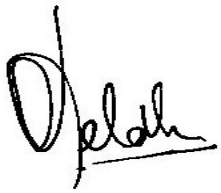
Soil samples will be stored for a period of 4 weeks and water samples for a period of 2 weeks after receipt of the samples at our laboratory. Without any additional request, samples will be disposed when the above mentioned periods have expired. If you require Eurofins Analytico to store the samples for a longer period, please complete this page and return it to Eurofins Analytico at least one businessday before the period is due to expire.
The costs of prolonged storage periods may be found in our pricelist.

Storage period:
Date: Name: Signature:

We are confident that we have performed the order in accordance with your expectations. If you have any remaining questions concerning this Certificate of Analysis, please don't hesitate to contact our Customer Service.

Yours sincerely,

Eurofins Analytico B.V.



Ing. A. Veldhuizen
Technical Manager

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Certificate of analysis

Your project number	NGSB2017003401-3	Certificate number/Version	2017086646/3
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils and Sediments	Report date	12-Jul-2017/10:58
		Annex	A,B,C,D
Sampled by		Page	1/6
Sample matrix	Soil, Sediment		

	Analysis	Unit	1	2	3	4	5
	Sample Pre-treatment						
Q	Cryogenic grinding		Executed	Executed	Executed	Executed	Executed
	Characteristics						
Q	Dry matter	% (w/w)			19.7		
Q	Dry matter	% (w/w)	99.4	91.9		99.7	99.0
Q	Moisture residue	% (w/w)	0.6	8.1	80.1	0.3	1.0
Q	Total Organic Carbon (TOC)	g/kg dm	5.2	<5.0	77	<5.0	<5.0
Q	Organic matter	% (w/w) dm	1.7	<0.7	16.6	<0.7	0.8
Q	Residue on ignition	% (w/w) dm	98.0	99.6	80.5	99.1	99.0
Q	Carbonates (CaC03)	g/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Fraction < 2000 µm	% (w/w) dm	83.2	98.2	78.8	97.3	91.7
Q	Fraction < 63 µm	% (w/w) dm	11.4	6.9	69.0	10.0	9.1
Q	Fraction < 45 µm	% (w/w) dm	8.8	4.6	62.5	7.0	6.6
Q	Fraction < 16 µm	% (w/w) dm	5.9	3.2	52.1	5.1	4.6
Q	Fraction < 2 µm	% (w/w) dm	3.4	2.3	41.5	3.7	3.1
	Metals						
Q	Arsenic (As)	mg/kg dm	<4.0	<4.0	<4.0	<4.0	<4.0
Q	Cadmium (Cd)	mg/kg dm	<0.30	<0.30	<0.30	<0.30	<0.30
Q	Chromium (Cr)	mg/kg dm	<15	27	110	<15	<15
Q	Copper (Cu)	mg/kg dm	<5.0	<5.0	32	<5.0	<5.0
Q	Mercury (Hg)	mg/kg dm	<0.050	<0.050	0.050	<0.050	<0.050
Q	Nickel (Ni)	mg/kg dm	<3.0	4.8	43	<3.0	<3.0
Q	Lead (Pb)	mg/kg dm	<13	<13	14	<13	<13
Q	Zinc (Zn)	mg/kg dm	<17	<17	55	<17	<17
Q	Antimony (Sb)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0
Q	Barium (Ba)	mg/kg dm	<15	<15	230	<15	17
Q	Cobalt (Co)	mg/kg dm	3.2	2.4	21	3.6	4.4
Q	Molybdenum (Mo)	mg/kg dm	<1.5	<1.5	<1.5	<1.5	<1.5
	Selenium (Se)	mg/kg dm	0.82	1.0	8.9	<0.70	<0.70
Q	Tin (Sn)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
Q	Vanadium (V)	mg/kg dm	10	15	96	<10	<10

No.	Sample description	Date sampling	Sample nr.
1	S15-170610-T1	10-Jun-2017	9612580
2	SE5-170614 B/BN	14-Jun-2017	9612581
3	SE5-170614 B/BS	14-Jun-2017	9612582
4	S6-170610-T1	10-Jun-2017	9612583
5	S6-170610-B1	10-Jun-2017	9612584

Q: Dutch Accreditation Council (RvA) accredited test
A: AP04 accredited test
S: AS3000 recognized test
V: VLAREL recognized test
M: MCERTS accredited

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Certificate of analysis

Your project number	NGSB2017003401-3	Certificate number/Version	2017086646/3
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils and Sediments	Report date	12-Jul-2017/10:58
		Annex	A,B,C,D
Sampled by		Page	2/6
Sample matrix	Soil, Sediment		

	Analysis	Unit	1	2	3	4	5
Q	Beryllium (Be)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0
Q	Calcium (Ca)	mg/kg dm	330	650	4200	160	320
Q	Potassium (K)	mg/kg dm	330	100	2700	200	260
Q	Magnesium (Mg)	mg/kg dm	220	200	4600	120	150
Q	Sodium (Na)	mg/kg dm	23	40	210	11	48
Q	Phosphorus total (P)	g/kg dm	0.090	0.061	0.55	0.080	0.083
Q	Phosphorus total (P04)	g/kg dm	0.28	0.19	1.7	0.24	0.26
Q	Phosphorus total (P205)	g/kg dm	0.21	0.14	1.2	0.18	0.19
	Mono Aromatic Hydrocarbons						
Q	Benzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Toluene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Ethylbenzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	o-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	m,p-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Xylenes (sum)	mg/kg dm	<0.10	<0.10	<0.10	<0.10	<0.10
Q	BTEX (sum)	mg/kg dm	<0.25	<0.25	<0.25	<0.25	<0.25
	Petroleum Hydrocarbons						
	EPH (C10-C12)	mg/kg dm	<3.0	<3.0	<12	<3.0	<3.0
	EPH (C12-C16)	mg/kg dm	<5.0	<5.0	<20	<5.0	<5.0
	EPH (C16-C21)	mg/kg dm	<6.0	<6.0	<24	<6.0	<6.0
	EPH (C21-C30)	mg/kg dm	<12	<12	<48	<12	<12
	EPH (C30-C35)	mg/kg dm	6.2	<6.0	<24	6.9	10.0
	EPH (C35-C40)	mg/kg dm	<6.0	<6.0	<24	<6.0	<6.0
Q	EPH Sum (C10-C40)	mg/kg dm	<38	<38	<150	<38	<38
	Physical and chemical analyses						
	Measuring temperature (pH)	°C	21	21	22	20	20
Q	Acidity (pH-CaCl2)		5.3	8.5 [1)]	5.5	5.4	4.8
	Inorganic Compounds						
	Nitrite (N02-N)	mg/kg dm	<0.20	<0.20	<0.20	<0.20	<0.20
	Nitrite (N02)	mg/kg dm	<0.60	<0.60	<0.60	<0.60	<0.60

No.	Sample description	Date sampling	Sample nr.
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3	SE5-170614 B/BS	14-Jun-2017	9612582
4	S6-170610-T1	10-Jun-2017	9612583
5	S6-170610-B1	10-Jun-2017	9612584

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Your order number	Soils and Sediments	Report date	12-Jul-2017/10:58
		Annex	A,B,C,D
Sampled by		Page	3/6
Sample matrix	Soil, Sediment		

Analysis	Unit	1	2	3	4	5
Nitrate (N03-N)	mg/kg dm	<2.0	<2.0	<2.0	<2.0	<2.0
Nitrate (N03)	mg/kg dm	<9.0	<9.0	<9.0	<9.0	<9.0

No.	Sample description	Date sampling	Sample nr.
1	S15-170610-T1	10-Jun-2017	9612580
2	SE5-170614 B/BN	14-Jun-2017	9612581
3	SE5-170614 B/BS	14-Jun-2017	9612582
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Certificate of analysis

Your project number	NGSB2017003401-3	Certificate number/Version	2017086646/3
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils and Sediments	Report date	12-Jul-2017/10:58
		Annex	A,B,C,D
Sampled by		Page	4/6
Sample matrix	Soil, Sediment		

	Analysis	Unit	6	7	8
	Sample Pre-treatment				
Q	Cryogenic grinding		Executed	Executed	Executed
	Characteristics				
Q	Dry matter	% (w/w)	99.3	98.3	98.1
Q	Moisture residue	% (w/w)	0.7	1.7	1.9
Q	Total Organic Carbon (TOC)	g/kg dm	<5.0	<5.0	<5.0
Q	Organic matter	% (w/w) dm	1.0	0.9	0.8
Q	Residue on ignition	% (w/w) dm	98.7	98.6	98.8
Q	Carbonates (CaCO3)	g/kg dm	<5.0	<5.0	<5.0
Q	Fraction < 2000 µm	% (w/w) dm	95.8	91.5	95.8
Q	Fraction < 63 µm	% (w/w) dm	12.2	17.1	11.9
Q	Fraction < 45 µm	% (w/w) dm	8.8	12.6	9.4
Q	Fraction < 16 µm	% (w/w) dm	6.6	9.5	7.3
Q	Fraction < 2 µm	% (w/w) dm	5.0	6.7	5.6
	Metals				
Q	Arsenic (As)	mg/kg dm	<4.0	<4.0	<4.0
Q	Cadmium (Cd)	mg/kg dm	<0.30	<0.30	<0.30
Q	Chromium (Cr)	mg/kg dm	<15	<15	<15
Q	Copper (Cu)	mg/kg dm	<5.0	<5.0	<5.0
Q	Mercury (Hg)	mg/kg dm	<0.050	<0.050	<0.050
Q	Nickel (Ni)	mg/kg dm	<3.0	3.4	<3.0
Q	Lead (Pb)	mg/kg dm	<13	<13	<13
Q	Zinc (Zn)	mg/kg dm	<17	<17	<17
Q	Antimony (Sb)	mg/kg dm	<1.0	<1.0	<1.0
Q	Barium (Ba)	mg/kg dm	<15	15	<15
Q	Cobalt (Co)	mg/kg dm	2.2	4.3	2.5
Q	Molybdenum (Mo)	mg/kg dm	<1.5	<1.5	<1.5
	Selenium (Se)	mg/kg dm	<0.70	<0.70	<0.70
Q	Tin (Sn)	mg/kg dm	<6.0	<6.0	<6.0
Q	Vanadium (V)	mg/kg dm	<10	14	11
Q	Beryllium (Be)	mg/kg dm	<1.0	<1.0	<1.0

No.	Sample description	Date sampling	Sample nr.
6	S12-170611-T1	11-Jun-2017	9612585
7	S15-170610-B1	10-Jun-2017	9612586
8	S12-170611-B1	11-Jun-2017	9612691

Q: Dutch Accreditation Council (RvA) accredited test
A: AP04 accredited test
S: AS3000 recognized test
V: VLAREL recognized test
M: MCERTS accredited

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BIC: BNPANL2A
KvK/CoC No. 09088623
BTW/VAT No. NL 8043.14.883.B01

Certificate of analysis

Your project number	NGSB2017003401-3	Certificate number/Version	2017086646/3
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils and Sediments	Report date	12-Jul-2017/10:58
		Annex	A,B,C,D
Sampled by		Page	5/6
Sample matrix	Soil, Sediment		

	Analysis	Unit	6	7	8
Q	Calcium (Ca)	mg/kg dm	270	500	91
Q	Potassium (K)	mg/kg dm	280	380	290
Q	Magnesium (Mg)	mg/kg dm	150	250	160
Q	Sodium (Na)	mg/kg dm	59	69	62
Q	Phosphorus total (P)	g/kg dm	0.079	0.064	0.066
Q	Phosphorus total (P04)	g/kg dm	0.24	0.20	0.20
Q	Phosphorus total (P205)	g/kg dm	0.18	0.15	0.15
	Mono Aromatic Hydrocarbons				
Q	Benzene	mg/kg dm	<0.050	<0.050	<0.050
Q	Toluene	mg/kg dm	<0.050	<0.050	<0.050
Q	Ethylbenzene	mg/kg dm	<0.050	<0.050	<0.050
Q	o-Xylene	mg/kg dm	<0.050	<0.050	<0.050
Q	m,p-Xylene	mg/kg dm	<0.050	<0.050	<0.050
Q	Xylenes (sum)	mg/kg dm	<0.10	<0.10	<0.10
Q	BTEX (sum)	mg/kg dm	<0.25	<0.25	<0.25
	Petroleum Hydrocarbons				
	EPH (C10-C12)	mg/kg dm	<3.0	<3.0	<3.0
	EPH (C12-C16)	mg/kg dm	<5.0	<5.0	<5.0
	EPH (C16-C21)	mg/kg dm	<6.0	<6.0	<6.0
	EPH (C21-C30)	mg/kg dm	<12	<12	<12
	EPH (C30-C35)	mg/kg dm	<6.0	<6.0	<6.0
	EPH (C35-C40)	mg/kg dm	<6.0	<6.0	<6.0
Q	EPH Sum (C10-C40)	mg/kg dm	<38	<38	<38
	Physical and chemical analyses				
	Measuring temperature (pH)	°C	20	22	21
Q	Acidity (pH-CaCl2)		5.8 [1)]	4.5	4.6
	Inorganic Compounds				
	Nitrite (N02-N)	mg/kg dm	<0.20	<0.20	<0.20
	Nitrite (N02)	mg/kg dm	<0.60	<0.60	<0.60
	Nitrate (N03-N)	mg/kg dm	<2.0	<2.0	<2.0

No.	Sample description	Date sampling	Sample nr.
6	S12-170611-T1	11-Jun-2017	9612585
7	S15-170610-B1	10-Jun-2017	9612586
8	S12-170611-B1	11-Jun-2017	9612691

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Certificate of analysis

Your project number	NGSB2017003401-3	Certificate number/Version	2017086646/3
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils and Sediments	Report date	12-Jul-2017/10:58
		Annex	A,B,C,D
Sampled by		Page	6/6
Sample matrix	Soil, Sediment		

Analysis	Unit	6	7	8
Nitrate (N03)	mg/kg dm	<9.0	<9.0	<9.0

No.	Sample description	Date sampling	Sample nr.
6	S12-170611-T1	11-Jun-2017	9612585
7	S15-170610-B1	10-Jun-2017	9612586
8	S12-170611-B1	11-Jun-2017	9612691

Q: Dutch Accreditation Council (RvA) accredited test
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Verified
ASM
FZ

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TESTING
RvA L010

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Annex (A) concerning subsample information referring to certificate of analysis 2017086646/3

Sample nr.	Drill-#	Description	From	To	Barcode	Sample description
9612580		S15-170610-T1				S15-170610-T1
9612580					0901991803	
9612581		SE5-170614 B/BN				SE5-170614 B/BN
9612581					0901991804	
9612582		SE5-170614 B/BS				SE5-170614 B/BS
9612582					0901991805	
9612583		S6-170610-T1				S6-170610-T1
9612583					0901991806	
9612584		S6-170610-B1				S6-170610-B1
9612584					0901991807	
9612585		S12-170611-T1				S12-170611-T1
9612585					0901991808	
9612586		S12-170611-T1				S15-170610-B1
9612586					0901991809	
9612691					0901991810	S12-170611-B1

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Annex (B) concerning remarks referring to certificate of analysis 2017086646/3

General remark referring to certificate of analysis

This certificate replaces previous published certificate(s) with lower version numbers.

Remark 1)

Measuring value not stabel (pH/EC/Redox)

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Annex (C): method references belonging to certificate of analysis 2017086646/3

Analysis	Method	Technique	Method reference
Cryogenic Milling (max 250 g)	W0106	Crushing	I.a.w. NVN 7313
Moisture residue	W6110	Gravimetry	In house method
Dry matter	W0104	Gravimetry	In accordance with NEN-EN 15934 & CMA 2/II/A.1
Dry matter	W0104	Gravimetry	In accordance with NEN-EN 15934 & CMA 2/II/A.1
TOC	W0594	Element analysis	I.a.w. ISO 10694
Organic matter (loss of ignition)	W0109	Gravimetry	Cf. NEN 5754
Calcite (CaC03)	W0177	Volumetric	Equivalent to NEN-EN-ISO 10693
Grainsize < 2000 µm	W0105	Sieving	I.a.w. NEN 5753
Grainsize < 63 µm	W0105	Sieving	I.a.w. NEN 5753
Grainsize < 45 Âµm (Sedimentation)	W0173	Sedimentation	I.a.w. NEN 5753
Grainsize < 16 µm (sedimentation)	W0173	Sedimentation	I.a.w. NEN 5753
Grainsize < 2 µm (clay) sedimentation	W0173	Sedimentation	I.a.w. NEN 5753
Metalen Royal degree	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
Calcium (Ca)	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
Potassium (K)	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
Magnesium (Mg)	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
Sodium (Na)	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
P	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
Aromatics (BTEX)	W0254	HS-GC/MS	In accordance with NEN-ISO 22155
EPH (C10-C40)	W0202	GC/FID	Eq. NEN-EN-ISO 16703
Acidity (pH-CaCl2)	W0524	Potentiometry	In accordance with NEN-ISO 10390
Nitrite	W0566	Spectrometry	In house method
Nitrate	W0566	Spectrometry	In house method

Additional information about the applied methods as well as the classification of the accuracy, are listed in our supplement: "Specification of methods of analyses", version June 2016.

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Annex (D) remarks concerning the sampling and preservation period 2017086646/3

Non compliance(s) of the criteria is(are) observed that may have influenced the accuracy of the test results of samples mentioned below.

	Sample nr.
The temperature of the samples received at the laboratory, exceded the limit.	9612580
	9612581
	9612582
	9612583
	9612584
	9612585
	9612586
	9612691

Analysis	Sample nr.
The preservation term for this parameter has been expired.	
Volatiles (HS weight)	9612580
	9612581
	9612582
	9612583
	9612584
	9612585
	9612586
	9612691
Voorbeh NC Sp	9612580
	9612581
	9612582
	9612583
	9612584
	9612585
	9612586
	9612691
Pretreatment TPH	9612580
	9612581
	9612582
	9612583
	9612584
	9612585
	9612586
	9612691

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TILENGA PROJECT ESIA - APPENDIX K: Hydrogeology

May 2018

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Annex 1: DWRM Groundwater Abstraction Permits - TEPU and TUOP

Annex 1: DWRM Groundwater Abstraction Permits - TEPU and TUOP

Geographic Location	Well Name	DWD BH Number	Permit Owner	Permit Issue Date	Permit Expiry Date	Eastings	Northings	Permitted Amount (m^3/day)	Well Status
CA1, North Nile									
	Tangi Camp	DWD 35670	TEPU	20-Jul-12	19-Jul-15			150	Capped
	Tangi Borehole 2	DWD 35646	TEPU	4-Jul-14	3-Jul-18			180	In use
	Jobi-2 BH	DWD 29473	TEPU	21-Jul-10	20-Jul-12	334326	261098	150	Capped
	Jobi-4 (C) BH	DWD 35657	TEPU	11-Oct-12	10-Oct-14	332964	258380	100	Capped
	Jobi-3 (D) BH	DWD 35655	TEPU	14-Jan-13	13-Jan-16	332594	253500	80	Capped
	Jobi-5 BH	DWD 35662	TEPU	31-Oct-12	30-Oct-14	332139	256025	60	Capped
	Jobi East-1	DWD 29459	TEPU	20-Jul-12	21-Jul-15	336318	260082	100	Capped
	Jobi East-3	DWD35655	TEPU			332594	253500		
	Jobi East-1 BH2	DWD 29460	TEPU	19-Jul-12	18-Jul-15	336399	260549	150	Capped
	Jobi East-2 BH1	DWD 29461	TEPU	20-Jul-12	19-Jul-14	337015	264731	150	Capped
	Mpyo-2	DWD 29468	TEPU	20-Jul-12	19-Jul-15	339131	245766	150	Capped
	Mpyo-4	DWD 40957	TEPU	14-Aug-13	13-Aug-15	338570	253878	150	Capped
	Raa-1	DWD 35668	TEPU	27-Feb-13	26-Feb-14	333050	269405	50	Capped
	Rii-2	DWD 40971	TEPU	6-Feb-14	5-Feb-15	329368	248179	75	Capped
	Til-1	DWD 35666	TEPU	18-Dec-12	17-Dec-13	342654	254394	100	Capped
EA IA North Nile									
	Lyec-1	DWD 35669	TEPU	27-Feb-13	26-Feb-14	338429	268206	100	Capped
CA1, South Nile									
	Bugungu Camp	DWD 29475	TEPU	25-May-16	24-May-21	336840	241907	100	In use
	Gunya-1	n/a	TEPU	28-Jun-11	27-Jun-16	334242	244154	60	Community
	Mpyo-1	DWD 29471	TEPU	20-Jul-12	19-Jul-15	337956	249446	150	Capped
	Mpyo-3 (C)	DWD 29470	TEPU	20-Jul-12	19-Jul-15	339518	249081	150	Capped
	Mpyo D	DWD 40959	TEPU	1-Oct-13	30-Sep-15	n/a	n/a	50	Capped
	Ngiri-1	DWD 21022	TEPU	27-Sep-12	26-Sep-17	326401	242120	100	In use
	Ngiri-2	DWD 29474	TEPU	25-May-13	24-May-16	326889	243526	150	Community
LA2, South Nile									
	Awaka-1	DWD 29905	TUOP	5-May-10	4-May-15	342732	229906	20	Abandoned

Geographic Location	Well Name	DWD BH Number	Permit Owner	Permit Issue Date	Permit Expiry Date	Eastings	Northings	Permitted Amount (m^3/day)	Well Status
	Awaka-1 Surface water		TUOP	5-May-10	4-May-15			40	Abandoned
	Karuka-2	DWD 21663	TUOP			322034	229591		Abandoned
	Kasamene-1	DWD 21665	TUOP	7/21/2011	7/20/2016	324055	236849	20	Community
	Kasamene-3/3A		TUOP	2/15/2011	2/14/2016	324055	236849		Abandoned
	Kasemene 3 Surface Water		TUOP	2/15/2011	2/14/2016			20	Abandoned
	Kigogole-1	DWD 25893	TUOP	9/1/2011	8/31/2016	313047.8	20912.5	20	Community
	Nsoga 5	DWD 25893	TUOP	9/2/2009	9/1/2011			20	Abandoned
	Kigogole-6/6A (Bugana)		TUOP	3/2/2012	3/1/2015	333972	228210	40	Abandoned
	Mputa-1	DWD 18688	TUOP	7/26/2011	7/25/2016	273307	159554	40	Abandoned
	Mputa-2	DWD 21654	TUOP	7/26/2006	7/26/2011	271413	161273		UWA wildlife support
	Mputa-3	DWD 21643	TUOP	8/30/2011	8/29/2016	274846	158680	30	Abandoned
	Mputa-4	DWD 21645	TUOP			274816	159509		Abandoned
	Mputa-5	DWD 18688	TUOP	7/26/2011	7/25/2016	273307	159554	40	Abandoned
	Ngara-1	DWD 29906	TUOP	1/14/2013	8/11/2015	336830	226905	100	Abandoned
	Ngassa-1		TUOP	10/23/2007	10/23/2008	N/A	N/A		Abandoned
	Ngassa-2		TUOP			N/A	N/A		Abandoned
	Ngege-1	DWD 21661	TUOP	6/21/2011	6/20/2016	322034	229591	389	Community
	Ngege-2/2A	DWD 25893	TUOP	9/2/2009	9/1/2011	313047.8	20912.5	20	Abandoned
	Ngege-5		TUOP			322034	229591		Abandoned
	Ngege-F	DWD 35656	TUOP	10/5/2012	10/4/2014	3133378	209456	100	Abandoned
	Nsoga-5	DWD 25893	TUOP	9/2/2009	9/1/2011	313047.8	20912.5	20	Abandoned
	Nsoga-3	CD2245	TUOP	2/3/2011	2/2/2016	332508	236820	40	Abandoned
	Nzizi-1	DWD 21659	TUOP	7/26/2011	7/25/2016	267750	157536		Abandoned
	Taitai-1	DWD 21660	TUOP	6/21/2011	6/20/2016			191	Abandoned
	Wahrindi-1		TUOP	9/2/2009	9/1/2014	N/A	N/A	20	Abandoned
	Buliisa Weatherford Camp	DWD 35633	TUOP	19-Apr-17	18-Dec-21			150	In use
	Lanya	DWD 21662	TUOP	6/21/2011	6/20/2016			382	Abandoned
	Kasurabanu		TUOP	1-Sep-11	31-Aug-16			20	

Geographic Location	Well Name	DWD BH Number	Permit Owner	Permit Issue Date	Permit Expiry Date	Eastings	Northings	Permitted Amount (m^3/day)	Well Status
	Bulisa Old Saracen Camp	DWD 21661	TUOP	19-Apr-17	28-Aug-20			25	In use
	Buliisa Seismic Camp	DWD 29942	TUOP	27-Nov-12	22-Mar-17			80	In use
	Ngara MW 1	DWD 35641	TUOP						In use
	Ngara MW 2	DWD 35641	TUOP						In use
	Ngara MW 3	DWD 35641	TUOP						In use

Annex 2: WHO 4th Edition Drinking Water Standards

Reference	ChemName	MatrixType	ActionLevelSource	ActionLevel	ActionLevel_Min	Units	Comments
79-06-1	Acrylamide	water	WHO 4th Edition Drinking Water	0.0005		mg/L	
15972-60-8	Alachlor	water	WHO 4th Edition Drinking Water	0.02		mg/L	
116-06-3	Aldicarb	water	WHO 4th Edition Drinking Water	0.01		mg/L	Applies to aldicarb sulfoxide and aldicarb sulfone
1646-87-3	aldicarb sulfoxide	water	WHO 4th Edition Drinking Water	0.01		mg/L	
1646-88-4	aldicarb sulfone	water	WHO 4th Edition Drinking Water	0.01		mg/L	
309-00-2 + 60-57-1	Aldrin and dieldrin	water	WHO 4th Edition Drinking Water	0.00003		mg/L	
7440-36-0	Antimony	water	WHO 4th Edition Drinking Water	0.02		mg/L	
7440-38-2	Arsenic	water	WHO 4th Edition Drinking Water	0.01		mg/L	A,T
1912-24-9+metabolite	Atrazine and its chloro-s-triazine metabolites	water	WHO 4th Edition Drinking Water	0.1		mg/L	
7440-39-3	Barium	water	WHO 4th Edition Drinking Water	0.7		mg/L	
71-43-2	Benzene	water	WHO 4th Edition Drinking Water	0.01		mg/L	
50-32-8	Benzo[a]pyrene	water	WHO 4th Edition Drinking Water	0.0007		mg/L	
7440-42-8	Boron	water	WHO 4th Edition Drinking Water	2.4		mg/L	
15541-45-4	Bromate	water	WHO 4th Edition Drinking Water	0.01		mg/L	A,T
75-27-4	Bromodichloromethane	water	WHO 4th Edition Drinking Water	0.06		mg/L	
75-25-2	Bromoform	water	WHO 4th Edition Drinking Water	0.1		mg/L	
7440-43-9	Cadmium	water	WHO 4th Edition Drinking Water	0.003		mg/L	
1563-66-2	Carbofuran	water	WHO 4th Edition Drinking Water	0.007		mg/L	
56-23-5	Carbon tetrachloride	water	WHO 4th Edition Drinking Water	0.004		mg/L	
14866-68-3	Chlorate	water	WHO 4th Edition Drinking Water	0.7		mg/L	D
57-74-9	Chlordane	water	WHO 4th Edition Drinking Water	0.0002		mg/L	
Total Chlorine	Chlorine	water	WHO 4th Edition Drinking Water	5		mg/L	
14998-27-7	Chlorite	water	WHO 4th Edition Drinking Water	0.7		mg/L	D
67-66-3	Chloroform	water	WHO 4th Edition Drinking Water	0.3		mg/L	
15545-48-9	Chlorotoluron	water	WHO 4th Edition Drinking Water	0.03		mg/L	
2921-88-2	Chlorpyrifos	water	WHO 4th Edition Drinking Water	0.03		mg/L	
7440-47-3	Chromium (Total)	water	WHO 4th Edition Drinking Water	0.05		mg/L	P
7440-50-8	Copper	water	WHO 4th Edition Drinking Water	2		mg/L	Staining of laundry and sanitary ware may occur below guideline value
21725-46-2	Cyanazine	water	WHO 4th Edition Drinking Water	0.0006		mg/L	
94-82-8	2,4-D (Free Acid)	water	WHO 4th Edition Drinking Water	0.03		mg/L	
94-82-6	2,4-DB	water	WHO 4th Edition Drinking Water	0.09		mg/L	
50-29-3(total)	DDT[d] and metabolites	water	WHO 4th Edition Drinking Water	0.001		mg/L	
3252-43-5	Dibromoacetonitrile	water	WHO 4th Edition Drinking Water	0.07		mg/L	
124-48-1	Dibromochloromethane	water	WHO 4th Edition Drinking Water	0.1		mg/L	
96-12-8	1,2-Dibromo-3-chloropropane	water	WHO 4th Edition Drinking Water	0.001		mg/L	
106-93-4	1-2 Dibromoethane	water	WHO 4th Edition Drinking Water	0.0004		mg/L	P
79-43-6	Dichloroacetate	water	WHO 4th Edition Drinking Water	0.05		mg/L	D
3018-12-0	Dichloroacetonitrile	water	WHO 4th Edition Drinking Water	0.02		mg/L	P
95-50-1	1,2-Dichlorobenzene	water	WHO 4th Edition Drinking Water	1		mg/L	C
106-46-7	1,4-Dichlorobenzene	water	WHO 4th Edition Drinking Water	0.3		mg/L	C
107-06-2	1,2-Dichloroethane	water	WHO 4th Edition Drinking Water	0.03		mg/L	
540-59-0	1,2-Dichloroethene	water	WHO 4th Edition Drinking Water	0.05		mg/L	
75-09-2	Dichloromethane	water	WHO 4th Edition Drinking Water	0.02		mg/L	
78-87-5	1,2-Dichloropropane	water	WHO 4th Edition Drinking Water	0.04		mg/L	P
542-75-6	1,3-Dichloropropene	water	WHO 4th Edition Drinking Water	0.02		mg/L	
120-36-5	Dichlorprop	water	WHO 4th Edition Drinking Water	0.1		mg/L	
117-81-7	Di(2-ethylhexyl)phthalate	water	WHO 4th Edition Drinking Water	0.008		mg/L	
60-51-5	Dimethoate	water	WHO 4th Edition Drinking Water	0.006		mg/L	
123-91-1	1,4-Dioxane	water	WHO 4th Edition Drinking Water	0.05		mg/L	
60-00-4	Edetic acid (Free Acid)	water	WHO 4th Edition Drinking Water	0.6		mg/L	

Reference	ChemName	MatrixType	ActionLevelSource	ActionLevel	ActionLevel_Min	Units	Comments
72-20-8	Endrin	water	WHO 4th Edition Drinking Water	0.0006		mg/L	
106-89-8	Epichlorohydrin	water	WHO 4th Edition Drinking Water	0.0004		mg/L	P
100-41-4	Ethylbenzene	water	WHO 4th Edition Drinking Water	0.3		mg/L	C
93-72-1	Fenoprop	water	WHO 4th Edition Drinking Water	0.009		mg/L	
16984-48-8	Fluoride	water	WHO 4th Edition Drinking Water	1.5		mg/L	Volume of water consumed and intake from other sources should be considered when setting national standards
87-68-3	Hexachlorobutadiene	water	WHO 4th Edition Drinking Water	0.0006		mg/L	
2163-68-0	Hydroxyatrazine	water	WHO 4th Edition Drinking Water	0.2		mg/L	Atrazine metabolite
34123-59-6	Isoproturon	water	WHO 4th Edition Drinking Water	0.009		mg/L	
7439-92-1	Lead	water	WHO 4th Edition Drinking Water	0.01		mg/L	A,T
58-89-9	Lindane	water	WHO 4th Edition Drinking Water	0.002		mg/L	
94-74-6	MCPA[e]	water	WHO 4th Edition Drinking Water	0.002		mg/L	
93-65-2	Mecoprop	water	WHO 4th Edition Drinking Water	0.01		mg/L	
7439-97-6	Mercury (inorganic)	water	WHO 4th Edition Drinking Water	0.006		mg/L	
72-43-5	Methoxychlor	water	WHO 4th Edition Drinking Water	0.02		mg/L	
51218-45-2	Metolachlor	water	WHO 4th Edition Drinking Water	0.01		mg/L	
101043-37-2	Microcystin-LR	water	WHO 4th Edition Drinking Water	0.001		mg/L	P:For total microcystin-LR (free plus cell-bound)
2212-67-1	Molinate	water	WHO 4th Edition Drinking Water	0.006		mg/L	
10599-90-3	Monochloramine	water	WHO 4th Edition Drinking Water	3		mg/L	
96-34-4	Monochloroacetate	water	WHO 4th Edition Drinking Water	0.02		mg/L	
7440-02-0	Nickel	water	WHO 4th Edition Drinking Water	0.07		mg/L	
14797-55-8	Nitrate (as NO3–)	water	WHO 4th Edition Drinking Water	50		mg/L	Short-term exposure
139-13-9	Nitrilotriacetic acid	water	WHO 4th Edition Drinking Water	0.2		mg/L	
14797-65-0	Nitrite (as NO2–)	water	WHO 4th Edition Drinking Water	3		mg/L	Short-term exposure
62-75-9	N-Nitrosodimethylamine	water	WHO 4th Edition Drinking Water	0.0001		mg/L	
40487-42-1	Pendimethalin	water	WHO 4th Edition Drinking Water	0.02		mg/L	
87-86-5	Pentachlorophenol	water	WHO 4th Edition Drinking Water	0.009		mg/L	P
7782-49-2	Selenium	water	WHO 4th Edition Drinking Water	0.04		mg/L	P
122-34-9	Simazine	water	WHO 4th Edition Drinking Water	0.002		mg/L	
2893-78-9	Sodium dichloroisocyanurate	water	WHO 4th Edition Drinking Water	50		mg/L	
2893-78-9(CA)	Sodium dichloroisocyanurate as cyanuric acid	water	WHO 4th Edition Drinking Water	40		mg/L	
100-42-5	Styrene	water	WHO 4th Edition Drinking Water	0.02		mg/L	C
93-76-5	2,4,5-T[f]	water	WHO 4th Edition Drinking Water	0.009		mg/L	
5915-41-3	Terbuthylazine	water	WHO 4th Edition Drinking Water	0.007		mg/L	
127-18-4	Tetrachloroethene	water	WHO 4th Edition Drinking Water	0.04		mg/L	
108-88-3	Toluene	water	WHO 4th Edition Drinking Water	0.7		mg/L	C
76-03-9	Trichloroacetate	water	WHO 4th Edition Drinking Water	0.2		mg/L	
79-01-6	Trichloroethene	water	WHO 4th Edition Drinking Water	0.02		mg/L	P
88-06-2	2,4,6-Trichlorophenol	water	WHO 4th Edition Drinking Water	0.2		mg/L	C
1582-09-8	Trifluralin	water	WHO 4th Edition Drinking Water	0.02		mg/L	
7440-61-1	Uranium	water	WHO 4th Edition Drinking Water	0.03		mg/L	P:Only chemical aspects of uranium addressed
75-01-4	Vinyl chloride	water	WHO 4th Edition Drinking Water	0.0003		mg/L	
1330-20-7	Xylenes	water	WHO 4th Edition Drinking Water	0.5		mg/L	C

Annex 3: Borehole logs for Surface Geology in the Study Area

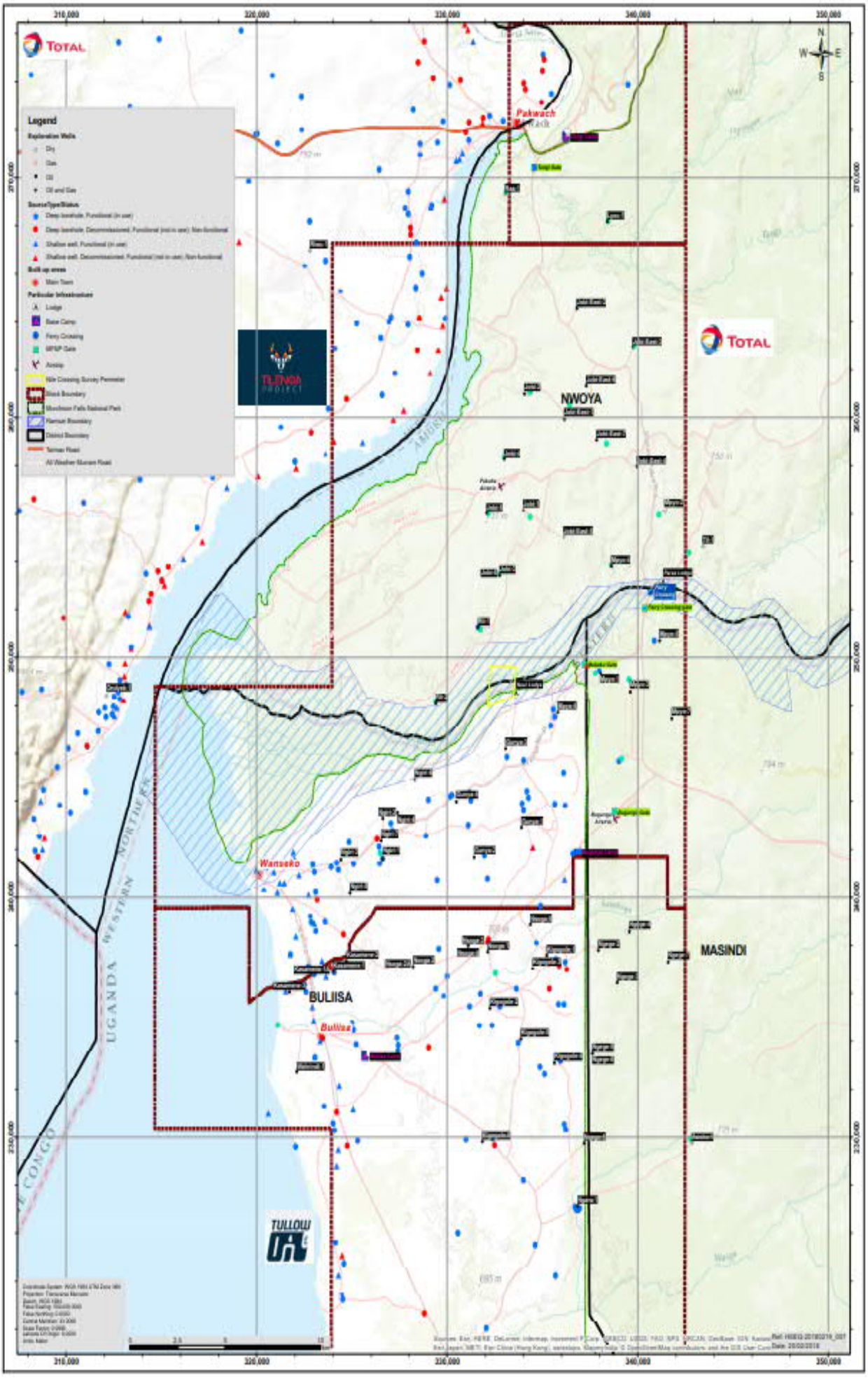
Annex 2: Borehole logs for Surface Geology in the Study Area

Name of oil or gas well	Depth	Lithological description
Block EA1		
Jobi C	0-12m	Red sand and gravel
	12-39m	Grey clay with fine sand
	39-48m	Course sand to fine sand
	48-60m	Brown grey clay
	60-75m	Dark brown clay and fine sand
	75-87m	Brown course sand with silt
	87-96m	Grey clay with fine sand
	96-115m	Dark grey clay with fine sand
Jobi East 3 DWD 35655	0-3m	Dark grey soil
	3-9m	Light brown clay
	9-24m	Yellowish clayey sand
	24-36m	Light brown clayey sand
	36-48m	Light grey clayey sand
	48-63m	Grey clay, sand and silt
	63-78m	Grey clay with some fine sand
	78-93m	Grey clayey sand
Jobi East 5	0-12m	Clay, brown
	12-18m	Cream sand
	18-30m	Brown clay and sand
	30-48m	Cream clayey sand
	48-60m	Cream clay and fine sand
	60-69m	Light grey sandy clay
	69-75m	Cream clayey sand
	75-78m	Sandy cream clay
	78-87m	Light grey sand , clayey
	87-93m	Cream sandy clay
	93-102m	Light grey sandy clay
Jobi East F	0-6m	Grey clay
	6-21m	Cream clay, some sand
	21-30m	Brown clay with sand
	30-33m	Brown sand clay
	33-39m	Grey sand, little clay
	39-48m	Sand and gravel, some silt
	48-60m	Grey clay and silt
	60-75m	Grey clay and fine sand

Name of oil or gas well	Depth	Lithological description
Mypo-F	0-6m	Grey clay
	6-21m	Cream clay, some sand
	21-30m	Brown clay with sand
	30-33m	Brown sand clay
	33-39m	Grey sand, little clay
	39-48m	Sand and gravel, some silt
	48-60m	Grey clay and silt
	60-75m	Grey clay and fine sand
Mypo –H	0-6m	Clay sandy, light grey
	6-18m	Brown yellowish sand
	18=39m	Brown sandy clay
	39-45m	Brown course sand
	45-57m	Brown clayey sand
	57-66m	Light Brown clayey sand
	66-72m	Course quartz sand
	72-75m	Dark grey clay
RAA	0-9m	Dark brown clay
	9-15m	Brown Clay and Course Sand
	15-24m	Brown Sand
	24-36m	Brown Clay
	36-69m	Light Grey clay
RII-B	0-3 m	Grey Soil
	3-9m	Brown Clayey sand
	9-15m	Light brown sandy clay
	15-36m	Grey course sand
	36 -45m	Grey Clayey sand
	45-54m	Grey Clay
TIL	0-6m	Brown clayey soil
	6-36m	Brown clay and sand
	36-42m	Grey Sand
	42-51m	Sandy
	51-60m	Clay and sand
	60-75m	Clayey sand
Block EA2		
Kasamene-1 DWD 21665	10-50m	Unconsolidated sand
	50-60m	Interbedded sand and claystone
Ngiri-1 DWD 21022	10-56m	Sand (predominantly very coarse to small pebble size; very porous)

Name of oil or gas well	Depth	Lithological description
	56-80m	Interbedded sand and clay
Nsoga-1	10-50m 50-70m	Unconsolidated sand sequence (predominantly medium to coarse; good inferred porosity) Interbedded sand and claystone
Kigogole-1 DWD 25893	10-60m 60-70m	Sand (medium – very coarse then fine to medium; fair to excellent inferred porosity) Interbedded clay and sand
Kigogole-3	10-20m 20-30m 30-40m	Sand with clay bands Sand (predominantly medium to coarse; highly porous) Interbedded clay and sand
Ngege-1 DWD 21661	10-15m 15-40m 40-45m 45-90m 90-100m	Clay Sand with clay bands Sand (medium-coarse; good inferred porosity) Clay with sand Sand
Ngara-1 DWD 29906	10-35m 35-45m 45-55m	Sand (medium-coarse; good inferred porosity) Sand with clay bands Sand
Awaka-1 DWD 29908	8-22m 22-75m	Clay and sand Sand (medium-coarse / medium; very porous)
EA-2 Notes: Only the uppermost geological layers are included here, these are underlain by low permeability tuff, claystone, clay, sometimes interbedded with further minor sand and sandstone. The first 10m is not recorded; depths are recorded as metres below rotary table elevation which is approximately 5m above ground level.		

Sources: EA 1 Boring Completion Reports prepared by Watertech; EA2 - Atkins Albertine Rift Development Project Injection Water Supply Study Groundwater Review, May 2010.
Note: Data from borehole I.D DWD16551 (Ugandan national borehole database)


TOTAL
Legend
Exploration Wells
Dry
Gas
Oil
Oil and Gas
Source/Type/Status
Deep borehole, Functional (in use)
Deep borehole, Decommissioned, Functional (not in use); Non-functional
Shallow well, Functional (in use)
Shallow well, Decommissioned, Functional (not in use); Non-functional
Built up areas
Main Town
Particular Infrastructure
Lodge
Base Camp
Ferry Crossing
MFNP Gate
Airstrip
Nile Crossing Survey Perimeter
Block Boundary
Murchison Falls National Park
Kiamun Boundary
District Boundary
Tarmac Road
All Weather Murram Road
TILENGA PROJECT
TOTAL
NWOYA
MASINDI
BULIISA
Pakwach
Wanseko
Buliisa
TULLOW
UGANDA
WESTERN
NORTHERN
N
S
E
W
310,000
320,000
330,000
340,000
350,000

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW1
Job No: Total Project	Date: 12-10-17 18-10-17	Ground Level (m):	Co-Ordinates (): E 328 837.0 N 242 377.0	
Contractor: GEOMECHANICS				Sheet: 1 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
0.00-1.50			91					(0.45) 0.45	0.00 - 0.45 Brown slightly silty SAND with abundant rootlets (1-15mm). TOPSOIL.	T	
									0.45 - 2.80 Light orange brown with increased light grey blotches with depth silty SAND.		
1.50-2.29			82					(2.35)			
2.29-3.79			99					2.80	2.80 - 8.10 Light orange brown blotched light grey gravelly clayey silty SAND. Note: Gravels are fine to medium sub-angular and of mixed origin but predominately ferricrete nodules and quartz grains.		
3.79-5.29			93								
5.29-6.79			85					(5.30)			
6.79-8.29			80						7.00-8.00m Increase in fine to medium sub-angular gravels of quartz.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.15m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 520 Rig No. P100	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW1
Job No: Total Project	Date: 12-10-17 18-10-17	Ground Level (m):	Co-Ordinates (): E 328 837.0 N 242 377.0	
Contractor: GEOMECHANICS				Sheet: 2 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
8.29-8.73			0					8.10	8.10 - 11.69 Light grey speckled light orange clayey silty fine to medium SAND. 8.29-8.73m Core loss.		
8.73-10.19			75					(3.59)			
10.19-11.69			0					11.69	10.19-11.69m Core loss.		
11.69-13.19			0						11.69 - 21.45 Light greenish grey silty CLAY with widely spaced thin lenses of clayey sand. 11.69-13.19m Core loss.		
13.19-13.69			100								
13.69-15.19			0						13.69-20.37m Core loss - may indicate a zone of increased sandy material.		
15.19-16.69			0								

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.15m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 520 Rig No. P100	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL_2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW1
Job No: Total Project	Date: 12-10-17 18-10-17	Ground Level (m):	Co-Ordinates (): E 328 837.0 N 242 377.0	
Contractor: GEOMECHANICS				Sheet: 3 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
16.69-17.37			0					(9.76)			
17.37-18.87			0								
18.87-20.37			0								
20.37-21.87			77						20.80m Pocket Penetrometer: 0.40MPa, 0.35MPa, 0.30MPa.		
21.87-23.37			0					21.45	21.45 - 27.80 Light greenish grey fine to coarse sandy CLAY with widely interbedded thinly bedded (40-100mm) clay and/or clayey sand. 21.87-23.37m Core loss.		
23.37-25.02									23.60m Pocket Penetrometer: 0.25MPa, 0.26MPa, 0.25MPa.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	
20.37	14-10-17	07.00	9.50	126						End of Borehole 55.15m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 520 Rig No. P100	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW1
Job No: Total Project	Date: 12-10-17 18-10-17	Ground Level (m):	Co-Ordinates (): E 328 837.0 N 242 377.0	
Contractor: GEOMECHANICS				Sheet: 4 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
			77					(6.35)			
25.02-26.46									25.02-26.35m Contaminated wash material.		
			76								
26.46-27.96											
			36								
								27.80			
27.96-29.79									27.80 - 29.90 Light greenish grey slightly clayey fine sandy SILT with widely spaced thinly to medium bedded clay.		
			85					(2.10)			
								29.90			
29.79-31.29									29.90 - 36.69 Light greenish grey silty fine SAND with widely spaced thin (10-50mm) beds of clay. Note: Lenses of thin (5-30mm) fine to medium sand lenses.		
			67								
31.29-32.11											
			76								

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	
27.96	15-10-17	07.00	9.50	126						End of Borehole 55.15m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 520 Rig No. P100	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW1
Job No: Total Project	Date: 12-10-17 18-10-17	Ground Level (m):	Co-Ordinates (): E 328 837.0 N 242 377.0	
Contractor: GEOMECHANICS				Sheet: 5 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
32.11-33.81			0					(6.79)	32.11-33.81m Core loss.		
33.81-36.19			0						33.81-36.19m Core loss.		
36.19-36.69			0					36.69	36.19-36.69m Core loss.		
36.69-38.02			100					(1.41)	36.69 - 38.10 Light greenish grey fine sandy SILT. 37.20m Pocket Penetrometer: 0.30MPa.		
38.02-39.69			68					38.10 (1.52) 39.62	38.10 - 39.62 Light yellowish brown slightly silty fine to coarse SAND.		
39.69-40.87									39.62 - 41.30 Light grey with minor light orange staining fine SAND with abundant micaceous		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	
32.11	16-10-17	07.00	9.50	126						End of Borehole 55.15m.
38.02	16-10-17	17.00	9.50	126						
38.02	17-10-17	07.00	9.50	126						

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 520 Rig No. P100	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW1
Job No: Total Project	Date: 12-10-17 18-10-17	Ground Level (m):	Co-Ordinates (): E 328 837.0 N 242 377.0	
Contractor: GEOMECHANICS				Sheet: 6 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
			69					(1.68)	minerals observed.		
40.87-42.64								41.30			
			92					(1.40)	41.30 - 42.70 Light greenish grey fine sandy SILT.		
42.64-44.34								42.70			
			78					(3.23)	42.70 - 45.93 Closely sheared light greenish grey fine to medium sandy CLAY with widely spaced thin (60-120mm) fine to medium sand beds. Note: Polished/ striated surfaces observed. 42.70m Pocket Penetrometer: 0.45MPa, 0.50MPa, 0.40MPa.		
44.34-45.93											
			100					45.93			
45.93-47.22									45.93 - 50.67 Light greenish grey slightly silty fine to medium SAND with micaceous minerals observed.		
			75								
47.22-48.70											

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.15m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 520 Rig No. P100	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW1
Job No	Date	Ground Level (m)	Co-Ordinates ()	
Total Project	12-10-17 18-10-17		E 328 837.0 N 242 377.0	
Contractor				Sheet
GEOMECHANICS				7 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
			58					(4.74)			
48.70-50.37			94						48.70-49.90m Thin (50-70mm) medium spaced beds of hard silt.		
50.37-52.02			88	U1				50.67			
52.02-53.49			80	U2					50.67 - 55.15 Closely sheared/jointed grey slightly organic slightly fine sandy clayey SILT with widely spaced (60-150mm) lenses of fine to medium sand. Note: Pocket penetrometer readings indicate material is borderline extremely weak and very weak rock strength. 51.90m Pocket Penetrometer: 0.7MPa. 52.50m Pocket Penetrometer: >1.0MPa, >1.0MPa.		
53.49-55.15			56	U3				(4.48)			
								55.15			

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	
48.70	18-10-17	07.00	9.50	126						End of Borehole 55.15m.

All dimensions in metres Scale 1:50	Client TOTAL	Method/ Plant Used DB 520 Rig No. P100	Logged By Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL_2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW2
Job No: Total Project	Date: 20-10-17 / 23-10-17	Ground Level (m):	Co-Ordinates (): E 330 332.0 N 242 233.0	
Contractor: GEOMECHANICS				Sheet: 1 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument / Backfill
0.00-1.74			89					(0.40) 0.40	0.00 - 0.40 Greyish brown slightly silty fine to medium SAND with abundant roots (1-5mm diameter). (TOPSOIL).	T	
									0.40 - 3.20 Light orangey brown silty fine to medium SAND.		
1.74-3.24			100					(2.80)			
								3.20			
3.24-4.49			82						3.20 - 7.35 Light greyish brown streaked light orange clayey fine to medium SAND.		
4.49-6.00			81					(4.15)			
6.00-7.50			100						6.35-7.20m Abundant iron leaching and the presence of abundant fine to medium sub-angular to sub-rounded ferricrete nodules.		
								7.35			
7.50-9.00				U1					7.35 - 11.00 Light grey mottled light orange and brown very fine to medium sandy CLAY with widely spaced thin beds of clayey sand. 7.52-7.70m Pocket Penetrometer 0.3MPa.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.01m. No ground water encountered in borehole.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 520 Rig No. P100	Logged By: Spha Luthuli

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW2
Job No: Total Project	Date: 20-10-17 / 23-10-17	Ground Level (m):	Co-Ordinates (): E 330 332.0 N 242 233.0	
Contractor: GEOMECHANICS				Sheet: 2 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument / Backfill
			100						0.3MPa, 0.35MPa. 7.75m Pocket Penetrometer 0.6MPa, 0.6MPa. 8.40-8.50m Abundant fine to medium sub-rounded quartz gravels encountered.		
9.00-10.60			100					(3.65)			
10.60-12.10			65					11.00	11.00 - 12.95 Light greenish grey slightly sandy CLAY. 11.55m Pocket Penetrometer 1.0MPa, 0.6MPa, 0.9MPa.		
12.10-13.60			100					(1.95)			
13.60-15.10			95					12.95 (2.15) 15.10	12.85-12.95m Hardpan ferricrete exhibiting extremely weak rock strength. (Engineer's Estimate). 12.95 - 15.10 Light greyish green slightly clayey silty fine to coarse SAND with numerous fine to medium sub-angular to sub-rounded gravel of predominantly quartz.		
15.10-16.60			85						15.10 - 17.10 Light greenish grey silty fine SAND with medium spaced thin beds of silt.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.01m. No ground water encountered in borehole.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 520 Rig No. P100	Logged By: Spha Luthuli

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0_GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW2
Job No	Date	Ground Level (m)	Co-Ordinates ()	
Total Project	20-10-17 23-10-17		E 330 332.0 N 242 233.0	
Contractor				Sheet
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SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
16.60-17.10			76					(2.00) 17.10			
17.10-18.76			95					(1.50) 18.60	17.10 - 18.60 Light greenish grey fine sandy clayey SILT.		
18.76-20.45			80						18.60 - 23.58 Light yellowish to light greenish grey clayey silty fine to medium SAND.		
20.45-22.01			100					(4.98)			
22.01-23.51			65								
23.51-24.56								23.58	23.58 - 26.30 Light yellowish grey silty fine to medium SAND with widely spaced thin beds of		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	
17.10	21-10-17	07.00	3.00	126						End of Borehole 55.01m. No ground water encountered in borehole.

All dimensions in metres Scale 1:50	Client TOTAL	Method/ Plant Used DB 520 Rig No. P100	Logged By Spha Luthuli

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL_2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW2
Job No	Date	Ground Level (m)	Co-Ordinates ()	
Total Project	20-10-17 23-10-17		E 330 332.0 N 242 233.0	
Contractor				Sheet
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SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
			87						slightly silty sand.		
24.55-25.05			100					(2.72)			
25.05-26.05			100								
26.05-27.69								26.30			
			72						26.30 - 30.32 Light grey fine tyo coarse SAND with medium spaced very thin to thin interbeds of silty fine sand. 26.30-28.43m Occasional fine to medium sub-rounded quartz gravel observed.		
27.69-28.43			100					(4.02)			
28.43-29.82			48								
29.82-30.32			100					30.32			
30.32-31.21			93						30.32 - 35.20 Light greenish grey clayey fine to coarse SAND. 30.45-30.60m Very stiff to hard (engineer's estimate) clay bed. 30.45m Pocket Penetrometer 0.85MPa, 0.75MPa, 0.70MPa.		
31.21-32.30			84								

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	
27.69	22-10-17	07.00	3.00	126						End of Borehole 55.01m. No ground water encountered in borehole.

All dimensions in metres Scale 1:50	Client TOTAL	Method/ Plant Used DB 520 Rig No. P100	Logged By Spha Luthuli

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL_2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW2
Job No	Date	Ground Level (m)	Co-Ordinates ()	
Total Project	20-10-17 23-10-17		E 330 332.0 N 242 233.0	
Contractor				Sheet
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SAMPLES & TESTS								STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument / Backfill
32.30-33.76									32.30-32.48m Very stiff to hard (engineer's estimate) clay bed.		
			100					(4.88)			
33.76-35.20									33.40-33.56m Very stiff to hard (engineer's estimate) clay bed.		
			100								
								35.20			
35.20-36.35									35.20 - 38.19 Light grey slightly silty fine to medium SAND with widely spaced very thin beds of coarse sand and the occasional fine to medium sub-rounded quartz gravel.		
			72								
36.35-37.53			34					(2.99)			
37.53-38.19			100								
								38.19			
38.19-39.59									38.19 - 43.70 Greenish grey slightly fine sandy closely sheared silty CLAY with medium spaced thinly laminated fine sand.		
			93								
				U2					39.30m Pocket Penetrometer 1.0MPa, >1MPa (Small tip: 0.70MPa x 2 = 1.4MPa and 0.65MPa x 2 = 1.3MPa).		
39.59-41.32											

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	
36.35	23-10-17	07.00	3.00	126						End of Borehole 55.01m. No ground water encountered in borehole.

All dimensions in metres Scale 1:50	Client TOTAL	Method/ Plant Used DB 520 Rig No. P100	Logged By Spha Luthuli

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL_2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW2
Job No	Date	Ground Level (m)	Co-Ordinates ()	
Total Project	20-10-17 23-10-17		E 330 332.0 N 242 233.0	
Contractor				Sheet
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SAMPLES & TESTS								STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument / Backfill
			81	U3				(5.51)	40.00m Pocket Penetrometer 0.6MPa, 0.58MPa		
41.32-42.71			91						41.26-41.51m Thin bed (250mm) of silty fine sand. 41.57-41.59m Thin lamination (1-2mm) of orange to dark reddish brown iron-stained sandy silt.		
42.71-44.32			100					43.70	42.71-43.10m Orange iron staining. 42.71-43.46m Medium bed (600mm) of slightly silty fine to coarse sand.		
44.32-45.59			100	U4				(3.61)	43.70 - 47.31 Greenish grey slightly clayey silty fine SAND with medium spaced thinly laminated (2-5mm) fine sand. 44.60m Pocket Penetrometer 0.65MPa, 0.85MPa. 44.64-44.86m Bed of sheared fine sandy silty CLAY.		
45.59-47.31			27					47.31	47.27-47.31m Orange iron staining.		
47.31-48.66									47.31 - 55.01 Light greenish grey with dark grey streaks fine to medium SAND. 47.31-48.66m Core loss.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.01m. No ground water encountered in borehole.

All dimensions in metres Scale 1:50	Client TOTAL	Method/ Plant Used DB 520 Rig No. P100	Logged By Spha Luthuli

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW2
Job No	Date	Ground Level (m)	Co-Ordinates ()	
Total Project	20-10-17 23-10-17		E 330 332.0 N 242 233.0	
Contractor				Sheet
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SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
			0								
48.66-50.23			16								
50.23-51.83			0					(7.70)	50.23-51.83m Core loss.		
51.83-53.41			70								
53.41-55.01			0					55.01	53.41-55.01m Core loss.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	
55.01	25-10-17	07.00	3.00	126						End of Borehole 55.01m. No ground water encountered in borehole.

All dimensions in metres Scale 1:50	Client TOTAL	Method/ Plant Used DB 520 Rig No. P100	Logged By Spha Luthuli

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL_2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW3
Job No: Total Project	Date: 07-10-17 / 10-10-17	Ground Level (m):	Co-Ordinates (): E 329 326.0 N 241 137.0	
Contractor: GEOMECHANICS				Sheet: 1 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
0.00-1.50			82					(1.50) 1.50	0.00 - 1.50 Light brown slightly silty fine to medium grained SAND.		
1.50-3.00			40						1.50 - 5.00 Light greyish brown fine to coarse grained SAND with minor isolated zones of silty sand.		
3.00-4.50			33					(3.50)			
4.50-6.00			47					5.00	5.00 - 7.60 Light grey blotched light orange gravelly clayey SAND. Note: Gravels are fine to coarse sub-angular fragments of mixed origin predominately quartz.		
6.00-7.50			92					(2.60)	6.60-6.85m: Gravel rich lens. 7.30-7.40m: Gravel rich lens.		
7.50-8.50								7.60	7.55-7.60m: Gravel rich lens. 7.60 - 10.60 Light grey blotched and stained light		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.00m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 525 Rig No. P243	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW3
Job No: Total Project	Date: 07-10-17 / 10-10-17	Ground Level (m):	Co-Ordinates (): E 329 326.0 N 241 137.0	
Contractor: GEOMECHANICS				Sheet: 2 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
			86						orange sandy CLAY with occasional fine to medium sub-angular to sub-rounded gravel fragments of mixed origin (predominately quartz).		
8.50-10.00			61					(3.00)			
10.00-11.50			100					10.60	10.45-10.50m: Occasional gravel rich lenses.		
									10.60 - 12.90 Light grey blotched and stained orange slightly sandy silty CLAY with isolated narrow bands of silt.		
11.50-13.00			95					(2.30)	11.40-11.45m: Narrow band of hardpan ferricrete.		
								12.90	12.90 - 15.20 Light greenish grey with minor light orange blotches slightly silty fine to medium grained SAND with interbedded closely spaced thin beds of silty clay. Note: Material characterized in places as randomly very closely spaced, mixed patches of sand, silt and clay. 13.00-14.50m Core loss.		
13.00-14.50			0					(2.30)			
14.50-16.00			100					15.20	15.20 - 16.00 Light greenish grey silty CLAY.		
								(0.80)			
								16.00			

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.00m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 525 Rig No. P243	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL_2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW3
Job No: Total Project	Date: 07-10-17 / 10-10-17	Ground Level (m):	Co-Ordinates (): E 329 326.0 N 241 137.0	
Contractor: GEOMECHANICS				Sheet: 3 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
16.00-17.50			27						16.00 - 29.00 Light greenish grey silty fine to medium grained SAND with interbedded closely to widely spaced thin beds of silty clay. Note: Fine to medium sub-angular to sub-rounded quartz gravels present.		
17.50-19.00			25								
19.00-20.50			47								
20.50-22.00			80								
22.00-23.50			70					(13.00)			
23.50-25.00									23.50-25.60m: Lenses of fine to medium grained sand.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	
22.00	07-10-17	17.00	3.00	126						End of Borehole 55.00m.
22.00	08-10-17	08.00	3.00	126						

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 525 Rig No. P243	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW3
Job No: Total Project	Date: 07-10-17 10-10-17	Ground Level (m):	Co-Ordinates (): E 329 326.0 N 241 137.0	
Contractor: GEOMECHANICS				Sheet: 4 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
25.00-26.50			37						25.00-26.50m Core loss.		
26.50-28.00			0								
28.00-29.50			21								
29.50-31.00			32					29.00			
31.00-32.50			100					(1.80)	29.00 - 30.80 Greenish grey silty CLAY with occasional beds of silty fine grained sand.		
			40					30.80	30.80 - 38.50 Light greenish grey with minor orange staining clayey silty fine grained SAND with the occasional thinly bedded widely spaced clay lenses.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.00m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 525 Rig No. P243	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW3
Job No: Total Project	Date: 07-10-17 10-10-17	Ground Level (m):	Co-Ordinates (): E 329 326.0 N 241 137.0	
Contractor: GEOMECHANICS				Sheet: 5 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
32.50-34.00			37								
34.00-35.50			73					(7.70)			
35.50-37.00			0						35.50-37.00m Core loss.		
37.00-38.50			33						38.20-38.50m: Lens of silt.		
38.50-40.00			100					38.50 (1.90)	38.50 - 40.40 Closely sheared light greenish grey silty CLAY interbedded with widely spaced thinly bedded (50-500mm) sandy material.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.00m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 525 Rig No. P243	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW3
Job No: Total Project	Date: 07-10-17 10-10-17	Ground Level (m):	Co-Ordinates (): E 329 326.0 N 241 137.0	
Contractor: GEOMECHANICS				Sheet: 6 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
40.00-41.50			60					40.40			
									40.40 - 46.00 Very light grey with minor streaks of heavy minerals slightly silty fine grained SAND with minor thin beds of silty and clayey material.		
41.50-43.00			0						41.50-43.00m Core loss.		
43.00-44.50			17					(5.60)			
44.50-46.00			0						44.50-46.00m Core loss.		
46.00-47.50			100					46.00	46.00 - 55.00 Light greenish grey speckled and blotched orange and dark grey slightly sandy clayey SILT interbedded with medium clay beds.		
									46.95m: Slightly undulating smooth and clean shear zone.		
47.50-49.00											

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.00m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 525 Rig No. P243	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW3
Job No	Date	Ground Level (m)	Co-Ordinates ()	
Total Project	07-10-17 10-10-17		E 329 326.0 N 241 137.0	
Contractor				Sheet
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SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
			57						48.40-48.60m: Zone of orange stained silty sand.		
49.00-50.50			100								
50.50-52.00			0					(9.00)	50.40-50.50m: Zone of orange stained silty sand. 50.50-52.00m: Core loss.		
52.00-53.50			0						52.00-53.50m: Core loss.		
53.50-55.00			0						53.50-55.00m: Core loss.		
								55.00			

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	
55.00	10-10-17	08.00	3.00	126						End of Borehole 55.00m.
55.00	10-10-17	15.00	3.00	126						

All dimensions in metres Scale 1:50	Client TOTAL	Method/ Plant Used DB 525 Rig No. P243	Logged By Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW4
Job No: Total Project	Date: 22-09-17 / 26-09-17	Ground Level (m):	Co-Ordinates (): E 328 439.0 N 241 781.0	
Contractor: GEOMECHANICS				Sheet: 1 of 7

SAMPLES & TESTS								STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
0.00-1.50			47					(0.40) 0.40	0.00 - 0.40 Light orange brown silty fine to medium grained SAND.		
									0.40 - 6.00 Orange brown becoming increasingly mottled light grey with orange staining slightly clayey silty SAND. Note: Horizon is characterized by pockets of clayey sand (4-18mm) and zones/lenses of sub-angular to sub-rounded fine to occasionally coarse grained gravel.		
1.50-3.00			0						1.50-3.00m Core loss.		
3.00-4.50			0					(5.60)	3.00-4.50m Core loss.		
4.50-5.50			90								
5.50-6.00			0						5.50-6.00m Core loss.		
6.00-7.50			80					6.00	6.00 - 11.50 Light grey stained orange clayey silty SAND. Note: Material is characterized by numerous sporadic pockets and lenses of silty clayey and sandy material. Note: Random zones of sub-angular to sub-rounded fine to medium grained gravel present.		
7.50-8.50											

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.00m. Piezometer installed with response zone from 35-55m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 525 Rig No.	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW4
Job No	Date	Ground Level (m)	Co-Ordinates ()	
Total Project	22-09-17 26-09-17		E 328 439.0 N 241 781.0	
Contractor				Sheet
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SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
8.50-10.10			95 100					(5.50) 11.50			
10.10-11.50			87								
11.50-13.00			97					(0.70) 12.20	11.50 - 12.20 Light orange grey streaked pink gravelly silty fine to coarse grained SAND.		
13.00-14.50			100						12.20 - 20.10 Light bluish grey with zones of yellowish orange staining slightly sandy clayey SILT. 13.05-13.32m Lens of silty fine sandy material.		
14.50-16.00			80						14.60-14.80m Lens of silty fine sandy material. 14.80-14.87m Hardpan ferricrete zone.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.00m. Piezometer installed with response zone from 35-55m.

All dimensions in metres Scale 1:50	Client TOTAL	Method/ Plant Used DB 525 Rig No.	Logged By Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW4
Job No	Date	Ground Level (m)	Co-Ordinates ()	
Total Project	22-09-17 26-09-17		E 328 439.0 N 241 781.0	
Contractor				Sheet
GEOMECHANICS				3 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
16.00-17.10			100					(7.90)			
17.10-18.60			93								
18.60-20.10			55								
								20.10			
20.10-21.60			86						20.10 - 23.10 Light greenish grey with minor blotches of orange staining silty CLAY.		
21.60-22.10			86					(3.00)			
22.10-24.60									22.05-23.10m Alternating lenses/pockets of fine sandy silty material.		
								23.10			
			40						23.10 - 33.60 No Core recovery - indicates sandy material.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.00m. Piezometer installed with response zone from 35-55m.

All dimensions in metres Scale 1:50	Client TOTAL	Method/ Plant Used DB 525 Rig No.	Logged By Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW4
Job No: Total Project	Date: 22-09-17 26-09-17	Ground Level (m):	Co-Ordinates (): E 328 439.0 N 241 781.0	
Contractor: GEOMECHANICS				Sheet: 4 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
24.60-26.10			0						24.60-26.10m Core loss.		
26.10-27.60			0						26.10-27.60m Core loss.		
27.60-29.10			0					(10.50)	27.60-29.10m Core loss.		
29.10-30.60			0						29.10-30.60m Core loss.		
30.60-32.10			0						30.60-32.10m Core loss.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.00m. Piezometer installed with response zone from 35-55m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 525 Rig No.	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW4
Job No: Total Project	Date: 22-09-17 / 26-09-17	Ground Level (m):	Co-Ordinates (): E 328 439.0 N 241 781.0	
Contractor: GEOMECHANICS				Sheet: 5 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
32.10-33.60			0					33.60	32.10-33.60m Core loss.		
33.60-35.10			100					(4.50)	33.60 - 38.10 Very closely sheared light greenish grey clayey SILT.		
35.10-36.60			0						35.10-36.60m Core loss.		
36.60-38.10			93					38.10			
38.10-39.60			0						38.10 - 45.60 No Core recovery - drilling issues on sandy material. 38.10-39.60m Core loss.		
39.60-41.10									39.60-41.10m Core loss.		

Boring Progress			Casing		Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Depth	Dia. mm	From	To	Hours	From	To	
36.60	23-09-17	17.00	16.50	126						End of Borehole 55.00m. Piezometer installed with response zone from 35-55m.
36.60	24-09-17	07.00	16.50	126						
38.10	24-09-17	17.00	16.50	126						
38.10	25-09-17	08.20	16.50	126						

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 525 Rig No.	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW4
Job No: Total Project	Date: 22-09-17 / 26-09-17	Ground Level (m):	Co-Ordinates (): E 328 439.0 N 241 781.0	
Contractor: GEOMECHANICS				Sheet: 6 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
41.10-42.60			0					(7.50)	41.10-42.60m Core loss.		
42.60-44.10			0						42.60-44.10m Core loss.		
44.10-45.60			0						44.10-45.60m Core loss.		
45.60-47.10			100					45.60 (4.50)	45.60 - 50.10 Light greenish grey with zones of orange staining clayey SILT. Note: Closely spaced laminae of heavy minerals and mica (muscovite) grains. 45.85-46.15m Silty sand zone.		
47.10-50.10											

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.00m. Piezometer installed with response zone from 35-55m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 525 Rig No.	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW4
Job No	Date	Ground Level (m)	Co-Ordinates ()	
Total Project	22-09-17 26-09-17		E 328 439.0 N 241 781.0	
Contractor				Sheet
GEOMECHANICS				7 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
			27								
								50.10			
50.10-53.10			0					(4.90)	50.10 - 55.00 Light grey blotched and stained yellow and orange silty fine grained SAND. Note: Due to low core recovery actual material between 50.10-55.00m cannot be defined. 50.10-53.10m Core loss.		
53.10-55.00			11					55.00			

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	
55.00	25-09-17	17.00	16.50	126						End of Borehole 55.00m. Piezometer installed with response zone from 35-55m.

All dimensions in metres Scale 1:50	Client TOTAL	Method/ Plant Used DB 525 Rig No.	Logged By Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

Annex 4: Groundwater laboratory datasheets: 2014

Appendix 6B

Groundwater Results 2014

This section presents the results from analysis of samples collected at each ground water sampling location. All ground water samples were analyzed by Eurofins Analytico BV (Analytico) in the Netherlands. Ground water samples were analyzed for a broad range of chemical constituents including metals, other inorganic compounds (i.e., nitrate, nitrite, ammonia, major cations/anions), and organic compounds (PAHs, BTEX, and petroleum hydrocarbons).

Table 6B-1: Groundwater results - North Nile

	Regulatory Standard or Criteria			Location															
				GW01				GW02				GW03				GW04			
				Description															
				Borehole at Tangi gate to MFNP				Borehole BH-2 at Jobi East-1 well pad in MFNP				Borehole at Jobi-3 in MFNP				Borehole at Jobi East-3 in MFNP			
	Uganda Class II Potable Standard	USEPA MCL[(A)]	USEPA Tap Water RSL[(A)]	Sample ID															
				GW01	GW01	GW01	GW01	GW01D	GW02	GW02	GW02	GW03	GW03	GW03	GW03	GW04	GW04	GW04	GW04
				Sample Date															
				10-Feb-14	23-Apr-14	28-Jun-14	30-Sep-14	30-Sep-14	10-Feb-14	26-Apr-14	29-Jun-14	10-Feb-14	25-Apr-14	29-Jun-14	28-Sep-14	10-Feb-14	26-Apr-14	29-Jun-14	28-Sep-14
				Sample Type															
				Primary	Primary	Primary	Primary	Duplicate	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
Field Parameters:																			
pH	6.5-8.5	-	-	6.83	6.87	6.85	6.93	6.93	6.84	6.65	6.62	6.88	7.55	7.48	7.49	6.87	6.53	6.5	6.54
Temperature, C	-	-	-	30.92	31.21	31.48	31.85	31.85	28.49	29.25	28.66	31.34	31.94	31.58	31.72	27.27	29.17	27.98	27.66
EC, uS/cm	2,500	-	-	1,491	2,318	2,347.8	2,325.4	2,325.4	572	902.1	835.1	467	689.3	721.6	735.2	303	469	470.1	464.7
ORP, mV	-	-	-	-110.8	-91.6	-70.7	-57.5	-57.5	-253	-51	-44.3	-132.7	-127.3	-118.5	-105.1	-89.8	-43.7	-31.1	-27.3
Diss. O_2, mg/L	-	-	-	1.05	2.30	1.21	2.29	2.29	0.01	0.76	1.51	1.19	0.38	0.77	2.14	0.16	0.49	1.15	1.25
Resistivity, Ω-cm	-	-	-	700	386	379	380	380	1800	1025	1119	2100	1281	1231	1,206	3,300	1,975	2,013	2,048
Salinity, PSU	-	-	-	0.74	1.2	1.2	1.2	1.2	0.27	0.4	0.4	0.22	0.3	0.4	0.4	0.14	0.2	0.2	0.2
TDS, mg/L	1,500-mg/L	-	-	746	1507	1526	1512	1512	286	586	543	234	448	469	478	151	305	306	302
PAHs: µg/L																			
Acenaphthene	-	-	940	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Acenaphthylene	-	-	-	< 0.050	< 0.05	< 0.05	< 0.050	< 0.050	< 0.050	< 0.05	< 0.05	< 0.050	< 0.05	< 0.05	< 0.050	< 0.050	< 0.05	< 0.05	< 0.050
Anthracene	-	-	4,700	< 0.0050	< 0.005	< 0.005	< 0.0050	< 0.0050	< 0.0050	< 0.005	< 0.005	< 0.0050	< 0.005	< 0.005	< 0.0050	0.0059	0.0095	0.0071	< 0.0050
Benzo(a)anthracene	-	-	0.029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(a)pyrene	-	-	0.0029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(b)fluoranthene	-	-	0.029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(g,h,i)perylene	-	-	-	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(k)fluoranthene	-	-	0.29	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Chrysene	-	-	2.9	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Dibenz(a,h)anthracene	-	-	0.0029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Fluoranthene	-	-	630	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	0.015	0.014	< 0.010
Fluorene	-	-	630	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Indeno(1,2,3-cd)pyrene	-	-	0.029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Naphthalene	-	-	0.14	< 0.020	< 0.02	< 0.02	< 0.020	< 0.020	< 0.020	< 0.02	< 0.02	< 0.020	< 0.02	< 0.02	< 0.020	< 0.020	< 0.02	< 0.02	< 0.020
Phenanthrene	-	-	-	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	0.018	< 0.010
Pyrene	-	-	-	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
PAH 10 VROM (sum)	-	-	-	< 0.10	< 0.105	< 0.105	< 0.10	< 0.10	< 0.10	< 0.105	< 0.105	< 0.10	< 0.105	< 0.105	< 0.10	< 0.10	< 0.105	< 0.105	< 0.10
PAH 16 EPA (sum)	-	-	470	< 0.20	< 0.205	< 0.205	< 0.20	< 0.20	< 0.20	< 0.205	< 0.205	< 0.20	< 0.205	< 0.205	< 0.20	< 0.20	< 0.205	< 0.205	< 0.20
BTEX: µg/L																			
Benzene	1	5	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
Ethylbenzene	300	700	-	< 0.20	< 0.2	0.25	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
Toluene	700	1,000	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	0.72	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
m-Xylene & p-Xylene	-	-	3,100	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	0.48	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
o-Xylene	-	-	3,100	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
Xylenes, total	500	10,000	-	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	0.48	< 0.4	< 0.4	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40
BTEX, summation	-	-	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Petroleum Hydrocarbons: µg/L																			
C10-C12	-	-	-	< 4.0	< 4	< 4	< 4.0	< 4.0	< 4.0	< 4	-	< 4.0	< 4	7.2	< 4.0	< 4.0	< 4	4.8	< 4.0
C12-C16	-	-	-	< 5.0	8.5	< 5	21	13	< 5.0	< 5	5.7	< 5.0	< 5	10	< 5.0	< 5.0	< 5	6.4	5.6
C16-C21	-	-	-	< 6.0	< 6	< 6	< 6.0	< 6.0	< 6.0	< 6	12	< 6.0	< 6	< 6	< 6.0	< 6.0	< 6	< 6	< 6.0
C21-C30	-	-	-	17	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10

	Regulatory Standard or Criteria			Location													
				GW01				GW02				GW03				GW04			
				Description													
				Borehole at Tangi gate to MFNP				Borehole BH-2 at Jobi East-1 well pad in MFNP				Borehole at Jobi-3 in MFNP				Borehole at Jobi East-3 in MFNP			
	Uganda Class II Potable Standard	USEPA MCL[(A)]	USEPA Tap Water RSL[(A)]	Sample ID															
				GW01	GW01	GW01	GW01	GW01D	GW02	GW02	GW02	GW03	GW03	GW03	GW03	GW04	GW04	GW04	GW04
				Sample Date															
				10-Feb-14	23-Apr-14	28-Jun-14	30-Sep-14	30-Sep-14	10-Feb-14	26-Apr-14	29-Jun-14	10-Feb-14	25-Apr-14	29-Jun-14	28-Sep-14	10-Feb-14	26-Apr-14	29-Jun-14	28-Sep-14
				Sample Type															
				Primary	Primary	Primary	Primary	Duplicate	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
C30-C35	-	-	-	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5.0	< 5	**5.5**	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5	< 5	5.5
C35-C40	-	-	-	< 8.0	< 8	< 8	< 8.0	< 8.0	< 8.0	< 8	< 8	< 8.0	< 8	< 8	< 8.0	< 8.0	< 8	< 8	< 8.0
Total Petroleum Hydrocarbons	-	-	-	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38
Metals: µg/L																			
Arsenic	50	10	-	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5.0	< 5	< 5	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0
Barium	1,000	2,000	-	410	400	420	410	420	1,600	1,700	1,600	350	360	380	380	100	100	1,700	110
Cadmium	3	5	-	2.1	1.7	1.3	0.75	0.77	< 0.40	< 0.4	< 0.4	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40
Chromium	50	100	-	< 1.0	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1.0	< 1	< 1	< 1.0	< 1.0	< 1	< 1	< 1.0
Cobalt	-	-	4.7	< 3.0	< 3	< 3	< 3.0	< 3.0	< 3.0	< 3	< 3	< 3.0	< 3	< 3	< 3.0	< 3.0	< 3	< 3	< 3.0
Copper	2,000	1,300	-	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5.0	< 5	< 5	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0
Lead	10	15	-	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5.0	< 5	< 5	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0
Mercury	1	2	-	< 0.050	< 0.05	< 0.05	< 0.050	< 0.050	< 0.050	< 0.05	< 0.05	< 0.050	< 0.05	< 0.05	< 0.050	< 0.050	< 0.05	< 0.05	< 0.050
Nickel	20	-	310	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5.0	< 5	< 5	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0
Zinc	-	-	4,700	750	750	530	340	340	< 10	66	< 10	< 10	< 10	< 10	< 10	< 10	33	< 10	< 10
Metals: mg/L																			
Calcium	-	-	-	38	35	43	38	38	120	110	110	23	27	29	27	7.5	7.1	7.2	7
Iron	1	-	11	3.4	3.4	3.6	3.5	3.6	1.5	1	1.7	0.22	0.29	0.28	0.29	1.4	1.5	1.4	1.5
Magnesium	150	-	-	11	11	11	12	12	19	19	18	5.4	5.8	6.2	6.2	2.4	2.3	2.4	2.4
Manganese	0.1	-	0.38	0.44	0.42	0.43	0.48	0.48	0.48	0.49	0.51	0.015	0.013	0.015	0.016	0.058	0.05	0.054	0.06
Potassium	100	-	-	10	11	11	11	11	6.4	6.9	6	3	3.5	3.6	3.4	4.8	4.6	4.7	4.5
Sodium	400	-	760	390	380	400	400	410	61	62	58	120	130	140	140	99	96	97	100
Uranium	-	0.03	-	-	< 0.0002	< 0.0002	< 0.0002	< 0.0002	-	0.003	0.0021	-	< 0.0002	< 0.0002	< 0.0002	-	< 0.0002	< 0.0002	< 0.0002
General Chemistry: mg/L (unless otherwise noted)																			
Ammonium (NH_4-N)	-	-	-	2.8	2.8	2.7	3	2.8	0.11	0.071	< 0.05	0.56	0.54	0.5	< 0.050	0.91	0.87	0.79	< 0.050
Ammonia (NH_4)	-	-	-	3.6	3.6	3.5	3.8	3.5	0.14	0.091	< 0.065	0.71	0.70	0.64	< 0.065	1.2	1.1	1	< 0.065
Bromide	-	-	-	< 6.0	< 0.3	4	3.9	< 30	< 0.30	< 0.3	< 0.3	0.33	< 0.3	0.31	< 0.30	0.33	< 0.3	< 0.3	< 0.30
Chloride, dissolved	500	-	-	350	670	670	700	690	15	15	14	20	18	18	18	19	17	17	18
Fluoride, dissolved	1.5	-	0.62	0.11	0.13	0.15	0.14	0.19	0.18	0.2	0.19	0.22	0.20	0.19	0.19	0.25	0.22	0.23	0.25
Sulfate, dissolved	-	-	-	< 0.5	< 0.5	< 0.5	1.6	1.8	3.3	3.8	2.8	0.52	0.52	0.98	0.8	0.62	2	< 0.5	0.53
Nitrate (NO_3)	50	-	-	< 0.90	< 0.9000	< 0.9	< 0.90	< 0.90	< 0.90	< 0.9000	< 0.9	< 0.90	< 0.9000	< 0.9	< 0.90	< 0.90	< 0.9000	< 0.9	< 0.90
Nitrate (as N)	-	10	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
Nitrite (NO_2)	0.2	-	-	< 0.030	< 0.0300	< 0.03	< 0.030	< 0.030	< 0.030	< 0.0300	< 0.03	< 0.030	< 0.0300	< 0.03	< 0.030	< 0.030	< 0.0300	< 0.03	< 0.030
Nitrite (as N)	-	1	-	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Ortho Phosphate (PO_4)	-	-	-	< 0.060	< 0.0600	< 0.06	< 0.060	< 0.060	< 0.060	< 0.0600	< 0.06	< 0.060	< 0.0600	< 0.06	< 0.060	4.4	3.7	3.8	4
Ortho Phosphate (PO_4-P)	-	-	-	< 0.020	< 0.02	< 0.02	< 0.020	< 0.020	< 0.020	< 0.02	< 0.02	< 0.020	< 0.02	< 0.02	< 0.020	1.4	1.2	1.2	1.3

Notes:
[(A)] MCL - Maximum Contaminant Level; RSL - Regional Screening Level
[(B)] Exceeds Uganda Class II Potable Standard:
Exceeds USEPA RSL & Uganda Class II Standard:

Table 6B–2: Groundwater results (GW05/GW06/GW07) - South Nile

	Regulatory Standard or Criteria			Location										
				GW05			GW06				GW07			
				Description										
				Borehole near Mpyo 5 (D) in MFNP			Community borehole near Mpyo 6				Water supply borehole in Bugungu Camp			
	Uganda Class II Potable Standard	USEPA MCL[(A)]	USEPA Tap Water RSL[(A)]	Sample ID										
				GW05	GW05	GW05	GW06	GW06	GW06	GW06	GW07	GW07	GW07	GW07
				Sample Date										
				13-Feb-14	26-Apr-14	30-Jun-14	13-Feb-14	28-Apr-14	1-Jul-14	25-Sep-14	11-Feb-14	26-Apr-14	1-Jul-14	25-Sep-14
				Sample Type										
				Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
Field Parameters:														
pH	6.5-8.5	-	-	6.88	7.33	7.1	6.89	6.89	6.65	5.56	6.87	6.06	6.15	6.4
Temperature, C	-	-	-	28.11	29.37	28.75	29.59	31.02	29.87	28.99	29.56	29.8	30	30.24
EC, uS/cm	2,500	-	-	707	1,108.2	1,089.7	319	2,331.9	460.4	54.2	236	377.5	379	413
ORP, mV	-	-	-	-122.8	-89.9	-91.4	-80.8	-87.7	-39.8	127.6	106.3	120.3	103.2	29.7
Diss. O_2, mg/L	-	-	-	0.34	5.16	0.84	2.15	2.07	2.62	3.83	4.42	4.54	4.86	3.64
Resistivity, Ω-cm	-	-	-	1,400	833	856	3,100	385	1,988	17146	4,200	2,427	2,408	2,199
Salinity, PSU	-	-	-	0.34	0.6	0.5	0.15	1.2	0.2	0	0.11	0.2	0.2	0.2
TDS, mg/L	1,500-mg/L	-	-	353	720	708	160	1516	299	35	120	245	246	268
PAHs: µg/L														
Acenaphthene	-	-	940	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Acenaphthylene	-	-	-	< 0.050	< 0.05	< 0.05	< 0.050	< 0.05	< 0.05	< 0.050	< 0.050	< 0.05	< 0.05	< 0.050
Anthracene	-	-	4,700	< 0.0050	< 0.005	< 0.005	< 0.0050	< 0.005	< 0.005	0.025	< 0.0050	< 0.005	< 0.005	< 0.0050
Benzo(a)anthracene	-	-	0.029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(a)pyrene	-	-	0.0029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(b)fluoranthene	-	-	0.029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(g,h,i)perylene	-	-	-	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(k)fluoranthene	-	-	0.29	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Chrysene	-	-	2.9	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Dibenz(a,h)anthracene	-	-	0.0029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Fluoranthene	-	-	630	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Fluorene	-	-	630	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	0.023	< 0.010	< 0.01	< 0.01	< 0.010
Indeno(1,2,3-cd)pyrene	-	-	0.029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Naphthalene	-	-	0.14	< 0.020	< 0.02	< 0.02	< 0.020	< 0.02	< 0.02	0.1	< 0.020	< 0.02	0.022	< 0.020
Phenanthrene	-	-	-	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	0.02	< 0.010	< 0.01	< 0.01	< 0.010
Pyrene	-	-	-	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
PAH 10 VROM (sum)	-	-	-	< 0.10	< 0.105	< 0.105	< 0.10	< 0.105	< 0.105	0.15	< 0.10	< 0.105	< 0.105	< 0.10
PAH 16 EPA (sum)	-	-	470	< 0.20	< 0.205	< 0.205	< 0.20	< 0.205	< 0.205	< 0.20	< 0.20	< 0.205	< 0.205	< 0.20
BTEX: µg/L														
Benzene	1	5	-	0.24	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
Ethylbenzene	300	700	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
Toluene	700	1,000	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
m-Xylene & p-Xylene	-	-	3,100	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
o-Xylene	-	-	3,100	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
Xylenes, total	500	10,000	-	< 0.40	< 0.4	< 0.4	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40
BTEX, summation	-	-	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Petroleum Hydrocarbons: µg/L														
C10-C12	-	-	-	< 4.0	< 4	< 4	< 4.0	4.9	< 4	< 4.0	< 4.0	< 4	4.4	< 4.0
C12-C16	-	-	-	< 5.0	< 5	5.5	< 5.0	< 5	< 5	16	< 5.0	< 5	< 5	< 5.0
C16-C21	-	-	-	< 6.0	< 6	< 6	< 6.0	< 6	< 6	< 6.0	< 6.0	< 6	< 6	6.4
C21-C30	-	-	-	13	< 10	< 10	< 10	< 10	< 10	< 10	18	< 10	< 10	< 10

	Regulatory Standard or Criteria			Location										
				GW05			GW06				GW07			
				Description										
				Borehole near Mpyo 5 (D) in MFNP			Community borehole near Mpyo 6				Water supply borehole in Bugungu Camp			
	Uganda Class II Potable Standard	USEPA MCL[(A)]	USEPA Tap Water RSL[(A)]	Sample ID										
				GW05	GW05	GW05	GW06	GW06	GW06	GW06	GW07	GW07	GW07	GW07
				Sample Date										
				13-Feb-14	26-Apr-14	30-Jun-14	13-Feb-14	28-Apr-14	1-Jul-14	25-Sep-14	11-Feb-14	26-Apr-14	1-Jul-14	25-Sep-14
				Sample Type										
				Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
C30-C35	-	-	-	< 5.0	< 5	< 5	< 5.0	< 5	< 5	< 5.0	8.1	< 5	< 5	< 5.0
C35-C40	-	-	-	< 8.0	< 8	< 8	< 8.0	< 8	< 8	< 8.0	< 8.0	< 8	< 8	< 8.0
Total Petroleum Hydrocarbons	-	-	-	< 38	< 38	< 38	< 38	< 38	< 38	< 38	44	< 38	< 38	< 38
Metals: µg/L														
Arsenic	50	10	-	< 5.0	< 5	< 5	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0
Barium	1,000	2,000	-	1,800	1,800	1,800	410	630	420	120	200	200	210	270
Cadmium	3	5	-	< 0.40	< 0.4	< 0.4	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40
Chromium	50	100	-	< 1.0	< 1	< 1	< 1.0	< 1	1.3	11	1.6	3.6	1.8	< 1.0
Cobalt	-	-	4.7	< 3.0	< 3	< 3	< 3.0	< 3	< 3	3	< 3.0	< 3	< 3	< 3.0
Copper	2,000	1,300	-	< 5.0	31	< 5	< 5.0	< 5	< 5	37	< 5.0	< 5	< 5	< 5.0
Lead	10	15	-	< 5.0	< 5	< 5	< 5.0	< 5	< 5	17	< 5.0	< 5	< 5	< 5.0
Mercury	1	2	-	< 0.050	< 0.05	< 0.05	< 0.050	< 0.05	< 0.05	< 0.050	< 0.050	< 0.05	< 0.05	< 0.050
Nickel	20	-	310	< 5.0	< 5	< 5	< 5.0	< 5	< 5	6.2	< 5.0	< 5	< 5	< 5.0
Zinc	-	-	4,700	< 10	54	< 10	1900	1400	920	2300	12	28	12	< 10
Metals: mg/L														
Calcium	-	-	-	36	42	46	27	50	32	5.3	29	31	35	31
Iron	1	-	11	0.54	0.87	1.1	1.4	3.5	2.4	3.7	0.13	0.071	< 0.05	0.57
Magnesium	150	-	-	19	21	21	9.1	14	10	1.1	9.4	9.4	10	12
Manganese	0.1	-	0.38	0.078	0.073	0.087	0.52	0.7	0.57	0.16	< 0.010	< 0.01	0.041	0.18
Potassium	100	-	-	3.7	4.4	4.3	3.5	5.3	4.1	1.4	3.6	4	4.1	4.4
Sodium	400	-	760	170	190	190	48	34	49	7.5	23	24	25	34
Uranium	-	0.03	-	-	< 0.0002	0.0003	-	< 0.0002	< 0.0002	0.0013	-	< 0.0002	< 0.0002	-
General Chemistry: mg/L (unless otherwise noted)														
Ammonium (NH_4-N)	-	-	-	0.92	0.93	0.84	0.34	0.12	0.32	< 0.050	< 0.050	< 0.05	< 0.05	< 0.050
Ammonia (NH_4)	-	-	-	1.2	1.2	1.1	0.43	0.16	0.4	< 0.065	< 0.065	< 0.0650	< 0.065	< 0.065
Bromide	-	-	-	< 0.30	< 0.3	< 0.3	< 0.30	0.32	< 0.3	< 0.30	< 0.30	0.33	0.57	0.34
Chloride, dissolved	500	-	-	6.7	6.8	6.4	41	52	39	3.1	47	49	49	45
Fluoride, dissolved	1.5	-	0.62	0.40	0.38	0.38	0.053	0.12	0.12	0.16	0.16	0.21	0.19	0.27
Sulfate, dissolved	-	-	-	0.86	4.8	0.74	1.3	0.89	9.7	6.8	29	27	25	11
Nitrate (NO_3)	50	-	-	< 0.90	< 0.9000	< 0.9	< 0.90	< 0.9000	< 0.9	< 0.90	20	20	17	3.8
Nitrate (as N)	-	10	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	4.5	4.5	3.9	0.86
Nitrite (NO_2)	0.2	-	-	< 0.030	< 0.0300	< 0.03	< 0.030	< 0.0300	< 0.03	0.082	< 0.030	< 0.0300	< 0.03	< 0.030
Nitrite (as N)	-	1	-	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	0.025	< 0.010	< 0.01	< 0.01	< 0.010
Ortho Phosphate (PO_4)	-	-	-	< 0.060	< 0.0600	< 0.06	0.34	< 0.0600	0.1	0.25	0.43	0.43	0.5	0.8
Ortho Phosphate (PO_4-P)	-	-	-	< 0.020	< 0.02	< 0.02	0.11	< 0.02	0.034	0.083	0.14	0.14	0.16	0.26

Notes:
[(A)] MCL - Maximum Contaminant Level; RSL - Regional Screening Level
[(B)] Exceeds Uganda Class II Potable Standard:
Exceeds USEPA RSL & Uganda Class II Standard:

Table 6B–3: Groundwater results (GW08/GW09/GW10) - South Nile

	Regulatory Standard or Criteria			Location												
				GW08				GW09					GW10			
				Description												
				Community borehole between CPF AOIs				Community borehole near Ngiri2					Community borehole in Wanseco village			
	Uganda Class II Potable Standard	USEPA MCL[(A)]	USEPA Tap Water RSL[(A)]	Sample ID												
				GW08	GW08	GW08	GW08	GW09	GW09	GW09D	GW09	GW09	GW10	GW10	GW10	GW10
				Sample Date												
				13-Feb-14	20-Apr-14	1-Jul-14	29-Sep-14	13-Feb-14	20-Apr-14	20-Apr-14	1-Jul-14	27-Sep-14	13-Feb-14	27-Apr-14	1-Jul-14	29-Sep-14
				Sample Type												
				Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary		
Field Parameters:																
pH	6.5-8.5	-	-	6.89	7.03	6.13	6.35	6.88	6.38	---	6.56	6.51	6.87	6.94	7.01	7.03
Temperature, C	-	-	-	29.81	29.3	29.95	30.07	36.87	30.45	---	30.57	30.24	30.03	28.25	30.75	28.62
EC, uS/cm	2,500	-	-	305	510	459.2	309.2	211	333.8	---	423	324.6	623	960.8	963.3	962.1
ORP, mV	-	-	-	-46.4	21.8	61.7	51.2	-92.7	-37.5	---	-45.6	-29.7	-70.7	87.8	37.8	55.3
Diss. O_2, mg/L	-	-	-	1.91	2.94	2.81	4.16	1.97	2.34	---	2.68	2.81	2.9	2.81	3.6	6.47
Resistivity, Ω-cm	-	-	-	3300	1972	1990	2950	4700	2713	---	2135	2801	1600	980	936	972
Salinity, PSU	-	-	-	0.14	0.2	0.2	0.1	0.1	0.2	---	0.2	0.2	0.3	0.5	0.5	0.5
TDS, mg/L	1,500-mg/L	-	-	153	332	298	201	106	217	---	275	211	312	625	626	625
PAHs: µg/L																
Acenaphthene	-	-	940	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Acenaphthylene	-	-	-	< 0.050	< 0.05	< 0.05	< 0.050	< 0.050	< 0.05	< 0.05	< 0.05	< 0.050	< 0.050	< 0.05	< 0.05	< 0.050
Anthracene	-	-	4,700	< 0.0050	< 0.005	< 0.005	< 0.0050	< 0.0050	< 0.005	< 0.005	< 0.005	< 0.0050	< 0.0050	< 0.005	< 0.005	< 0.0050
Benzo(a)anthracene	-	-	0.029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(a)pyrene	-	-	0.0029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(b)fluoranthene	-	-	0.029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(g,h,i)perylene	-	-	-	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(k)fluoranthene	-	-	0.29	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Chrysene	-	-	2.9	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Dibenz(a,h)anthracene	-	-	0.0029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Fluoranthene	-	-	630	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Fluorene	-	-	630	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Indeno(1,2,3-cd)pyrene	-	-	0.029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Naphthalene	-	-	0.14	< 0.020	< 0.02	< 0.02	< 0.020	< 0.020	< 0.02	< 0.02	< 0.02	< 0.020	< 0.020	< 0.02	< 0.02	< 0.020
Phenanthrene	-	-	-	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Pyrene	-	-	-	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
PAH 10 VROM (sum)	-	-	-	< 0.10	< 0.105	< 0.105	< 0.10	< 0.10	< 0.105	< 0.105	< 0.105	< 0.10	< 0.10	< 0.105	< 0.105	< 0.10
PAH 16 EPA (sum)	-	-	470	< 0.20	< 0.205	< 0.205	< 0.20	< 0.20	< 0.205	< 0.205	< 0.205	< 0.20	< 0.20	< 0.205	< 0.205	< 0.20
BTEX: µg/L																
Benzene	1	5	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
Ethylbenzene	300	700	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
Toluene	700	1,000	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
m-Xylene & p-Xylene	-	-	3,100	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
o-Xylene	-	-	3,100	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
Xylenes, total	500	10,000	-	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40
BTEX, summation	-	-	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Petroleum Hydrocarbons: µg/L																
C10-C12	-	-	-	5.6	6.3	< 4	< 4.0	< 4.0	< 4	< 4	6.6	< 4.0	< 4.0	< 4	< 4	< 4.0
C12-C16	-	-	-	< 5.0	< 5	< 5	< 5.0	< 5.0	5	< 5	8.3	< 5.0	< 5.0	< 5	5	20
C16-C21	-	-	-	< 6.0	< 6	< 6	7.9	< 6.0	6.1	< 6	< 6	8.8	< 6.0	< 6	< 6	< 6.0
C21-C30	-	-	-	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10

	Regulatory Standard or Criteria			Location												
				GW08				GW09					GW10			
				Description												
				Community borehole between CPF AOIs				Community borehole near Ngiri2					Community borehole in Wanseco village			
	Uganda Class II Potable Standard	USEPA MCL[(A)]	USEPA Tap Water RSL[(A)]	Sample ID												
				GW08	GW08	GW08	GW08	GW09	GW09	GW09D	GW09	GW09	GW10	GW10	GW10	GW10
				Sample Date												
				13-Feb-14	20-Apr-14	1-Jul-14	29-Sep-14	13-Feb-14	20-Apr-14	20-Apr-14	1-Jul-14	27-Sep-14	13-Feb-14	27-Apr-14	1-Jul-14	29-Sep-14
				Sample Type												
				Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary		
C30-C35	-	-	-	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0
C35-C40	-	-	-	< 8.0	< 8	< 8	< 8.0	< 8.0	< 8	< 8	< 8	< 8.0	< 8.0	< 8	< 8	< 8.0
Total Petroleum Hydrocarbons	-	-	-	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38
Metals: µg/L																
Arsenic	50	10	-	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0
Barium	1,000	2,000	-	330	370	360	99	210	250	270	260	260	150	160	170	180
Cadmium	3	5	-	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40
Chromium	50	100	-	< 1.0	3.2	< 1	1.4	< 1.0	1.3	< 1	< 1	< 1.0	< 1.0	< 1	< 1	< 1.0
Cobalt	-	-	4.7	< 3.0	< 3	< 3	< 3.0	< 3.0	< 3	< 3	< 3	< 3.0	< 3.0	< 3	< 3	< 3.0
Copper	2,000	1,300	-	< 5.0	14	< 5	9.4	< 5.0	< 5	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0
Lead	10	15	-	< 5.0	7.1	< 5	8.9	< 5.0	< 5	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0
Mercury	1	2	-	< 0.050	0.06	< 0.05	< 0.050	< 0.050	< 0.05	< 0.05	< 0.05	< 0.050	< 0.050	< 0.05	< 0.05	< 0.050
Nickel	20	-	310	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0
Zinc	-	-	4,700	78	470	90	530	720	320	330	470	410	110	28	28	20
Metals: mg/L																
Calcium	-	-	-	28	40	42	25	16	19	20	20	18	60	87	93	91
Iron	1	-	11	2.3	11	1.2	4.1	2.7	4.6	4.7	4.3	4.8	0.11	0.094	0.11	< 0.050
Magnesium	150	-	-	8.8	10	11	6.2	5.1	5.7	6.1	5.9	5.9	25	28	29	29
Manganese	0.1	-	0.38	0.072	0.12	0.074	0.025	0.52	0.55	0.57	0.57	0.61	0.74	1	0.98	1.1
Potassium	100	-	-	4.3	5.2	5.4	4.3	5.1	6	6.4	6.2	6.4	4.1	5	5.1	4.9
Sodium	400	-	760	25	29	29	26	35	39	41	38	40	80	90	90	90
Uranium	-	0.03	-		< 0.0002	< 0.0002	0.0004	-	< 0.0002	< 0.0002	< 0.0002	< 0.0002	-	0.005	0.006	0.0068
General Chemistry: mg/L (unless otherwise noted)																
Ammonium (NH_4-N)	-	-	-	< 0.050	< 0.05	< 0.05	< 0.050	0.94	1.1	0.98	1	< 0.050	0.15	0.25	0.1	< 0.050
Ammonia (NH_4)	-	-	-	< 0.065	< 0.0650	< 0.065	< 0.065	1.2	1.4	1.3	1.3	< 0.065	0.19	0.32	0.13	< 0.065
Bromide	-	-	-	0.57	0.45	0.74	< 0.30	< 0.30	< 0.3	< 0.3	< 0.3	< 0.30	< 0.30	< 0.3	< 0.3	< 0.30
Chloride, dissolved	500	-	-	83	76	80	23	5.0	4.8	4.8	5.3	4.7	28	28	30	31
Fluoride, dissolved	1.5	-	0.62	0.11	0.2	0.25	0.34	0.13	0.23	0.076	0.23	0.27	0.69	0.68	0.67	0.7
Sulfate, dissolved	-	-	-	15	14	20	31	0.73	6.8	2.4	4.8	< 0.50	60	65	56	52
Nitrate (NO_3)	50	-	-	7	4.9	7.4	1.4	< 0.90	< 0.9000	< 0.9000	< 0.9	< 0.90	2.9	3.5	3.9	4.6
Nitrate (as N)	-	10	-	1.6	1.1	1.7	0.31	< 0.20	< 0.2	< 0.2	< 0.2	< 0.20	0.67	0.8	0.89	1
Nitrite (NO_2)	0.2	-	-	0.21	0.15	0.092	< 0.030	< 0.030	< 0.0300	< 0.0300	< 0.03	< 0.030	< 0.030	0.066	< 0.03	0.11
Nitrite (as N)	-	1	-	0.063	0.045	0.028	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	0.02	< 0.01	0.032
Ortho Phosphate (PO_4)	-	-	-	< 0.060	< 0.0600	< 0.06	< 0.060	0.95	0.3	0.38	0.31	0.98	0.20	0.17	0.16	0.22
Ortho Phosphate (PO_4-P)	-	-	-	< 0.020	< 0.02	< 0.02	< 0.020	0.31	0.099	0.12	0.1	0.32	0.065	0.055	0.052	0.072

Notes:
[(A)] MCL - Maximum Contaminant Level; RSL - Regional Screening Level
[(B)] Exceeds Uganda Class II Potable Standard:
Exceeds USEPA RSL & Uganda Class II Standard:
Exceed USEPA RSL:

Annex 5: Photographs of ESIA Campaigns 1 & 2 Groundwater Survey Locations: 2016 and 2017

Photographs of ESIA Campaigns 1 & 2 Groundwater Survey Locations

GW01 07/11/2016		GW02 07/11/2016	
GW03 07/11/2016		GW04 08/11/2016	
GW05 08/11/2016		GW06 08/11/2016	

GW10 06/11/2016	
GW11 06/11/2016	
GW12 06/11/2016	
GW 13 08/11/2016	

Annex 6: Groundwater Quality analyses 2016/2017

		Certificate number Sample Date	2016138562/1 23/11/2016	2017083857 15/06/2017	2016138562/1 23/11/2016	2016138562/1 23/11/2016	2017083857 15/06/2017	2016138562/1 23/11/2016	2017083857 16/06/2017	2016138562/1 23/11/2016	2016138562/1 23/11/2016	2017083857 16/06/2017	2016138562/1 23/11/2016	2017083857 16/06/2017	2016138562/1 23/11/2016	2016138562/1 23/11/2016	2017083857 16/06/2017	2016138562/1 23/11/2016	2017083857 17/06/2017	2016138562/1 23/11/2016	2017083857 16/06/2017
			Jobi East-2 water supply borehole		Jobi-4 water supply borehole	Rii-1 water supply borehole		Kilyango community borehole		Murchison River Lodge	Kirama community borehole		Kijumbya community borehole		Community borehole near Ngwedo Primary	Kisansya West community borehole		Kichoke community borehole		Bakers Lodge	
Analysis	Unit	Sample I.D	GW1-161107	(GW1-1706-15)	GW2-161107	GW3-161107	(GW3-1706-15)	GW4-161108	(GW4-1706-16)	GW5-161108	GW6-161108	(GW6-1706-16 FD)	GW10-161106	(GW10-1706-16)	GW11-161106	GW11ALT-161109	(GW11-ALT-1706-16)	GW12-161106	(GW12-1706-17)	GW13-161109	(GW13-1706-16)
			GW1		GW2	GW3		GW4		GW5	GW6		GW10		GW11	GW11-ALT		GW12		GW13	
Metals		EAS 12:2014																			
Aluminum (Al)	mg/L	0.2	<0.10	<0.10	0.1	<0.10	<0.10	0.1	<0.10	<0.10	0.1	<0.10	0.1	<0.10	0.1	0.1	<0.10	0.1	<0.10	0.1	<0.10
Arsenic (As)**	mg/L	0.01	<0.005	<0.005	0.016	0.025	0.028	0.005	<0.005	<0.025	0.005	<0.005	0.005	<0.005	0.005	0.005	<0.005	0.005	<0.005	0.019	0.025
Barium (Ba)	mg/L	0.7	0.64	0.6	0.078	0.37	0.4	0.16	0.19	0.39	0.2	0.27	0.14	0.2	0.07	0.05	<0.05	0.05	0.052	0.68	0.85
Uranium (U)	µg/L	-	<5.0	<5.0	5	<5.0	<5.0	5	<5.0	<5.0	5	<5.0	5	<5.0	5	5	<5.0	5	<5.0	5	<5.0
Cadmium (Cd)**	mg/L	0.003	-	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	0.00057	<0.40	0.4	0.4	<0.40	0.001	<0.0004	<0.0004	<0.0004
Cobalt (Co)	µg/L	-	-	<3.0	3	<3.0	<3.0	3	<3.0	<3.0	3	<3.0	3	<3.0	3	3	<3.0	3	<3.0	3	<3.0
Chromium (Cr)**	mg/L	0.05	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0029	0.0015	<0.001	<0.001
Copper (Cu)**	mg/L	1	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0055	0.0054	<0.005	<0.005	<0.005	<0.005
Iron (Fe)	mg/L	0.3	-	0.98	0.16	0.53	0.56	0.29	0.21	2.9	8.3	14	0.68	5.9	2.3	1.9	2.3	0.42	10	1	1.3
Mercury (Hg)**	mg/L	0.001	-	<0.00005	<0.00008	<0.00005	<0.00005	<0.05000	<0.00005	<0.00005	<0.05000	<0.00005	<0.05000	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Manganese	mg/L	0.1	-	0.055	0.01	0.039	0.039	0.046	0.047	0.42	0.56	0.64	0.67	0.85	0.5	0.089	0.087	0.043	0.13	0.81	0.68
Nickel (Ni)**	mg/L	0.02	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005
Lead (Pb)**	mg/L	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.012	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc (Zn)**	mg/L	5	<0.014	<0.010	<0.010	<0.010	<0.010	0.051	0.025	0.01	0.97	0.92	9.2	0.055	1.6	0.2	0.57	4	0.12	0.01	<0.010
Mono Aromatic Hydrocarbons																					
Benzene	µg/L	10	<0.20	<0.20	0.2	<0.20	<0.20	0.2	<0.20	<0.20	0.2	<0.20	0.2	<0.20	0.2	0.2	<0.20	0.2	<0.20	0.2	<0.20
Toluene	µg/L	700	<0.20	<0.20	0.2	<0.20	<0.20	0.2	<0.20	<0.20	0.2	<0.20	0.2	<0.20	0.2	0.2	<0.20	0.2	<0.20	0.2	<0.20
Ethylbenzene	µg/L	-	<0.32	<0.20	0.2	<0.20	<0.20	0.2	<0.20	<0.44	0.4	<0.20	0.2	<0.20	0.3	0.2	<0.20	0.2	0.76	0.2	<0.20
o-Xylene	µg/L	-	<0.20	<0.20	0.2	<0.20	<0.20	0.2	<0.20	<0.20	0.2	<0.20	0.2	<0.20	0.2	0.2	<0.20	0.2	<0.20	0.2	<0.20
m,p-Xylene	µg/L	-	<0.20	<0.20	0.2	<0.20	<0.20	0.2	<0.20	<0.20	0.2	<0.20	0.2	<0.20	0.2	0.2	<0.20	0.2	<0.20	0.2	<0.20
Xylenes (sum)	µg/L	500	<0.40	<0.40	0.4	<0.40	<0.40	0.4	<0.40	<0.40	0.4	<0.40	0.4	<0.40	0.4	0.4	<0.40	0.4	<0.40	0.4	<0.40
BTEX (sum)	µg/L	-	<1.0	<1.0	1	<1.0	<1.0	1	<1.0	<1.0	1	<1.0	1	<1.0	1	1	<1.0	1	<1.0	1	<1.0
Petroleum Hydrocarbons																					

		Certificate number Sample Date	2016138562/1 23/11/2016	2017083857 15/06/2017	2016138562/1 23/11/2016	2016138562/1 23/11/2016	2017083857 15/06/2017	2016138562/1 23/11/2016	2017083857 16/06/2017	2016138562/1 23/11/2016	2016138562/1 23/11/2016	2017083857 16/06/2017	2016138562/1 23/11/2016	2017083857 16/06/2017	2016138562/1 23/11/2016	2016138562/1 23/11/2016	2017083857 16/06/2017	2016138562/1 23/11/2016	2017083857 17/06/2017	2016138562/1 23/11/2016	2017083857 16/06/2017
			Jobi East-2 water supply borehole		Jobi-4 water supply borehole	Rii-1 water supply borehole		Kilyango community borehole		Murchison River Lodge	Kirama community borehole		Kijumbya community borehole		Community borehole near Ngwedo Primary	Kisansya West community borehole		Kichoke community borehole		Bakers Lodge	
Analysis	Unit	Sample I.D	GW1-161107	(GW1-1706-15)	GW2-161107	GW3-161107	(GW3-1706-15)	GW4-161108	(GW4-1706-16)	GW5-161108	GW6-161108	(GW6-1706-16 FD)	GW10-161106	(GW10-1706-16)	GW11-161106	GW11ALT-161109	(GW11-ALT-1706-16)	GW12-161106	(GW12-1706-17)	GW13-161109	(GW13-1706-16)
			GW1		GW2	GW3		GW4		GW5	GW6		GW10		GW11	GW11-ALT		GW12		GW13	
TPH (C10-C12)	µg/L		<10	<10	<10	<10	<10	10	<10	<10	10	<10	10	<10	10	10	<10	10	<10	10	<10
TPH (C12-C16)	µg/L	-	<10	<10	<10	<10	<10	10	<10	<10	10	<10	10	<10	10	10	<10	10	<10	10	<10
TPH (C16-C21)	µg/L	-	<10	<10	<10	<10	<10	10	<10	<10	10	<10	10	<10	10	10	<10	10	<10	10	<10
TPH (C21-C30)	µg/L	-	<15	<15	<15	<15	<15	15	<15	<15	15	<15	15	<15	15	15	<15	15	<15	15	<15
TPH (C30-C35)	µg/L	-	<10	<10	<10	<10	<10	10	<10	<10	10	<10	10	<10	10	10	<10	10	<10	10	<10
TPH (C35-C40)	µg/L	-	<10	<10	<10	<10	<10	10	<10	<10	10	<10	10	<10	10	10	<10	10	<10	10	<10
TPH Sum (C10-C40)	µg/L	-	<38	<38	<38	<38	<38	38	<38	<38	38	<38	38	<38	38	38	<38	38	<38	38	<38
Physical and chemical analyses																					
Total suspended solids	mg/L	-	10	15	2.9	<2.0	<3.8	2	<3.8	5.8	22	17	2.2	12	9.4	5.4	7.4	2	20	6.2	7.4
Inorganic Compounds																					
Bromide	mg/L	0.01	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	0.31	0.48	0.43	0.54	<0.30	0.43	0.49	<0.30	0.7	0.63	0.44	0.38
Chloride	mg/L	250	16	22	11	12	12	12	12	45	80	74	85	27	52	70	13	97	95	13	12
Fluoride	mg/L	1.5	0.05	0.062	0.28	0.05	0.057	0.05	<0.050	0.16	0.16	0.18	0.21	0.19	0.26	0.22	<0.050	0.24	0.21	0.3	0.36
Sulphate	mg/L	400	1.5	1.2	0.58	0.6	1.1	0.57	0.7	0.79	18	19	88	30	69	38	180	22	18	1	0.7
Inorganic Compounds																					
Ortho-phosphate (PO4-P)	mg P/L	2.2	<0.200	<0.020	0.2	0.09	0.1	0.078	0.079	<0.098	0.15	<0.020	0.076	0.024	0.5	0.2	0.034	0.1	<0.020	0.02	0.021
Ortho-phosphate (PO4)	mg PO4/L		<0.060	<0.060	0.06	0.28	0.31	0.24	0.24	<0.300	0.47	<0.060	0.23	0.074	1.5	0.62	0.1	0.32	<0.060	0.06	0.064
Nitrate equivalent NO3-N	mg N/L		<0.20	<0.20	0.2	<0.20	<0.20	0.2	<0.20	<0.81	0.2	<0.20	0.36	<0.20	0.2	0.52	<0.20	0.23	<0.20	0.2	<0.20
Nitrate (NO3)	mg/L	45	<0.90	<0.90	0.9	<0.90	<0.90	0.9	<0.90	<3.60	0.9	<0.90	1.6	<0.90	0.9	2.3	<0.90	1	<0.90	0.9	<0.90
Nitrite as NO2-N	mg N/L		<0.010	<0.010	0.01	<0.017	<0.010	0.046	<0.010	<3.200	0.01	<0.010	0.01	<0.010	0.39	0.01	<0.010	0.01	<0.010	0.01	<0.010

		Certificate number Sample Date	2016138562/1 23/11/2016	20170857 15/06/2017	2016138562/1 23/11/2016	2016138562/1 23/11/2016	20170857 15/06/2017	2016138562/1 23/11/2016	20170857 16/06/2017	2016138562/1 23/11/2016	2016138562/1 23/11/2016	20170857 16/06/2017	2016138562/1 23/11/2016	20170857 16/06/2017	2016138562/1 23/11/2016	2016138562/1 23/11/2016	20170857 16/06/2017	2016138562/1 23/11/2016	20170857 17/06/2017	2016138562/1 23/11/2016	20170857 16/06/2017
			Jobi East-2 water supply borehole		Jobi-4 water supply borehole	Rii-1 water supply borehole		Kilyango community borehole		Murchison River Lodge	Kirama community borehole		Kijumbya community borehole		Community borehole near Ngwedo Primary	Kisansya West community borehole		Kichoke community borehole		Bakers Lodge	
Analysis	Unit	Sample I.D	GW1-161107	(GW1-1706-15)	GW2-161107	GW3-161107	(GW3-1706-15)	GW4-161108	(GW4-1706-16)	GW5-161108	GW6-161108	(GW6-1706-16 FD)	GW10-161106	(GW10-1706-16)	GW11-161106	GW11ALT-161109	(GW11-ALT-1706-16)	GW12-161106	(GW12-1706-17)	GW13-161109	(GW13-1706-16)
			GW1		GW2	GW3		GW4		GW5	GW6		GW10		GW11	GW11-ALT		GW12		GW13	
Nitrite (NO2)	mg/L	0.003	<0.030	<0.030	0.03	<0.056	<0.030	0.15	<0.030	11.00	0.03	<0.030	0.03	<0.030	1.3	0.03	<0.030	0.03	<0.030	0.03	<0.030
Ammonia*	mg/L	0.5		0.22			2.05		1.53			1.37		0.74			0.26		0.07		0.8
miscellaneous research																					
Turbidity	NTU	25		<1.0			<1.0		<1.0			<1.0		3.1			<1.0		5.5		<1.0
Micro-Biology																					
Coliforms*		Absent		14			78		0			0		14			0		30		4

*EnviroServ analysis 29/06/2017
** Results converted µg/L to mg/L

Exceedance of EAS 12:2014

Annex 7: Groundwater Quality analyses 2018

ENVOCHEM CONSULTANTS (U) LIMITED
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TIN: 1007027899

CERTIFICATE OF ANALYSIS –BOREHOLE WATER SAMPLE

Client:	Teclab Ltd
Project:	CPF/NILE CROSSING (BORE HOLE WATER)
Contact Person:	NANCY
Mobile :	0771301622
Reception Date:	23.01.2018
Sampler:	Client

Ref: LCL 2/2/18
Issue Date: 2nd Feb 2018
Label: BH 9 & BH 11

PARAMETER	METHOD	UNITS	CPF BH 9	CPF BH 11	US EAS 12: 2014 LIMIT (Natural Potable Water)
pH	ISO 10523:2008		6.26	6.19	5.50-9.50
Conductivity	ISO 7888:1985	µscm^{-1}	328	543	2500
Colour (Apparent)	ISO 7887A: 2011	PtCo	>500	0	50
Turbidity	ISO 7027-1:2016	NTU	93	0	25
Total Suspended Solids	ISO 11923:1997	mg/L	92	<0.2	1
Sulphates	ISO 15923-1:2013	mg/L	2	8	400
Chlorides	ASTM D512	mg/L	48.83	104.35	250
Nitrites as NO_2^-	ISO 15923-1:2013	mg/L	<0.001	0.058	0.003
Nitrates as NO_3^-	ISO 15923-1:2013	mg/L	11.073	4.782	45
Bicarbonates	ECL-AM-004	mg/L	146.26	105.56	
Fluorides	Method 8029 (SPADNS Method)	mg/L	0.53	0.56	1.50
Total Hardness as $CaCO_3$	ISO 6059:1984	mg/L	42.11	77.66	600
Total Alkalinity as $CaCO_3$	ECL-AM-017	mg/L	120.93	87.57	
Calcium	ISO 7980:1986	mg/L	13.44	34.70	150
Magnesium	ISO 7980:1986	mg/L	6.38	10.31	100
Sodium	ISO 9964-1:1993	mg/L	23.56	34.81	200
Potassium	ISO 9964-2:1993	mg/L	7.16	8.32	
Cadmium	ISO 8288-1:1986	mg/L	<0.001	<0.001	0.003
Lead	ISO 8288-1:1986	mg/L	0.004	0.001	0.01
Chromium	ISO 9174:1998	mg/L	<0.001	0.005	0.05
Iron	ISO 8288-1:1986	mg/L	4.939	0.055	0.3
Zinc	ISO 8288-1:1986	mg/L	0.025	0.024	5
Copper	ISO 8288-1:1986	mg/L	<0.001	<0.001	1.000
Nickel	ISO 8288-1:1986	mg/L	0.014	0.02	0.02
Manganese	ISO 8288-1:1986	mg/L	0.542	0.100	0.1
Cobalt	ISO 8288-1:1986	mg/L	0.002	0.002	
Arsenic	ISO 11885:2003	mg/L	0.010	0.012	0.01
Aluminium	ISO 11885:2003	mg/L	0.263	0.357	0.2
Barium	ISO 11885:2003	mg/L	7.01	<0.10	0.7
Mercury	ISO 11885:2003	mg/L	<0.001	<0.001	0.001
Faecal coliforms		Cfu/100ml	00	00	Absent
$B.O.D_5$		mg/L	8.7	15.2	
Total Petroleum Hydrocarbons (TPH)	PQA/LIM/006	mg/L	<0.01	4.61	N/A
BTEX					
Benzene	APHA 6200B	mg/L	<0.01	0.11	0.010
Toluene	APHA 6200B	mg/L	<0.01	<0.01	0.700
Ethyl-benzene	APHA 6200B	mg/L	<0.01	<0.01	N/A
Xylene	APHA 6200B	mg/L	<0.01	0.02	0.500
PAH					0.001
Naphthalene	APHA 6440B	mg/L	<0.01	0.07	N/A
Acenaphthylene	APHA 6440B	mg/L	<0.01	<0.01	N/A

Excellent Analytical Laboratory Services and Hazardous Waste Management Consultants
Contact us on: envochem.ug@gmail.com

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E-mail: envochem.ug@gmail.com
TIN: 1007027399

Acenaphthene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Fluorene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Phenanthrene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Anthracene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Fluoranthene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Pyrene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Benzo (a) anthracene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Chrysene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Benzo (b) fluoranthene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Benzo (k) fluoranthene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Benzo (a) pyrene	APHA 6440B	mg/L	<0.01	<0.01	N/A
ALIPHATIC HYDROCARBONS					
Total Aliphatic Hydrocarbons (C_4-C_{32})	APHA 6040B	mg/L	<0.01	<0.01	N/A

**********END**********

Please note;

**N/A is not available*

**Cfu is Coliform units*

**US EAS 12:2014 is the Uganda Standard as adapted from the East African Standard, it specifies the limits of contaminants in natural potable water unless advised otherwise (to apply a different protocol) we shall continue to use this as a reference in this monitoring.*

**Bold figures are outside the acceptable limits for potable natural water.*

**Under normal circumstances borehole water is supposed to be free of suspended solids and turbidity unless if the caging is damaged and/ or if sampling is done before purging (this should be done 12 hours before the time of sampling for clear water to sip in.*

**Petro-chemical contaminants, Faecal coliforms and B.O.D was sub-contracted to Polucon Services (K) Ltd and Government Analytical laboratory respectively, their test reports are therefore attached.*

ENVOCHEM CONSULTANTS (U) LIMITED
05 FEB 2018
P. O. BOX 40168, Kampala (U)

George Mugambwa
(QA- Coordinator)

Daniel Okwako
(Head of Laboratory)

ENVOCHEM CONSULTANTS (U) LIMITED

ANALYTICAL SERVICES LABORATORY

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Tel: 0778065016/ 0705956283
E-mail: envochem.ug@gmail.com
TIN: 1007027399

CERTIFICATE OF ANALYSIS –BOREHOLE WATER SAMPLE

Client:	Teclab Ltd	Ref: ECL 31/1/18	
Project:	CPP/NILE CROSSING (BORE HOLE WATER)	Issue Date: 31st Jan 2018	
Contact Person:	NANCY		
Mobile :	0771301622	Label: CPP BH MW3	
Reception Date:	17.01.2018		
Samples:	Client		

PARAMETER	METHOD	UNITS	RESULTS	US EAS 12: 2014 LIMIT (Natural Potable Water)
pH	ISO 10523:2008		6.46	5.50-9.50
Conductivity	ISO 7888:1985	µscm^{-1}	281	2500
Colour (Apparent)	ISO 7887A: 2011	PtCo	335	50
Turbidity	ISO 7027-1:2016	NTU	60	25
Total Suspended Solids	ISO 11923:1997	mg/L	65	
Sulphates	ISO 15923-1:2013	mg/L	6	400
Chlorides	ASTM D512	mg/L	24.67	250
Nitrites as $NO2^-$	ISO 15923-1:2013	mg/L	0.007	0.003
Nitrates as NO_3^-	ISO 15923-1:2013	mg/L	0.04	45
Bicarbonates	ECL-AM-004	mg/L	2.47	
Fluorides	Method 8029 (SPADNS Method)	mg/L	0.74	1.50
Total Hardness as $CaCO_3$	ISO 6059:1984	mg/L	166.56	600
Total Alkalinity as $CaCO_3$	ECL-AM-017	mg/L	104.25	
Calcium	ISO 7980:1986	mg/L	15.97	150
Magnesium	ISO 7980:1986	mg/L	5.55	100
Sodium	ISO 9964-1:1993	mg/L	23.97	200
Potassium	ISO 9964-2:1993	mg/L	6.59	
Cadmium	ISO 8288-1:1986	mg/L	0.002	0.003
Lead	ISO 8288-1:1986	mg/L	0.009	0.01
Chromium	ISO 9174:1998	mg/L	<0.001	0.05
Iron	ISO 8288-1:1986	mg/L	0.217	0.3
Zinc	ISO 8288-1:1986	mg/L	0.003	5
Copper	ISO 8288-1:1986	mg/L	<0.001	1.000
Nickel	ISO 8288-1:1986	mg/L	<0.001	0.02
Manganese	ISO 8288-1:1986	mg/L	0.066	0.1
Cobalt	ISO 8288-1:1986	mg/L	<0.001	
Arsenic	ISO 11885:2003	mg/L	<0.001	0.01
Aluminium	ISO 11885:2003	mg/L	0.288	0.2
Barium	ISO 11885:2003	mg/L	0.003	0.7
Mercury	ISO 11885:2003	mg/L	<0.001	0.001
Faecal coliforms		Cfu/100ml	00	Absent
$B.O.D_5$		mg/L	13.1	
Total Petroleum Hydrocarbons (TPH)	EQA/LIM/006	mg/L	<0.01	N/A
BTEX				
Benzene	APHA 6200B	mg/L	<0.01	0.010
Toluene	APHA 6200B	mg/L	<0.01	0.700
Ethyl-benzene	APHA 6200B	mg/L	<0.01	N/A
Xylene	APHA 6200B	mg/L	<0.01	0.500
PAH				0.001
Naphthalene	APHA 6440B	mg/L	<0.01	N/A
Acenaphthylene	APHA 6440B	mg/L	<0.01	N/A

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TIN: 1007027399

Acenaphthene	APHA 6440B	mg/L	<0.01	N/A
Fluorene	APHA 6440B	mg/L	<0.01	N/A
Phenanthrene	APHA 6440B	mg/L	<0.01	N/A
Anthracene	APHA 6440B	mg/L	<0.01	N/A
Fluoranthene	APHA 6440B	mg/L	<0.01	N/A
Pyrene	APHA 6440B	mg/L	<0.01	N/A
Benzo (a) anthracene	APHA 6440B	mg/L	<0.01	N/A
Chrysene	APHA 6440B	mg/L	<0.01	N/A
Benzo (b) fluoranthene	APHA 6440B	mg/L	<0.01	N/A
Benzo (k) fluoranthene	APHA 6440B	mg/L	<0.01	N/A
Benzo (a) pyrene	APHA 6440B	mg/L	<0.01	N/A
ALIPHATIC HYDROCARBONS				
Total Aliphatic Hydrocarbons (C_4-C_{32})	APHA 6040B	mg/L	<0.01	N/A

**********END**********

Please note:

**N/A is not available*

**Cfu is Coliform units*

**US EAS 12:2014 is the Uganda Standard as adopted from the East African Standard, it specifies the limits of contaminants in natural potable water unless advised otherwise (to apply a different protocol) we shall continue to use this as a reference in this monitoring.*

**Bold figures are values above the acceptable limits of potable natural water.*

**Under normal circumstances borehole water is supposed to be free of suspended solids and turbidity unless if the caging is damaged and/ or if sampling is done before purging (this should be done 12 hours before the time of sampling for clear water to slp in.*

**Petro-chemical contaminants, Faecal coliforms and B.O.D was sub-contracted to Polucon Services (K) Ltd and Government Analytical laboratory respectively, their test reports are therefore attached.*

George Mugambwa
(QA- Coordinator)

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05 DEC 2018
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In any Correspondence on this subject please quote No.....

GE 019/2018

THE REPUBLIC OF UGANDA

MINISTRY OF INTERNAL AFFAIRS
DIRECTORATE OF GOVERNMENT ANALYTICAL LABORATORY
Plot No. 2 Lourdel Road
Wandegeya,
P.O.BOX 2174
Kampala - Uganda

22nd January 2018

Envochem Consultants (U) Ltd
Nalubale Link Road
P.O Box 40168,
Kampala, Uganda

REPORT OF ANALYSIS

Description of Sample
One (1) clear borehole water sample in a 1000ml amber glass bottle labelled **'CPFBHMW3'** was received from Envochem Consultants (U) Ltd C/o Mr. Okwako Daniel on 18th January 2018.

Analysis Requested
Total Plate Count, Total coliforms and E.coli.

Methods of Analysis
Faecal coliforms was determined by the Membrane Filtration Technique at 44°C. The determinations were done in duplicate.

Results of Analysis
The mean analysis values are as below;

[illegible]	Results	US EAS 12:2014 Limits
Faecal coliforms as E.coli in 100ml	00	Absent

Remarks
1. The sample was analysed against the microbiological limits of the US EAS 12:2014 standard for Potable water.
2. The sample was found to comply with the microbiological specifications of the standard for the parameter analysed.
3. The results relate to sample submitted and are reported as on received basis.

Christine Zawedde
Government Analyst

"Go Scientific for a Safe and Just Society"

Polucon
At your service

ENVOCHEM CONSULTANTS (U) LTD
P.O. BOX 40168
KAMPALA, UGANDA

TEST REPORT N0: 2018/ENV/0034			
SAMPLE	WATER		
DATE & PLACE SUBMITTED	22-January-2018 at Polucon Laboratory, Nyali		
SAMPLING METHOD	N/A		
MARK	CPF BH MW3		
Test	Method	Results	Clients Specifications
BTEX			
Benzene, mg/L	APHA 6200B	<0.01	-
Toluene, mg/L	APHA 6200B	<0.01	-
Ethyl benzene, mg/L	APHA 6200B	<0.01	-
Xylene, mg/L	APHA 6200B	<0.01	-
TPH			
Total Petroleum Hydrocarbons, TPH, mg/L	PQA/LIM/006	<0.01	-
PAH			
Naphthalene, mg/L	APHA 6440B	<0.01	-
Acenaphthylene, mg/L	APHA 6440B	<0.01	-
Acenaphthene, mg/L	APHA 6440B	<0.01	-
Fluorene, mg/L	APHA 6440B	<0.01	-
Phenanthrene, mg/L	APHA 6440B	<0.01	-
Anthracene, mg/L	APHA 6440B	<0.01	-
Fluoranthene, mg/L	APHA 6440B	<0.01	-
Pyrene, mg/L	APHA 6440B	<0.01	-
Benzo (a) anthracene, mg/L	APHA 6440B	<0.01	-
Chrysene, mg/L	APHA 6440B	<0.01	-
Benzo (b) fluoranthene, mg/L	APHA 6440B	<0.01	-
Benzo (k) fluoranthene, mg/L	APHA 6440B	<0.01	-
Benzo (a) pyrene, mg/L	APHA 6440B	<0.01	-
ALIPHATIC HYDROCARBONS			
Total Aliphatic Hydrocarbons, (C_6-C_{32}),mg/L	APHA 6040B	<0.01	-

**********End of test results**********

Mombasa Lab
26th January, 2018

Analyst
Pascal Mbithi – Chemist

Technical signatory
Jared Onsinyo – Technical Manager

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"Unless otherwise stated the results shown in this test report refer only to sample(s) tested and such sample(s) are retained for 90 days only (if non-perishable)."

NB: This report refers to submitted samples. The source and markings have not been verified or confirmed.

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E-mail: envochem.ug@gmail.com
TIN: 1007027399

CERTIFICATE OF ANALYSIS –BOREHOLE WATER SAMPLE

Client:	Teclab Ltd	**Ref:**	ECL 16/3/18
Project:	CPF/NILE CROSSING (BORE HOLE WATER)	**Issue Date:**	16th Mar 2018
Contact Person:	NANCY		
Mobile :	0771301622	**Label:**	MW1 & MW 04
Reception Date:	26.02.2018		
Sampler:	Client		

PARAMETER	METHOD	UNITS	MW 1	MW 04	US EAS 12: 2014 LIMIT (Natural Potable Water)
pH	ISO 10523:2008		6.49	6.79	5.50-9.50
Conductivity	ISO 7888:1985	μscm^{-1}	360	1707	2500
Colour (Apparent)	ISO 7887A: 2011	PtCo	**161**	**>500**	50
Turbidity	ISO 7027-1:2016	NTU	21	157	25
Total Suspended Solids	ISO 11923:1997	mg/L	17	153	-
Sulphates	ISO 15923-1:2013	mg/L	4	1	400
Chlorides	ASTM D512	mg/L	34.44	**318.70**	250
Nitrites as $NO2^-$	ISO 15923-1:2013	mg/L	<0.001	**0.027**	0.003
Nitrates as NO_3^-	ISO 15923-1:2013	mg/L	0.089	0.487	45
Bicarbonates	ECL-AM-004	mg/L	16.534	48.330	
Fluorides	Method 8029 (SPADNS Method)	mg/L	0.6	0.4	1.50
Total Hardness as $CaCO_3$	ISO 6059:1984	mg/L	57.33	251.53	600
Total Alkalinity as $CaCO_3$	ECL-AM-017	mg/L			
Calcium	ISO 7980:1986	mg/L	30.12	120.9	150
Magnesium	ISO 7980:1986	mg/L	6.53	31.35	100
Sodium	ISO 9964-1:1993	mg/L	32.670	175.6	200
Potassium	ISO 9964-2:1993	mg/L	3.08	13.06	
Cadmium	ISO 8288-1:1986	mg/L	**0.024**	**0.034**	0.003
Lead	ISO 8288-1:1986	mg/L	<0.001	<0.001	0.01
Chromium	ISO 9174:1998	mg/L	0.020	0.026	0.05
Iron	ISO 8288-1:1986	mg/L	**2.462**	**22.40**	0.3
Zinc	ISO 8288-1:1986	mg/L	0.022	0.086	5
Copper	ISO 8288-1:1986	mg/L	<0.001	<0.001	1.000
Nickel	ISO 8288-1:1986	mg/L	0.018	0.020	0.02
Manganese	ISO 8288-1:1986	mg/L	**0.417**	**3.808**	0.1
Cobalt	ISO 8288-1:1986	mg/L	0.002	0.001	
Arsenic	ISO 11885:2003	mg/L			0.01
Aluminium	ISO 11885:2003	mg/L			0.2
Barium	ISO 11885:2003	mg/L	4.00	0.3	0.7
Mercury	ISO 11885:2003	mg/L			0.001
Faecal coliforms		Cfu/100ml	16	09	Absent
$B.O.D_5$		mg/L	84.9	8.7	
C.O.D		mg/L	30	146	
Total Petroleum Hydrocarbons (TPH)	PQA/LIM/006	mg/L	<0.01	<0.01	N/A
BTEX					
Benzene	APHA 6200B	mg/L	<0.01	<0.01	0.010
Toluene	APHA 6200B	mg/L	<0.01	<0.01	0.700
Ethyl-benzene	APHA 6200B	mg/L	<0.01	<0.01	N/A
Xylene	APHA 6200B	mg/L	<0.01	<0.01	0.500
PAH					**0.001**
Naphthalene	APHA 6440B	mg/L	<0.01	<0.01	N/A

ENVOCHEM CONSULTANTS (U) LIMITED

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TIN: 1007027399

Acenaphthylene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Acenaphthene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Fluorene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Phenanthrene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Anthracene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Fluoranthene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Pyrene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Benzo (a) anthracene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Chrysene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Benzo (b) fluoranthene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Benzo (k) fluoranthene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Benzo (a) pyrene	APHA 6440B	mg/L	<0.01	<0.01	N/A
ALIPHATIC HYDROCARBONS					
Total Aliphatic Hydrocarbons (C_4-C_{12})	APHA 6040B	mg/L	<0.01	<0.01	N/A

**********END**********

Please note:

**N/A is not available*

**Cfu is Coliform units*

**US EAS 12:2014 is the Uganda Standard as adopted from the East African Standard, it specifies the limits of contaminants in natural potable water unless advised otherwise (to apply a different protocol) we shall continue to use this as a reference in this monitoring.*

**Bold figures are outside the acceptable limits for potable natural water.*

**Under normal circumstances borehole water is supposed to be free of suspended solids and turbidity unless if the caging is damaged and/ or if sampling is done before purging (this should be done 12 hours before the time of sampling for clear water to sip in.*

**Petro-chemical contaminants, Faecal coliforms and B.O.D was sub-contracted to Polucon Services (K) Ltd and Government Analytical laboratory respectively, their test reports are therefore attached.*

**C.O.D was not requested for but was done for our quality control purposes*

George Mugambwa
(QA- Coordinator)

Daniel Okwako
(Head of Laboratory)

Excellent Analytical Laboratory Services and Hazardous Waste Management Consultants
Contact us on; envochem.ug@gmail.com

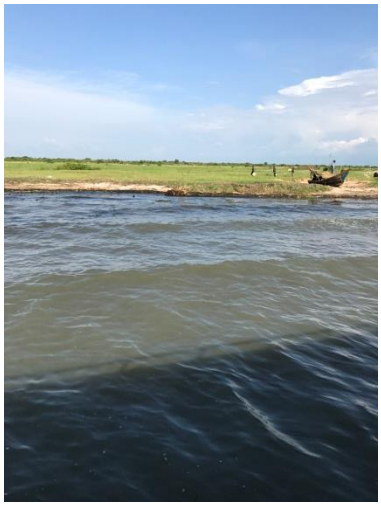
TILENGA PROJECT ESIA - APPENDIX L: Surface Water

May 2018

Table of Contents

Annex 01: Photographs Of Surface Water and Sediment Sampling Locations

Annex 01: Photographs of Surface Water and Sediment Sampling Locations

SW01 Nov. 2016 June 2017  and	SW02 Nov. 2016 and June 2017 
SW06 Nov. 2016 June 2017  and	SW07 Nov. 2016 and June 2017 
SW08 Nov. 2016 and June 2017 	SW09 Nov. 2016 and June 2017 

SW10
Nov. 2016 and
June 2017

SW12
Nov. 2016 and June 2017

SW 13
June 2017

SW14S
June 2017

SW14N
June 2017

SE1
Sampled only in Nov. 2016

SE2
Sampled only in Nov. 2016

SE3
Sampled only in Nov 2016

SE4
Sampled only in Nov. 2016

SE5_BB/N
Sampled only in June 2017

SE5_BB/S
Sampled only in June 2017

Annex 02: Surface Water Quality Analysis Results From 2014 to 2017 ESIA Field Campaigns

Annex 02: Surface Water Quality Analysis Results From 2014 To 2017 ESIA Field Campaigns

Sample Location						SW01		SW02		SW06		SW07		SW08	
Certificate number						337545	2017083843	331947	2017083843	320948	2017083843	320579	2017083843	322595	2017083843
Date sampling						04/11/2016	12-06-2017	04/11/2016	12-06-2017	05/11/2016	14-06-2017	05/11/2016	14-06-2017	16/12/2016	12-06-2017
Location descritpion						Wetland in North Nile MFNP		Watering hole in North Nile		Lake Albert near shore		Lake Albert offshore		Watercourse near JBR09	
Analysis	Unit	USEPA Water Quality Human Health Criteria	USEPA Water Quality Aquatic Life Criteria	WHO Guidelines (4th Edition 2011)	EAS 12:2014	SW1-161104	SW1-1706-12	SW2-161104	SW2-1706-12	SW6-161105	SW6-1706-14	SW7-161105	SW7-1706-14	SW8-1612	SW8-1706-12
Metals															
Aluminum (Al)	mg/L	-		0.2	0.2	0.15	15	5	5.9	0.27	<0.10	0.18	<0.10	4.1	2.2
Arsenic (As)**	mg/L	0.018	0.15	0.01	0.01	<0.005	0.0078	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Barium (Ba)**	mg/L	0.1		0.7	0.7	0.08	2	0.081	0.35	0.087	0.078	0.084	0.077	0.5	0.29
Uranium (U)	µg/L	-		0.03	-	< 5	<5.0	< 5	<5.0	< 5	<5.0	< 5	<5.0	< 5	<5.0
Cadmium (Cd)**	mg/L	0.005	0.00025	1.003	0.003	< 0.0004	0.00055	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Cobalt (Co)	µg/L	-		-	-	< 3	170	6.4	29	< 3	<3.0	< 3	<3.0	17	5.2
Chromium (Cr)**	mg/L	0.01	0.0074	0.05	0.05	<0.001	0.023	0.016	0.015	<0.001	<0.001	<0.001	<0.001	0.0044	0.0037
Copper (Cu)**	mg/L	1.3		2	1	<0.005	0.22	0.01	0.033	<0.005	<1.6	<0.005	<1.6	0.023	0.013
Iron (Fe)	mg/L	-	1	-	0.3	4.2	110	7.5	43	0.39	<0.050	0.26	<0.050	9.8	9.6
Mercury (Hg)**	mg/L	-	0.00077	0.006	0.001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Manganese	mg/L	50		-	0.1	0.14	8.8	0.18	1.1	0.016	<0.010	< 0.01	<0.010	1.2	0.17
Nickel (Ni)**	mg/L	0.61	0.0052	0.07	0.02	<0.005	0.075	0.009	0.019	<0.005	<0.005	<0.005	<0.005	0.011	<0.005
Lead (Pb)**	mg/L	-	0.0025	0.01	0.01	0.25	0.094	0.0051	0.028	<0.005	<0.005	<0.005	<0.005	0.015	0.014
Zinc (Zn)**	mg/L	7.4	0.12	-	5	< 0.01	0.088	0.015	0.021	< 0.01	<0.005	< 0.01	<0.005	0.017	0.0083
Mono Aromatic Hydrocarbons															
Benzene	µg/L	2.2		10	10	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20
Toluene	µg/L	1300		700	700	< 0.2	0.79	< 0.2	<0.20	0.33	<0.20	< 0.2	<0.20	< 0.2	<0.20
Ethylbenzene	µg/L	530		300	-	< 0.2	0.96	< 0.2	0.55	0.29	0.46	< 0.2	1.3	< 0.2	1.6
o-Xylene	µg/L	-		-	-	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20
m,p-Xylene	µg/L	-		-	-	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20
Xylenes (sum)	µg/L	-		500	500	< 0.4	<0.40	< 0.4	<0.40	< 0.4	<0.40	< 0.4	<0.40	< 0.4	<0.40
BTEX (sum)	µg/L	-		-	-	< 1	1.8	< 1	<1.0	< 1	<1.0	< 1	1.3	< 1	1.6
Petroleum Hydrocarbons															
TPH (C10-C12)	µg/L	-				< 10	<10	< 10	<10	< 10	<10	< 10	<10	< 10	<10
TPH (C12-C16)	µg/L	-			-	< 10	<10	< 10	<10	< 10	<10	< 10	<10	< 10	<10
TPH (C16-C21)	µg/L	-			-	< 10	<10	< 10	<10	< 10	<10	< 10	<10	< 10	<10
TPH (C21-C30)	µg/L	-			-	< 15	<15	< 15	<15	< 15	<15	< 15	<15	< 15	<15
TPH (C30-C35)	µg/L	-			-	< 10	<10	< 10	<10	< 10	<10	< 10	<10	< 10	<10
TPH (C35-C40)	µg/L	-			-	< 10	<10	< 10	<10	< 10	<10	< 10	<10	< 10	<10
TPH Sum (C10-C40)	µg/L	-			-	< 38	<38	< 38	<38	< 38	<38	< 38	<38	< 38	<38
Physical and chemical analyses															
Total suspended solids	mg/L	-			-	27	5200	430	2500	37	<3.8	18	<3.8	2800	960
Inorganic Compounds															
Bromide	mg/L	-				< 0.05	0.14	< 0.05	<0.050	0.051	0.068	0.058	0.068	< 0.3	<0.050
Chloride	mg/L	-	230		250	0.31	24	1.3	1.6	20	19	20	19	0.54	0.45
Fluoride	mg/L	-		1.5	1.5	0.4	0.3	0.093	0.21	0.78	0.76	0.78	0.76	0.19	0.42
Sulphate	mg/L	-			400	0.75	15	4.2	3.3	12	11	12	10	1.1	2.1
Inorganic Compounds		-													
Ortho-phosphate (PO4-P)	mg P/L	-		-	2.2	< 0.06	0.13	0.38	0.16	0.061	<0.020	0.086	<0.020	0.11	0.021
Ortho-phosphate (PO4)	mg PO4/L	-		-		< 0.02	0.39	0.12	0.49	0.02	<0.060	0.028	<0.060	0.036	0.064
Nitrate equivalent NO3-N	mg N/L	10		-		0.44	<0.20	0.85	<0.20	0.21	<0.20	< 0.2	<0.20	< 0.2	<0.20
Nitrate (NO3)	mg/L			50	45	1.9	<0.90	3.8	<0.90	0.93	<0.90	< 0.9	<0.90	< 0.9	<0.90
Nitrite as NO2-N	mg N/L			-		0.013	<0.010	0.02	0.012	0.14	<0.010	0.097	<0.010	< 0.01	0.036
Nitrite (NO2)	mg/L			3	0.003	0.043	<0.030	0.066	0.039	0.46	<0.030	0.32	<0.030	< 0.03	0.12
miscellaneous research															
Turbidity	NTU				25	20.8	35.2	685	514	19	<1.0	13.7	<1.0		129.8
Total coliforms	cfu/100ml					-	-	-	-	-	-	-	-	-	-

** Results converted µg/L to mg/L

Exceedance of EAS 12:2014

Exceedance of USEPA

Note: USEPA standard applied where no EAS12:2014 standard exists

Sample Location						SW09		SW10		SW12		SW13	SW14
Certificate number						332984	2017083843	317858	2017083843	333863	2017083843	2017083843	2017083843
Date sampling						05/11/2016	14-06-2017	05/11/2016	14-06-2017	16/12/2016	13-06-2017	12-06-2017	14-06-2017
Location descritpion						Nile River		Nile River at Lake Albert		Waiga River		Wildlife watering hole in north of Nile	
Analysis	Unit	USEPA Water Quality Human Health Criteria	USEPA Water Quality Aquatic Life Criteria	WHO Guidelines (4th Edition 2011)	EAS 12:2014	SW9-161105	SW9-1706-14	SW10-161105	SW10-1706-14	SW12-1612	SW12-1706-13	SW13-1706-12	SW14-1706-14
Metals													
Aluminum (Al)	mg/L	-		0.2	0.2	0.48	<0.10	0.16	<0.10	0.22	0.31	1.2	<0.10
Arsenic (As)**	mg/L	0.018	0.15	0.01	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Barium (Ba)**	mg/L	0.1		0.7	0.7	< 0.05	<0.05	< 0.05	<0.05	0.096	0.087	0.24	<0.05
Uranium (U)	µg/L	-		0.03	-	< 5	<5.0	< 5	<5.0	< 5	<5.0	<5.0	<5.0
Cadmium (Cd)**	mg/L	0.005	0.00025	1.003	0.003	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Cobalt (Co)	µg/L	-		-	-	< 3	<3.0	< 3	<3.0	4.3	3.3	14	<3.0
Chromium (Cr)**	mg/L	0.01	0.0074	0.05	0.05	0.0016	<0.001	<0.001	<0.001	<0.001	<0.001	0.0017	<0.001
Copper (Cu)**	mg/L	1.3		2	1	<0.005	<1.6	<0.005	<0.0016	<0.005	0.027	0.069	<0.0016
Iron (Fe)	mg/L	-	1	-	0.3	0.82	0.27	0.38	0.27	9.6	5.8	17	0.3
Mercury (Hg)**	mg/L	-	0.00077	0.006	0.001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Manganese	mg/L	50		-	0.1	0.036	0.027	0.026	0.027	0.6	0.39	1.7	0.028
Nickel (Ni)**	mg/L	0.61	0.0052	0.07	0.02	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0051	<0.005
Lead (Pb)**	mg/L	-	0.0025	0.01	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0098	<0.005
Zinc (Zn)**	mg/L	7.4	0.12	-	5	< 0.01	0.0051	< 0.01	0.0065	< 0.01	<0.005	0.0065	<0.005
Mono Aromatic Hydrocarbons													
Benzene	µg/L	2.2		10	10	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20	<0.20	<0.20
Toluene	µg/L	1300		700	700	< 0.2	0.52	< 0.2	<0.20	< 0.2	<0.20	<0.20	<0.20
Ethylbenzene	µg/L	530		300	-	< 0.2	0.96	< 0.2	1.1	< 0.2	0.72	0.81	0.51
o-Xylene	µg/L	-		-	-	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20	<0.20	<0.20
m,p-Xylene	µg/L	-		-	-	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20	<0.20	<0.20
Xylenes (sum)	µg/L	-		500	500	< 0.4	<0.40	< 0.4	<0.40	< 0.4	<0.40	<0.40	<0.40
BTEX (sum)	µg/L	-		-	-	< 1	1.5	< 1	1.1	< 1	<1.0	<1.0	<1.0
Petroleum Hydrocarbons													
TPH (C10-C12)	µg/L	-				< 10	<10	< 10	<10	< 10	<10	<10	<10
TPH (C12-C16)	µg/L	-			-	< 10	<10	< 10	<10	< 10	<10	<10	<10
TPH (C16-C21)	µg/L	-			-	< 10	<10	11	<10	< 10	<10	<10	<10
TPH (C21-C30)	µg/L	-			-	< 15	<15	27	<15	< 15	<15	<15	<15
TPH (C30-C35)	µg/L	-			-	< 10	<10	12	<10	< 10	<10	<10	<10
TPH (C35-C40)	µg/L	-			-	< 10	<10	< 10	<10	< 10	<10	<10	<10
TPH Sum (C10-C40)	µg/L	-			-	< 38	<38	61	<38	< 38	<38	<38	<38
Physical and chemical analyses													
Total suspended solids	mg/L	-			-	92	15	12	14	120	86	450	14
Inorganic Compounds													
Bromide	mg/L	-				< 0.05	<0.050	< 0.05	<0.050	< 0.3	<0.050	<0.050	<0.050
Chloride	mg/L	-	230		250	4.8	4.6	5	4.6	0.89	0.28	2.3	4.7
Fluoride	mg/L	-		1.5	1.5	0.33	0.32	0.34	0.31	0.15	0.16	0.25	0.32
Sulphate	mg/L	-			400	1.4	2.7	1.5	2.4	0.89	1.4	1	2
Inorganic Compounds		-											
Ortho-phosphate (PO4-P)	mg P/L	-		-	2.2	< 0.06	<0.020	< 0.06	<0.020	0.33	0.082	0.029	<0.020
Ortho-phosphate (PO4)	mg PO4/L	-		-		< 0.02	<0.060	< 0.02	<0.060	0.11	0.25	0.089	<0.060
Nitrate equivalent NO3-N	mg N/L	10		-		0.33	0.31	0.33	0.33	< 0.2	<0.20	<0.20	<0.20
Nitrate (NO3)	mg/L			50	45	1.5	1.4	1.5	1.5	< 0.9	<0.90	<0.90	<0.90
Nitrite as NO2-N	mg N/L			-		< 0.01	<0.010	< 0.01	<0.010	< 0.01	<0.010	0.015	<0.010
Nitrite (NO2)	mg/L			3	0.003	< 0.03	<0.030	< 0.03	<0.030	< 0.03	<0.030	0.049	<0.030
miscellaneous research													
Turbidity	NTU				25	37.5	<1.0	6.93	<1.0		35.9	17.6	<1.0
Total coliforms	cfu/100ml					-	-	-	-	-	-	-	-

** Results converted µg/L to mg/L

Exceedance of EAS 12:2014

Exceedance of USEPA

Note: USEPA standard applied where no EAS12:2014 standard exists

Sample Location						SW07	SW07	SW07	SW07	SW08	SW08	SW08	SW08	SW09	SW09	SW09	SW09	SW14	SW14	SW14	SW14	SW14	SW16
Certificate number																							
Date sampling						13-Feb-14	27-Apr-14	02-Jul-14	25-Sep-14	13-Feb-14	27-Apr-14	02-Jul-14	25-Sep-14	13-Feb-14	27-Apr-14	01-Jul-14	29-Sep-14	13-Feb-14	28-Apr-14	30-Jun-14	30-Jun-14	29-Sep-14	29-Sep-14
Location descritpion						Victoria Nile downstream of Murchison				Victoria Nile near Murchison Falls Lodge				Victoria Nile at Wanseco village inside				Seasonal stream in MFNP next to road					
Analysis	Unit	USEPA Water Quality Human Health Criteria	USEPA Water Quality Aquatic Life Criteria	WHO Guidelines (4th Edition 2011)	EAS 12:2014																		
Physical and chemical analyses																							
pH		5.0 - 9.0	6.5-9		5.5-8.5	6.85	7.94	8.06	7.58	6.86	7.8	7.44	7.17	6.87	6.88	6.28	7.01	6.86	6.71	6.53	6.53	6.31	5.33
Temperature, C						25.91	28.67	27.74	27.7	26.17	29.14	27.14	27.17	26.06	28.55	26.71	30.15	24.74	28.81	31.09	31.09	23.7	29.38
EC, uS/cm					2500	81	116.1	118.2	116.4	82	115.9	117.9	117.3	89	126.2	131.2	126.5	98	68	84.7	84.7	84.3	54
ORP, mV						-15	68.8	47.8	68.1	9.7	70.7	52	80.9	-70.9	54.8	73	65.5	-8.7	10.1	47.1	47.1	-18.8	221.5
Diss. O_2, mg/L						8.37	9.51	9.2	9.7	8.7	8.95	8.72	8.77	0.34	0.55	0.59	4.57	3.35	3.64	10.13	10.13	0.45	1.75
Resistivity, Ω-cm						12,400	8,051	8,042	8,173	12,200	8,000	8,147	8,189	11,200	7,422	7,384	7,197	10,200	13,705	10,580	10,580	12,168	17,095
Salinity, PSU						0.06	0.1	0.1	0.1	0.06	0.1	0.1	0.1	0.04	0.1	0.1	0.1	0.04	0	0	0	0	0
TDS, mg/L					1500	40	75	77	76	42	75	77	76	45	82	85	82	49	44	55	55	55	35
Metals																							
Arsenic (As)**	mg/L	0.018	0.15	0.01	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Barium (Ba)**	mg/L	0.1		0.7	0.7	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.17	0.11	0.13	0.14	0.15	0.073
Uranium (U)	µg/L	-		0.03	-		< 0.0002	< 0.0002	< 0.0002		< 0.0002	< 0.0002	< 0.0002		< 0.0002	< 0.0002	< 0.0002		< 0.0002	< 0.0002	< 0.0002	0.0003	< 0.0002
Calcium	mg/L			-	150	5.6	8.4	8.9	8	6.7	7.5	9	8.5	6.3	8.3	9.9	10	7.7	6.4	8.2	8.1	5.9	3.5
Cadmium (Cd)**	mg/L	0.005	0.00025	0.003	0.003	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040
Cobalt (Co)	µg/L	-		-	-	< 3.0	< 3	< 3	< 3.0	< 3.0	< 3	< 3	< 3.0	< 3.0	< 3	< 3	< 3.0	8.2	8.3	9.7	11	8.5	5.9
Chromium (Cr)**	mg/L	0.01	0.0074	0.05	0.05	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.0011	< 0.001	< 0.001	< 0.001	< 0.001
Copper (Cu)**	mg/L	1.3		2	1	< 0.005	< 0.005	< 0.005	0.0054	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.0053	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Iron (Fe)	mg/L	-	1	-	0.3	0.1	0.31	0.56	0.41	0.18	0.68	0.35	0.34	0.58	0.7	0.75	0.5	9.6	9.9	11	14	13	0.7
Mercury (Hg)**	mg/L	-	0.00077	0.006	0.001	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050
Magnesium	mg/L				100	3	3.1	3.4	3.3	3	3.1	3.3	3.3	3.3	3.4	3.5	3.5	3.9	2.2	2.8	2.8	1.9	0.99
Manganese	mg/L	50		-	0.1	0.019	0.026	0.032	0.037	0.019	0.031	0.033	0.037	0.038	0.045	0.045	0.037	1.6	1.3	1.6	1.6	1.2	0.33
Nickel (Ni)**	mg/L	0.61	0.0052	0.07	0.02	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0087
Lead (Pb)**	mg/L	-	0.0025	0.01	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Potassium	mg/L			-	-	3.2	3.7	4	3.5	3.3	3.7	3.9	3.5	3.2	4.3	3.7	3.8	6.5	5.8	3.5	3.5	1.7	1.4
Sodium	mg/L			-	200	11	13	13	12	12	12	12	12	13	13	13	13	9.4	2.5	4.8	4.9	4.4	4.4
Zinc (Zn)**	mg/L	7.4	0.12	-	5	0.011	0.011	< 0.01	< 0.01	0.016	< 0.01	< 0.01	< 0.01	< 0.01	0.095	< 0.01	< 0.01	< 0.01	0.059	< 0.01	< 0.01	< 0.01	< 0.01
Mono Aromatic Hydrocarbons																							
Benzene	µg/L	2.2		10	10	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20
Toluene	µg/L	1300		700	700	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20
Ethylbenzene	µg/L	530		300	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	0.55	0.3	< 0.2	< 0.20	< 0.20	0.69	< 0.2	< 0.2	5.4	< 0.20
o-Xylene	µg/L	-		-	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20
m,p-Xylene	µg/L	-		-	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	0.74	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20
Xylenes (sum)	µg/L	-		500	500	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.4	< 0.40	< 0.40
BTEX (sum)	µg/L	-		-	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	5.4	< 1.0
Petroleum Hydrocarbons																							
TPH (C10-C12)	µg/L	-				6.1	< 4	< 4	< 4.0	32	< 4	< 4	< 4.0	< 4.0	< 4	4.1	< 4.0	< 4.0	5.6	< 4	< 4	< 4.0	< 4.0
TPH (C12-C16)	µg/L	-			-	< 5.0	< 5	< 5	< 5.0	16	< 5	< 5	< 5.0	< 5.0	< 5	5.9	16	< 5.0	11	< 5	< 5	10	< 5.0
TPH (C16-C21)	µg/L	-			-	6.8	6.2	< 6	< 6.0	19	< 6	< 6	< 6.0	7.4	< 6	< 6	< 6.0	< 6.0	6.5	< 6	< 6	< 6.0	< 6.0
TPH (C21-C30)	µg/L	-			-	16	< 10	< 10	12	30	< 10	< 10	12	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
TPH (C30-C35)	µg/L	-			-	13	< 5	< 5	< 5.0	37	< 5	< 5	< 5.0	11	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5	< 5.0	< 5.0
TPH (C35-C40)	µg/L	-			-	< 8.0	< 8	< 8	18	15	< 8	< 8	< 8.0	< 8.0	< 8	< 8	< 8.0	< 8.0	< 8	< 8	< 8	< 8.0	< 8.0
TPH Sum (C10-C40)	µg/L	-			-	49	< 38	< 38	38	150	< 38	< 38	< 38	69	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38
Inorganic Compounds																							
Bromide	mg/L	-			0.01	< 0.30	< 0.3	< 0.3	< 0.30	< 0.30	< 0.3	< 0.3	< 0.30	< 0.30	< 0.3	< 0.3	< 0.30	< 0.30	< 0.3	< 0.3	< 0.3	< 0.30	< 0.30
Chloride	mg/L	-	230		250	5.5	5.3	5	4.9	5.6	5.1	4.9	4.7	5.3	5.5	4.8	5.3	0.96	1.3	0.33	0.35	0.28	4.4
Fluoride	mg/L	-		1.5	1.5	0.36	0.38	0.29	0.39	0.37	0.38	0.32	0.38	0.37	0.38	0.32	0.4	0.17	0.15	0.13	0.11	0.13	< 0.050
Sulphate	mg/L	-			400	1.1	9.7	1.3	1.1	3.3	2.3	11	1.4	0.79	5.4	2.9	1.6	<0.50	3.4	2.1	2	< 0.50	6.1
Inorganic Compounds		-																					
Ortho-phosphate (PO4-P)	mg P/L	-		-	2.2	< 0.060	< 0.0600	< 0.0600	< 0.060	< 0.060	< 0.0600	< 0.0600	< 0.060	< 0.060	< 0.0600	< 0.0600	< 0.060	< 0.060	0.23	< 0.0600	< 0.0600	0.1	< 0.060
Ortho-phosphate (PO4)	mg PO4/L	-		-		< 0.020	< 0.02	< 0.02	< 0.020	< 0.020	< 0.02	< 0.02	< 0.020	< 0.020	< 0.02	< 0.02	< 0.020	< 0.020	0.074	< 0.02	< 0.02	0.033	< 0.020
Nitrate equivalent NO3-N	mg N/L	10,000		-		1.8	1.5	1.7	1.5	1.6	1.3	5.2	1.5	< 0.90	< 0.9000	< 0.9	< 0.90	< 0.90	< 0.9000	< 0.9	< 0.9	< 0.90	4.8
Nitrate (NO3)	mg/L			50	45	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010
Nitrite as NO2-N	mg N/L			-		0.41	0.35	0.39	0.33	0.37	0.28	1.2	0.33	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.20	1.1
Nitrite (NO2)	mg/L			3	0.003	< 0.030	< 0.0300	< 0.03	< 0.030	< 0.030	< 0.0300	< 0.03	< 0.030	< 0.030	< 0.0300	< 0.03	< 0.030	< 0.030	< 0.0300	< 0.03	< 0.03	< 0.030	< 0.030
Ammonium (NH_4-N)	mg/L				0.5	< 0.050	0.065	< 0.05	< 0.050	< 0.050	0.051	< 0.05	< 0.050	0.4	0.11	0.13	< 0.050	0.069	< 0.05	< 0.05	0.068	< 0.050	< 0.050
Ammonia (NH_4)	mg/L					< 0.065	0.084	< 0.065	< 0.065	< 0.065	0.066	< 0.065	< 0.065	0.52	0.14	0.17	< 0.065	0.089	< 0.0650	< 0.065	0.087	< 0.065	< 0.065
miscellaneous research																							
Turbidity	NTU				25																		
Total coliforms	cfu/100ml																						

** Results converted µg/L to mg/L

Exceedance of EAS 12:2014

Determinands not analysed in 2016/2017

Note: USEPA standard applied where no EAS12:2014 standard exists

Sample Location						SW01	SW01	SW01	SW01	SW2	SW02	SW02	SW03	SW03	SW03	SW04	SW04	SW04	SW04	SW05	SW05D	SW05	SW05	SW05	SW06	SW06	SW06	SW06	SW12	SW12[A]	SW12	SW12	SW17
Certificate number																																	
Date sampling						10-Feb-14	23-Apr-14	28-Jun-14	30-Sep-14	10-Feb-14	24-Apr-14	26-Jun-14	10-Feb-14	27-Jun-14	28-Sep-14	10-Feb-14	24-Apr-14	28-Jun-14	30-Sep-14	11-Feb-14	11-Feb-14	26-Apr-14	29-Jun-14	25-Sep-14	13-Feb-14	27-Apr-14	02-Jul-14	25-Sep-14	10-Feb-14	21-Apr-14	28-Jun-14	26-Sep-14	26-Jun-14
Location descritpion						Tangi River near MFNP entrance				Opengor/Ajai River in MFNP			Kituna river in MFNP			Victoria Nile, near delta, MFNP				Victoria Nile at Paraa Ferry, MFNP					Victoria Nile 4 km upstream of Paraa Ferry, MFNP				Albert Nile at Pakwach village				Small pool near Tangi River in MFNP
Analysis	Unit	USEPA Water Quality Human Health Criteria	USEPA Water Quality Aquatic Life Criteria	WHO Guidelines (4th Edition 2011)	EAS 12:2014																												
Physical and chemical analyses																																	
pH		5.0 - 9.0	6.5-9		5.5-8.5	6.84	7.53	7.62	7.59	6.86	7.93	8.43	6.88	6.61	7.52	6.85	7.58	7.7	7.16	6.86	6.86	7.46	8.01	7.33	6.85	7.99	7.88	7.47	6.84	8.05	8.96	8.02	6.87
Temperature, C						28.33	32.61	26.73	27.89	24.4	29.89	31.69	27.72	26.36	33.71	29.29	28.71	30.52	29.02	26.48	26.48	28.83	28.74	29.11	26.28	29.25	27.83	27.81	28.63	29.13	29.35	28.68	26.33
EC, uS/cm					2500	278	240	378.7	204.3	375	243.7	403	141	74.3	0.2	81	113	120.8	122.5	79	79	117.3	119	117	81	115.6	118.2	118	196	281.1	264.4	187.2	1,187.30
ORP, mV						-107.9	59.6	47.4	59.3	-6.3	50.9	46.7	-24.8	126.9	41.2	3	128.8	45.5	71.8	21.5	21.5	57.5	39.8	90	44.1	68.6	43.5	68.1	-49	45.7	31.8	38.6	-91.7
Diss. O_2, mg/L						5.32	5.16	3.59	6.62	5.7	6.92	7.16	2.92	1.34	6.84	6.35	7.3	7.99	5.39	8.02	8.02	8.72	10.3	9.33	8.99	9.39	8.94	8.55	4.59	6.9	9.69	7.15	0.02
Resistivity, Ω-cm						3,600	4,220	2,556	4,641	2,700	3,752	2,200	7,100	13,119	4,012,066	12,400	8,260	7,486	7,585	12,600	12,600	7,941	7,842	7,927	12,300	8,001	8,028	8,043	5,100	3,298	3,492	4,978	821
Salinity, PSU						0.13	0.1	0.2	0.1	0.18	0.1	0.2	0.06	0	0	0.04	0.1	0.1	0.1	0.04	0.04	0.1	0.1	0.1	0.06	0.1	0.1	0.1	0.09	0.1	0.1	0.1	0.6
TDS, mg/L					1500	935	156	246	133	188	158	262	70	48	0	40	73	79	80	40	40	76	77	76	41	75	77	77	98	183	172	122	772
Metals																																	
Arsenic (As)**	mg/L	0.018	0.15	0.01	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Barium (Ba)**	mg/L	0.1		0.7	0.7	0.17	0.16	0.19	0.23	0.11	0.08	0.078	0.17	0.53	0.2	<0.050	<0.050	<0.050	0.053	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.057	0.13	0.053	<0.050	0.31
Uranium (U)	µg/L	-		0.03	-	-	< 0.0002	0.0008	0.0034	-	< 0.0002	0.0004	-	< 0.0002	0.0007	-	< 0.0002	< 0.0002	< 0.0002	-	-	< 0.0002	< 0.0002	< 0.0002	-	< 0.0002	< 0.0002	< 0.0002	-	0.0002	0.0002	< 0.0002	0.0005
Calcium	mg/L	-		-	150	40	18	40	21	30	15	30	16	22	9.5	7.5	7.6	9.4	8.6	8.3	8.2	8.8	9.4	8.3	7.8	7.8	9.5	8.5	10	83	11	8.8	34
Cadmium (Cd)**	mg/L	0.005	0.00025	0.003	0.003	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040
Cobalt (Co)	µg/L	-		-	-	< 3.0	3	< 3	4.3	< 3.0	< 3	< 3	5.1	5.1	< 3.0	< 3.0	< 3	< 3	< 3.0	< 3.0	< 3.0	< 3	< 3	< 3.0	< 3.0	< 3	< 3	< 3.0	< 3.0	< 3	< 3	< 3.0	9
Chromium (Cr)**	mg/L	0.01	0.0074	0.05	0.05	< 0.001	0.0036	0.0015	0.0017	< 0.001	0.0071	0.0021	< 0.001	0.0034	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.0062
Copper (Cu)**	mg/L	1.3		2	1	< 0.005	0.0056	< 0.005	0.0067	< 0.005	0.0052	< 0.005	< 0.005	0.016	0.0062	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.015
Iron (Fe)	mg/L	-	1	-	0.3	0.93	2.6	1.1	2.5	0.82	4	0.67	1.9	5	1.8	0.44	0.55	0.41	1.1	0.22	0.23	0.59	0.53	0.56	0.28	0.4	0.44	0.58	0.23	0.58	0.18	0.28	9.5
Mercury (Hg)**	mg/L	-	0.00077	0.006	0.001	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050
Magnesium	mg/L				100	17	7.6	15	9.4	12	7.2	12	5.5	5.4	2.9	3.2	3.1	3.4	3.5	3.7	3.7	3.2	3.3	3.4	3.2	3.1	3.4	3.4	12	42	10	6.6	15
Manganese	mg/L	50		-	0.1	0.22	0.2	0.37	0.26	0.12	0.079	0.032	0.53	0.31	0.07	0.027	0.039	0.025	0.086	0.024	0.025	0.035	0.037	0.05	0.023	0.03	0.033	0.043	0.026	< 0.01	0.016	0.025	0.79
Nickel (Ni)**	mg/L	0.61	0.0052	0.07	0.02	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0088	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.018
Lead (Pb)**	mg/L	-	0.0025	0.01	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.011	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0053
Potassium	mg/L	-	-	-	-	6	7.7	5.7	4.2	7.7	6.8	5.8	5.5	6.1	6.5	3.3	3.7	3.8	3.8	3.9	3.9	3.8	3.7	3.4	3.3	3.7	3.9	3.5	19	5	16	9	10
Sodium	mg/L	-	-	-	200	33	14	29	13	77	25	45	28	7.6	4	12	11	13	13	13	13	12	12	12	12	12	13	12	32	83	28	19	190
Zinc (Zn)**	mg/L	7.4	0.12	-	5	0.017	0.09	< 0.01	< 0.01	< 0.01	0.037	< 0.01	0.012	< 0.01	< 0.01	< 0.01	0.03	< 0.01	< 0.01	< 0.01	0.011	0.056	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.38	< 0.01	< 0.01	0.018
Mono Aromatic Hydrocarbons																																	
Benzene	µg/L	2.2		10	10	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	0.34	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2
Toluene	µg/L	1300		700	700	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2
Ethylbenzene	µg/L	530		300	-	< 0.20	0.22	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	1.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	0.71	0.25	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2
o-Xylene	µg/L	-		-	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	0.36	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2
m,p-Xylene	µg/L	-		-	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2
Xylenes (sum)	µg/L	-		500	500	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40	< 0.4
BTEX (sum)	µg/L	-		-	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Petroleum Hydrocarbons																																	
TPH (C10-C12)	µg/L	-			-	5.4	< 4	4.6	< 4.0	< 4.0	< 4	< 4	< 4.0	< 4	< 4.0	< 4.0	< 4	< 4	< 4.0	5.4	< 4.0	< 4	< 4	< 4.0	< 4.0	< 4	< 4	4.2	< 4.0	< 4	< 4	4	< 4
TPH (C12-C16)	µg/L	-			-	< 5.0	< 5	< 5	10	< 5.0	15	< 5	< 5.0	< 5	5.4	< 5.0	< 5	< 5	6.8	< 5.0	9.3	< 5	< 5	< 5.0	< 5.0	< 5	< 5	5.1	7.5	12	< 5	10	< 5
TPH (C16-C21)	µg/L	-			-	< 6.0	< 6	7.9	< 6.0	< 6.0	< 6	6.1	< 6.0	< 6	7.9	< 6.0	8.9	6.9	< 6.0	< 6.0	19	< 6	< 6	< 6.0	< 6.0	< 6	< 6	8.5	6.9	< 6	< 6	< 6.0	< 6
TPH (C21-C30)	µg/L	-			-	12	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	13	< 10	< 10	13	40	< 10	< 10	< 10	13	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
TPH (C30-C35)	µg/L	-			-	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0	8.3	17	5.1	< 5	< 5.0	11	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0	< 5
TPH (C35-C40)	µg/L	-			-	< 8.0	< 8	< 8	< 8.0	< 8.0	< 8	< 8	< 8.0	< 8	< 8.0	< 8.0	< 8	< 8	< 8.0	< 8.0	< 8.0	< 8	< 8	< 8.0	< 8.0	< 8	< 8	< 8.0	< 8.0	< 8	< 8	< 8.0	< 8
TPH Sum (C10-C40)	µg/L	-			-	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	93	< 38	< 38	< 38	38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38
Inorganic Compounds		-																															
Bromide	mg/L	-			0.01	< 0.30	< 0.3	< 0.3	< 0.30	< 0.60	< 0.3	< 0.3	< 0.30	< 0.3	< 0.30	< 0.30	< 0.3	< 0.3	< 0.30	< 0.30	< 0.30	< 0.3	< 0.3	< 0.30	< 0.30	< 0.3	< 0.3	< 0.30	< 0.30	< 0.3	< 0.3	< 0.30	< 0.3
Chloride	mg/L	-	230		250	13	4.9	< 0.2	2	48	13	22	1.5	2.6	1.7	5.7	5	5	5.5	5.6	5.6	5	4.9	4.8	5.5	5.3	5	4.8	12	9.1	9.4	7.1	220
Fluoride	mg/L	-		1.5	1.5	0.82	0.39	< 0.05	0.3	2	0.72	1.1	0.39	0.22	0.22	0.43	0.3	0.3	0.39	0.38	0.4	0.38	0.31	0.37	0.38	0.39	0.3	0.38	0.57	0.19	0.7	0.43	0.63
Sulphate	mg/L	-			400	13	8	1.5	2.8	53	16	24	4.1	3.6	1.1	0.71	1.7	2.9	1.3	0.9	1.3	1.9	1.3	1.5	1	8.6	2.7	1.9	4.9	46	28	2.9	27
Inorganic Compounds		-																															
Ortho-phosphate (PO4-P)	mg P/L	-		-	2.2	0.4	0.59	0.36	0.34	0.28	0.41	0.4	< 0.060	0.34	0.26	< 0.060	< 0.0600	< 0.0600	< 0.060	< 0.060	< 0.060	< 0.0600	< 0.0600	< 0.060	< 0.060	< 0.0600	< 0.0600	< 0.060	< 0.060	< 0.060	< 0.0600	< 0.0600	< 0.060	< 0.0600
Ortho-phosphate (PO4)	mg PO4/L	-		-		0.13	0.19	0.12	0.11	0.093	0.13	0.13	< 0.020	0.11	0.086	< 0.020	< 0.02	< 0.02	< 0.020	< 0.020	< 0.020	< 0.02	< 0.02	< 0.020	< 0.020	< 0.02	< 0.02	< 0.020	< 0.020	< 0.02	< 0.02	< 0.020	< 0.02
Nitrate equivalent NO3-N	mg N/L	10,000		-		0.97	1.2	< 0.9	< 0.90	< 0.90	< 0.9000	< 0.9	< 0.90	4.1	< 0.90	1.2	1.1	0.93	< 0.90	1.6	2.5	1.1	1.3	1.4	1.5	1.4	1.6	1.4	2.3	1.2	1.1	1.2	< 0.9
Nitrate (NO3)	mg/L	-		50	45	< 0.010	0.031	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	0.01	0.011	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01
Nitrite as NO2-N	mg N/L	-		-		0.22	0.26	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	0.92	< 0.20	0.28	0.26	0.21	< 0.20	0.37	0.57	0.25	0.28	0.31	0.34	0.32	0.35	0.32	0.53	0.26	0.24	0.27	< 0.2
Nitrite (NO2)	mg/L	-		3	0.003	< 0.030	0.1	< 0.03	< 0.030	< 0.030	< 0.0300	< 0.03	< 0.030	0.033	0.036	< 0.030	< 0.0300	< 0.03	< 0.030	< 0.030	< 0.030	< 0.0300	< 0.03	< 0.030	< 0.030	< 0.0300	< 0.03	< 0.030	< 0.030	< 0.0300	< 0.03	< 0.030	< 0.03
Ammonium (NH_4-N)	mg/L				0.5	< 0.050	0.067	0.06	< 0.050	0.11	0.053	< 0.05	0.14	< 0.05	< 0.050	< 0.050	< 0.05	0.082	< 0.050	< 0.050	< 0.050	< 0.05	< 0.05	< 0.050	< 0.050	< 0.05	< 0.05	< 0.050	0.1	< 0.05	< 0.05	< 0.050	0.051
Ammonia (NH_3)	mg/L					< 0.065	0.086	0.077	< 0.065	0.14	0.068	< 0.065	0.18	< 0.065	< 0.065	< 0.065	< 0.0650	0.11	< 0.065	< 0.065	< 0.065	< 0.0650	< 0.065	< 0.065	< 0.065	< 0.0650	< 0.065	< 0.065	0.13	< 0.0650	< 0.065	< 0.065	0.066
miscellaneous research																																	
Turbidity	NTU				25																												
Total coliforms	cfu/100ml																																

** Results converted µg/L to mg/L

Exceedance of EAS 12:2014

Determinands not analysed in 2016/2017

Note: USEPA standard applied where no EAS12:2014 standard exists

Annex 03: Sediment Samples Analysis Results From 2016 – 2017 ESIA Field Campaigns

Sample Location			SE1	SE2	SE3	SE4	SE5	SE5 B/BN
Certificate number			SE2-1612	SE3-1612	SE1-1612	SE4-161106	SE5-170614 B/BS	SE5-170614 B/BN
Date sampling			16/12/2016	16/12/2016	16/12/2016	06/11/2016	14-06-2017	14-06-2017
Location descritpion			Victoria Nile central channel	Victoria Nile 8 m from south bank	Victoria Nile 10 m from north bank	Lake Albert near shore	Bridge Barge crossing on the north bank of the Nile	Bridge Barge crossing on the south bank of the Nile
Analysis	Units	TEC (McDonald et al)						
Metals								
Arsenic (As)	mg/kg	9.8	<3.0	<3.0	<3.0	<3.0	<4.0	<4.0
Antimony (Sb)	mg/kg	2	<3.0	<3.0	<3.0	<3.0	<1.0	<1.0
Barium (Ba)	mg/kg		11	29	140	58	230	<15
Beryllium (Be)	mg/kg		<1.0	<1.0	1.2	<1.0	<1.0	<1.0
Cadmium (Cd)	mg/kg	0.99	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Chromium (Cr)	mg/kg	43	7.8	9.1	50	15	110	27
Cobalt (Co)	mg/kg		<2.0	<2.0	11	2.1	21	2.4
Copper (Cu)	mg/kg	32	<3.0	<3.0	13	<3.0	32	<5.0
Mercury (Hg)	mg/kg	0.18	<0.050	<0.050	<0.050	<0.050	0.05	<0.050
Lead (Pb)	mg/kg	36	<3.0	<3.0	7.5	<3.0	14	<13
Molybdenum (Mo)	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.5	<1.5
Nickel (Ni)	mg/kg	23	2.3	2.3	22	2.1	43	4.8
Selenium (Se)	mg/kg		<5.0	<5.0	<5.0	<5.0	8.9	1
Tin (Sn)	mg/kg		<5.0	<5.0	<5.0	<5.0	<6.0	<6.0
Vanadium (V)	mg/kg		3.9	4.2	41	18	96	15
Zinc (Zn)	mg/kg	120	<10	<10	30	<10	55	<17
Total Petrolem Hydrocarbons								
C10-C12 Petroleum Hydrocarbons	mg/kg		<3.0	<3.0	<3.0	<3.0	<12	<3.0
C12-C16 Petroleum Hydrocarbons	mg/kg		<5.0	<5.0	<5.0	<5.0	<20	<5.0
C16-C21 Petroleum Hydrocarbons	mg/kg		<6.0	<6.0	<6.0	<6.0	<24	<6.0
C21-C30 Petroleum Hydrocarbons	mg/kg		<12	<12	<12	<12	<48	<12
C30-C35 Petroleum Hydrocarbons	mg/kg		6.4	6	8.9	<6.0	<24	<6.0
C35-C40 Petroleum Hydrocarbons	mg/kg		<6.0	<6.0	<6.0	<6.0	<24	<6.0
Total Petroleum Hydrocarbons	mg/kg		<38	<38	<38	<38	<150	<38
Mono Aromatic Hydrocarbons								
Benzene	mg/kg	57	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Toluene	mg/kg	890	<0.050	<0.050	0.13	<0.050	<0.050	<0.050
Ethylbenzene	mg/kg	25	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
m-Xylene & p-Xylene	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
o-Xylene	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Xylenes, total	mg/kg	25	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
BTEX, summation	mg/kg		<0.25	<0.25	<0.25	<0.25	<0.25	<0.25

Sample Location			SE1	SE2	SE3	SE4	SE5	SE5 B/BN
Certificate number			SE2-1612	SE3-1612	SE1-1612	SE4-161106	SE5-170614 B/BS	SE5-170614 B/BN
Date sampling			16/12/2016	16/12/2016	16/12/2016	06/11/2016	14-06-2017	14-06-2017
Location descritpion			Victoria Nile central channel	Victoria Nile 8 m from south bank	Victoria Nile 10 m from north bank	Lake Albert near shore	Bridge Barge crossing on the north bank of the Nile	Bridge Barge crossing on the south bank of the Nile
Analysis	Units	TEC (McDonald et al)						
Polycyclic Aromatic Hydrocarbons, PAH								
Naphthalene	mg/kg	176	<0.010	<0.010	<0.010	<0.010	-	-
Acenaphtylene	mg/kg	5.9	<0.010	<0.010	<0.010	<0.010	-	-
Acenaphtene	mg/kg	6.7	<0.010	<0.010	<0.010	<0.010	-	-
Fluorene	mg/kg	77.4	<0.010	<0.010	0.012	<0.010	-	-
Phenanthrene	mg/kg	204	<0.010	0.022	0.018	<0.010	-	-
Anthracene	mg/kg	57.2	<0.010	0.017	<0.010	<0.010	-	-
Fluoranthene	mg/kg	423	<0.010	0.012	0.015	<0.010	-	-
Pyrene	mg/kg	195	<0.010	<0.010	0.011	<0.010	-	-
Benzo(a)anthracene	mg/kg	108	<0.010	<0.010	<0.010	<0.010	-	-
Chrysene	mg/kg	166	<0.010	<0.010	0.011	<0.010	-	-
Benzo(b)fluoranthene	mg/kg	240	<0.010	<0.010	0.012	<0.010	-	-
Benzo(k)fluoranthene	mg/kg	240	<0.010	<0.010	<0.010	<0.010	-	-
Benzo(a)pyrene	mg/kg	150	<0.010	<0.010	<0.010	<0.010	-	-
Dibenzo(ah)anthracene	mg/kg	108	<0.010	<0.010	<0.010	<0.010	-	-
Benzo(ghi)perylene	mg/kg	170	<0.010	<0.010	<0.010	<0.010	-	-
Indeno(123cd)pyrene	mg/kg	200	<0.010	<0.010	<0.010	<0.010	-	-
PAH 10 VROM (sum)	mg/kg		<0.10	<0.10	<0.10	<0.10	-	-
PAH 16 EPA (sum)	mg/kg	1,610	<0.16	<0.16	<0.16	<0.16	-	-
Physical and chemical analyses								
Acidity (pH-CaCl2)	Std units		7.6	8	5.2		5.5	8.5
Calcium (Ca)	mg/kg	-	-	-	-	-	4200	650
Potassium (K)	mg/kg	-	-	-	-	-	2700	100
Magnesium (Mg)	mg/kg	-	-	-	-	-	4600	200
Sodium (Na)	mg/kg	-	-	-	-	-	210	40
Phosphorus total (P)	mg/kg	-	-	-	-	-	0.55	0.061
Phosphorus total (PO4)	mg/kg	-	-	-	-	-	1.7	0.19
Phosphorus total (P2O5)	mg/kg	-	-	-	-	-	1.2	0.14
Inorganic Compounds	mg/kg	-	-	-	-	-		
Nitrite (NO2-N)	mg/kg	-	-	-	-	-	<0.20	<0.20
Nitrite (NO2)	mg/kg	-	-	-	-	-	<0.60	<0.60
Nitrate (NO3-N)	mg/kg	-	-	-	-	-	<2.0	<2.0
Nitrate (NO3)	mg/kg	-	-	-	-	-	<9.0	<9.0

TILENGA PROJECT ESIA - APPENDIX M: Landscape and Visual

May 2018

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Figures

Appendix M: Landscape and Visual

Appendix M Landscape and Visual

M.1. Zone of Theoretical Visibility (ZTV)

A series of ZTVs have been prepared to illustrate the potential spread of visibility from each of the well pads in the north MFNP, individually and in-combination, shown on figures M.1-1 to M.1-11. ZTVs have been considered within the north MFNP to illustrate the theoretical visibility of long term change within the most sensitive part of this designated landscape. The production of ZTVs is one of the tools used to provide an indicative understanding of the potential spread of visibility, it is accepted that some short term operations would be more prominent such as drilling.

The ZTVs have been generated by analysis of a 3D digital elevation model (DEM) of the surrounding terrain and the Scheme using the following parameters:

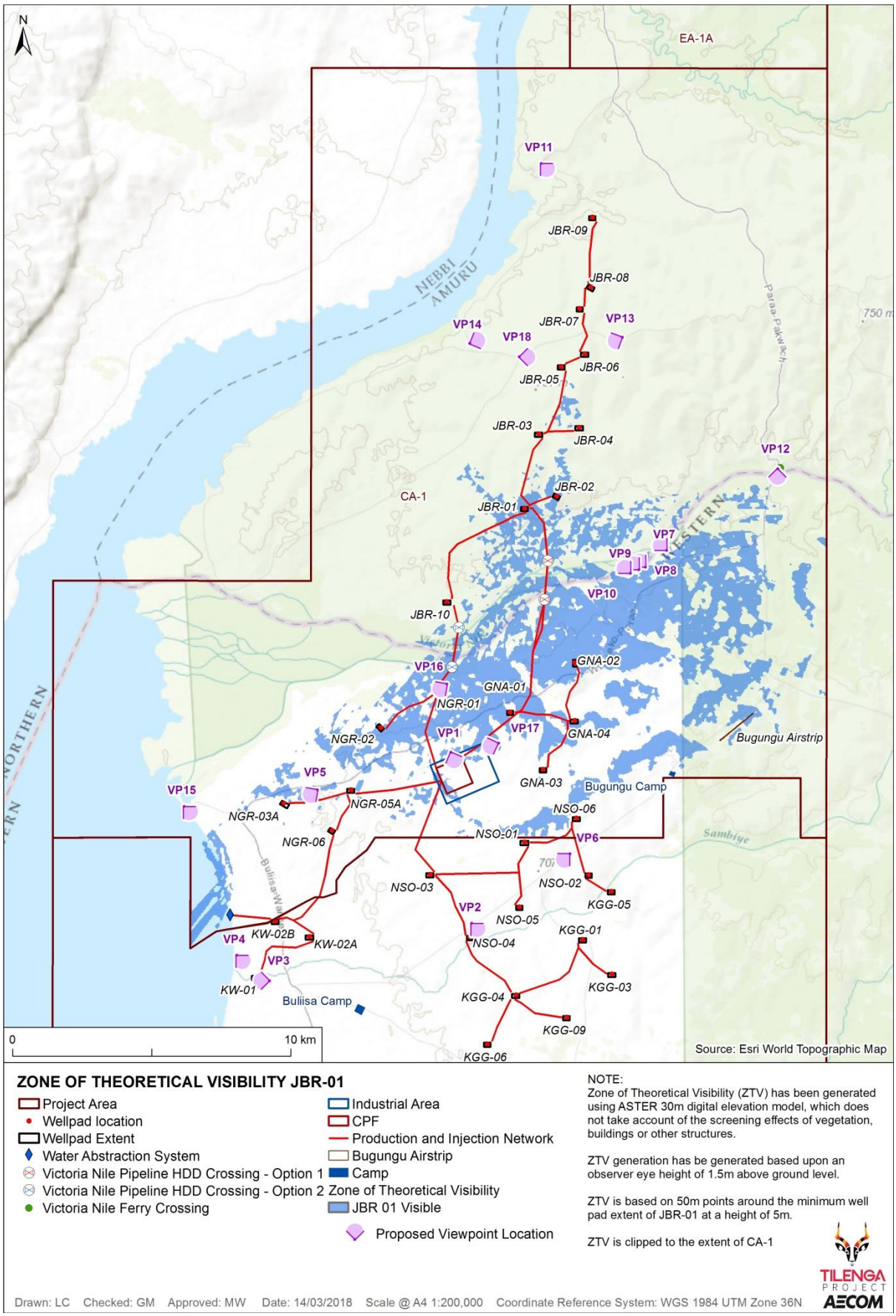
- Terrain model based on ASTER 30 metre (m) DEM dataset;
- Eye height of viewer set at 1.5 m; and
- Visibility assessed on the proposed well pad block height assumed at 5 m[1].

The output provides a graphical representation of the computer calculated inter-visibility between a viewer (at 1.5 m height) and the top of the 5 m block height.

M.1.1. Limitations

The ZTV is for illustrative purposes only and does not take into account the vegetation and micro topography between the 30 m DEM survey points. At the time of undertaking the ESIA, specific heights and dimensions of permanent Project components within the well pad sites were not available, however it is anticipated that no individual component would be greater than 5 m in height. Therefore ZTV is based on a block of 5 m rather than the individual Project component dimensions. The ZTV maps do not take account of the likely orientation of a viewer, such as the direction of travel and there is no allowance for reduction of visibility with distance, weather or light.
These limitations mean that the ZTV maps tend to overestimate the extent of the visibility, both in terms of the area from which the Project is visible and the extent of the Project, which is visible. It should be considered as a tool to assist in assessing the theoretical visibility of the Development and not a measure of the visual effect.

[1] It is accepted that some short term operations would be more prominent in height such as drilling however these are not permanent.



ZONE OF THEORETICAL VISIBILITY JBR-01

- Project Area
- Wellpad location
- Wellpad Extent
- Water Abstraction System
- Victoria Nile Pipeline HDD Crossing - Option 1
- Victoria Nile Pipeline HDD Crossing - Option 2
- Victoria Nile Ferry Crossing
- Industrial Area
- CPF
- Production and Injection Network
- Bugungu Airstrip
- Camp
- Zone of Theoretical Visibility
- JBR 01 Visible
- Proposed Viewpoint Location

NOTE:
Zone of Theoretical Visibility (ZTV) has been generated using ASTER 30m digital elevation model, which does not take account of the screening effects of vegetation, buildings or other structures.

ZTV generation has be generated based upon an observer eye height of 1.5m above ground level.

ZTV is based on 50m points around the minimum well pad extent of JBR-01 at a height of 5m.

ZTV is clipped to the extent of CA-1

Drawn: LC Checked: GM Approved: MW Date: 14/03/2018 Scale @ A4 1:200,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT AECOM

Figure M.1-1 Zone of Theoretical Visibility: JBR-01

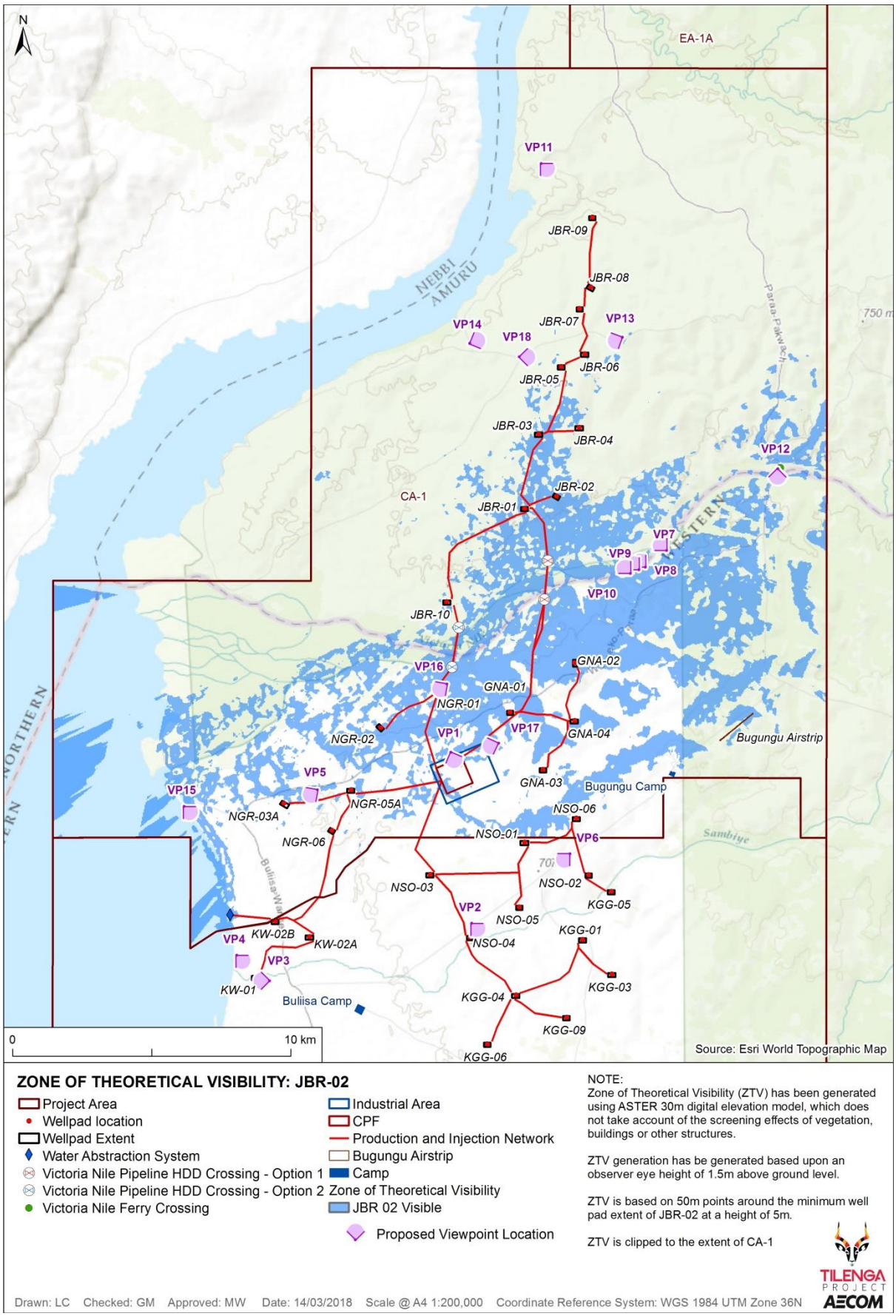


Figure M.1-2 Zone of Theoretical Visibility: JBR-02

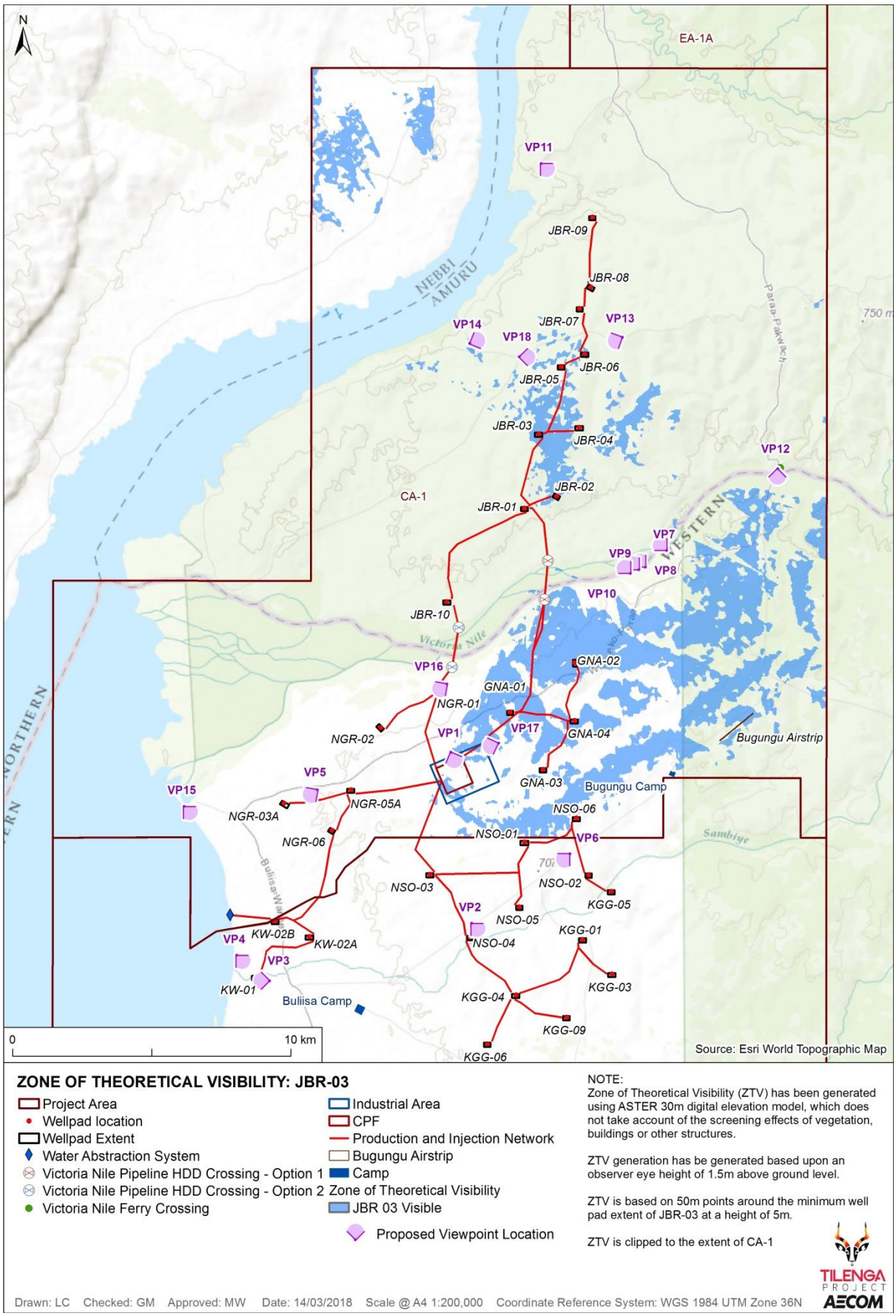


Figure M.1-3 Zone of Theoretical Visibility: JBR-03

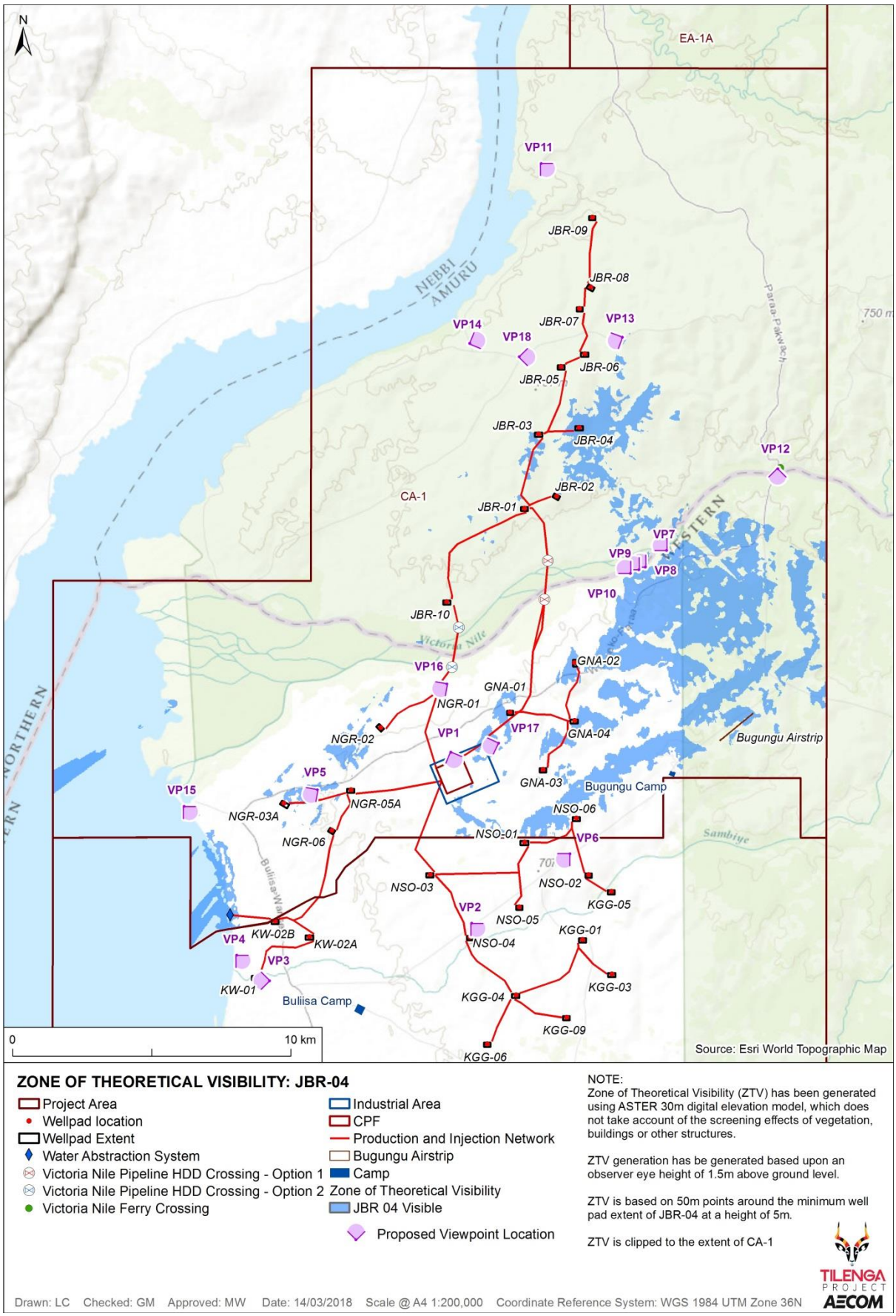


Figure M.1-4 Zone of Theoretical Visibility: JBR-04

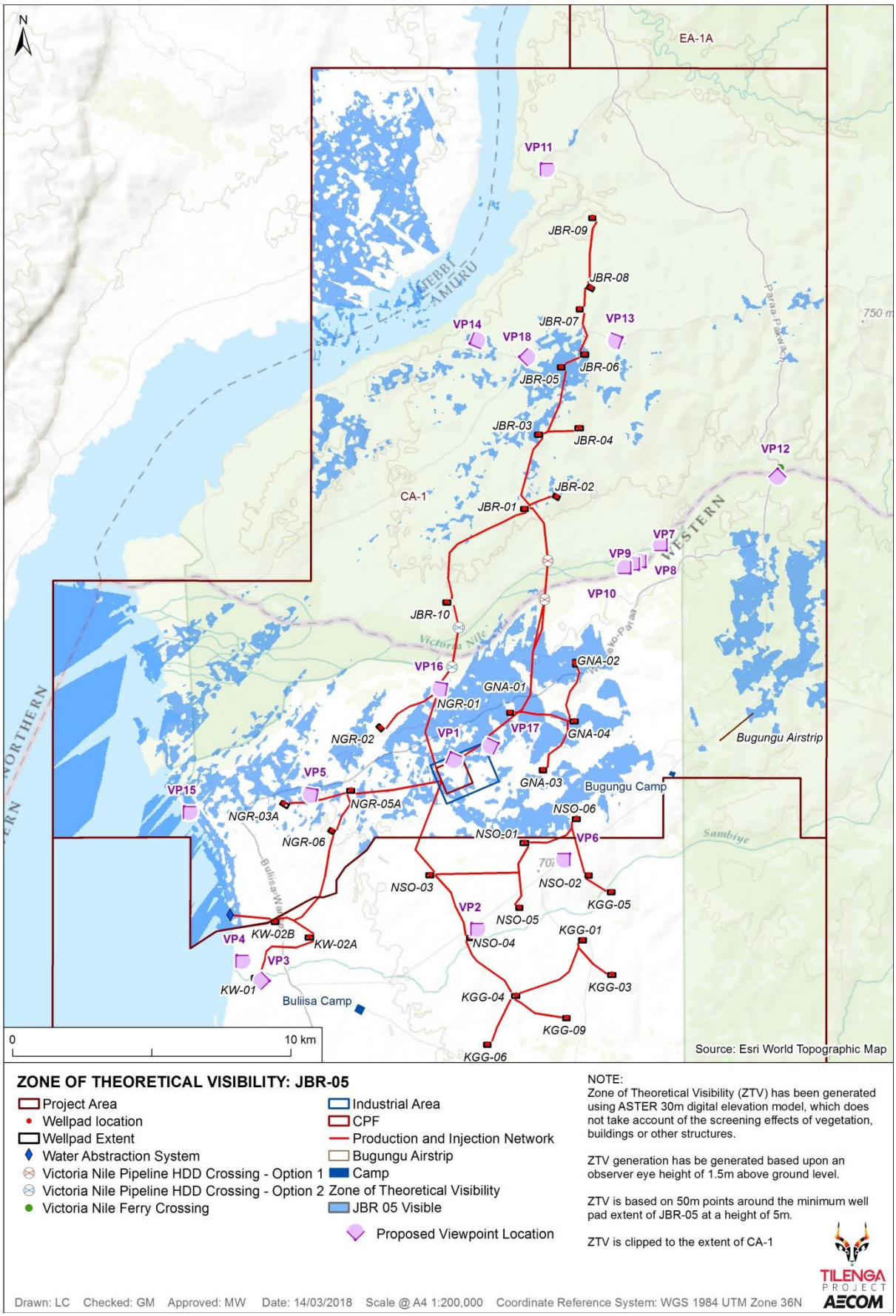


Figure M.1-5 Zone of Theoretical Visibility: JBR-05

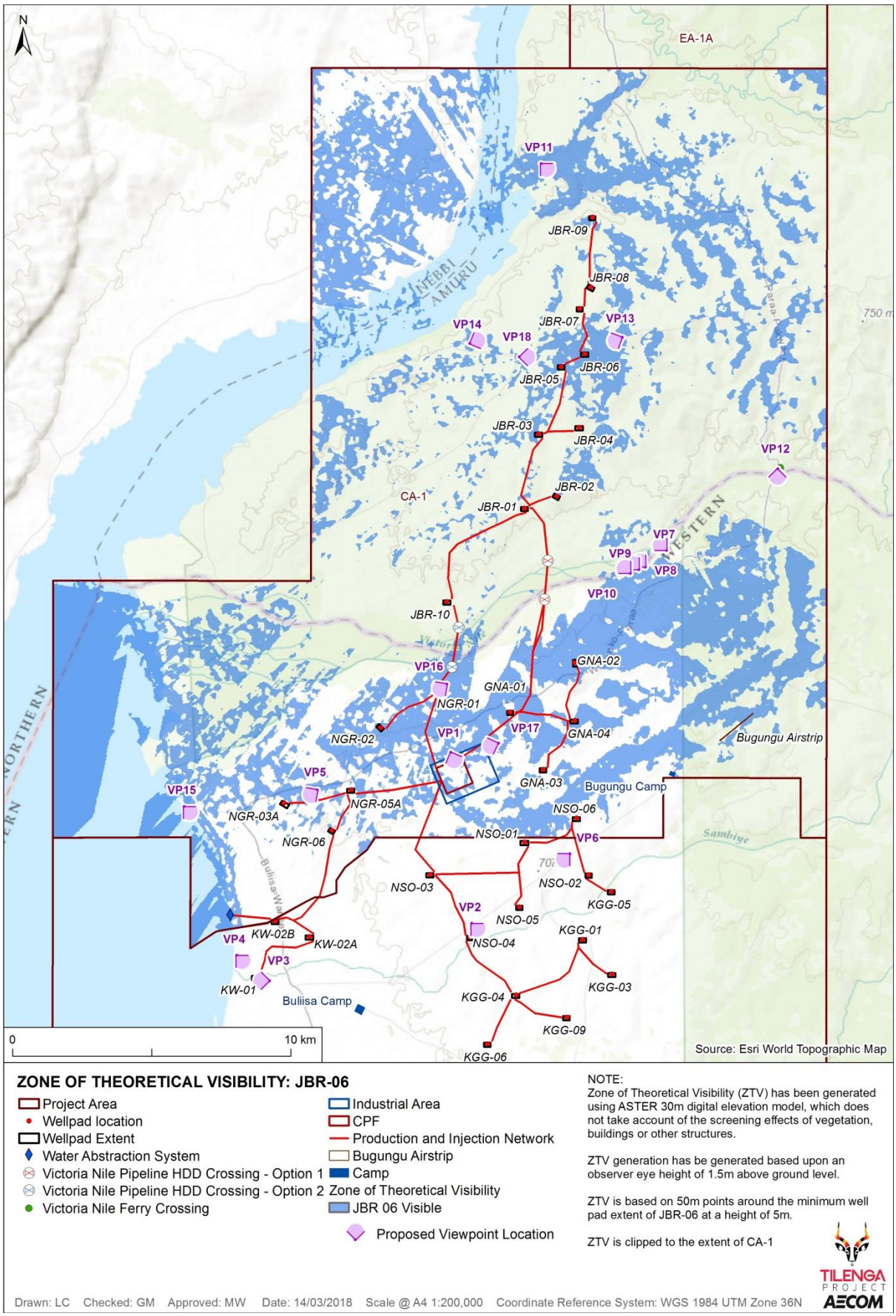


Figure M.1-6 Zone of Theoretical Visibility: JBR-06

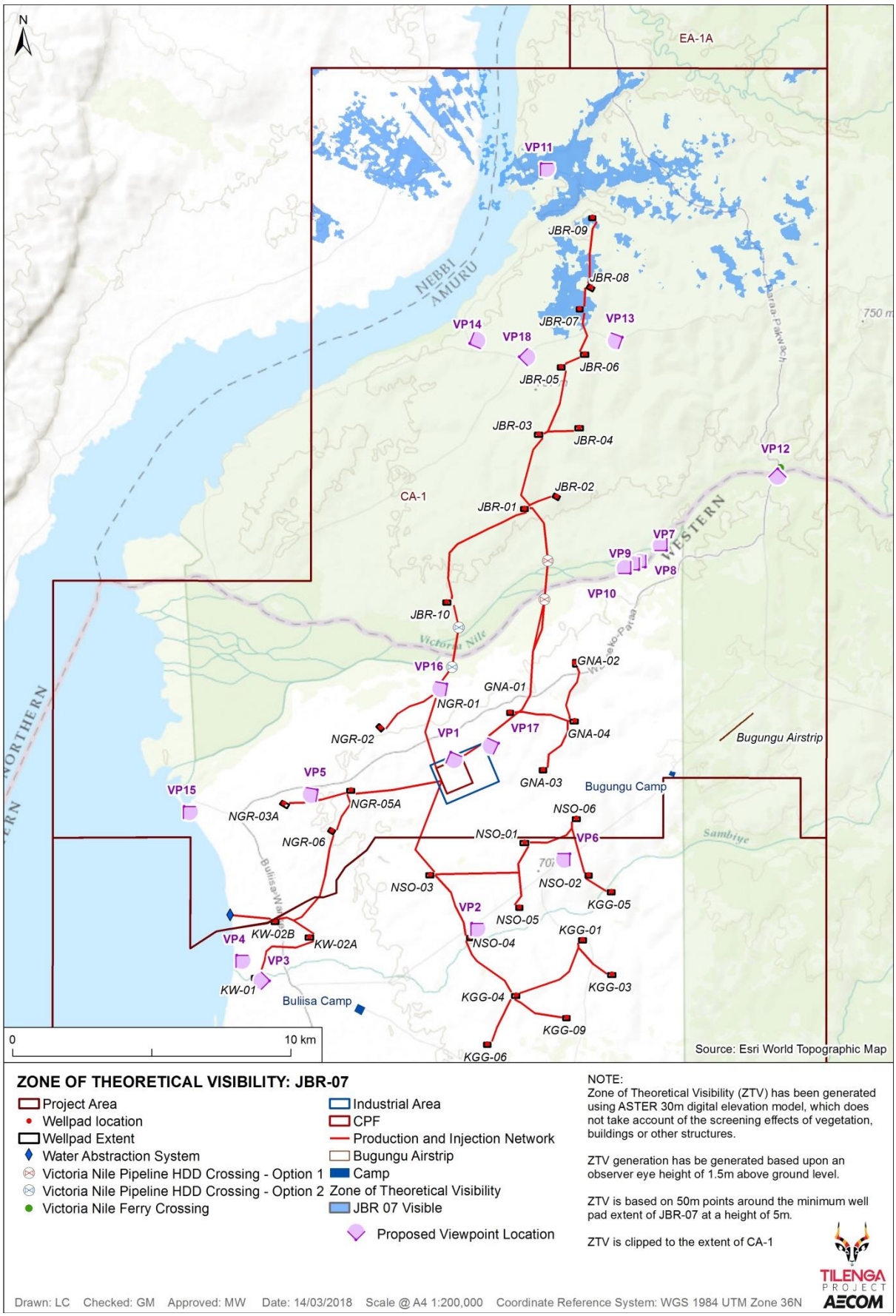


Figure M.1-7 Zone of Theoretical Visibility: JBR-07

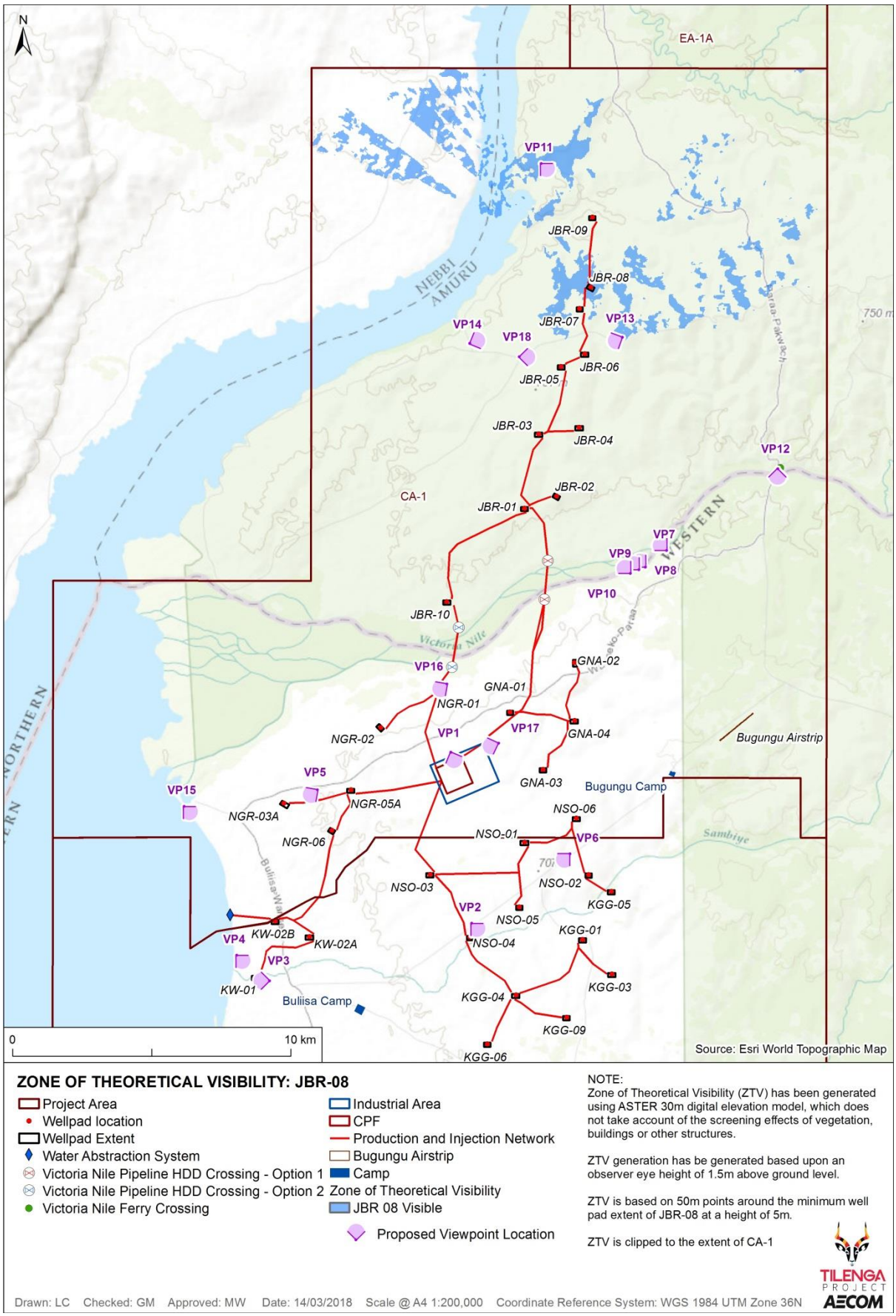


Figure M.1-8 Zone of Theoretical Visibility: JBR-08

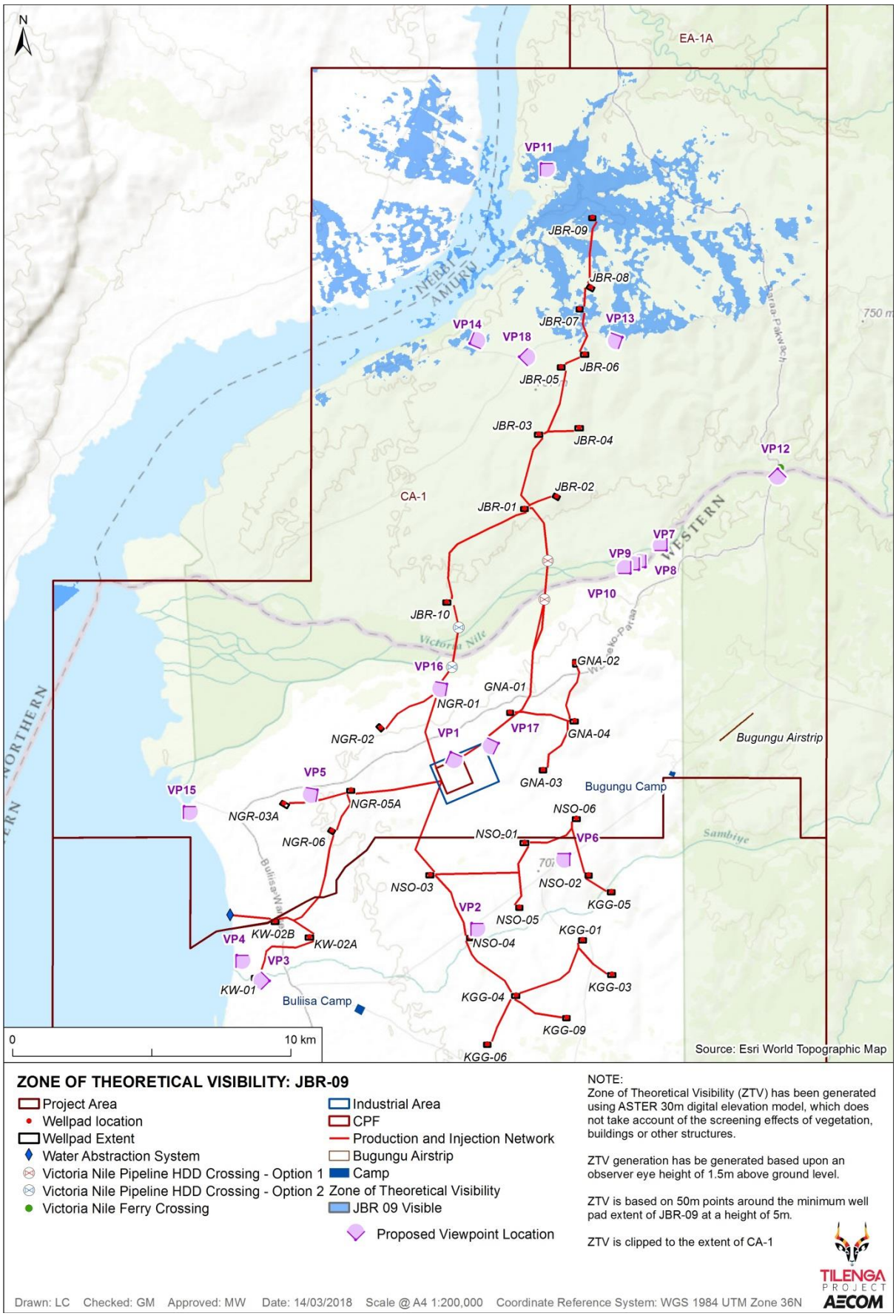


Figure M.1-9 Zone of Theoretical Visibility: JBR-09

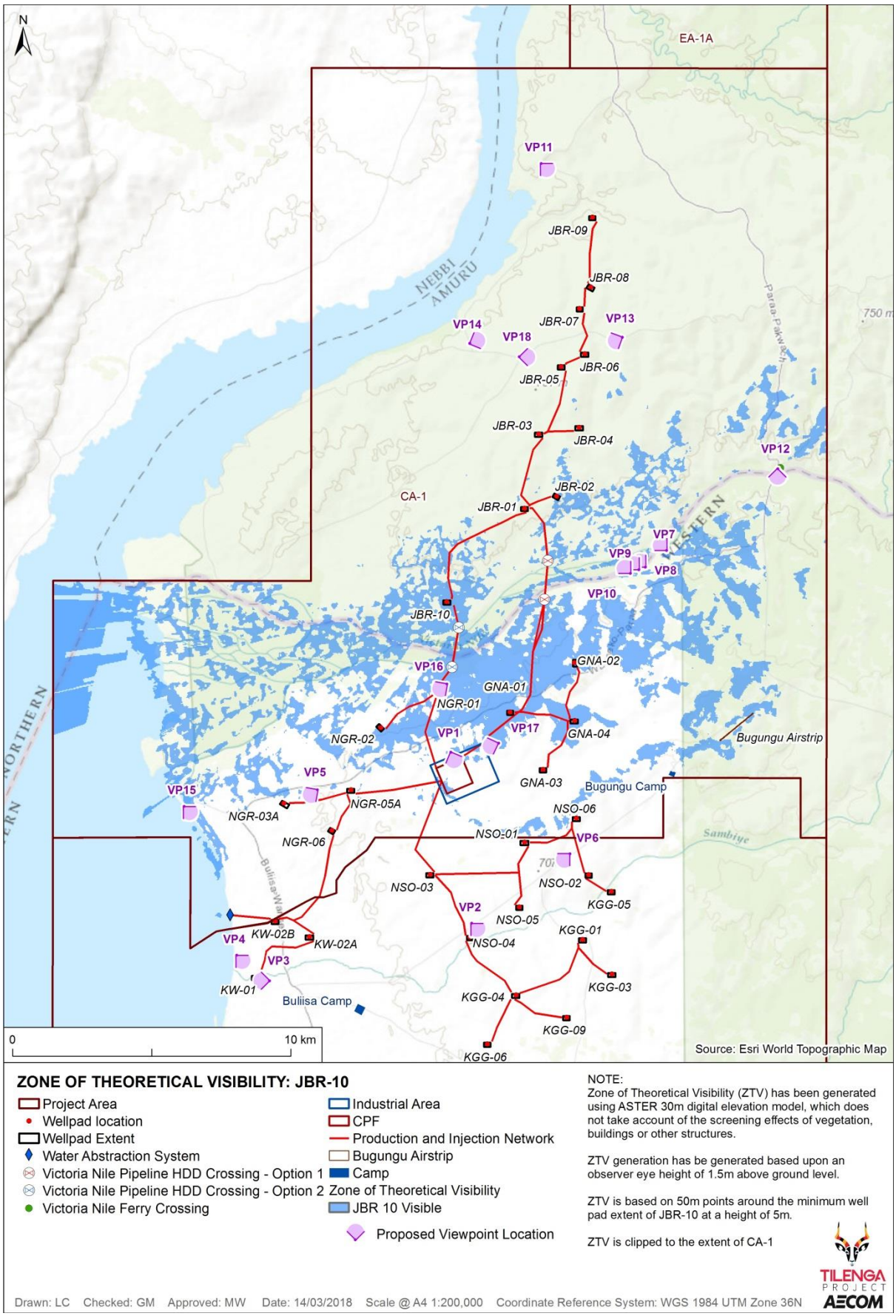


Figure M.1-10 Zone of Theoretical Visibility: JBR-10

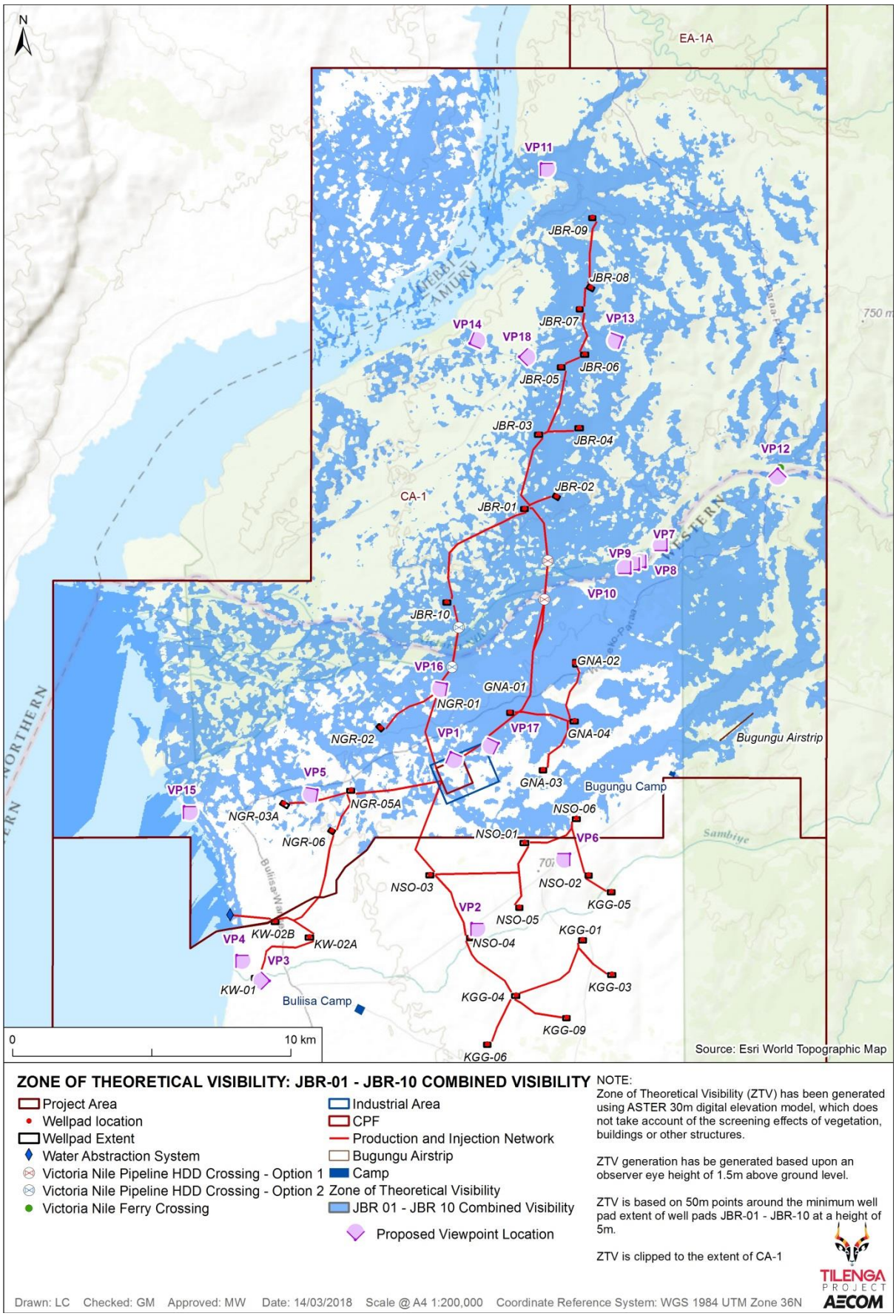


Figure M.1-11 Zone of Theoretical Visibility: JBR-1-10 Combined

M.2. Assessment of Impacts: Decommissioning

M.2.1. LCA 01 - Buliisa Lowland Pastoral Farmland

Sensitivity to Change**: Low**

Impact Magnitude:

At decommissioning the majority of the Project infrastructure would be removed and reinstated.

Much of the activity and decommissioning operations would be similar to those experienced during construction, and as such the scale and extent of change would be similar. However the duration of activities would be reduced.

It is anticipated that most of the Project components would be removed and land reinstated, however some Project infrastructure would remain. As such, impacts would not be completely reversible. Access roads would remain as would below ground pipelines limiting the potential for established or mature trees above.

There is the potential network of flat expanses at former well pad sites and the Industrial Area may lead to other further forms of development given their access to infrastructure.

Although decommissioning would be disruptive across pockets of this LCA once decommissioning activities and reinstatement is complete, the extent of change across this LCA would be less noticeable and as such the magnitude is considered to be **Low**.

Impact significance

Impact Significance: **Low Significance**

M.2.2. LCA 02 - Buliisa Lowland Rolling Farmland

Sensitivity to Change: **Low**

Impact Magnitude:

At decommissioning the majority of the Project infrastructure would be removed and reinstated.

Much of the activity and decommissioning operations would be similar to those experienced during construction, and as such the scale and extent of change would be similar. However the duration of activities would be reduced.

It is anticipated that most of the Project components would be removed and land reinstated, however some Project infrastructure would remain. As such impacts would not be completely reversible. Access roads would remain as would below ground pipelines limiting the potential for established vegetation above. Furthermore the network of flat expanses at former well pads sites and the Industrial Area may lead to other further forms of development given their access to infrastructure.

However, in the long term once decommissioning activities and reinstatement is complete the extent of change across this LCA would be less noticeable and as such the impact magnitude is considered to be **Low**.

Impact significance

Impact Significance: **Low Significance**

M.2.3. LCA 03 - Lake Albert Coastal Fringe

Sensitivity to Change: **Moderate**

Impact Magnitude:

At decommissioning the majority of the Project infrastructure would be removed and reinstated.

Much of the activity and decommissioning operations would be similar to those experienced during construction, and as such the scale and extent of change would be similar. However the duration of activities would be reduced.

It is anticipated that most of the Project components would be removed and land reinstated, however some Project infrastructure would remain. Remaining pipelines would limit the potential for mature tree vegetation to establish above. As such impacts would not be completely reversible. Given the limited footprint of the Project components in this LCA, once decommissioning has been completed the scale and extent of change would be barely perceptible, therefore the impact magnitude is considered to be Negligible.

Impact significance

Impact Significance: **Insignificant**

M.2.4. LCA 04 - River Nile Corridor

Sensitivity to Change**: High**

Impact Magnitude:

At decommissioning the majority of the Project infrastructure would be removed and reinstated. Much of the activity and decommissioning operations would be similar to those experienced during construction, and as such the scale and extent of change would be similar. However the duration of activities would be reduced.

Careful reinstatement of vegetation and topography within Murchison Falls National Park (MFNP) at well pad JBR-10 would be required to fully integrate into the landscape. Vegetation above pipeline would be reinstated such that any change to the key characteristics of this LCA would be barely perceptible.

In the short term, during decommissioning operations, the impact magnitude would be Low. Once decommissioning and reinstatement is completed the magnitude of impact would be **Negligible.**

Impact significance

Impact Significance: **Insignificant**

M.2.5. LCA 05 - Lake Albert-Victoria Nile Delta

Sensitivity to Change**: High**

Impact Magnitude:

Decommissioning activities are not anticipated within this LCA and activities in the neighboring LCA would not affect the setting and quality of this LCA. Therefore the impact magnitude is considered to be **Negligible**.

Impact significance

Impact Significance: **Insignificant**

M.2.6. LCA 06 - MFNP South, Rolling Woodland

Sensitivity to Change**: High**

Impact Magnitude:

Decommissioning activities at the Bugungu Airstrip have the potential to reduce the levels of use. As such any change to the character of this LCA would barely discernible and the impact magnitude would be **Negligible**.

Impact significance

Impact Significance: **Insignificant**

M.2.7. LCA 07 – MFNP North, Savanna Plateau

Sensitivity to Change**: High**

Impact Magnitude:

At decommissioning the majority of the Project infrastructure would be removed and reinstated. Much of the activity and decommissioning operations would be similar to those experienced during construction, and as such the scale and extent of change would be similar. However the duration of activities would be reduced.

It is anticipated that most of the Project components would be removed and land reinstated, however some Project infrastructure would remain. As such impacts would not be completely reversible. Remaining pipelines would limit the potential for mature trees to establish above.

The profiling of landform would go some way to reinstate the areas covered by well pads and would help re-assimilate this into the landscape. However, in the long term once decommissioning activities and reinstatement is complete the extent of change across this LCA would be less noticeable and as such the impact magnitude is considered to be **Low**.

Impact significance

Impact Significance: **Low Significance**

M.3. Potential Visual Impacts

M.3.1. Viewpoint 1- Kilomi

Sensitivity to Change**: Moderate**

Impact Magnitude:

The predicted extent of change would be similar to that experienced during construction. However, the duration of activity would be compressed into a shorter duration, and therefore the impact magnitude would reduce. The open clearings extending over the Industrial Area to the south would eventually be re-established with vegetation (or new facilities agreed and introduced), whilst buried pipelines to the southeast would remain void of mature trees. On balance the impact magnitude would reduce to **Low**.

Impact significance

Impact Significance: **Low Significance**

M.3.2. Viewpoint 2 - Kibambura

Sensitivity to Change**: Low**

Impact Magnitude:

At decommissioning, the predicted extent of change would be similar to that experienced during construction. However the duration of activity would be compressed into a shorter duration, as such the impact magnitude would reduce. The change in view would then be limited to open clearings in vegetation extending along the pipeline corridor and the impact magnitude would reduce to **Negligible**.

Impact significance

Impact Significance: **Insignificant**

M.3.3. Viewpoint 3 - Buliisa (West)

Sensitivity to Change**: Moderate**

Impact Magnitude:

Once the well pad site is reinstated, the change in view would be small, and although a flat expanse would remain, uncharacteristic infrastructure would be removed, some vegetation reinstated and the fundamental character of existing views re-established. Therefore the impact magnitude would be **Negligible.**

Impact significance

Impact Significance: **Insignificant**

M.3.4. Viewpoint 4 - Kisimo

Sensitivity to Change**: Low**

Impact Magnitude:

Once the well pad site is reinstated, the change in view would be barely perceptible from this distance and although a flat expanse would remain at the footprint of the well pad, uncharacteristic infrastructure would be removed. The impact magnitude would be **Negligible.**

Impact significance

Impact Significance: **Insignificant**

M.3.5. Viewpoint 5 - Kirama

Sensitivity to Change: **Moderate**

Impact Magnitude:

Once the well pad site is reinstated, the change in view would be barely perceptible from this distance and although a flat expanse would remain at the footprint of the well pad, uncharacteristic infrastructure would be removed. In the longer term once decommissioning is complete, the Project would result in a barely perceptible change in views therefore the impact magnitude is considered to be **Negligible.**

Impact significance

Impact Significance: **Insignificant**

M.3.6. Viewpoint 6 - Ngwedo Farm

Sensitivity to Change**: Low**

Impact Magnitude:

In the longer term once decommissioning is complete, the visible extent of change would be barely perceptible, therefore the impact magnitude is considered to be **Negligible**.

Impact significance

Impact Significance: **Insignificant**

M.3.7. Viewpoint 7 - Baker's Lodge

Sensitivity to Change**: High**

Impact Magnitude:

In the longer term once decommissioning is complete, the visible extent of change would be barely perceptible, therefore the impact magnitude is considered to be **Negligible**.

Impact significance

Impact Significance: **Insignificant**

M.3.8. Viewpoint 8 - Kabalega Wilderness Lodge

Sensitivity to Change**: High**

Impact Magnitude:

At decommissioning, activities would be similar to those experienced during construction. However the duration of activity would be compressed into a shorter duration, and therefore the impact magnitude would reduce.

In the longer term once decommissioning is complete, the visible extent of change would be barely perceptible, therefore the impact magnitude is considered to be **Negligible**.

Impact significance

Impact Significance: **Insignificant**

M.3.9. Viewpoint 9 - Murchison River Lodge

Sensitivity to Change: **High**

Impact Magnitude:

In the longer term once the well pad site is reinstated and decommissioning is complete, the visible extent of change would be barely perceptible, therefore the impact magnitude is considered to be **Negligible**.

Impact significance

Impact Significance: **Insignificant**

M.3.10. Viewpoint 10- Nile River Lodge

Sensitivity to Change**: High**

Impact Magnitude:

In the longer term once decommissioning is complete, and vegetation has been established, there would be no discernible change, therefore the impact magnitude is considered to be **Negligible.**

Impact significance

Impact Significance: **Insignificant**

M.3.11. Viewpoint 11 - Pakuba Safari lodge

Sensitivity to Change: **High**

Impact Magnitude:

At decommissioning, activities would be similar to those experienced during construction. In the longer term, once decommissioning is complete the composition of the view would return to the existing state. Therefore the impact magnitude is considered to be **Negligible.**

Impact significance

Impact Significance: **Insignificant**

M.3.12. Viewpoint 12 - Paraa Ferry Crossing

Sensitivity to Change**: High**

Impact Magnitude:

At decommissioning, activities would be similar to those experienced during construction. After decommissioning is complete, there would be no discernible change in the view therefore the impact magnitude would **Negligible**.

Impact significance

Impact Significance: **Negligible**

M.3.13. Viewpoint 13 - Buligi Track, Delta Track

Sensitivity to Change**: High**

Impact Magnitude:

At decommissioning, activities would be similar to those experienced during construction. In the longer term once reinstatement earthworks have been re-integrated, the visible extent of change would be limited to the flat expanses of the three well pad sites and gaps in trees along buried pipeline routes; however, this would be barely perceptible from this location. Therefore the impact magnitude is considered to be **Negligible**.

Impact significance

Impact Significance: **Negligible**

M.3.14. Viewpoint 14 - Albert Track

Sensitivity to Change**: High**

Impact Magnitude:

At decommissioning, activities would be similar to those experienced during construction. However the duration of activity would be less than the construction period, therefore the impact magnitude would reduce.

Once activities have been completed, the extent of change in views would be limited to the land above buried pipelines, where trees appear in the existing view. As pipelines are likely to remain in situ, mature trees are unlikely to establish in similar locations. The flat expanses of the former well pads would not be discernible from this location.

Overall given the distance to the former Project components, the overall extent of change would be barely perceptible. As such the impact magnitude would be **Negligible**.

Impact significance

Impact Significance: **Negligible**

M.3.15. Viewpoint 15 - Wanseko Beach

Sensitivity to Change: **Moderate**

Impact Magnitude:

At decommissioning, activities would be similar to those experienced during construction. The overall extent of change in the view would be barely discernible. As such the impact magnitude would be **Negligible**.

Impact significance

Impact Significance: **Negligible**

M.3.16. Viewpoint 16 - Kasinyi (West)

Sensitivity to Change: **Moderate**

Impact Magnitude:

Once the well pad site is reinstated, the change in view would be barely perceptible from this distance and although a flat expanse would remain at the footprint of the well pad, uncharacteristic infrastructure would be removed. In the longer term, once decommissioning is complete the impact magnitude is considered to be **Negligible.**

Impact significance

Impact Significance: **Insignificant**

M.3.17. Viewpoint 17 - Kasinyi (East)

Sensitivity to Change: **Moderate**

Impact Magnitude:

The predicted extent of change would be similar to that experienced during construction. However the duration of activity would be compressed into a shorter duration, and therefor the impact magnitude would reduce.

The open clearings extending over the Industrial Area at the background of views west would eventually be re-established with vegetation (or new facilities agreed and introduced), whilst the road corridor would remain at the greater 10 m width .The impact magnitude would reduce to **Low**.

Impact significance

Impact Significance: **Low Significance**

M.3.18. Viewpoint 18 - Buligi Track (Pakuba Airfield)

Sensitivity to Change**: High**

Impact Magnitude:

At decommissioning, activities would be similar to those experienced during construction. In the longer term, once reinstatement earthworks have been re-integrated, the visible extent of change would be limited to the flat expanses of the three well pad sites and gaps in trees along buried pipeline routes; however, this would be barely perceptible from this location. Therefore the impact magnitude is considered to be **Negligible**.

Impact significance

Impact Significance: **Negligible**