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LAMPIRAN

Lampiran 1. Surat Keterangan Melakukan Penelitian

KEMENTERIAN PENDIDIKAN, KEBUDAYAAN, RISET, DAN TEKNOLOGI
UNIVERSITAS HASANUDDIN
FAKULTAS TEKNIK
Jl. Poros Malino Km. 6, Bontomarannu (92172) Gowa, Sulawesi Selatan,
Telp. (0411) 586015,586262 Fax (0411) 586015,
http://eng.unhas.ac.id Email : teknik@unhas.ac.id

Nomor: 15430/UN4.7.1/PT.01.04/2023 18 Juli 2023
Hal : Permohonan Data Penelitian Mahasiswa

Kepada Yth.
Balai Besar Laboratorium Kesehatan Makassar
Jl. Perintis Kemerdekaan KM.11, Tamalanrea Indah, Kec. Tamalanrea, Kota Makassar

Dengan hormat, kami sampaikan bahwa dalam rangka penyelesaian skripsi / tugas akhir pada Program Studi Teknik Lingkungan Fakultas Teknik Universitas Hasanuddin, maka kami mohon kebijaksanaan Bapak/Ibu kiranya berkenan memberikan kesempatan melakukan pengambilan data penelitian bagi mahasiswa :

Nama (NIM)	:	Andi Raihana Afiyah (D131191071)
Judul TA	:	Analisis Penyebaran Logam Berat Timbal (Pb) dan Kadmium (Cd) pada Sedimen di Perairan Sungai Tallo
Tujuan	:	Izin Penelitian

Atas perhatian dan kerjasama yang baik kami sampaikan terima kasih.

a.n. Dekan,
Wakil Dekan Bidang Akademik dan Kemahasiswaan

Dr. Amil Ahmad Ilham, S.T., M.IT
NIP. 197310101998021001

Tembusan :
1. Ketua Departemen Teknik Lingkungan FT-UH
2. Arsip

Lampiran 2. Hasil Pengujian Laboratorium Kadar Logam Berat

KEMENTERIAN KESEHATAN RI
DIREKTORAT JENDERAL PELAYANAN KESEHATAN
BALAI BESAR LABORATORIUM KESEHATAN MAKASSAR
Jl. Perintis Kemerdekaan KM. 11 Tamalanrea Makassar 90245

LAPORAN HASIL UJI
Report of Analysis
No : 23019349 - 23019369 / LHU / BBLK-MKS / VII / 2023

Nama Customer *Customer Name*	:	ANDI RAIHANA AFIYAH		
Alamat *Address*	:	Perum Taman Makassar Indah Blok A7 / 18 Antang		
Jenis Sampel *Type of Sample (S)*	:	Sedimen / Tanah		
No. Sampel *No. Sample*	:	23019349 - 23019369		
Tanggal Penerimaan *Received Date*	:	31 Juli 2023 *July 31, 2023*		
Tanggal Pengujian *Test Date*	:	01 Agustus 2023 *August 01, 2023*	s/d *to*	16 Agustus 2023 *August 16, 2023*

HASIL PEMERIKSAAN

No	No. Lab	Kode Sampel	Parameter	Satuan	Hasil Uji	Spesifikasi Metode
1	23019349	T1 1 A	Timbal (Pb)	μg/g	20,02	
2	23019350	T1 1 B	Timbal (Pb)	μg/g	20,04	
3	23019351	T1 1 C	Timbal (Pb)	μg/g	19,75	
4	23019352	T2 2 A	Timbal (Pb)	μg/g	18,73	
5	23019353	T2 2 B	Timbal (Pb)	μg/g	17,66	
6	23019354	T2 2 C	Timbal (Pb)	μg/g	18,60	
7	23019355	T3 3 A	Timbal (Pb)	μg/g	18,36	
8	23019356	T3 3 B	Timbal (Pb)	μg/g	20,14	
9	23019357	T3 3 C	Timbal (Pb)	μg/g	20,13	
10	23019358	T4 4 A	Timbal (Pb)	μg/g	20,85	
11	23019359	T4 4 B	Timbal (Pb)	μg/g	20,88	IKM/KKT/7.4/D/BBLK-MKS (ICP-MS)
12	23019360	T4 4 C	Timbal (Pb)	μg/g	20,92	
13	23019361	T5 5 A	Timbal (Pb)	μg/g	20,44	
14	23019362	T5 5 B	Timbal (Pb)	μg/g	19,24	
15	23019363	T5 5 C	Timbal (Pb)	μg/g	20,17	
16	23019364	T6 6 A	Timbal (Pb)	μg/g	18,52	
17	23019365	T6 6 B	Timbal (Pb)	μg/g	19,05	
18	23019366	T6 6 C	Timbal (Pb)	μg/g	19,32	
19	23019367	T7 7 A	Timbal (Pb)	μg/g	21,47	
20	23019368	T7 7 B	Timbal (Pb)	μg/g	15,16	
21	23019369	T7 7 C	Timbal (Pb)	μg/g	18,67	

Makassar, [illegible] Agustus 2023
Koordinator Pelayanan

dr. IRMAWATY HAERUDDIN
NIP. [illegible]

Telp. 0411 586457, 586458, 586270, Fax. 0411 586270
Surat Elektronik : bblk.maks@gmail.com, bblk_makassar@yahoo.com

KEMENTERIAN KESEHATAN RI
DIREKTORAT JENDERAL PELAYANAN KESEHATAN
BALAI BESAR LABORATORIUM KESEHATAN MAKASSAR
Jl. Perintis Kemerdekaan KM.11 Tamalanrea Makassar 90245

LAPORAN HASIL UJI
Report of Analysis
No : 23020322 - 23020342 / LHU / BBLK-MHS / VIII / 2023

Nama Customer : **ANDI RAIHANA AFIYAH**
Customer Name :
Alamat : Perum Taman Makassar Indah Blok A7 / 18 Antang
Address :
Jenis Sampel : Sedimen
Type of Sample (S) :
No. Sampel : 23020322 - 23020342
No. Sample :
Tanggal Penerimaan : 09 Agustus 2023
Received Date : August 09, 2023
Tanggal Pengujian : 09 Agustus 2023 s/d 18 Agustus 2023
Test Date : August 09, 2023 to August 18, 2023

HASIL PEMERIKSAAN

No	No. Lab	Kode Sampel	Parameter	Satuan	Hasil Uji	Spesifikasi Metode
1	23020322	1 A	Cadmium (Cd)	µg/g	0.11	IKM.KKT/140/BBLK-MKS (ICP-MS)
2	23020323	1 B	Cadmium (Cd)	µg/g	0.08	
3	23020324	1 C	Cadmium (Cd)	µg/g	0,08	
4	23020325	2 A	Cadmium (Cd)	µg/g	0.08	
5	23020326	2 B	Cadmium (Cd)	µg/g	0,06	
6	23020327	2 C	Cadmium (Cd)	µg/g	0.07	
7	23020328	3 A	Cadmium (Cd)	µg/g	0.07	
8	23020329	3 B	Cadmium (Cd)	µg/g	0,07	
9	23020330	3 C	Cadmium (Cd)	µg/g	0,06	
10	23020331	4 A	Cadmium (Cd)	µg/g	0,08	
11	23020332	4 B	Cadmium (Cd)	µg/g	0,08	
12	23020333	4 C	Cadmium (Cd)	µg/g	0,07	
13	23020334	5 A	Cadmium (Cd)	µg/g	0,07	
14	23020335	5 B	Cadmium (Cd)	µg/g	0.07	
15	23020336	5 C	Cadmium (Cd)	µg/g	0,08	
16	23020337	6 A	Cadmium (Cd)	µg/g	0,05	
17	23020338	6 B	Cadmium (Cd)	µg/g	0,08	
18	23020339	6 C	Cadmium (Cd)	µg/g	0,06	
19	23020340	7 A	Cadmium (Cd)	µg/g	0,05	
20	23020341	7 B	Cadmium (Cd)	µg/g	0,05	
21	23020342	7 C	Cadmium (Cd)	µg/g	0,05	

Makassar, 18 Agustus 2023
Koordinator Pelayanan,

dr. IRMAWATY HAERUDDIN
NIP. 19[illegible]2[illegible]01 2001

Telp. 0411 586457, 586458, 586270, Fax. 0411 586270
Surat Elektronik : bblk.mksr@gmail.com, bblk_makassar@yahoo.com

Lampiran 3. Metode *Sediment Sampling* USEPA-600 (SOP#:2016)

SOP #EH-02

Sediment Sampling

(Adapted from ERT/REAC SOP #2016 Rev 0.0)

Lampiran 4. SNI 06-6992.3-2004 tentang Sedimen – Bagian 3: Cara uji timbal (Pb) secara destruksi asam dengan Spektrofotometer Serapan Atom (SSA)

SNI

SNI 06-6992.3-2004

Standar Nasional Indonesia

Sedimen – Bagian 3: Cara uji timbal (Pb) secara destruksi asam dengan Spektrofotometer Serapan Atom (SSA)

Lampiran 5. Baku mutu logam berat pada sedimen (mg/kg, berat kering), menurut *Swedish Enviromental Protection Agency* (SEPA 2002).

Tabel 3. Baku mutu logam berat di perairan.
Table 3. The quality standard of heavy metals in waters.

No.	Parameters (mg/l)	River water quality standards *) Class I	II	III	IV	Well water quality standard **)	Seawater quality standards ***)
1	Mercury (Hg)	0.001	0.002	0.002	0.005	0.001	0.001
2	Chromium (Cr)	0.05	0.05	0.05	1	0.05	0.005
3	Arsenic (As)	0.05	1	1	1	0.05	0.012
4	Cadmium (Cd)	0.01	0.01	0.01	0.01	0.005	0.001
5	Copper (Cu)	0.02	0.02	0.02	0.2	1.000	0.008
6	Lead (Pb)	0.03	0.03	0.03	1	0.05	0.008
7	Zinc (Zn)	0.05	0.05	0.05	2	5	0.05

*) Quality standards, according to Republic of Indonesia Government Regulation Number 82 of 2001 concerning management of water quality and water pollution control

**) Quality standards, according to regulation of the Minister of Health of the Republic of Indonesia. No.416 / MENKES / PER / IX / 1990 (Appendix II, Requirements for Quality of Drinking Water)

***) Quality standards, according to Decree of state Minister of Environmental affairs of the Republic of Indonesia. Decree 51 of 2004 Attachment III (for marine biota)

Tabel 4. Baku mutu logam berat pada sedimen (mg/kg, berat kering), menurut Swedish Enviromental Protection Agency (SEPA 2002).
Table 4. The quality standard of heavy metal in sediment (mg/kg, dry weight), according to Swedish Enviromental Protection Agency (SEPA 2002).

Heavy metals	Class 1 None/Insignificant	Class 2 Slight	Class 3 Significant	Class 4 Large	Class 5 Very large
Arsenic (As)	<10	10-17	17-28	28-45	>45
Cadmium (Cd)	<0,2	0,2-0,5	0,5-1,2	1,2-3	>3
Cobalt (Co)	< 12	12-20,4	20,4-34,8	34,8-60	> 60
Chromium (Cr)	<40	40-48	48-60	60-72	> 72
Copper (Cu)	< 15	15-30	30-49,5	49,5-79,5	>79,5
Mercury (Hg)	<0,04	0,04-0,12	0,12-0,4	0,4-1	> 1
Nickel (Ni)	<30	30-45	45-66	66-99	> 99
Lead (Pb)	<25	25-40	40-65	65-110	>110
Zinc Zn)	< 85	85-127,5	127,5-204	204-357	>357

Tabel 5. Baku mutu logam berat pada sedimen (mg/kg, berat kering) (CCME 2001).
Table 5. The quality standard of heavy metal in sediment (mg/kg, dry weight), according to Canadian Council of Ministers of the Environment (CCME 2001).

Heavy metals	ISQG/TEL	PEL
Arsenic (As)	7,24	41,6
Cadmium (Cd)	0,7	4,2
Chromium (Cr)	52,3	160
Copper (Cu)	18,7	108
Mercury (Hg)	0,13	0,7
Lead (Pb)	30,2	112
Zinc(Zn)	124	271

Lampiran 6. Data Sekunder

Pasang Surut

Lat	Lon	yyyy-mm-dd	hh:mm:ss	(UTC)	z(m)
-5.1117	119.4179	7/1/2023	0:00:00	0.286	0.419775
-5.1117	119.4179	7/1/2023	1:00:00	0.251	0.318671
-5.1117	119.4179	7/1/2023	2:00:00	0.2	0.194939
-5.1117	119.4179	7/1/2023	3:00:00	0.124	0.060139
-5.1117	119.4179	7/1/2023	4:00:00	0.017	-0.07482
-5.1117	119.4179	7/1/2023	5:00:00	-0.116	-0.20079
-5.1117	119.4179	7/1/2023	6:00:00	-0.268	-0.31107
-5.1117	119.4179	7/1/2023	7:00:00	-0.419	-0.40128
-5.1117	119.4179	7/1/2023	8:00:00	-0.55	-0.46868
-5.1117	119.4179	7/1/2023	9:00:00	-0.639	-0.51123
-5.1117	119.4179	7/1/2023	10:00:00	-0.67	-0.52689
-5.1117	119.4179	7/1/2023	11:00:00	-0.634	-0.51332
-5.1117	119.4179	7/1/2023	12:00:00	-0.533	-0.46835
-5.1117	119.4179	7/1/2023	13:00:00	-0.378	-0.39089
-5.1117	119.4179	7/1/2023	14:00:00	-0.189	-0.28223
-5.1117	119.4179	7/1/2023	15:00:00	0.011	-0.14701
-5.1117	119.4179	7/1/2023	16:00:00	0.198	0.006215
-5.1117	119.4179	7/1/2023	17:00:00	0.353	0.165463
-5.1117	119.4179	7/1/2023	18:00:00	0.464	0.316585
-5.1117	119.4179	7/1/2023	19:00:00	0.526	0.445286
-5.1117	119.4179	7/1/2023	20:00:00	0.545	0.539372
-5.1117	119.4179	7/1/2023	21:00:00	0.53	0.590713
-5.1117	119.4179	7/1/2023	22:00:00	0.492	0.596435
-5.1117	119.4179	7/1/2023	23:00:00	0.441	0.559037
-5.1117	119.4179	7/2/2023	0:00:00	0.383	0.485416
-5.1117	119.4179	7/2/2023	1:00:00	0.321	0.385084
-5.1117	119.4179	7/2/2023	2:00:00	0.251	0.268057
-5.1117	119.4179	7/2/2023	3:00:00	0.167	0.143013
-5.1117	119.4179	7/2/2023	4:00:00	0.063	0.016186
-5.1117	119.4179	7/2/2023	5:00:00	-0.063	-0.10871
-5.1117	119.4179	7/2/2023	6:00:00	-0.21	-0.22959
-5.1117	119.4179	7/2/2023	7:00:00	-0.365	-0.34446
-5.1117	119.4179	7/2/2023	8:00:00	-0.515	-0.44985
-5.1117	119.4179	7/2/2023	9:00:00	-0.64	-0.53971
-5.1117	119.4179	7/2/2023	10:00:00	-0.72	-0.60536
-5.1117	119.4179	7/2/2023	11:00:00	-0.739	-0.6366
-5.1117	119.4179	7/2/2023	12:00:00	-0.69	-0.62378
-5.1117	119.4179	7/2/2023	13:00:00	-0.574	-0.56049
-5.1117	119.4179	7/2/2023	14:00:00	-0.402	-0.44594
-5.1117	119.4179	7/2/2023	15:00:00	-0.192	-0.28645

Lat	Lon	yyyy-mm-dd	hh:mm:ss	(UTC)	z(m)
-5.1117	119.4179	7/2/2023	16:00:00	0.031	-0.09555
-5.1117	119.4179	7/2/2023	17:00:00	0.242	0.107648
-5.1117	119.4179	7/2/2023	18:00:00	0.419	0.301399
-5.1117	119.4179	7/2/2023	19:00:00	0.548	0.46503
-5.1117	119.4179	7/2/2023	20:00:00	0.622	0.582562
-5.1117	119.4179	7/2/2023	21:00:00	0.644	0.645353
-5.1117	119.4179	7/2/2023	22:00:00	0.621	0.653122
-5.1117	119.4179	7/2/2023	23:00:00	0.567	0.613111
-5.1117	119.4179	7/3/2023	0:00:00	0.494	0.537631
-5.1117	119.4179	7/3/2023	1:00:00	0.412	0.440636
-5.1117	119.4179	7/3/2023	2:00:00	0.325	0.334261
-5.1117	119.4179	7/3/2023	3:00:00	0.233	0.226259
-5.1117	119.4179	7/3/2023	4:00:00	0.133	0.119003
-5.1117	119.4179	7/3/2023	5:00:00	0.019	0.01034
-5.1117	119.4179	7/3/2023	6:00:00	-0.112	-0.10401
-5.1117	119.4179	7/3/2023	7:00:00	-0.259	-0.22721
-5.1117	119.4179	7/3/2023	8:00:00	-0.414	-0.35819
-5.1117	119.4179	7/3/2023	9:00:00	-0.562	-0.48974
-5.1117	119.4179	7/3/2023	10:00:00	-0.686	-0.6084
-5.1117	119.4179	7/3/2023	11:00:00	-0.765	-0.69638
-5.1117	119.4179	7/3/2023	12:00:00	-0.784	-0.7353
-5.1117	119.4179	7/3/2023	13:00:00	-0.731	-0.71063
-5.1117	119.4179	7/3/2023	14:00:00	-0.607	-0.61588
-5.1117	119.4179	7/3/2023	15:00:00	-0.421	-0.4553
-5.1117	119.4179	7/3/2023	16:00:00	-0.194	-0.24433
-5.1117	119.4179	7/3/2023	17:00:00	0.05	-0.00741
-5.1117	119.4179	7/3/2023	18:00:00	0.282	0.226311
-5.1117	119.4179	7/3/2023	19:00:00	0.476	0.428448
-5.1117	119.4179	7/3/2023	20:00:00	0.616	0.576836
-5.1117	119.4179	7/3/2023	21:00:00	0.691	0.659511
-5.1117	119.4179	7/3/2023	22:00:00	0.704	0.676341
-5.1117	119.4179	7/3/2023	23:00:00	0.665	0.637868
-5.1117	119.4179	7/4/2023	0:00:00	0.59	0.561724
-5.1117	119.4179	7/4/2023	1:00:00	0.494	0.467555
-5.1117	119.4179	7/4/2023	2:00:00	0.393	0.37182
-5.1117	119.4179	7/4/2023	3:00:00	0.293	0.283841
-5.1117	119.4179	7/4/2023	4:00:00	0.197	0.204161
-5.1117	119.4179	7/4/2023	5:00:00	0.1	0.125642
-5.1117	119.4179	7/4/2023	6:00:00	-0.006	0.036988
-5.1117	119.4179	7/4/2023	7:00:00	-0.127	-0.0723
-5.1117	119.4179	7/4/2023	8:00:00	-0.265	-0.20696
-5.1117	119.4179	7/4/2023	9:00:00	-0.414	-0.36242

Lat	Lon	yyyy-mm-dd	hh:mm:ss	(UTC)	z(m)
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-5.1117	119.4179	7/4/2023	12:00:00	-0.776	-0.76875
-5.1117	119.4179	7/4/2023	13:00:00	-0.8	-0.80153
-5.1117	119.4179	7/4/2023	14:00:00	-0.749	-0.75132
-5.1117	119.4179	7/4/2023	15:00:00	-0.619	-0.61633
-5.1117	119.4179	7/4/2023	16:00:00	-0.423	-0.40977
-5.1117	119.4179	7/4/2023	17:00:00	-0.18	-0.15809
-5.1117	119.4179	7/4/2023	18:00:00	0.08	0.104026
-5.1117	119.4179	7/4/2023	19:00:00	0.325	0.340625
-5.1117	119.4179	7/4/2023	20:00:00	0.526	0.521825
-5.1117	119.4179	7/4/2023	21:00:00	0.662	0.629691
-5.1117	119.4179	7/4/2023	22:00:00	0.723	0.66123
-5.1117	119.4179	7/4/2023	23:00:00	0.714	0.627777
-5.1117	119.4179	7/5/2023	0:00:00	0.649	0.55097
-5.1117	119.4179	7/5/2023	1:00:00	0.549	0.456391
-5.1117	119.4179	7/5/2023	2:00:00	0.434	0.366562
-5.1117	119.4179	7/5/2023	3:00:00	0.324	0.29514
-5.1117	119.4179	7/5/2023	4:00:00	0.227	0.243855
-5.1117	119.4179	7/5/2023	5:00:00	0.145	0.202986
-5.1117	119.4179	7/5/2023	6:00:00	0.069	0.155251
-5.1117	119.4179	7/5/2023	7:00:00	-0.013	0.082039
-5.1117	119.4179	7/5/2023	8:00:00	-0.111	-0.02974
-5.1117	119.4179	7/5/2023	9:00:00	-0.233	-0.18208
-5.1117	119.4179	7/5/2023	10:00:00	-0.374	-0.36322
-5.1117	119.4179	7/5/2023	11:00:00	-0.523	-0.54877
-5.1117	119.4179	7/5/2023	12:00:00	-0.657	-0.70649
-5.1117	119.4179	7/5/2023	13:00:00	-0.751	-0.80359
-5.1117	119.4179	7/5/2023	14:00:00	-0.781	-0.81478
-5.1117	119.4179	7/5/2023	15:00:00	-0.731	-0.72903
-5.1117	119.4179	7/5/2023	16:00:00	-0.597	-0.55313
-5.1117	119.4179	7/5/2023	17:00:00	-0.39	-0.31116
-5.1117	119.4179	7/5/2023	18:00:00	-0.136	-0.03983
-5.1117	119.4179	7/5/2023	19:00:00	0.131	0.219281
-5.1117	119.4179	7/5/2023	20:00:00	0.376	0.428592
-5.1117	119.4179	7/5/2023	21:00:00	0.566	0.562473
-5.1117	119.4179	7/5/2023	22:00:00	0.68	0.61218
-5.1117	119.4179	7/5/2023	23:00:00	0.71	0.586648
-5.1117	119.4179	7/6/2023	0:00:00	0.665	0.50896
-5.1117	119.4179	7/6/2023	1:00:00	0.567	0.40945
-5.1117	119.4179	7/6/2023	2:00:00	0.44	0.317272
-5.1117	119.4179	7/6/2023	3:00:00	0.314	0.252649

Lat	Lon	yyyy-mm-dd	hh:mm:ss	(UTC)	z(m)
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-5.1117	119.4179	7/6/2023	5:00:00	0.13	0.216061
-5.1117	119.4179	7/6/2023	6:00:00	0.079	0.214914
-5.1117	119.4179	7/6/2023	7:00:00	0.04	0.192909
-5.1117	119.4179	7/6/2023	8:00:00	-0.005	0.127815
-5.1117	119.4179	7/6/2023	9:00:00	-0.073	0.00826
-5.1117	119.4179	7/6/2023	10:00:00	-0.173	-0.16141
-5.1117	119.4179	7/6/2023	11:00:00	-0.305	-0.36044
-5.1117	119.4179	7/6/2023	12:00:00	-0.452	-0.55551
-5.1117	119.4179	7/6/2023	13:00:00	-0.59	-0.70813
-5.1117	119.4179	7/6/2023	14:00:00	-0.689	-0.78393
-5.1117	119.4179	7/6/2023	15:00:00	-0.721	-0.76135
-5.1117	119.4179	7/6/2023	16:00:00	-0.668	-0.63752
-5.1117	119.4179	7/6/2023	17:00:00	-0.527	-0.42977
-5.1117	119.4179	7/6/2023	18:00:00	-0.314	-0.17231
-5.1117	119.4179	7/6/2023	19:00:00	-0.057	0.091226
-5.1117	119.4179	7/6/2023	20:00:00	0.205	0.317491
-5.1117	119.4179	7/6/2023	21:00:00	0.431	0.47305
-5.1117	119.4179	7/6/2023	22:00:00	0.59	0.541467
-5.1117	119.4179	7/6/2023	23:00:00	0.661	0.526142
-5.1117	119.4179	7/7/2023	0:00:00	0.644	0.448218
-5.1117	119.4179	7/7/2023	1:00:00	0.554	0.340156
-5.1117	119.4179	7/7/2023	2:00:00	0.419	0.236671
-5.1117	119.4179	7/7/2023	3:00:00	0.272	0.165416
-5.1117	119.4179	7/7/2023	4:00:00	0.145	0.139838
-5.1117	119.4179	7/7/2023	5:00:00	0.057	0.156056
-5.1117	119.4179	7/7/2023	6:00:00	0.014	0.194574
-5.1117	119.4179	7/7/2023	7:00:00	0.008	0.226334
-5.1117	119.4179	7/7/2023	8:00:00	0.016	0.221498
-5.1117	119.4179	7/7/2023	9:00:00	0.015	0.158608
-5.1117	119.4179	7/7/2023	10:00:00	-0.019	0.031652
-5.1117	119.4179	7/7/2023	11:00:00	-0.097	-0.1469
-5.1117	119.4179	7/7/2023	12:00:00	-0.216	-0.34797
-5.1117	119.4179	7/7/2023	13:00:00	-0.359	-0.53233
-5.1117	119.4179	7/7/2023	14:00:00	-0.495	-0.65994
-5.1117	119.4179	7/7/2023	15:00:00	-0.591	-0.69996
-5.1117	119.4179	7/7/2023	16:00:00	-0.617	-0.63866
-5.1117	119.4179	7/7/2023	17:00:00	-0.557	-0.48344
-5.1117	119.4179	7/7/2023	18:00:00	-0.41	-0.26157
-5.1117	119.4179	7/7/2023	19:00:00	-0.196	-0.01416
-5.1117	119.4179	7/7/2023	20:00:00	0.051	0.213288
-5.1117	119.4179	7/7/2023	21:00:00	0.29	0.381375

Lat	Lon	yyyy-mm-dd	hh:mm:ss	(UTC)	z(m)
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-5.1117	119.4179	7/7/2023	23:00:00	0.585	0.461909
-5.1117	119.4179	7/8/2023	0:00:00	0.599	0.38585
-5.1117	119.4179	7/8/2023	1:00:00	0.524	0.268507
-5.1117	119.4179	7/8/2023	2:00:00	0.386	0.147441
-5.1117	119.4179	7/8/2023	3:00:00	0.219	0.056733
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-5.1117	119.4179	7/8/2023	5:00:00	-0.051	0.035725
-5.1117	119.4179	7/8/2023	6:00:00	-0.107	0.095306
-5.1117	119.4179	7/8/2023	7:00:00	-0.103	0.168873
-5.1117	119.4179	7/8/2023	8:00:00	-0.057	0.222722
-5.1117	119.4179	7/8/2023	9:00:00	0.002	0.227185
-5.1117	119.4179	7/8/2023	10:00:00	0.044	0.165349
-5.1117	119.4179	7/8/2023	11:00:00	0.043	0.038459
-5.1117	119.4179	7/8/2023	12:00:00	-0.013	-0.13348
-5.1117	119.4179	7/8/2023	13:00:00	-0.118	-0.31607
-5.1117	119.4179	7/8/2023	14:00:00	-0.25	-0.46887
-5.1117	119.4179	7/8/2023	15:00:00	-0.377	-0.55544
-5.1117	119.4179	7/8/2023	16:00:00	-0.462	-0.55268
-5.1117	119.4179	7/8/2023	17:00:00	-0.476	-0.457
-5.1117	119.4179	7/8/2023	18:00:00	-0.406	-0.28557
-5.1117	119.4179	7/8/2023	19:00:00	-0.256	-0.07255
-5.1117	119.4179	7/8/2023	20:00:00	-0.051	0.138935
-5.1117	119.4179	7/8/2023	21:00:00	0.172	0.307075
-5.1117	119.4179	7/8/2023	22:00:00	0.368	0.401198
-5.1117	119.4179	7/8/2023	23:00:00	0.5	0.408778
-5.1117	119.4179	7/9/2023	0:00:00	0.541	0.337855
-5.1117	119.4179	7/9/2023	1:00:00	0.488	0.214299
-5.1117	119.4179	7/9/2023	2:00:00	0.356	0.074699
-5.1117	119.4179	7/9/2023	3:00:00	0.176	-0.04328
-5.1117	119.4179	7/9/2023	4:00:00	-0.008	-0.11057
-5.1117	119.4179	7/9/2023	5:00:00	-0.159	-0.11388
-5.1117	119.4179	7/9/2023	6:00:00	-0.245	-0.05868
-5.1117	119.4179	7/9/2023	7:00:00	-0.257	0.032833
-5.1117	119.4179	7/9/2023	8:00:00	-0.201	0.128192
-5.1117	119.4179	7/9/2023	9:00:00	-0.103	0.193695
-5.1117	119.4179	7/9/2023	10:00:00	0.003	0.203768
-5.1117	119.4179	7/9/2023	11:00:00	0.082	0.148123
-5.1117	119.4179	7/9/2023	12:00:00	0.108	0.034859
-5.1117	119.4179	7/9/2023	13:00:00	0.072	-0.11131
-5.1117	119.4179	7/9/2023	14:00:00	-0.018	-0.25522
-5.1117	119.4179	7/9/2023	15:00:00	-0.134	-0.36027

Lat	Lon	yyyy-mm-dd	hh:mm:ss	(UTC)	z(m)
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-5.1117	119.4179	8/31/2023	6:00:00	-0.093	0.058566
-5.1117	119.4179	8/31/2023	7:00:00	-0.134	-0.04749
-5.1117	119.4179	8/31/2023	8:00:00	-0.175	-0.16182
-5.1117	119.4179	8/31/2023	9:00:00	-0.222	-0.27162
-5.1117	119.4179	8/31/2023	10:00:00	-0.279	-0.36265
-5.1117	119.4179	8/31/2023	11:00:00	-0.34	-0.42187
-5.1117	119.4179	8/31/2023	12:00:00	-0.395	-0.44006
-5.1117	119.4179	8/31/2023	13:00:00	-0.428	-0.41384
-5.1117	119.4179	8/31/2023	14:00:00	-0.423	-0.34658
-5.1117	119.4179	8/31/2023	15:00:00	-0.37	-0.24799
-5.1117	119.4179	8/31/2023	16:00:00	-0.265	-0.13237
-5.1117	119.4179	8/31/2023	17:00:00	-0.118	-0.01597
-5.1117	119.4179	8/31/2023	18:00:00	0.053	0.086175
-5.1117	119.4179	8/31/2023	19:00:00	0.222	0.16295
-5.1117	119.4179	8/31/2023	20:00:00	0.361	0.209124
-5.1117	119.4179	8/31/2023	21:00:00	0.449	0.225881
-5.1117	119.4179	8/31/2023	22:00:00	0.472	0.219939
-5.1117	119.4179	8/31/2023	23:00:00	0.43	0.201413

DATA ARAH DAN KECEPATAN ANGIN																								
	Jam (gmt)																							
Tgl		00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	ddd	80	360	10	340	300	280	270	250	240	80	80	80	90	110	90	90	120	120	120	110	120	120	120	120
	ff	1	1	2	4	6	6	6	4	5	3	4	4	1	2	2	2	2	2	2	2	2	2	3	1
2	ddd	120	290	290	260	270	250	240	230	230	0	110	110	90	100	0	20	50	70	90	120	110	120	140	110
	ff	2	3	5	4	5	5	6	6	8	0	5	3	3	2	0	1	2	4	3	1	2	3	3	3
3	ddd	100	320	290	290	250	250	270	110	130	110	90	100	110	130	360	290	120	130	350	290	10	60	50	30
	ff	3	1	4	4	5	6	5	6	5	3	3	3	2	1	1	1	4	1	5	8	8	8	5	4
4	ddd	20	340	30	340	300	290	280	240	200	170	100	50	130	100	130	110	100	80	90	110	100	100	130	150
	ff	6	2	2	3	4	5	4	4	3	1	2	3	2	1	4	2	1	2	1	2	1	2	4	3
5	ddd	140	0	270	270	270	280	270	260	260	310	40	70	110	100	0	0	0	0	0	80	100	110	100	100
	ff	4	0	4	4	5	7	6	5	5	4	6	5	3	4	0	0	0	0	0	1	2	3	2	1
6	ddd	40	10	280	250	250	250	250	250	250	250	230	240	190	290	30	130	70	70	110	130	130	0	0	120
	ff	2	1	5	5	5	6	6	8	7	5	4	3	4	5	1	1	3	3	2	2	3	0	0	2
7	ddd	0	280	310	270	270	260	260	260	270	230	300	310	260	170	170	160	190	220	250	230	0	120	100	80
	ff	0	3	3	5	5	5	6	6	4	4	3	4	2	1	2	1	2	2	3	2	0	1	1	2
8	ddd	120	110	50	20	40	30	10	280	250	230	220	190	150	110	120	120	110	60	160	110	130	120	0	170
	ff	1	3	4	5	9	8	9	6	7	6	4	1	3	2	2	3	3	1	1	2	2	2	0	1
9	ddd	130	290	250	240	260	250	250	250	250	260	320	310	20	60	0	0	0	0	0	110	90	120	160	0
	ff	2	3	5	6	5	5	6	9	5	4	6	6	7	3	0	0	0	0	0	1	2	4	2	0
			10	20	290	240	230	230	220	240	190	160	160	60	110	130	150	100	0	0	120	120	130	130	120
			1	5	4	7	7	9	8	7	3	6	5	3	2	3	4	1	0	0	2	3	3	2	2
			110	70	330	300	280	260	220	180	170	140	130	100	130	170	150	180	160	110	130	130	130	110	110
			2	3	4	6	7	5	7	6	6	2	3	4	3	2	2	1	1	3	3	1	1	3	3

DATA ARAH DAN KECEPATAN ANGIN																								
	Jam (gmt)																							
Tgl		00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
12	ddd	100	310	260	250	260	280	270	320	310	330	60	150	160	160	160	160	140	130	70	0	0	0	80	110
	ff	3	3	4	5	5	6	5	6	7	4	2	4	5	6	6	6	5	5	1	0	0	0	1	2
13	ddd	130	80	70	260	320	310	270	310	280	310	320	0	30	100	130	130	120	100	150	120	120	150	50	170
	ff	3	2	2	3	5	3	2	3	3	3	3	0	3	1	1	2	2	2	1	4	3	1	2	2
14	ddd	0	290	260	290	280	260	240	270	240	210	160	150	140	140	150	150	130	110	100	140	160	160	110	120
	ff	0	2	7	3	5	3	7	4	4	3	2	4	3	2	3	2	2	3	3	2	2	3	3	4
15	ddd	100	100	280	270	270	240	250	250	220	230	180	160	160	160	160	140	140	120	120	120	120	120	120	120
	ff	3	2	4	4	6	8	8	7	6	5	3	4	4	5	4	3	4	3	2	2	2	2	2	2
16	ddd	120	140	290	270	240	220	220	300	190	140	130	150	150	150	130	100	180	180	160	100	120	130	130	140
	ff	3	3	4	5	7	9	8	9	3	7	6	7	6	2	3	3	1	1	2	3	3	4	4	2
17	ddd	90	310	310	340	300	300	290	270	320	280	320	180	170	180	170	160	0	230	250	190	0	110	120	0
	ff	2	4	4	3	6	8	9	5	4	7	2	3	3	1	2	1	0	3	2	2	0	1	1	0
18	ddd	110	312	290	270	250	240	230	220	260	290	330	40	60	90	70	160	0	0	100	130	120	130	140	150
	ff	4	1	3	4	6	8	6	7	4	4	5	7	5	3	3	1	0	0	2	1	2	1	1	4
19	ddd	130	10	300	260	250	260	250	260	260	270	310	20	30	30	60	80	120	140	150	120	100	0	160	120
	ff	3	1	1	5	6	5	6	6	4	3	2	3	3	6	3	2	1	1	1	1	1	0	2	2
20	ddd	160	280	260	280	270	270	220	220	220	200	160	80	20	100	140	150	150	150	150	140	130	130	130	130
	ff	2	2	4	4	5	6	7	8	5	4	4	6	8	4	3	2	2	1	1	2	3	3	2	2
21	ddd	120	350	300	280	280	270	220	220	200	160	120	110	110	160	140	140	140	30	30	120	120	140	130	140
	ff		2	3	4	7	7	7	8	7	8	6	4	3	3	3	2	2	1	1	3	2	3	3	3
	ddd		30	20	290	290	290	270	270	270	260	30	10	60	90	160	130	90	100	90	140	90	0	80	110
	ff		4	3	5	7	8	7	6	4	2	1	2	5	3	3	2	1	3	3	1	1	0	1	3
	ddd		60	340	280	280	270	260	260	250	280	310	20	60	80	80	120	0	110	100	120	140	140	150	140

DATA ARAH DAN KECEPATAN ANGIN																								
	Jam (gmt)																							
Tgl		00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	ff	3	3	2	6	7	6	5	6	5	3	1	4	5	2	4	3	0	1	2	1	1	1	3	2
24	ddd	120	20	40	250	250	260	270	250	250	260	290	320	10	50	80	120	0	80	110	100	110	120	130	140
	ff	1	2	2	6	6	5	5	7	8	4	5	5	4	4	4	3	0	2	2	2	2	2	4	2
25	ddd	140	170	280	280	250	250	250	230	230	240	280	20	30	70	110	110	110	110	110	120	140	150	140	140
	ff	4	2	5	5	5	7	7	7	9	7	2	4	5	3	3	3	2	2	1	2	3	3	3	3
26	ddd	130	270	270	260	250	260	260	250	230	230	230	170	140	110	80	80	90	100	120	100	110	130	110	110
	ff	3	3	5	4	5	5	5	8	9	6	5	3	4	1	3	4	5	4	3	2	3	3	3	2
27	ddd	110	80	40	280	250	240	240	230	220	200	160	160	30	80	110	110	4	100	140	150	140	0	120	120
	ff	3	3	4	6	6	8	7	8	6	5	7	7	10	1	2	2	0	4	1	2	1	0	4	4
28	ddd	100	180	260	270	280	250	280	240	240	280	330	360	30	70	70	70	0	0	130	150	130	130	100	120
	ff	1	2	3	4	6	5	8	8	6	3	5	6	8	1	3	1	0	0	3	1	2	2	2	3
29	ddd	100	300	280	250	250	250	250	250	230	250	260	330	30	70	170	160	140	130	120	120	120	120	130	140
	ff	3	4	4	4	5	6	9	6	7	4	2	3	7	4	1	3	2	2	1	1	2	2	1	1
30	ddd	320	240	250	240	230	250	270	290	290	290	310	50	60	110	100	0	0	340	160	140	150	150	130	130
	ff	1	4	5	8	8	8	6	7	7	5	5	5	6	4	1	0	0	3	1	1	1	2	2	2
31	ddd	150	300	250	280	240	240	240	260	270	280	290	170	0	170	0	0	80	140	220	0	0	120	120	120
	ff	2	4	3	5	9	8	8	6	6	6	4	4	0	4	0	0	1	1	1	0	0	3	3	1

Lampiran 7. Perhitungan

Perhitungan data hidrodinamik

Titik Pengambilan	Kedalaman (m)	Kedalaman Rata-Rata	Kecepatan Aliran (m/s)		Kecepatan Aliran Rata-rata (m/s)	
			0.2 h	0.8 h		
1A	3.0	3.2	0.358	0.128	0.243	
1B	3.4		0.349	0.115	0.232	0.238
2A	6.8	6.6	0.328	0.104	0.216	
2B	6.5		0.298	0.109	0.203	0.210
3A	4.7	4.7	0.211	0.104	0.157	
3B	4.7		0.205	0.097	0.151	0.154
4A	3.6	3.4	0.195	0.090	0.143	
4B	3.2		0.200	0.093	0.147	0.145
5A	3.5	3.5	0.115	0.098	0.107	
5B	3.4		0.121	0.081	0.101	0.104
6A	2.8	2.7	0.137	0.080	0.109	
6B	2.5		0.128	0.071	0.100	0.104
7A	2.0	2.1	0.060	0.032	0.046	
7B	2.2		0.030	0.026	0.028	0.037

Sampel	Kecepatan Aliran Rata-rata (m/s)	Kedalaman (m)
1A	0.243	5.0
1B	0.232	4.2
2A	0.216	5.0
2B	0.203	4.0
3A	0.157	2.0
3B	0.151	2.5
4A	0.143	3.4
4B	0.147	2.5
5A	0.107	1.8
5B	0.101	2.0
6A	0.109	2.0
6B	0.100	1.5
7A	0.046	1.2
7B	0.028	1.0

Titik Pengambilan Sampel	Kedalaman (m)	arus	lebar	lebar dasar	slope	kemiringan	luas penampang	debit
1A	3.2	0.238	61.18	47.200	13.980	4.389	194.86	46.28
2A	6.6	0.210	55.00	46.700	8.300	1.253	364.38	76.34
3A	4.7	0.154	103.75	99.800	3.950	0.841	487.11	75.08
4A	3.4	0.145	106.78	96.200	10.580	3.112	363.05	52.46
5A	3.5	0.104	166.15	154.000	12.150	3.522	573.22	59.47
6A	2.7	0.104	182.07	165.000	17.070	6.442	482.49	50.18
7A	2.1	0.037	195.07	183.000	12.070	5.748	409.65	15.16

Data hasil uji logam

Kadar Pb

Kode sampel	Berat Sampel (W) (g)	V Akhir (ml)	Kons. Alat (C) (µg/ml)	Blanko	Pb (mg/kg)	Baku Mutu
1A	0.507	50	204.487	1.499	20.019	25
1B	0.501	50	202.364	1.499	20.038	25
2A	0.502	50	189.591	1.499	18.734	25
2B	0.501	50	178.523	1.499	17.660	25
3A	0.501	50	185.479	1.499	18.376	25
3B	0.502	50	203.776	1.499	20.135	25
4A	0.501	50	210.444	1.499	20.853	25
4B	0.504	50	211.962	1.499	20.883	25
5A	0.504	50	207.594	1.499	20.442	25
5B	0.504	50	195.294	1.499	19.241	25
6A	0.501	50	190.982	1.499	18.918	25
6B	0.503	50	192.954	1.499	19.050	25
7A	0.503	50	217.358	1.499	21.474	25
7B	0.505	50	211.534	1.499	20.787	25

Kadar Cd

Kode sampel	Berat Sampel (W) (g)	V Akhir (ml)	Kons. Alat (C) (µg/ml)	Blanko	Cd (mg/kg)	Baku Mutu
1A	0.507	50	1.252	0.137	0.110	0.2
1B	0.501	50	0.939	0.137	0.080	0.2
2A	0.502	50	0.940	0.137	0.080	0.2
2B	0.501	50	0.939	0.137	0.080	0.2
3A	0.501	50	0.838	0.137	0.070	0.2
3B	0.502	50	0.840	0.137	0.070	0.2
4A	0.501	50	0.939	0.137	0.080	0.2
4B	0.504	50	0.943	0.137	0.080	0.2
5A	0.504	50	0.843	0.137	0.070	0.2
5B	0.504	50	0.842	0.137	0.070	0.2
6A	0.501	50	0.638	0.137	0.050	0.2
6B	0.503	50	0.640	0.137	0.050	0.2
7A	0.503	50	0.640	0.137	0.050	0.2
7B	0.505	50	0.642	0.137	0.050	0.2

Sampel	Pb (mg/kg)	Baku Mutu	Ket
1A	20.019	<25 mg/kg	Memenuhi
1B	20.038		Memenuhi
2A	18.734		Memenuhi
2B	17.660		Memenuhi
3A	18.376		Memenuhi
3B	20.135		Memenuhi
4A	20.853		Memenuhi
4B	20.883		Memenuhi
5A	20.442		Memenuhi
5B	19.241		Memenuhi
6A	18.918		Memenuhi
6B	19.050		Memenuhi
7A	21.474		Memenuhi
7B	15.177		Memenuhi

Sampel	Cd (mg/kg)	Baku Mutu	Ket
1A	0.110	<0.2 mg/kg	Memenuhi
1B	0.080		Memenuhi
2A	0.080		Memenuhi
2B	0.080		Memenuhi
3A	0.070		Memenuhi
3B	0.070		Memenuhi
4A	0.080		Memenuhi
4B	0.080		Memenuhi
5A	0.070		Memenuhi
5B	0.070		Memenuhi
6A	0.050		Memenuhi
6B	0.050		Memenuhi
7A	0.050		Memenuhi
7B	0.050		Memenuhi

Analisis status mutu

Titik Sampling	Pb (µg/kg)	Cd (µg/kg)
1A	20.019	0.110
1B	20.038	0.080
2A	18.734	0.080
2B	17.660	0.080
3A	18.376	0.070
3B	20.135	0.070
4A	20.853	0.080
4B	20.883	0.080
5A	20.442	0.070
5B	19.241	0.070
6A	18.918	0.050
6B	19.050	0.050
7A	21.474	0.050
7B	20.787	0.050

Titik Samplin	Basis	Nilai	Pb
1A	2	0.667284681	-0.58362571
1B	2	0.667946927	-0.58219462
2A	2	0.624475432	-0.67928328
2B	2	0.588667199	-0.76447585
3A	2	0.612531629	-0.70714375
3B	2	0.671169288	-0.57525139
4A	2	0.695093147	-0.52472177
4B	2	0.696113647	-0.52260524
5A	2	0.681395887	-0.55343486
5B	2	0.641365502	-0.64078134
6A	2	0.630601038	-0.66520055
6B	2	0.635008292	-0.65515266
7A	2	0.715807799	-0.48235583
7B	2	0.692910399	-0.52925929

Basis	Nilai	Cd
2	0.24444	-2.03242
2	0.17778	-2.49185
2	0.17778	-2.49185
2	0.17778	-2.49185
2	0.15556	-2.6845
2	0.15556	-2.6845
2	0.17778	-2.49185
2	0.17778	-2.49185
2	0.15556	-2.6845
2	0.15556	-2.6845
2	0.11111	-3.16993
2	0.11111	-3.16993
2	0.11111	-3.16993
2	0.11111	-3.16993

kelas 0	kelas 1	kelas 2	kelas 3	kelas 4	kelas 5	kelas 6
0	1	2	3	4	5	6
0	1	2	3	4	5	6
0	1	2	3	4	5	6
0	1	2	3	4	5	6
0	1	2	3	4	5	6
0	1	2	3	4	5	6
0	1	2	3	4	5	6
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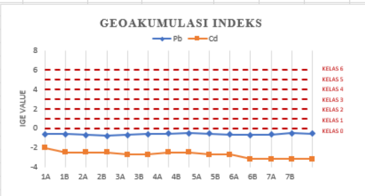
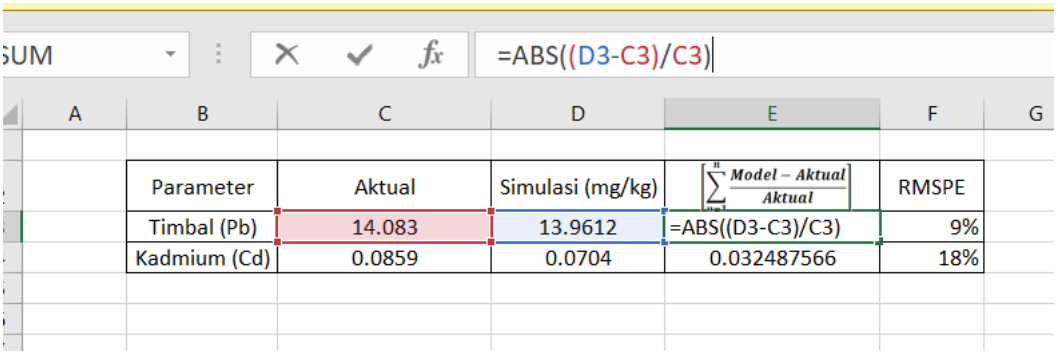
0	1	2	3	4	5	6
0	1	2	3	4	5	6
0	1	2	3	4	5	6
0	1	2	3	4	5	6
0	1	2	3	4	5	6
0	1	2	3	4	5	6

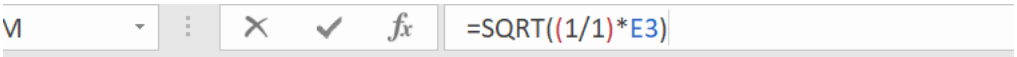
Sampel	Pb	Cd	Igeo Value	Kelas	Keterangan
1A	-0.584	-2.032	< 0	0	Tidak Tercemar
[illegible]	[illegible]	-2.492			
[illegible]	[illegible]	-2.492			
[illegible]	[illegible]	-2.492			
[illegible]	[illegible]	-2.684			
[illegible]	[illegible]	-2.684			
[illegible]	[illegible]	-2.492			
[illegible]	[illegible]	-2.492			
[illegible]	[illegible]	-2.684			
[illegible]	[illegible]	-2.684			
[illegible]	[illegible]	-3.170			
[illegible]	[illegible]	-2.492			
[illegible]	[illegible]	-3.170			
[illegible]	[illegible]	-3.170			



Validasi



Parameter	Aktual	Simulasi (mg/kg)	$\sum_{n=1}^{n} \frac{Model - Aktual}{Aktual}$	RMSPE
Timbal (Pb)	14.083	13.9612	=ABS((D3-C3)/C3)	9%
Kadmium (Cd)	0.0859	0.0704	0.032487566	18%



Parameter	Aktual	Simulasi (mg/kg)	$\sum_{n=1}^{n} \frac{Model - Aktual}{Aktual}$	RMSPE
Timbal (Pb)	14.083	13.9612	0.008647305	1)*E3)
Kadmium (Cd)	0.0859	0.0704	0.032487566	18%