DAFTAR PUSTAKA

Afaz, T., Gusman, M. 2020. Analisis Kelayakan Investasi Menggunakan Metode *Discounted Cash Flow* pada Tambang Aspal PT. Wijaya Karya Bitumen di Desa Nambo Kecematan Lasalimu, Kabupaten Buton, Sulawesi Tenggara. *Jurnal Bina Tambang*, Vol. 6 No. 6.

Anas, A.V., Surimihardja, D.A., Pallu, S., Irvan, U.R. 2017. Sensitivity Analysis Of Supply-Demand Model of Jeneberang River Construction Materials, South Sulawesi. *ARPN Journal of Engineering and Applied Sciences*, Vol. 12 No. 6.

Anas, A.V., Amalia, R., Qaidahiyani, N.F., Djamaluddin., Herin, S.R.D. 2020. Sensitivity Analysis of Net Present Value due to Optimal Pit Limit in PT Ceria Nugraha Indotama, Kolaka Regency, Southeast Sulawesi Province. *IOP Conference Series: Materials Science and Engineering*, Vol. 875, Issue 1, pp. 012050.

Askuri, N., Ben, E.A. 2011*. In Pit and External Oil Sands Dyke Construction Scheduling Using Goal Programming*. Canada: University of Alberta, Edmonton.

Basiri, M.H., Khodayari, A.A., Saedi, Javadnejad. 2013. *Valuation of a Mining Project under Uncertainty: Can the Real Options Approach be a Viable Solution?.* Tehran: Tarbiat Modares University.

Blank, L., Tarquin. 2018. *Engineering Economy*, *Eight Edition*. New York: McGraw-*Hill* Education.

Brand, B., Elias. 1998. Nickel Laterites: Classification and Features. *AGSO Journal of Australian Geology and Geophysics*, Vol. 81 No. 88.

Brigham, E.F., Houston. 2006*. Fundamental of Financial Management: Dasar-Dasar Manajemen Keuangan*. Edisi 10. Jakarta: Salemba Empat.

Chowdhury, T. Sinha, S., Udip, K. 2021. Analysis of Mine Haul Road Performance Using Artificial Neural Network. *Journal of the Institution of Engineers,* Vol. 7 No. 18.

Damodaran, A. 2001. *Corporate Finance: Theory and Practice. 2nd International Edition*. New York: John Wiley & Sons.

Diego, A. 2009. Reduction of Uncertainty Using Sensitivity Analysis Methods for Infinite Random Sets of Indexable Type. *International Journal of Approximate Reasoning*. Vol. 50 No. 5.

Hadyan, A., Yoszi, A. 2020. *Analisis Kelayakan Ekonomi Tambang Batu Andesit PT. Batu Nago Mandiri Kecamatan Batang Kapeh, Kabupaten Pesisir Selatan, Provinsi Sumatera Barat.* Padang: Universitas Negeri Padang.

Hardianti, S., Halim. 2021. *Perencanaan Disposal Area serta Sequence Timbunan Overburden Guna Mengakomodasi Produksi Bulan Juli Tahun 2020 di PT. X.* Palembang: Politeknik Akamigas Palembang.

Hariyadi, S. 2018. *Kajian Teknis Tahapan Penambangan Batubara pada PT. Mega Global Energi.* Tenggarong: Universitas Kutai Kartanegara.

Hartman, H.L. 1987. *Introductory Mining Engineering*. Canada: John Wiley and Sons Inc.

Hustrulid, W., Kuchta, M. 1995. *Open Pit Mine Planning and Design, Vol. 1 Fundamentals.* Netherland: AA Balkema.

Hustrulid, W.A., Kuchta, M., Martin, R.K. 2013. *Open Pit Mine Planning and Design*. Florida: CRC Press.

Gentry, W., O'Neil, J. *and*. 1984. *Mine Investment Analysis*. New York: American Institude of Mining, Metallurgical, and Petroleum Engineers.

Lieberman, V. 2014. *Dyke Design at Mo O in Tran De District, Soc Trang Province/Viet Nam*. Hamburg: Ingenieurgesellschaft.

Listiawati, S.W., Murad, M.S. 2019. Investment Analysis Planning Untuk Kelayakan Ekonomi Penambangan Batubara pada Blok A PT. Tebo Agung International*. Jurnal Bina Tambang,* Vol. 4 No.1.

Maulana, B.S*.,* Sumarya, Gusman, M. 2018. Evaluasi Kondisi Jalan Angkut dari *Front* Penambangan Menuju *Rom Stockpile* untuk Mencapai Target Produksi 15.000 Ton Batubara Perbulan PT. Prima Dito Nusantara *Jobsite* KBB Kabupaten Sarolangun, Provinsi Jambi. *Jurnal Bina Tambang*, Vol. 3 No. 3.

Marbun, G., Alex, F. 2010. *SJP Update Reserve Pit Compartment.* Sorowako: PT. INCO Tbk.

Ministry of Water, Land and Air Protection. 2003. *Dike Design and Construction Guide*. British Columbia.

Mohapatra, D. 2009. *Investment Analysis in Mining Industry.* Rourkel: National Institute of Technology.

Noor, D. 2017. *Perhitungan Cadangan Nikel Dengan Metoda Area of Influence Daerah Uko Uko, Kecamatan Pomalaa, Kabupaten Kolaka Propinsi Sulawesi Tenggara*. Bogor: Universitas Pakuan.

Prayogo, R. 2020. Rancangan Penambangan di Pit Ferrari Pinang Balaba 12 PT.Vale Indonesia,Tbk Desa Sorowako Kecamatan Nuha Kabupaten Luwu Timur Provinsi Sulawesi Selatan. *Prosiding: Seminar Teknologi Kebumian dan Kelautan (SEMITAN II)*, Vol. 2, No. 1.

PT Vale Indonesia Tbk 2015. *Laporan Study Kelayakan Indonesia Growth Program*. Jakarta.

PT Vale Indonesia Tbk. 2017. *Mengubah Tantangan Menjadi Kesempata*n. *Laporan Tahunan*. Sorowako.

PT Vale Indonesia Tbk. 2017. *Sustainability Report*. Jakarta.

PT Vale Indonesia Tbk 2018. *Management Diposal*. Sorowako.

PT Vale Indonesia Tbk. 2019. *Mine Haul Road-Design, Construction, Maintenance, Dan Operational Manual*. Jakarta.

PT Vale Indonesia Tbk. 2021. *Annual Report: Responsible Contribution For Better Life*. Jakarta.

Riyanto, B. 2009. *Dasar-Dasar Pembelanjaan Perusahaan Edisi 2*. Yogyakarta: Penerbit GPFE.

Rifandy, A., Hefni. 2016. Kajian Teknis Geometri Jalan Hauling pada PT. Guruh Putra Bersama Site Desa Gunung Sari Kecamatan Tabang Kabupaten Kutai Kartanegara. *Jurnal Geologi Pertambangan*, Vol. 1 No. 19.

Rifandy, A., Sutan, M.P. 2018. Optimasi Pit Tambang Terbuka Batubara dengan Pendekatan Incremental Pit Expansion, BESR dan Profit Margin. *Jurnal Geologi Pertambangan*, Vol. 2 No. 24.

Ross, S.A., Westerfield, R.W., Jeffe, J.F. 2010. *Corporate Finance, 10th ed*. New York: McGraw Hill.

Sasongko, W. 2009. *Pemodelan Optimasi Pit Tambang Terbuka Batubara: Pendekatan Instrumental Pit Expansion dan Model Cash Flow.* Yogyakarta: Universitas Gadjah Mada.

Sari, K., Sawaki, M., Sabarofek, M. 2018. Pengaruh Analisis Investasi Terhadap Kelayakan Penambangan Batu Mangan di PT. Berkat Esa Mining. *Jurnal Science Tech,* Vol. 4 No. 1.

Sayuti, Z., Azikin, B., Tonggiroh, A. 2013. Kajian Teknis Geometri Jalan Angkut Tambang dan Rencana Pembuatan Saluran Penirisan di Tepi Jalan Angkut Tambang (Studi Kasus: Pit Seam 11 Selatan PT. Kitadin TDM, Kalimantan Timur). *Jurnal Geosains,* Vol. 9 No. 1.

Sidauruk, D. 2018. *Analisis Kelayakan Investasi Menggunakan Metoda Discounted Cash Flow Tambang Galena PT.Triple Eight Energy, Kecamatan Koto Parik Gadang Diateh Kabupaten Solok Selatan Provinsi Sumatera Barat.* Padang: Universitas Negeri Padang.

Sinclair, A., Garston, H. 2005. *Applied Mineral Investory Estimation*. Cambridge: Cambridge University Press.

Standar Nasional Indonesia. 1998. *Klasifikasi Sumberdaya Mineral dan Cadangan*. Jakarta: Badan Standarisasi Nasional.

Stermole, F.J., Stermole, J. 2000. *Economic Evaluation and Investment Decision Method Fourth Edition*. Colorado: Investment Evaluation.

Sufa, M.F. 2007. Analisis Sensitivitas Pada Keputusan Pembangunan *Meeting Hall* untuk Minimasi Resiko Investasi. *Jurnal Ilmiah Teknik Industri*, Vol. 5 No. 3.

Tannant, D.D., Regensburg, B. 2001. *Guidelines for Mine Haul Road Design*. Canada: University of British Columbia – Okanagan.

Thompson, R., Peroni, R., Visser, A.T. 2018. *Mining Haul Roads, Theory and Practice 1st Edition*. London: CRC Press.

Wandy, M., Saismana, U., Riswan, R., Hakim, R.N., Gusfrimanuel, G. 2016. Perhitungan Cadangan Batubara dan Perancangan *Pit* PT Anugrah Karya Raya, Desa Penain, Kec. Teweh Tengah Kabupaten Barito Utara, Kalimantan Tengah. *Jurnal Geosains untuk Aplikasi Pertambangan*, Vol. 1 No. 1.

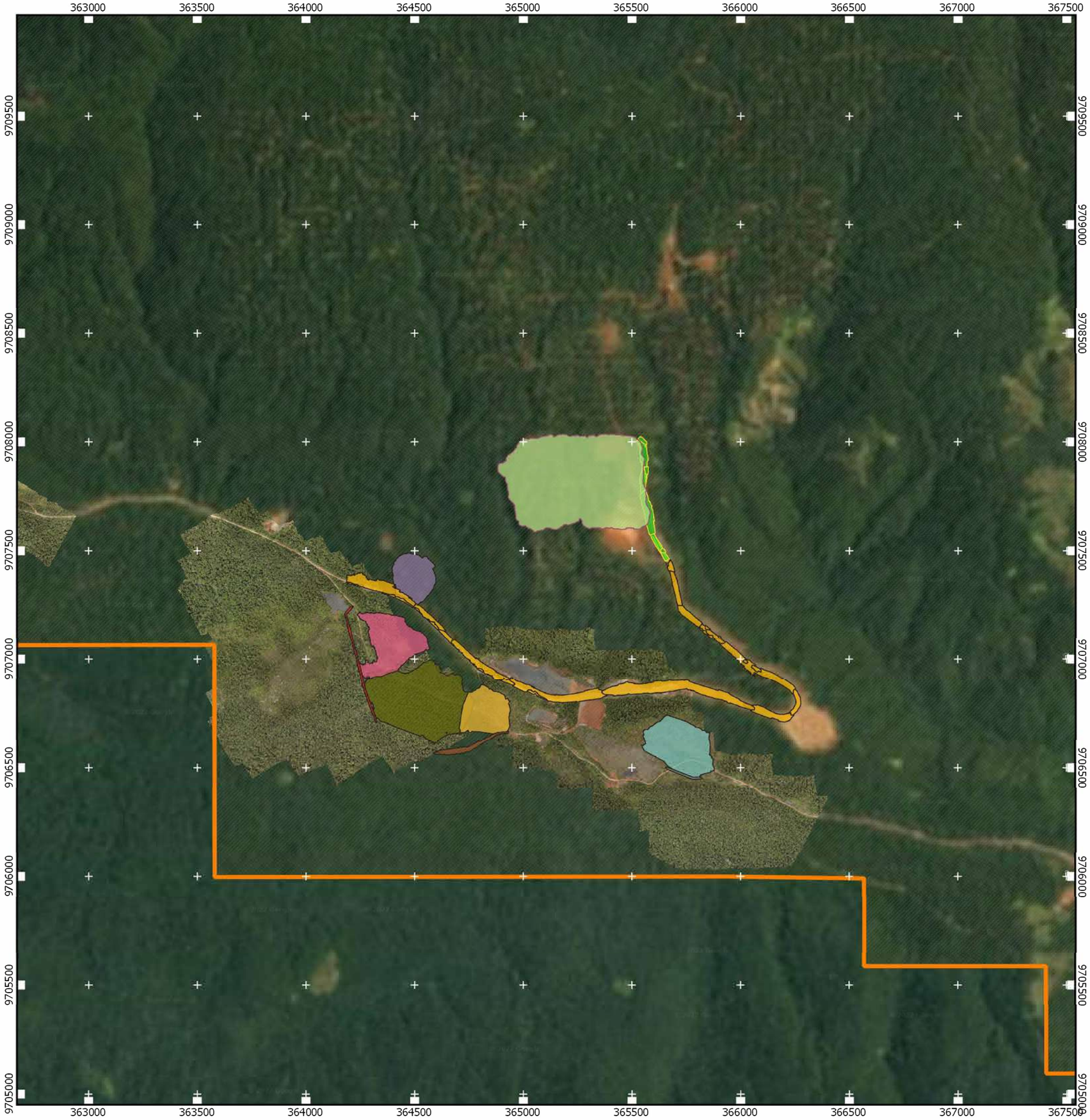
Wetherelt, A., Wielen, K. 2011. *Introduction to Open Pit Mining, Vol. 3rd edition.* United States of America: Society for Mining, Metallurgy, and Exploration (SME).

Zakri, S., Saldy, G.T. 2019. Analisis Sensitivitas Deterministik Investasi Pengadaan Alat Berat di Perusahaan Pertambangan Batubara dengan Metode NPV. *Jurnal Bina Tambang*, Vol. 4 No. 3.

LAMPIRAN

LAMPIRAN A

PETA TUNJUK LOKASI PENELITIAN



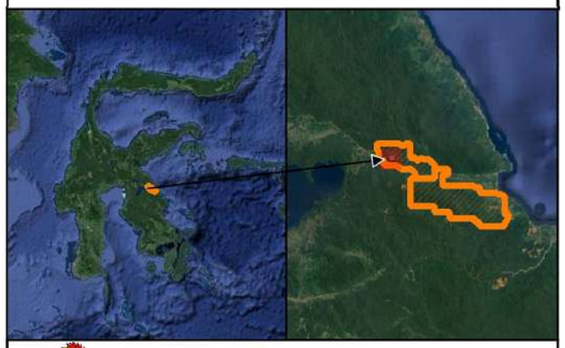
U

200 400 600 800

Legenda

- Kontrak Karya PT Vale Indonesia Tbk
- *Pit Compartment* 2
- *New Road*
- *Existing Road*
- *Dyke* 1
- *Dyke* 2
- *Dyke* 3
- *Disposal* 1
- *Disposal* 2
- *Disposal* 3
- *Disposal* 4
- *Quarry*

Infromasi Kartografi
Proyeksi : UTM, Zona 51 S
Datum Unit : WGS-84



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2022

SKRIPSI

PERENCANAAN JANGKA PANJANG *PIT COMPARTMENT* 2 DI BLOK BAHODOPI PT VALE INDONESIA TBK PROVINSI SULAWESI TENGAH

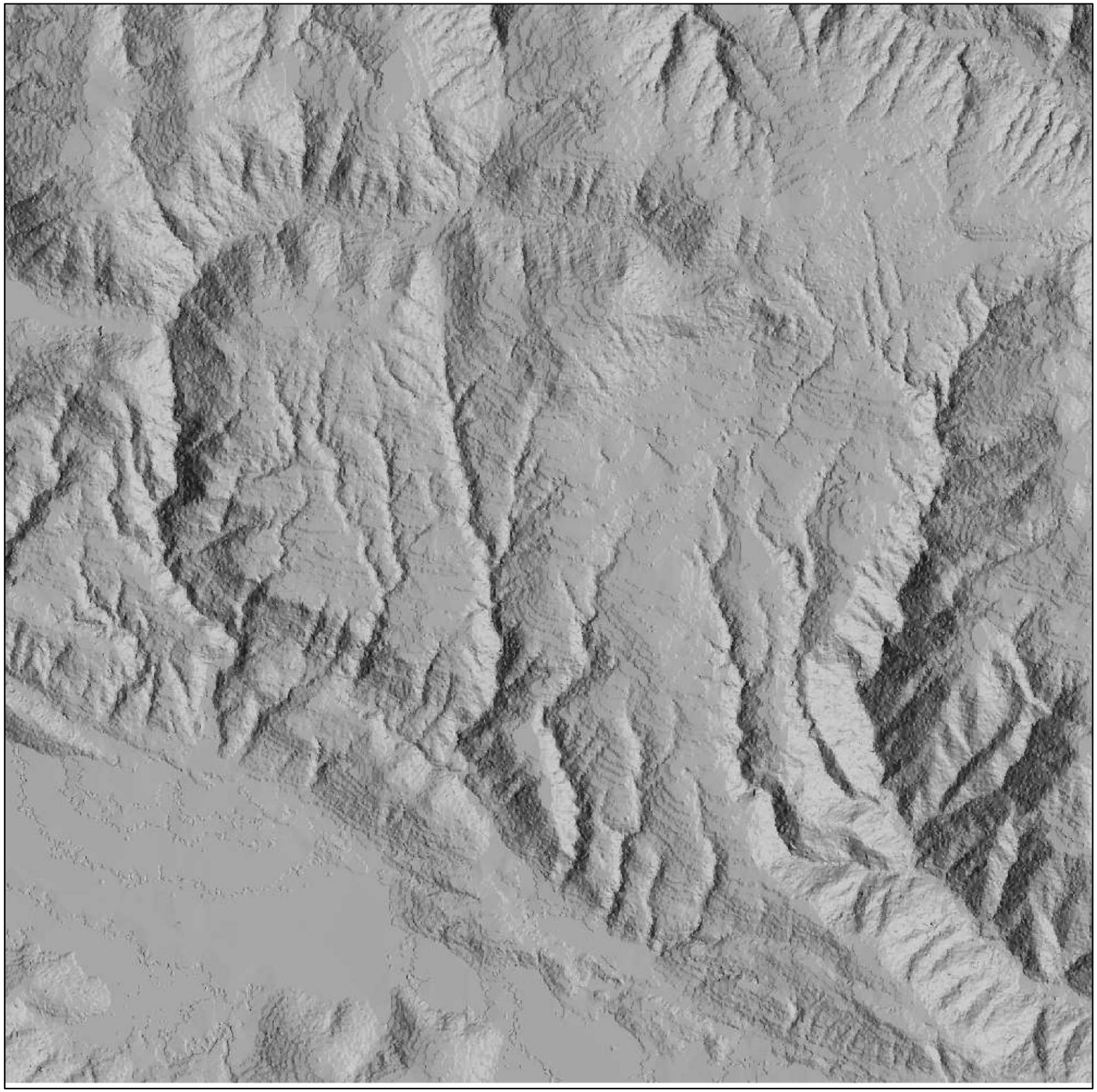
DIGAMBAR OLEH	TASYAH SHAFIRA D111181006
PEMBIMBING UTAMA	Dr. Eng. RINI NOVRIANTI SUTADJO TUI, S.T., M.T. NIP. 198311142014042001
PEMBIMBING PENDAMPING	Dr. ARYANTI VIRTANTI ANAS, S.T., M.T. NIP. 197010120101210001

PETA TUNJUK LOKASI PENELITIAN

LAMPIRAN	HALAMAN
A	100

LAMPIRAN B

TOPOGRAFI BLOK BAHODOPI



N

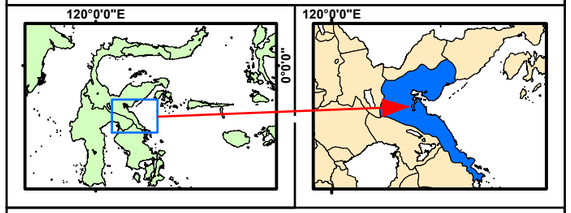
0 95190 380 570 760

Kilometer

Legenda:

Topografi Blok Bahodopi

Informasi Kartografi
Proyeksi : UTM, Zona 51 S
Datum Unit: WGS-84



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SKRIPSI

PERENCANAAN JANGKA PANJANG AREA *PIT COMPARTMENT* 2 BLOK BAHODOPI DI PT VALE INDONESIA Tbk PROVINSI SULAWESI SELATAN

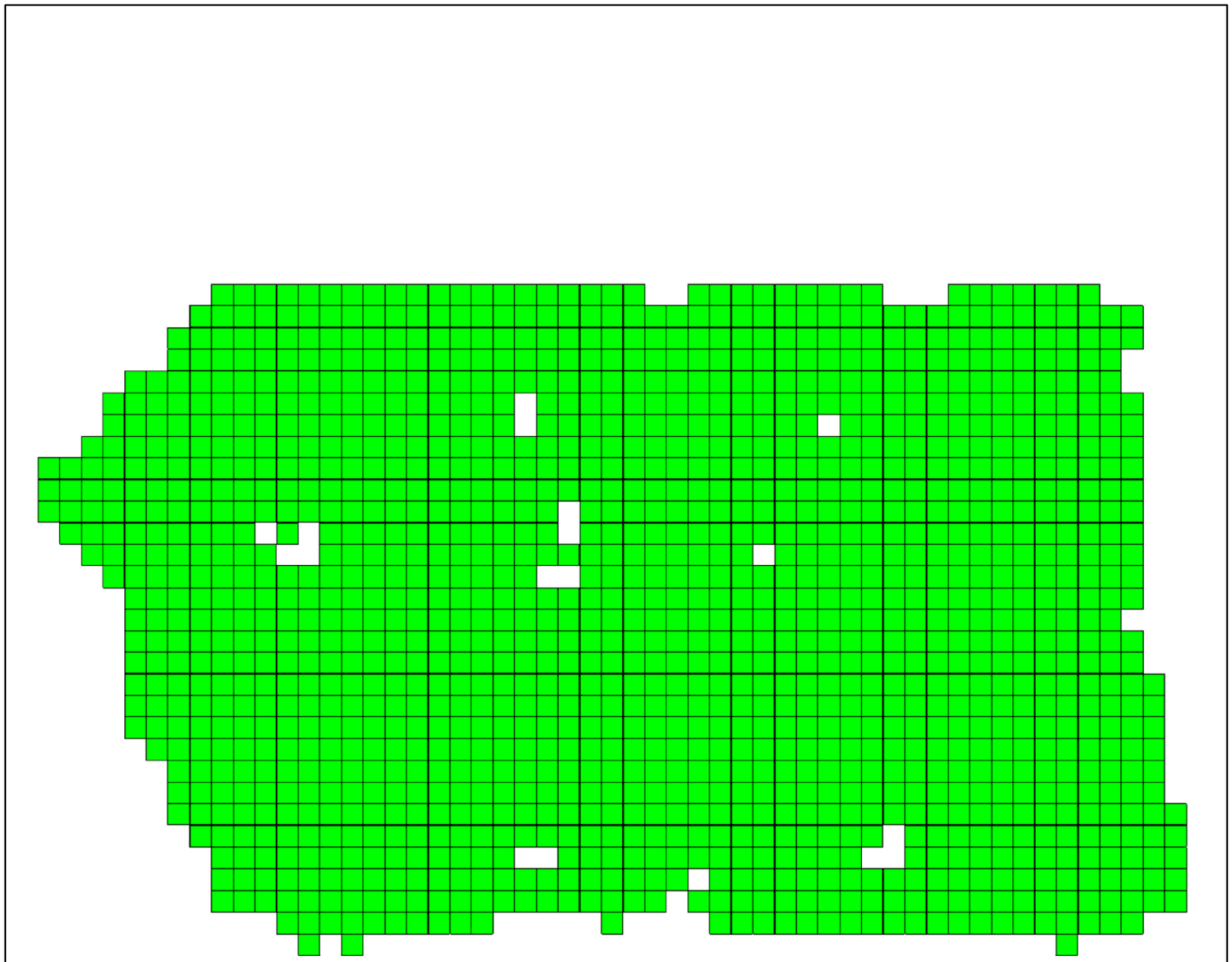
DIGAMBAR OLEH	TASYAH SHAFIRA D111181006
PEMBIMBING UTAMA	Dr. Eng. RINI NOVRIANTI SUTADJO TUI, S.T., M.T. NIP. 19831114201404200 1
PEMBIMBING PENDAMPING	Dr. ARYANTI VIRTANTI ANAS, S.T., M.T. NIP. 197101012010121001

TOPOGRAFI BLOK BAHODOPI

LAMPIRAN	HALAMAN
B	102

LAMPIRAN C

BLOCK MODEL PIT COMPARTMENT 2



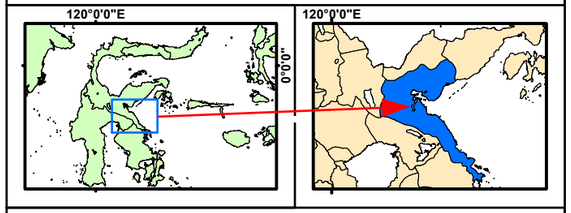
N

0 130260 520 780 1.040
Kilometer

Legenda:

Blok Model *Pit Compartment* 2

Informasi Kartografi
Proyeksi : UTM, Zona 51 S
Datum Unit: WGS-84



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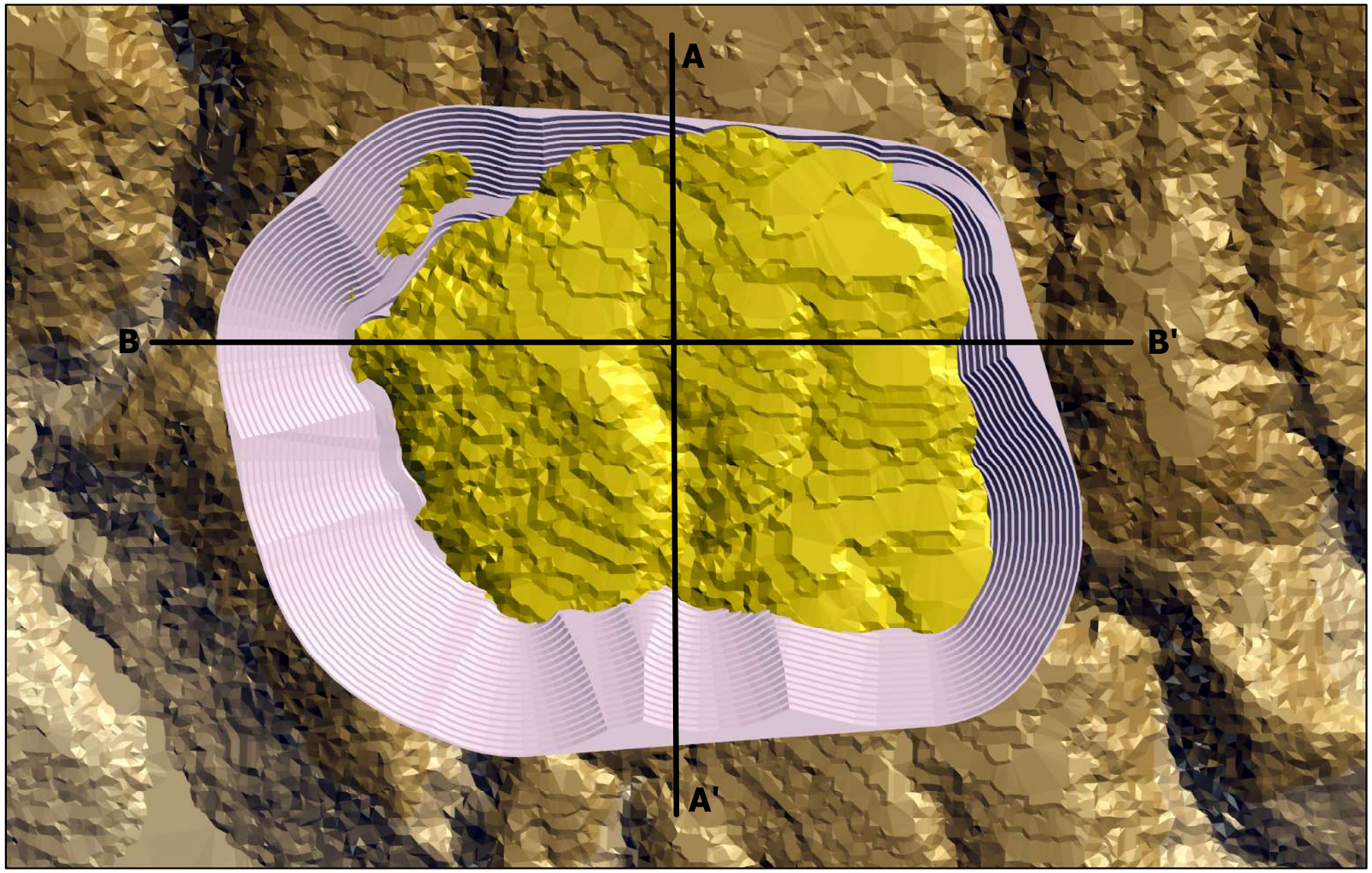
PEMBIMBING PENDAMPING	Dr. ARYANTI VIRTANTI ANAS, S.T., M.T. NIP. 197101012010121001

MODEL BLOK *PIT COMPARTMENT* 2

LAMPIRAN C	HALAMAN 104

LAMPIRAN D

DESAIN *PIT COMPARTMENT* 2



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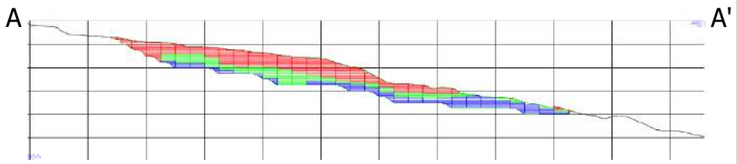

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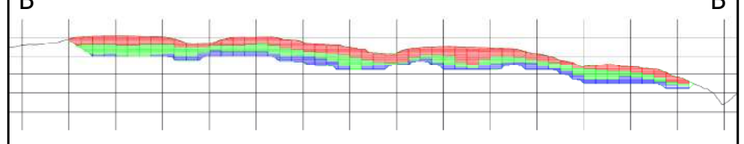


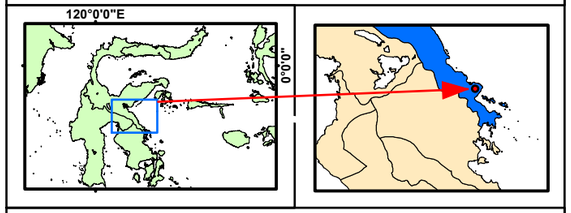
N

0 30 60 120 180 240
Kilometer

Legenda:

- *Pit Compartment* 2
- *Solid Pit Compartment* 2
- Topografi
- *Overburden*
- *Ore*
- *Bluezone*

Informasi Kartografi
Proyeksi : UTM, Zona 51 S
Datum Unit: WGS-84



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2022

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PERENCANAAN JANGKA PANJANG AREA *PIT COMPARTMENT* 2 DI BLOK BAHODOPI DI PT VALE INDONESIA Tbk PROVINSI SULAWESI TENGAH

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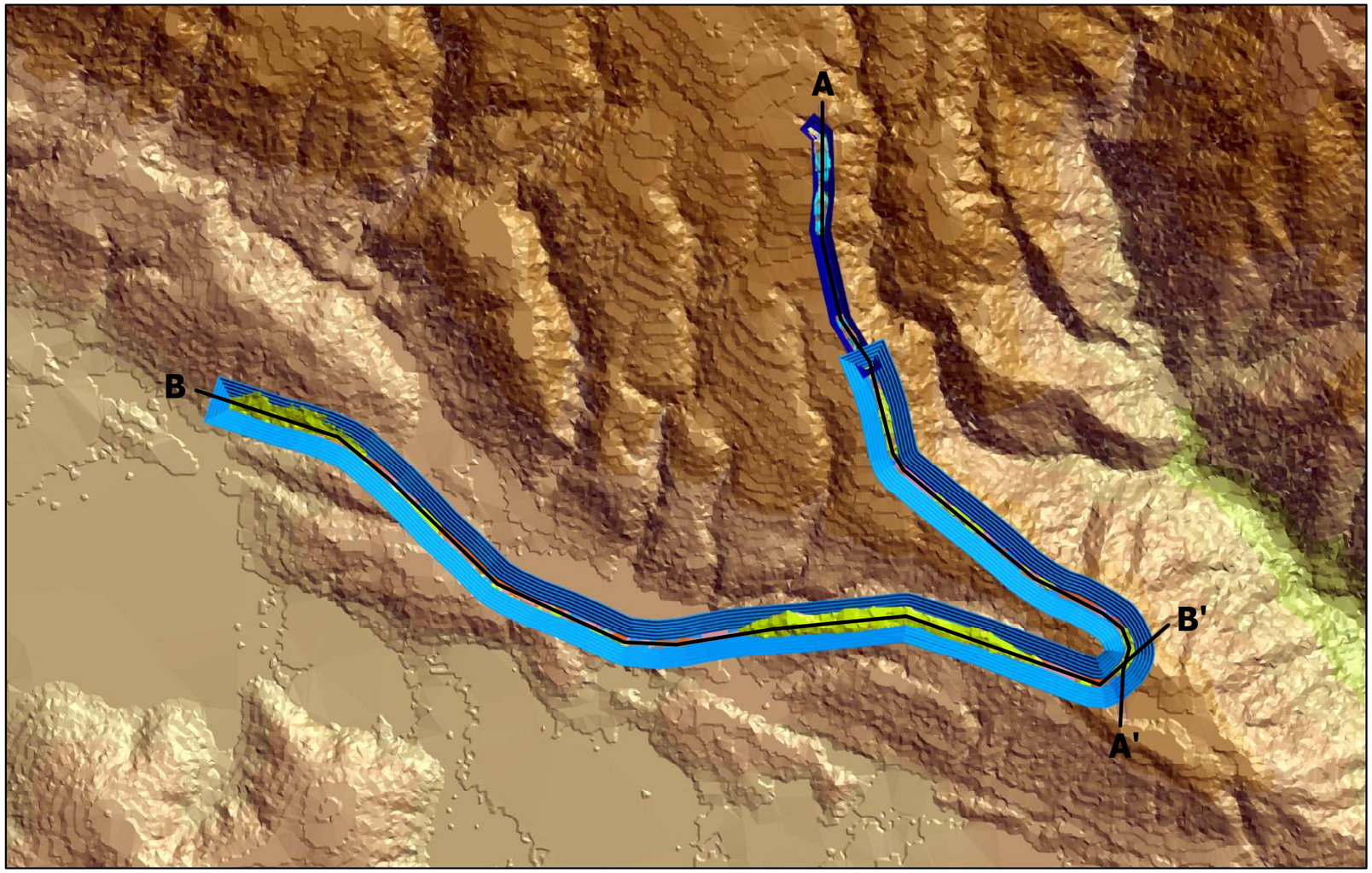
PEMBIMBING PENDAMPING	Dr. ARYANTI VIRTANTI ANAS, S.T., M.T. NIP. 197101012010121001

DESAIN *PIT COMPARTMENT* 2 AREA *HILL* MYARA 02, BLOK BAHODOPI

LAMPIRAN D	HALAMAN 106

LAMPIRAN E

DESAIN *MINE HAUL ROAD*



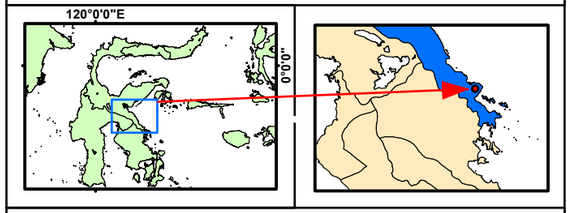
N

0 325 650 1.300 1.950 2.600
Kilometer

Legenda:

- *Solid Cut New Road*
- *Solid Cut Existing Road*
- *Solid Fill New Road*
- *Solid Fill Existing Road*
- Desain *Cut New Road*
- Desain *Cut Existing Road*
- Desain *Fill New Road*
- Desain *Fill Existing Road*
- Topografi

Informasi Kartografi
Proyeksi : UTM, Zona 51 S
Datum Unit: WGS-84



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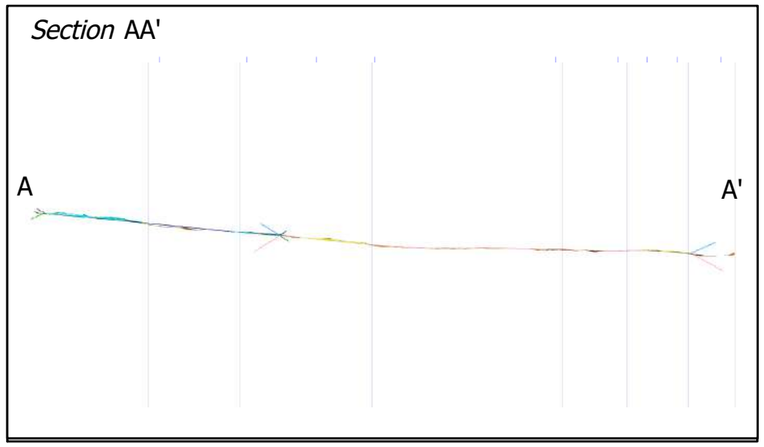

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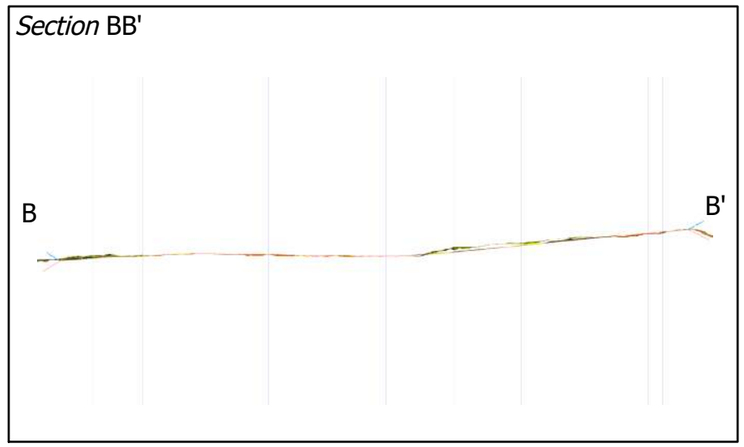

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SKRIPSI

PERENCANAAN JANGKA PANJANG AREA *PIT COMPARTMENT* 2 DI BLOK BAHODOPI PT VALE INDONESIA Tbk PROVINSI SULAWESI TENGAH

DIGAMBAR OLEH	TASYAH SHAFIRA D111181006
PEMBIMBING UTAMA	Dr. Eng. RINI NOVRIANTI SUTADJO TUI, S.T., M.T. NIP. 198311142014042001
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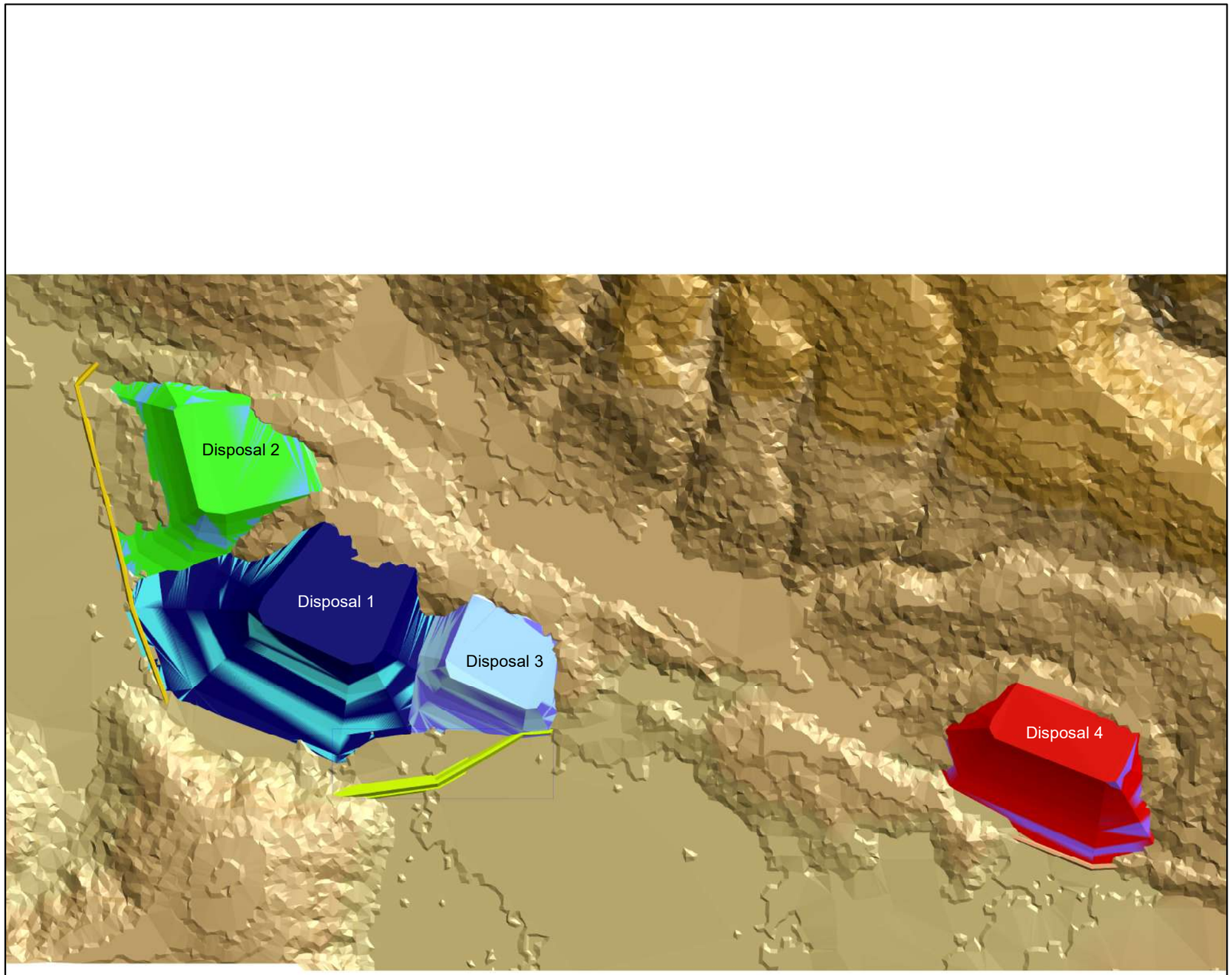
DESAIN *MINE HAUL ROAD*

LAMPIRAN E	HALAMAN 108

LAMPIRAN F

DESAIN *DISPOSAL* DAN *DYKE*



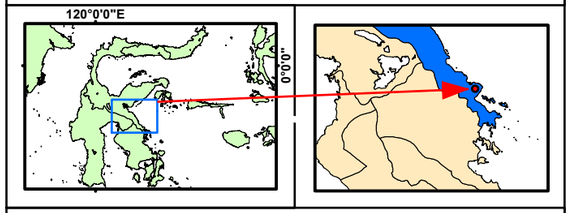
N

0 420 840 1.680 2.520 3.360
Kilometer

Legenda:

- Desain *Disposal* 1
- Desain *Disposal* 2
- Desain *Disposal* 3
- Desain *Disposal* 4
- *Solid Disposal* 1
- *Solid Disposal* 2
- *Solid Disposal* 3
- *Solid Disposal* 4
- *Solid Dyke* 1
- *Solid Dyke* 2
- *Solid Dyke* 3

Informasi Kartografi
Proyeksi : UTM, Zona 51 S
Datum Unit: WGS-84



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PERENCANAAN JANGKA PANJANG AREA *PIT COMPARTMENT* 2 DI BLOK BAHODOPI PT VALE INDONESIA Tbk PROVINSI SULAWESI TENGAH

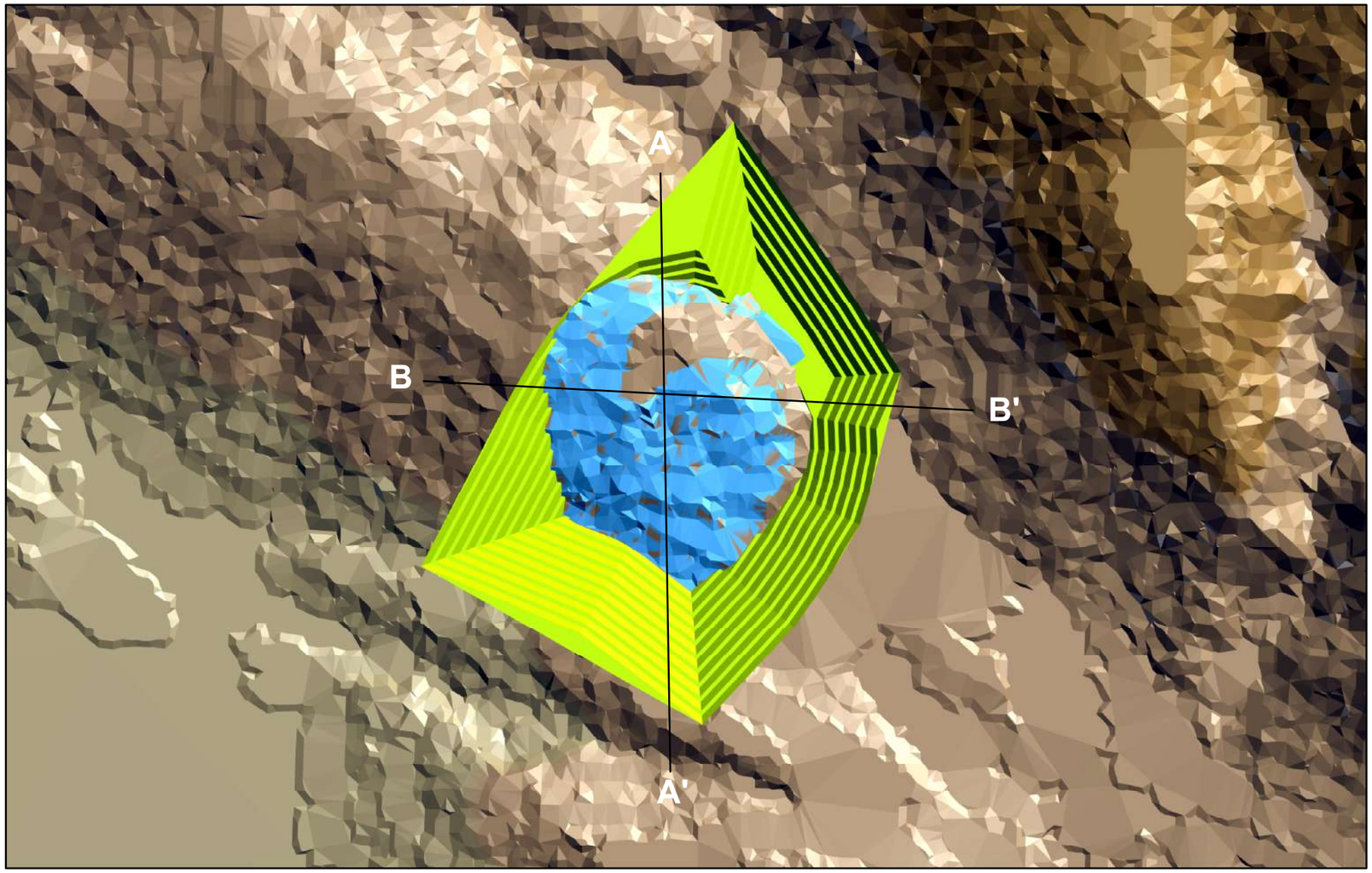
DIGAMBAR OLEH	TASYAH SHAFIRA D111181006
PEMBIMBING UTAMA	Dr. Eng. RINI NOVRIANTI SUTADJO TUI, S.T., M.T. NIP. 198311142014042001
PEMBIMBING PENDAMPING	Dr. ARYANTI VIRTANTI ANAS, S.T., M.T. NIP. 197010120101210001

DESAIN *DISPOSAL* DAN *DYKE*

LAMPIRAN	HALAMAN
F	110

LAMPIRAN G

DESAIN *QUARRY*



N

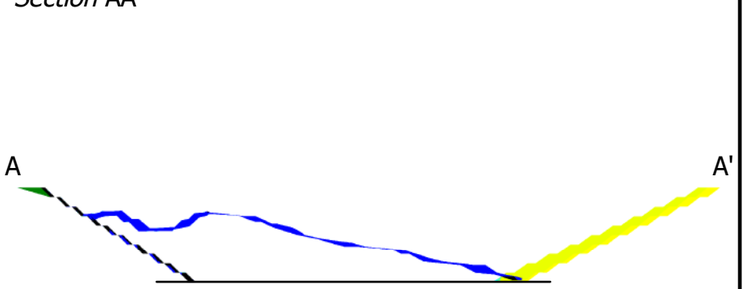
0 1.150 2.300 4.600 6.900 9.200
Kilometer

Legenda:

- Desain *Quarry*
- *Solid Quarry*
- Topografi

Informasi Kartografi
Proyeksi : UTM, Zona 51 S
Datum Unit: WGS-84

Section AA'



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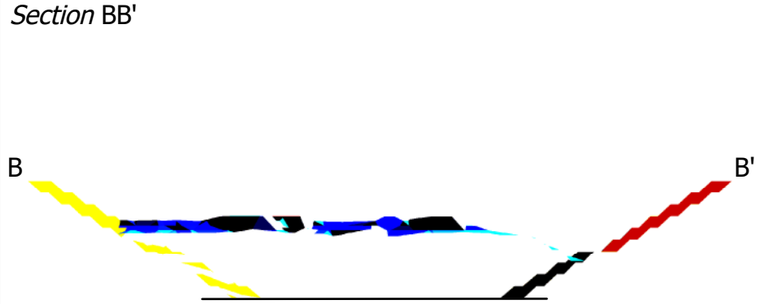

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PERENCANAAN JANGKA PANJANG AREA *PIT COMPARTMENT* 2 DI BLOK BAHODOPI PT VALE INDONESIA Tbk PROVINSI SULAWESI TENGAH

DIGAMBAR OLEH	TASYAH SHAFIRA D111181006
PEMBIMBING UTAMA	Dr. Eng. RINI NOVRIANTI SUTADJO TUI, S.T., M.T. NIP. 19831114201404200 1
PEMBIMBING PENDAMPING	Dr. ARYANTI VIRTANTI ANAS, S.T., M.T. NIP. 19710101201012100 1

DESAIN *QUARRY*

LAMPIRAN	HALAMAN
G	112

LAMPIRAN H

CADANGAN *PIT COMPARTMENT* 2

TOTAL CADANGAN *PIT COMPARTMENT* 2

Bench	*Overburden* (wmt)	*Ore* (wmt)	*Overburden* dan *waste* (wmt)	SR (%)	*Bluezone* (Ton)	Ni_*Ore* (%)	Fe_*Ore* (%)	Si_*Ore* (%)	Mg_*Ore* (%)	SM_*Ore* (%)	Co_*Ore* (%)	Cr_*Ore* (%)	Al_*Ore* (%)	Mn_*Ore* (%)	Ca_*Ore* (%)	Ton Ni	SSP (wmt)	DKP (dmt)
915	9.763	-	9.763	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
910	111.903	-	111.903	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
905	173.851	11.812	173.851	14,72	31	2,09	27,92	21,55	12,39	1,74	0,09	1,22	3,80	0,62	0,11	100,50	9.450	5.788
900	171.133	94.710	171.133	1,81	933	2,22	20,83	29,69	17,37	1,71	0,06	0,93	2,76	0,45	0,18	856,65	75.768	46.408
895	256.802	105.163	256.802	2,44	30.135	2,00	14,95	35,08	23,31	1,50	0,03	0,69	1,91	0,27	0,27	857,89	84.130	51.530
890	302.750	113.464	302.750	2,67	24.720	2,15	20,89	29,44	17,98	1,64	0,06	0,91	2,70	0,46	0,18	995,41	90.771	55.597
885	375.539	187.167	376.421	2,01	28.195	2,26	17,51	32,68	20,70	1,58	0,04	0,78	2,29	0,40	0,20	1.724,87	149.733	91.712
880	336.541	232.178	336.541	1,45	63.042	2,09	17,14	32,95	21,15	1,56	0,04	0,75	2,18	0,38	0,23	1.973,40	185.743	113.767
875	334.668	201.394	335.843	1,67	95.080	2,11	15,86	34,25	21,82	1,57	0,04	0,70	2,02	0,30	0,25	1.732,43	161.115	98.683
870	397.340	215.429	398.222	1,85	78.944	2,14	15,82	34,89	21,13	1,65	0,03	0,71	1,93	0,29	0,24	1.881,77	172.343	105.560
865	342.117	254.270	342.705	1,35	76.720	2,08	15,55	35,27	21,27	1,66	0,03	0,71	1,98	0,29	0,29	2.155,16	203.416	124.592
860	252.136	266.853	253.789	0,95	109.323	2,02	15,04	36,07	21,54	1,67	0,03	0,69	1,95	0,28	0,31	2.197,57	213.482	130.758
855	166.579	202.593	167.895	0,83	82.558	2,03	14,85	36,25	21,68	1,67	0,03	0,68	1,85	0,28	0,33	1.677,79	162.074	99.271
850	125.016	155.405	125.016	0,8	78.221	1,95	14,63	36,18	21,91	1,65	0,03	0,69	1,85	0,27	0,34	1.232,05	124.324	76.148
845	99.287	103.959	99.287	0,96	61.806	1,94	14,12	36,78	22,52	1,63	0,03	0,68	1,89	0,25	0,39	823,59	83.167	50.940
840	68.748	76.598	68.748	0,9	34.181	2,02	14,17	36,51	22,65	1,61	0,03	0,68	1,90	0,25	0,34	629,99	61.279	37.533
835	46.716	63.506	46.716	0,74	22.330	1,99	13,34	37,12	23,35	1,59	0,03	0,66	1,66	0,23	0,35	514,26	50.805	31.118
830	20.738	43.153	20.738	0,48	26.782	1,96	14,85	35,57	22,40	1,59	0,03	0,74	2,03	0,28	0,42	343,92	34.522	21.145
825	3.775	21.560	3.775	0,18	17.097	1,89	13,47	36,12	23,78	1,52	0,03	0,67	1,80	0,25	0,45	165,79	17.248	10.565
820	853,52	6.447	854	0,13	8.794	1,86	13,49	35,52	25,58	1,39	0,03	0,67	1,80	0,26	0,60	48,73	5.158	3.159
815	-	2.733	-	-	6.241	2,06	9,48	38,85	29,58	1,31	0,02	0,48	1,08	0,15	0,53	22,96	2.187	1.339
810	-	993,75	-	-	1.349	1,83	8,67	39,10	29,32	1,33	0,02	0,48	0,68	0,14	0,26	7,40	795	487
Total	3.596.256	2.359.388	3.602.751	1,52	846.482	2,07	16,02	34,54	21,31	1,62	0,04	0,73	2,05	0,31	0,28	19.942	1.887.510	1.156.100

LAMPIRAN I

STANDAR OPERASIONAL PROSEDUR (SOP)

PT. INTERNATIONAL NICKEL INDONESIA

MINING DEPARTEMENT
LTP Creating Conceptual Pit Design
STANDARD JOB PROCEDURE

NOMOR : 07.LTP.04

DEPARTEMENT : Mine Technology

SECTION/AREA : LTP

PROCEDURE : **Creating Conceptual Pit Design**

TYPE : Routine

Date of writer : April 24th 2007

Number of Revision : 1

Next Revision : April 24th 2008

Pages : 1 – 15

Made by: Yudhistianto	Date: 24-04-07	
Revised by: Ruth Sitorus	Date: 20-08-07	
Checked by: Harry Ginting	Date:	
Approved by: Dwayne Kroll	Date:	

1. Introduction

The main reason of making this procedure is to make guidance for Vulcan user to have the right procedure to create Pit Design from Vulcan Block model.

2. Responsible

The qualified person in LTP who has already coached or trained in order to produce optimal and safe pit design so there aren't ore will be loss because of an unknown procedure.

3. Definition and Abbreviation

- *dgd = base file for running Vulcan software where all the design file saved
- *dg1 = base file for running Vulcan software that consist of your range working area (Easting Northing and Elevation)
- *dgx = base file for running Vulcan software for all the system and index design file that follows *.dgd
- *scd = base file for running Vulcan Software that related with colour display for every scheme in Vulcan

4. Reference

This Vulcan Software is referring to Vulcan Help menu that available in Vulcan 4.5 and Vulcan 6.0 version menu.

5. Related Procedure

This working procedure is related with other LTP procedures; SJP Transferring Block Model from Datamine to Vulcan.

6. Standard Document and Form

There is a document that must be seen before create a pit. This Document is related with the validity of BM which will be used to create a pit. The document is located in 02-ltp\BlockModel\BM_Assigning Form

7. Training and Other Qualification

Basic training that should be followed is:

- Basic knowledge about Computer and Hardware.
- Basic Vulcan
- Basic of Block Model

8. Environment, Health and Safety Consideration

Good communication between all Vulcan users in every section is important due to limited Vulcan licenses in PT. Inco because it might affect to the bad working condition if all Vulcan users are selfish.

9. Procedure

9.1. Preparation

- Make sure that in your working directory already have all these files below. The file is located in 02-ltp\V\3vulcandata;

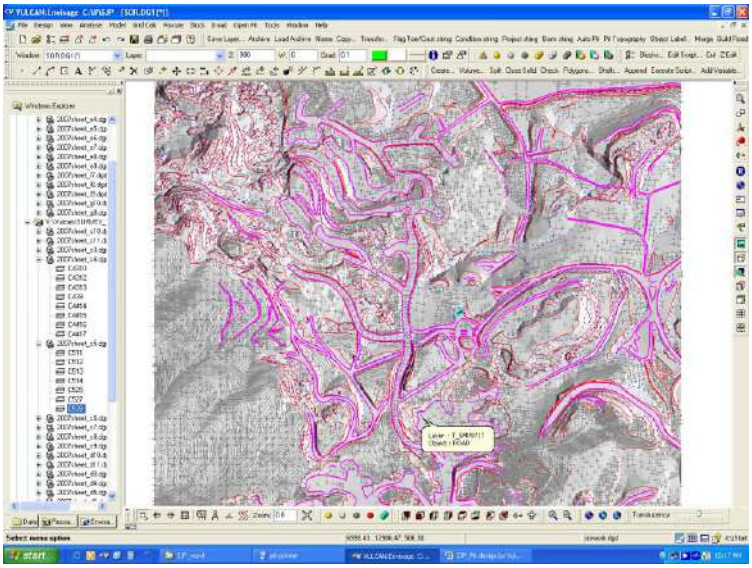
1. *.dgd
2. *.dg1
3. *.dgx
4. *.scd

- Make sure that Block Model that you used to design a pit is the correct one (see SJP transferring block model from datamine to Vulcan & BM Assigning Form).
- Make sure that you copy the right *.scd file. The file is in directory; 02-ltp\V\3vulcandata.
- Make sure that you copy the latest update blue zone. The file is located in 02-ltp\BlockModel\BZ_Orex.

9.2. Job Execution

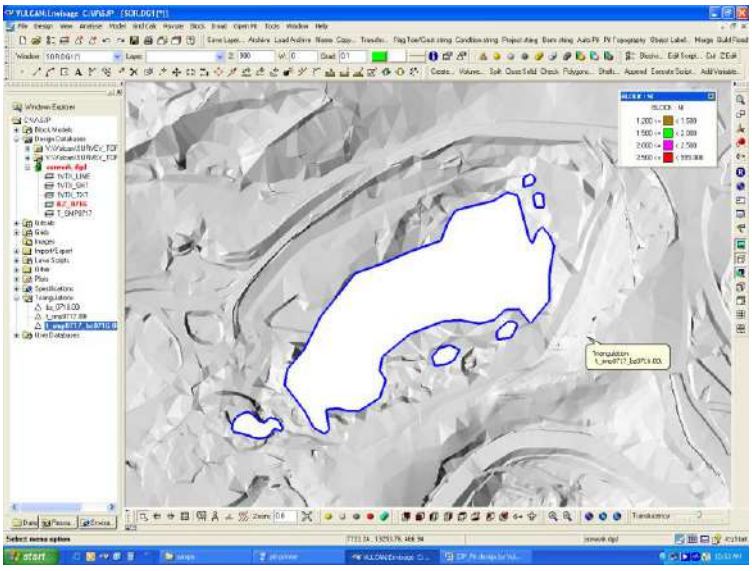
Creating Pit Design

1. Load the update topography and make triangulation.



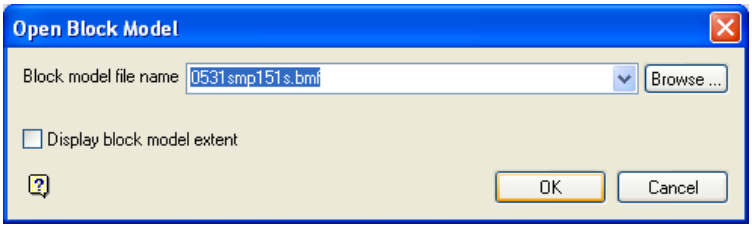
Load the update blue zone (mined out area) and make solid polygon, go to Model > Triangle Solid > Polygons

Cut topography triangulation with blue zone solid polygon, go to Model > Triangle Utility > Boolean. Exclude topography area which inside Blue zone boundary and save with new name of topography triangulation.

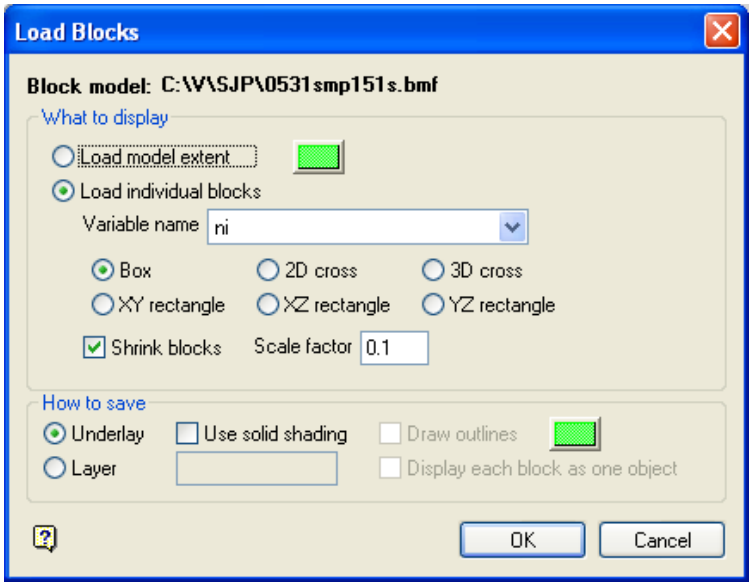


2. Open Block model below topography triangulation.

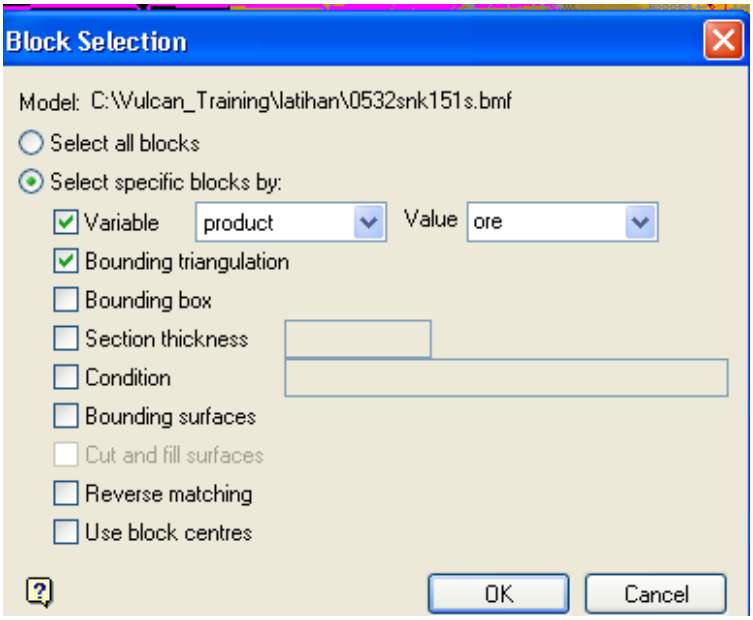
   Go to Block > Open, select the block model

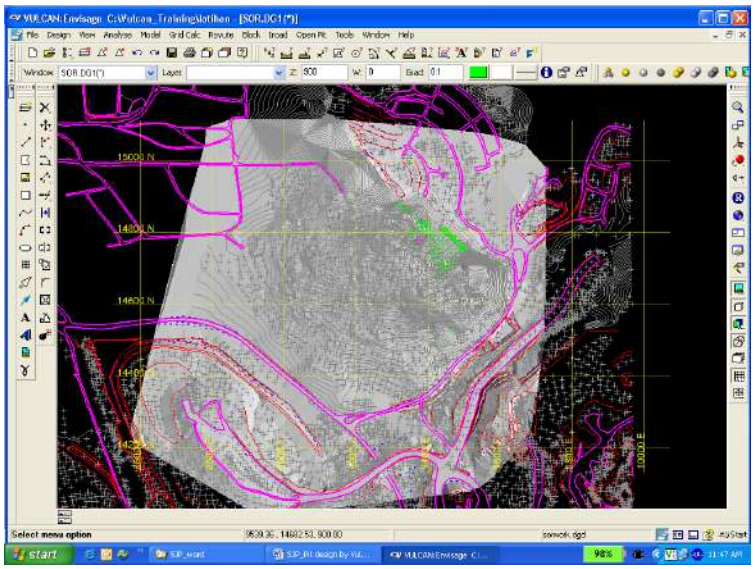


   Go to Block > Viewing > Block, put "ni' for Variable name and select "ni" on schemes table.



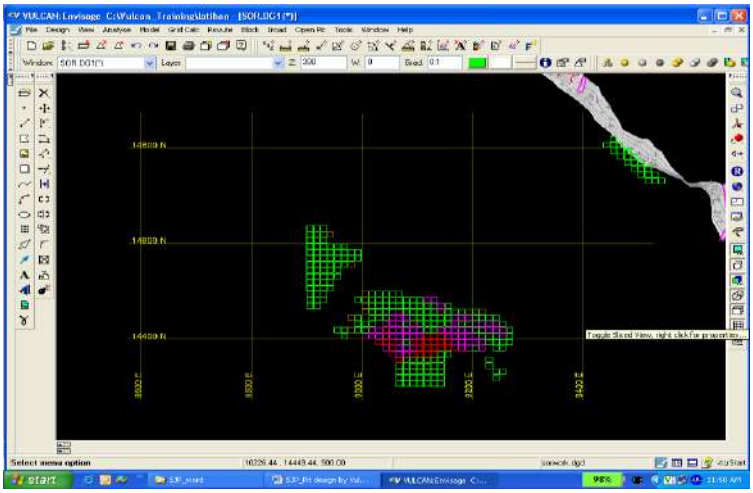
   Select specific block by : Variable "product" , Value "ore" and click Bounding triangulation.





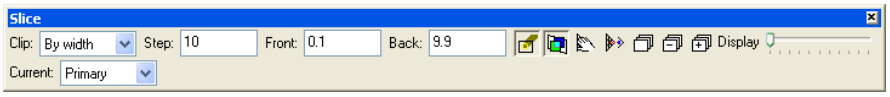
3. Create block slice per 10 m

   To active slice view table, right click on the “Toggle Sliced View”



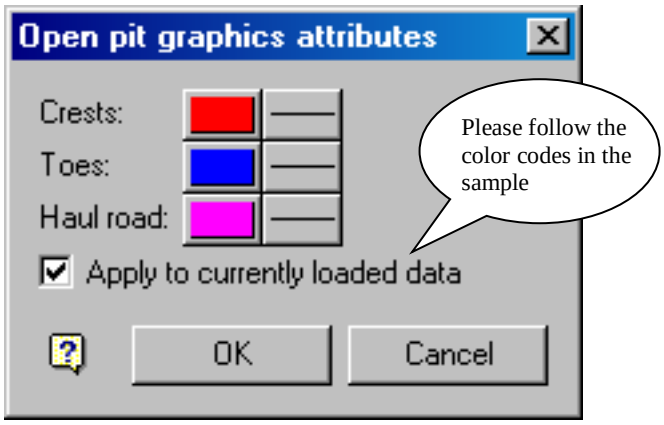
   Fill the clip : “By width” , Step/Interval : 10, Front : 0.1, Back : 9.9,

   Click icon slice backwards or slice forward.



4. Prepare to Create pit.

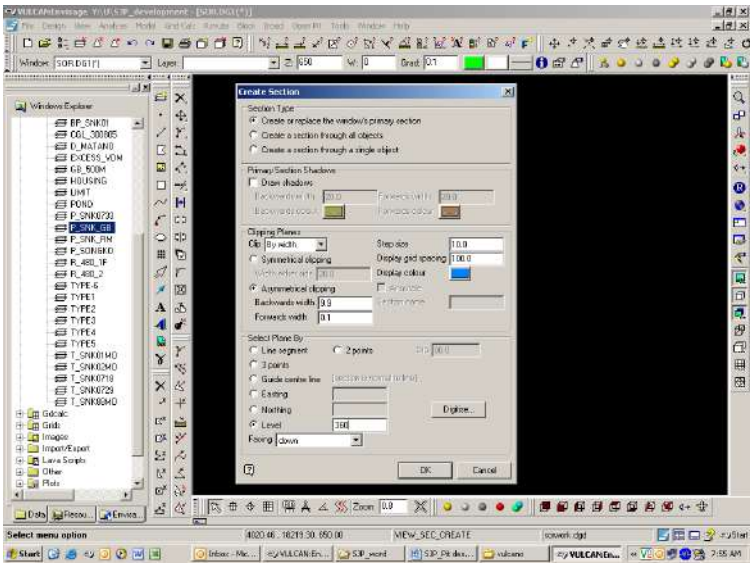
   a. Put the colour of toe & crest: Go to Open Pit > Ramps > Graphic Toe/Crest/Road

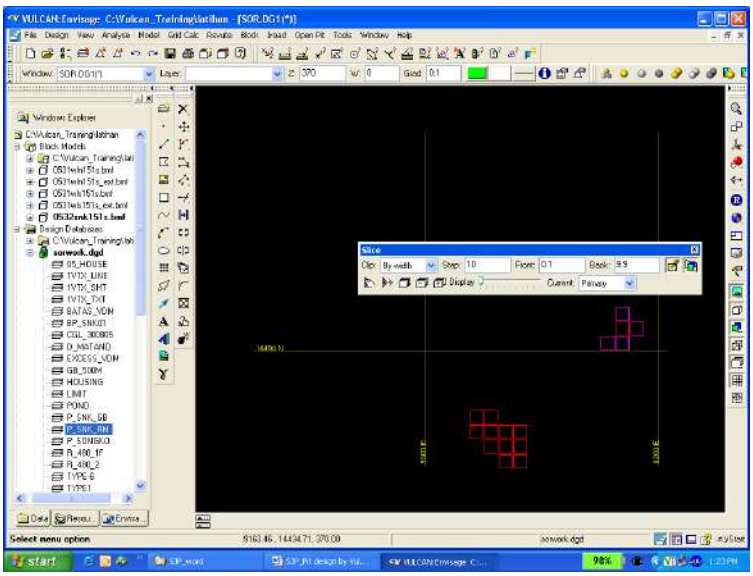


b. Design pit start from the lowest bench of the block model: go to View > Create

Section > Fill Backward with = 9.9 > Fill Forward with = 0.1 > Fill level with the lowest

ore level , ex = 360.

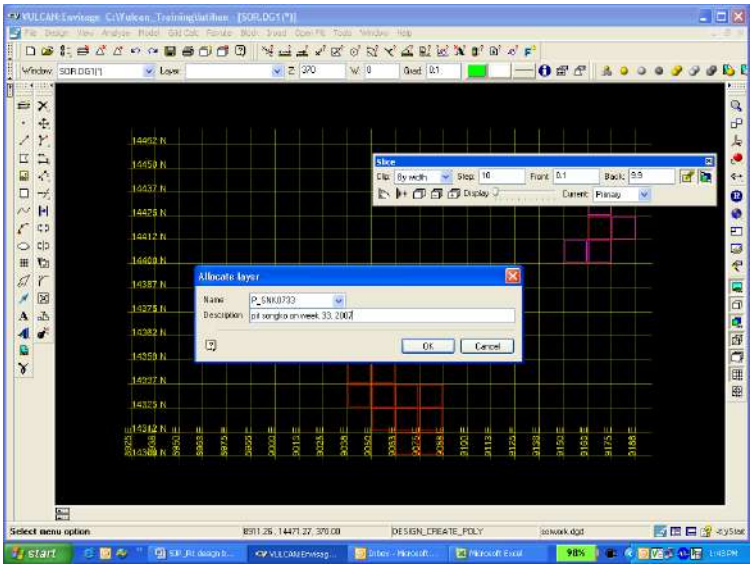




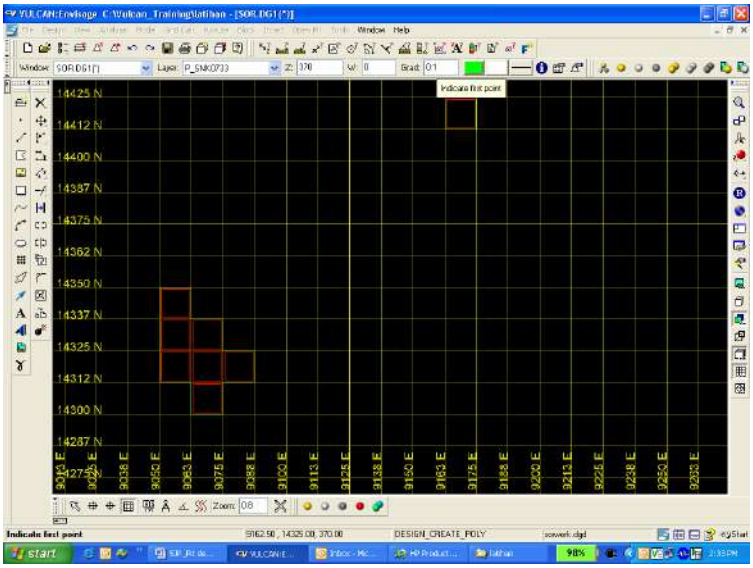
c. Generate grid 12.5 X 12.5 m

5. Create a Pit

a. Make Polygon: go to Design > Create > Polygon, put the name of pit.



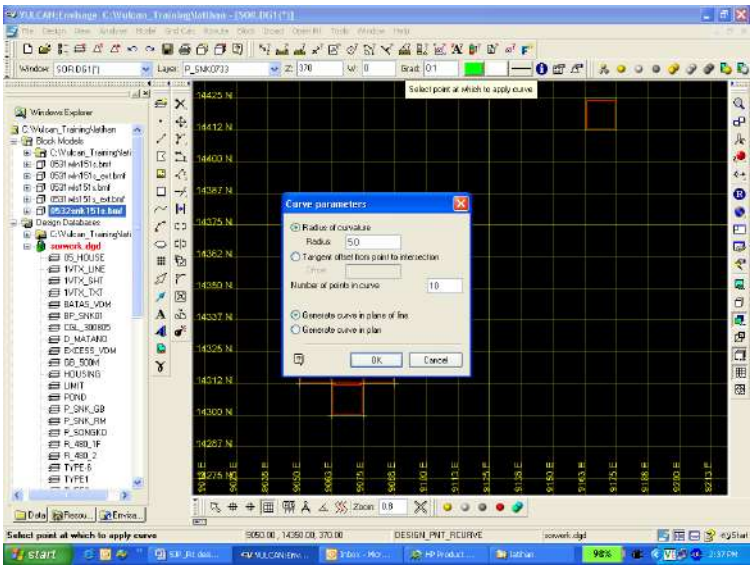
Digitize: snap to grid > click at the gridline > digitize all ore counter wise.



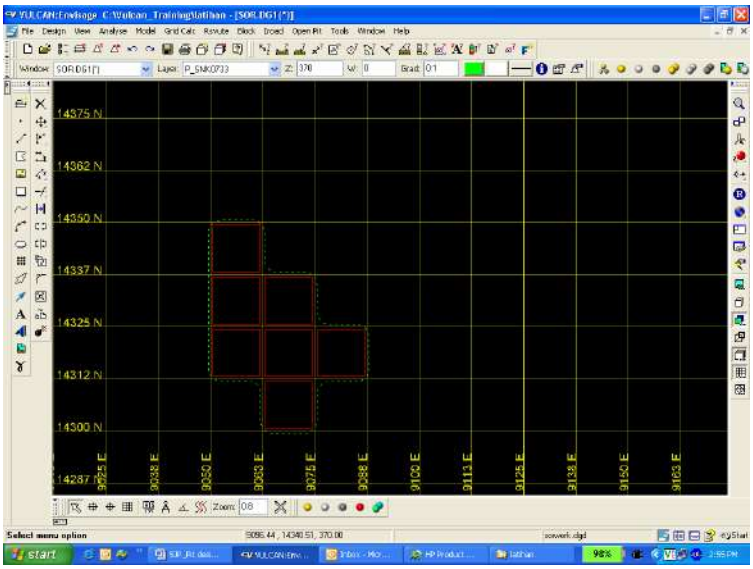
b. Offset existing polygon 0.5 m from original: go to Open pit> open cut design > berm string

c. Curve the offset polygon to make it smooth: go to Design > point insert > apply curve >select object for curve > select point at which to apply curve (click at the first point to be Curve & so on) > input radius curvature 3-10 (as required) > number of point = 10 (as required) > OK

> retain curve

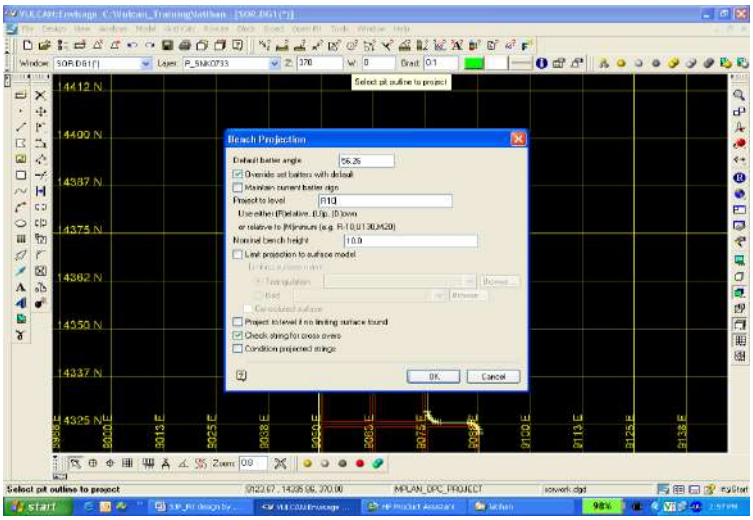


d. Delete previous polygon

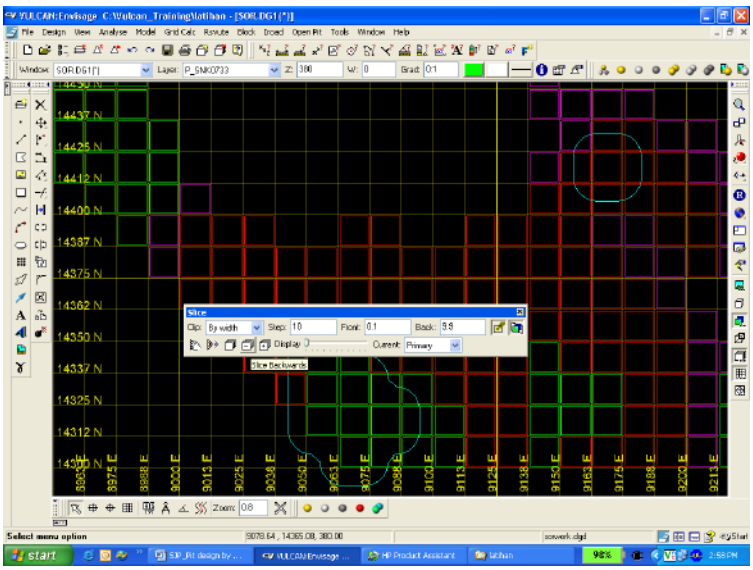


e. Flagging the boundary being toe/crest (as needed): go to open pit > open cut design > flag toe/crest string

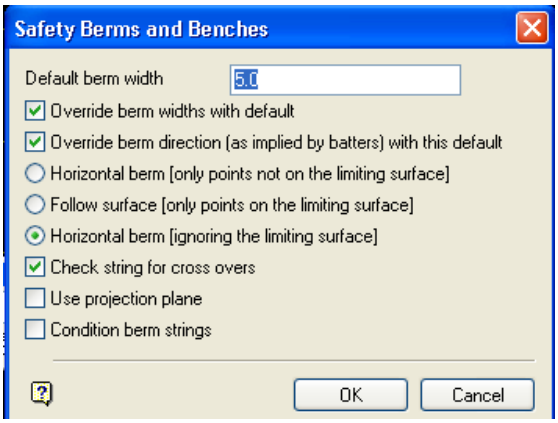
f. Projected pit up: go to Open pit > open cut design > project string > fill default batter angle = "56.26^{o}" for west block and "45°" for east block > fill Project to level = "R10" > OK > retain > click at the polygon (toe)

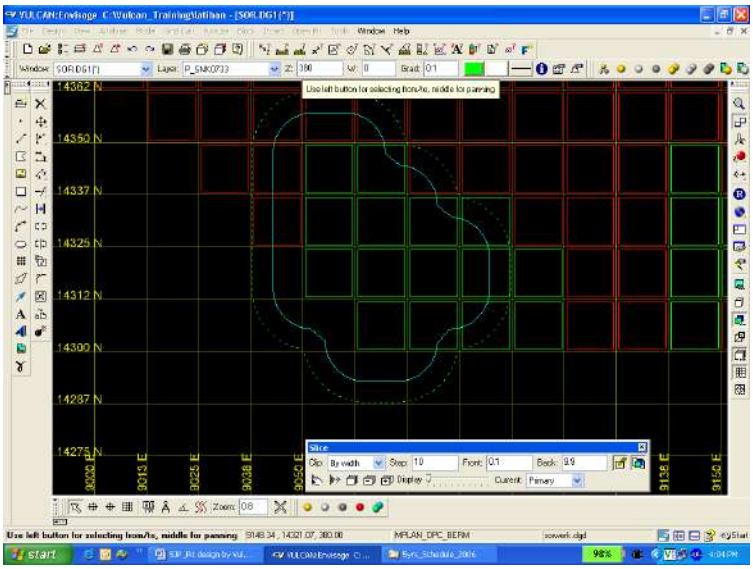


To see the projected polygon, go up to the next level: Slice backward > (-)



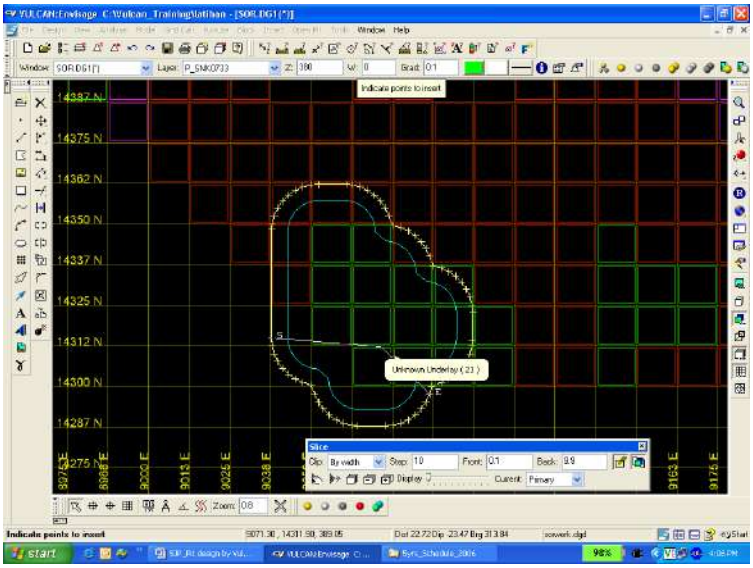
g. Create berm at it level: Open pit > Open cut design > berm string > Click at the polygon line > fill default berm width = 5 > ok > retain:





h. Modify berm to counter all ore in that level: go to design > point insert > replace string >

Click at first & end point > digitize snap to gridline >



Curve the berm and do the same step from 5b to 5h until get ore in the highest level.

PT. INTERNATIONAL NICKEL INDONESIA

MINING DEPARTEMENT LTP
DESIGN DISPOSAL STANDARD JOB PROCEDURE

NOMOR : 07.LTP.07

DEPARTEMENT : Mine Technology

SECTION/AREA : LTP

PROCEDURE : **Design Disposal**

TYPE : Routine

Date of writer : August 29th 2007

Number of Revision : 0

Next Revision : August 29th 2008

Pages : 1 – 8

Made by: Ruth Sitorus	Date: 29-08-07	
Revised by:	Date:	
Checked by: Harry Ginting	Date:	
Approved by: Dwayne Kroll	Date:	

1. **Introduction**
   Disposal is the dump location of overburden as the impact of mining activity. There are some of parameter has to be applied on disposal design in order to fulfill the safety standard.

2. **Responsible**
   The qualified person in LTP who has already coached or trained in order to produce optimal and safe disposal design so there aren't ore will be dumped because of an unknown procedure.

3. **Definition and Abbreviation**
   - *dgd = base file for running Vulcan software where all the design file saved
   - *dg1 = base file for running Vulcan software that consist of your range working area (Easting Northing and Elevation)
   - *dgx = base file for running Vulcan software for all the system and index design file that follows *.dgd
   - *scd = base file for running Vulcan Software that is related with colour display for every scheme in Vulcan

4. **Reference**
   This Vulcan Software is referring to Vulcan Help menu that available in Vulcan 4.5 and Vulcan 6.0 version menu.

5. **Related Procedure**
   This working procedure is not related with other LTP procedures.

6. **Standard Document and Form**
   There is a document that related with this SJP. The document is located in …….. This document is consisting of all area have already released so those area can be used for disposal.

7. **Training and Other Qualification**
   Basic training that should be followed by Vulcan user is:
   - Basic knowledge about Computer and Hardware
   - Basic Vulcan
   - Basic knowledge of Block Model.

8. **Environment, Health, and Safety Consideration**
   Good communication between all Vulcan users in every section is important due to limited Vulcan licenses in PT. Inco because it might affect to the bad working condition if all Vulcan users are selfish.

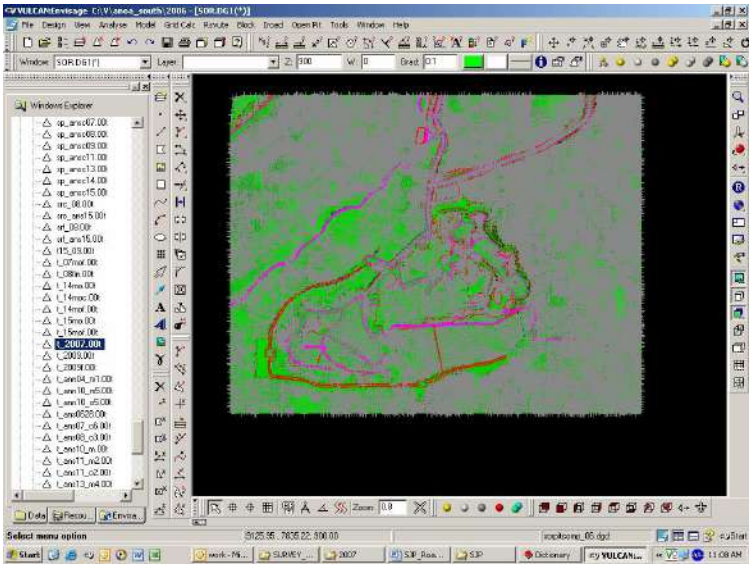
9. **Procedure 9.1. Preparation**
   - Make sure that in your working directory already have all these files below. The file is located in 02-ltp\V\3vulcandata:
     1. *.dgd
     2. *.dg1
     3. *.dgx
     4. *.scd

- Make sure that you copy the right *.scd file. The file is located in; 02-ltp\V\3vulcandata.
- Make sure that you copy the latest update blue zone. The file is located in 02-ltp\BlockModel\BZ_Orex

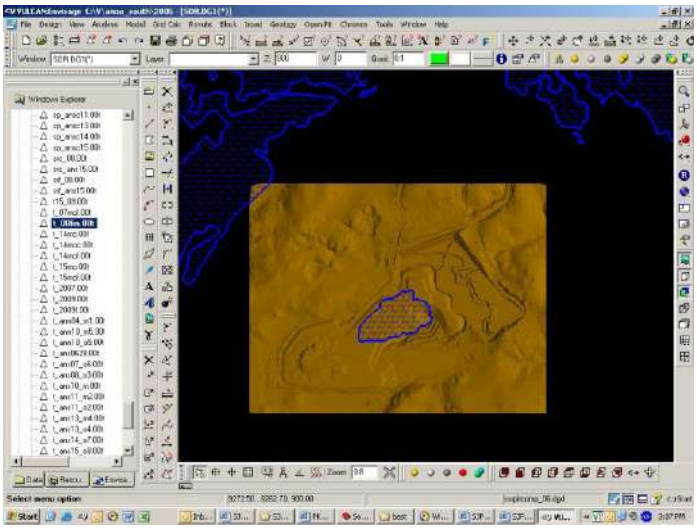
9.2. Job Execution

Creating Pit Design

1. Load the update topography and make triangulation; go to model > triangle surface > create > choose layer topography which be triangulated > fill triangulation name cell (usually same with layer name) > Ok.

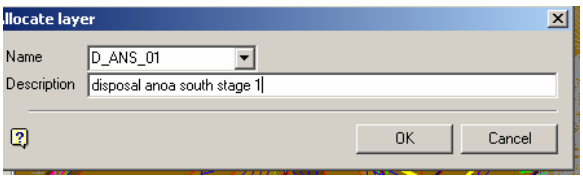


2. Usually conceptual disposal design by LTP mostly is located in mine out pit compartment. Load the update blue zone and release boundary before you plan disposal design.

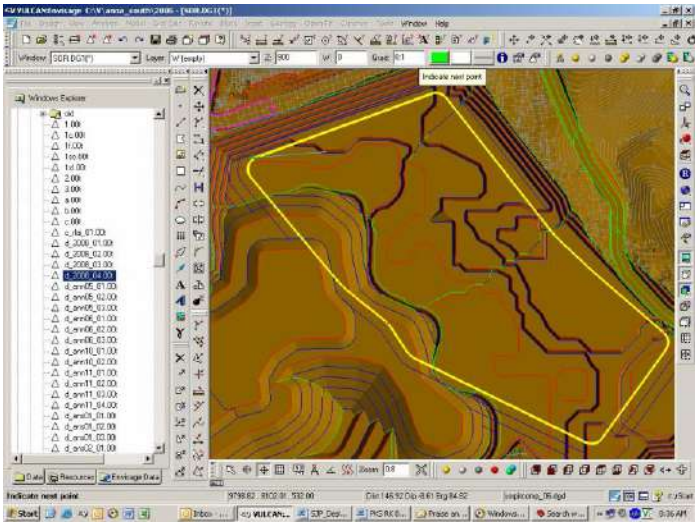


3. There are some technical aspect has to be considerate before designing the disposal in order to safe in operation. The technical aspect as below:
   - Finger Disposal ; The height is 10-15 m, the slope plan of disposal is 26°
   - Induce Flow Disposal: 1st height is 10 m with angle of slope is 5°, 2nd height is 10 m with angle of slope 10-15°, 3rd height is 15 m with angle of slope 26°.

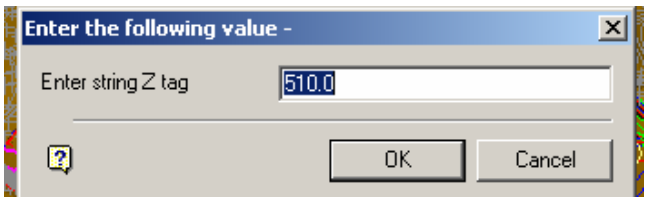
4. Create disposal design, choose area where disposal will be made (blue zone area, release area, mine out area). For example we will make finger disposal in mine out area. The design could be started from crest or toe; go to design > create > polygon > fill name cell (ex. D_ANS_01 = Disposal at Anoa South stage 1)> OK.



> design the polygon (create the polygon) > OK.

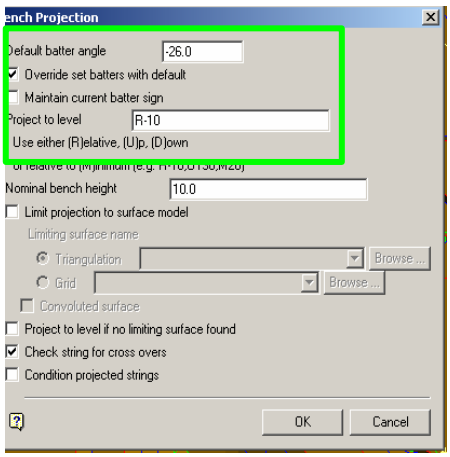


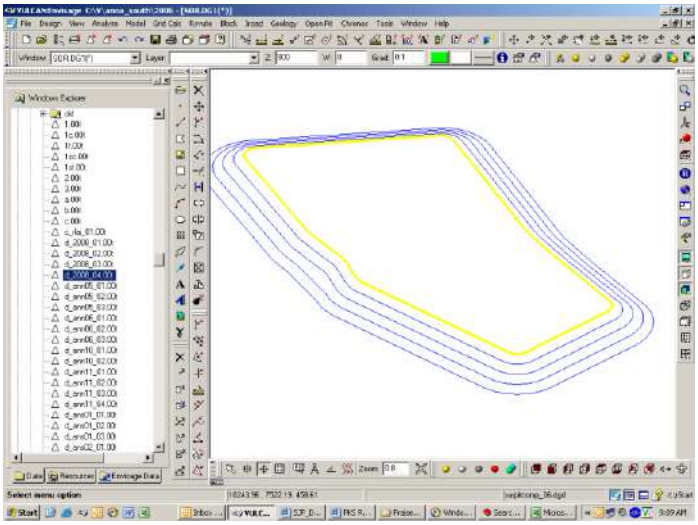
Register polygon level (z) in order to the height of design not more than provision; go to design > object edit > z value > click the polygon > fill enter string z tag cell as needed (ex. 510) > OK



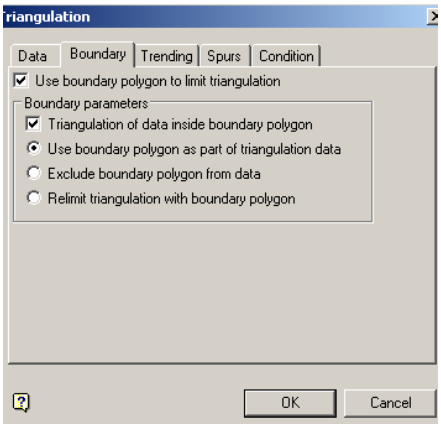
Flagging the polygon as toe or crest; go to open pit > open cut design > flag toe/crest string > click the polygon > OK.
If you need to modify the polygon, there are many tools to do that, for example; go to design > point edit > move.

Project the polygon up or down with height and angle of slope as needed (see number 3); go to open pit > open cut design > project string > click the polygon > fill the cells below > OK.

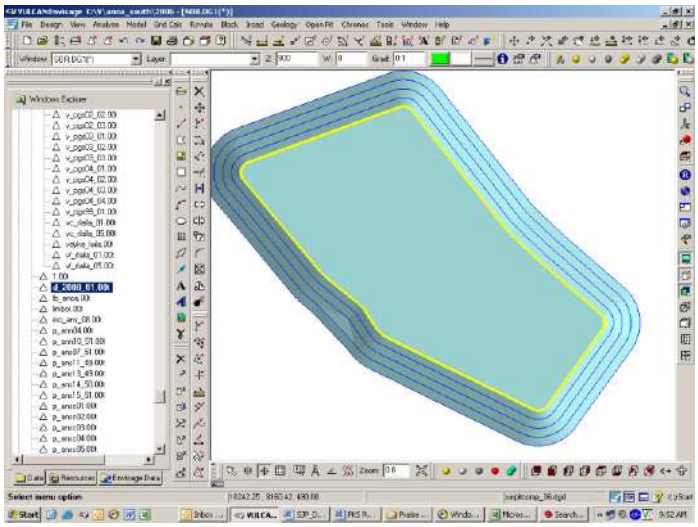




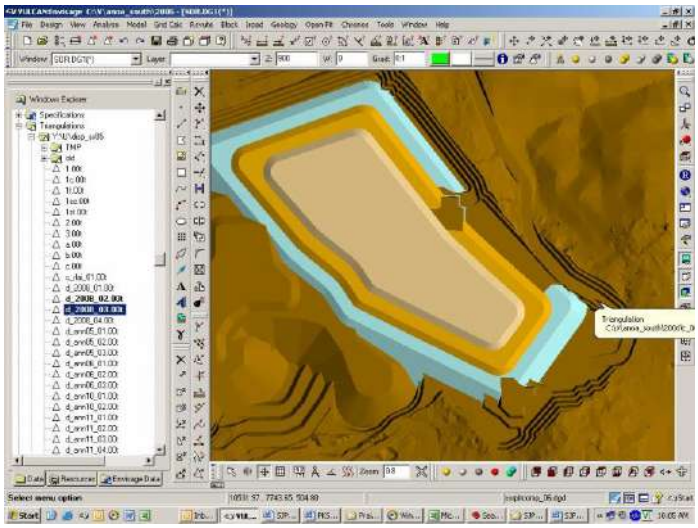
5. Create triangulation of disposal layer; go to model > triangle surface > create > BOUNDARY (click use boundary polygon) > OK > next step same with number 1.



6. Calculating disposal capacity; look at SJP Updating Reserves.



7. Conceptual disposal usually achieve 3 stages. Berm length between every stage is 25m. To create a berm; go to open pit > open cut design > berm string. Design Disposal stage 2 & 3 same as design disposal stage 1 (see number 5-7).



8. Every finish design a disposal, give disposal string file to geotech team to do geotechnical assessment. The result will explain wether design disposal must be revised or not.

PT. INTERNATIONAL NICKEL INDONESIA

MINING DEPARTEMENT
LTP Road Design
STANDARD JOB PROCEDURE

NOMOR : 07.LTP.05

DEPARTEMENT : Mine Technology

SECTION/AREA : LTP

PROCEDURE : **Road Design**

TYPE : Routine

Date of writer : August 21th 2007

Number of Revision : 0

Next Revision : August 21th 2008

Pages : 1 – 14

Made by: Ruth Sitorus	Date: 21-08-07	
Revised by:	Date:	
Checked by: Harry Ginting	Date:	
Approved by: Dwayne Kroll	Date:	

1. Introduction

Road is one of important part that support mine succeed. The main reason of making this procedure is to make guidance for Vulcan user to have the right procedure to create Road Design by Vulcan.

2. Responsible

The qualified person in LTP who has already coached or trained in order to produce optimal and safe road design and support operation team to achieve their target by reduce cycle time.

3. Definition and Abbreviation

- *dgd = base file for running Vulcan software where all the design file saved
- *dg1 = base file for running Vulcan software that consist of your range working area (Easting Northing and Elevation)
- *dgx = base file for running Vulcan software for all the system and index design file that follows *.dgd
- *scd = base file for running Vulcan Software that is related with colour display for every scheme in Vulcan

4. Reference

This Vulcan Software is referring to Vulcan Help menu that available in Vulcan 4.5 and Vulcan 6.0 version menu.

5. Related Procedure

This working procedure is not related with other procedures.

6. Standard Document and Form

There is a standard road dimension document that published by geotech team that related with this SJP.

7. Training and Other Qualification

Basic training that should followed by Vulcan user is:

- Basic knowledge about Computer and Hardware
- Basic Vulcan
- Basic of Block Model

8. Environment, Health and Safety Consideration

Good communication between all Vulcan users in every section is important due to limited Vulcan licenses in PT. Inco because it might affect to the bad working condition if all Vulcan users are selfish.

9. Procedure

9.1. Preparation

- Make sure that in you working directory, you already have all the files below. The file is located in 02-ltp\V\3vulcandata;
  1. *.dgd
  2. *.dg1

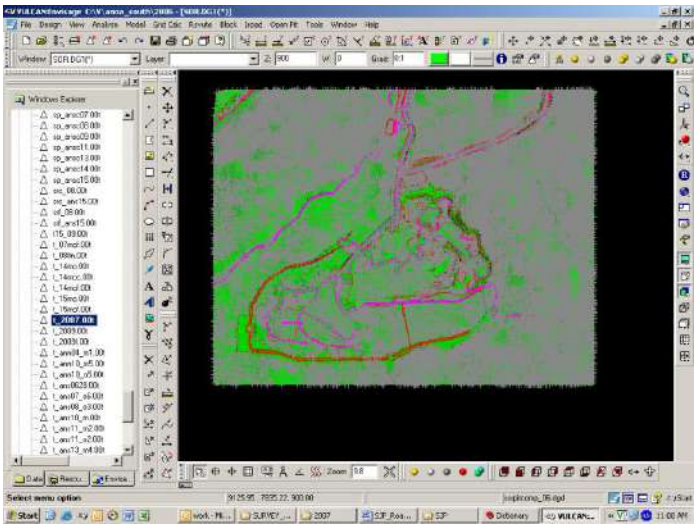
3. *.dgx
4. *.scd

- Make sure that you copy the latest update topography. The file is located in 02-ltp\Vulcan\SURVEY_TOPO2007

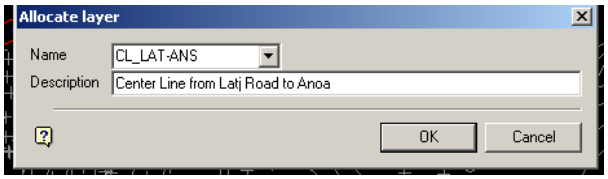
9.2. Job Execution

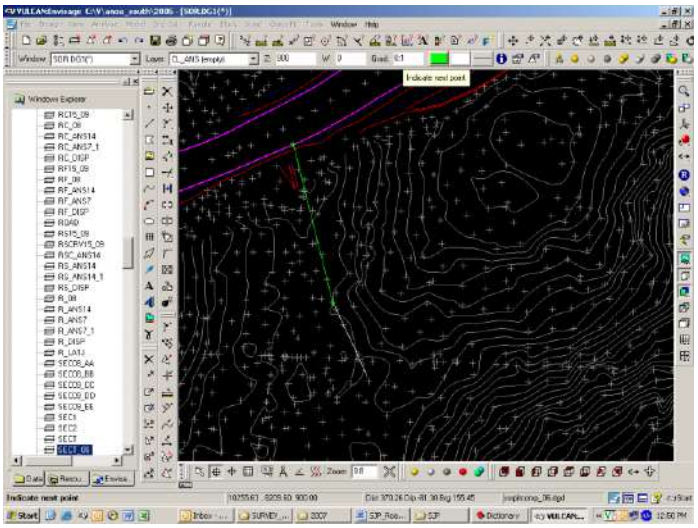
Preparing Topography

1. Load the update topography and make triangulation; go to model > triangle surface create

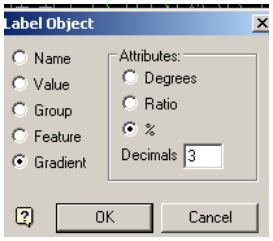


2. Create centre line of road design; go to design > create > line > fill name cell > OK

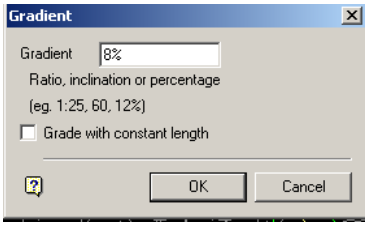




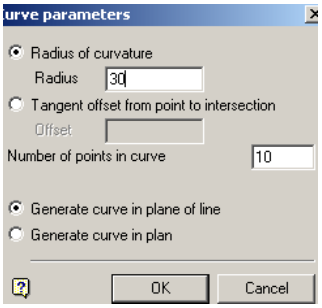
3. Make sure the grade of centre line not more than 10% (as road standard dimension PT. Inco). To check centre line grade; go to Analyse > label > object label > click gradient > % (attributes) > OK



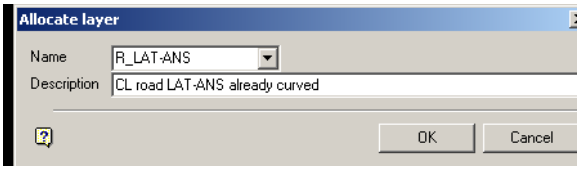
4. You can change the grade automatic without move all points at centreline; go to design > object edit > grade > specific grade manually > fill gradient cell (max 10%) > OK.



5. Curve all point at centre line as needed (min = 15); go to design > point insert > apply curve > click point to curve > fill radius cell > OK

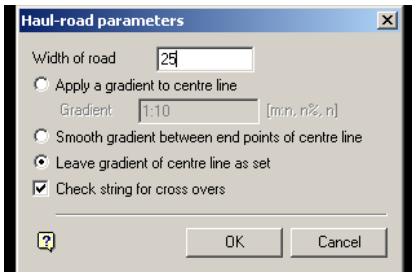


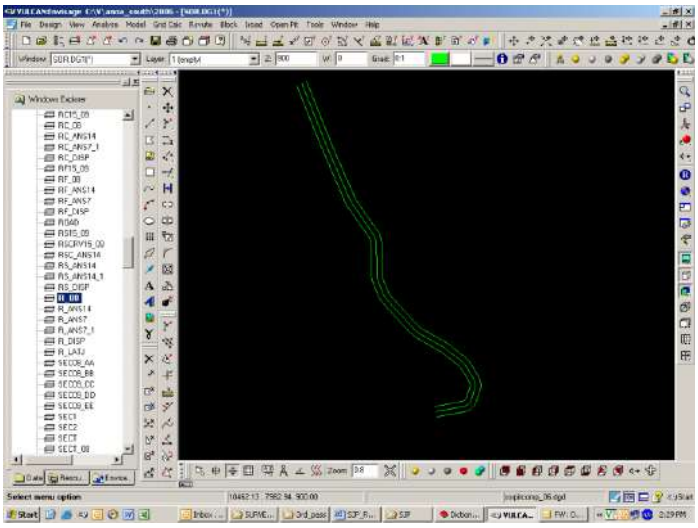
Copy existing centre line that already curved with new name; go to design > layer edit > copy > fill name cell > OK.



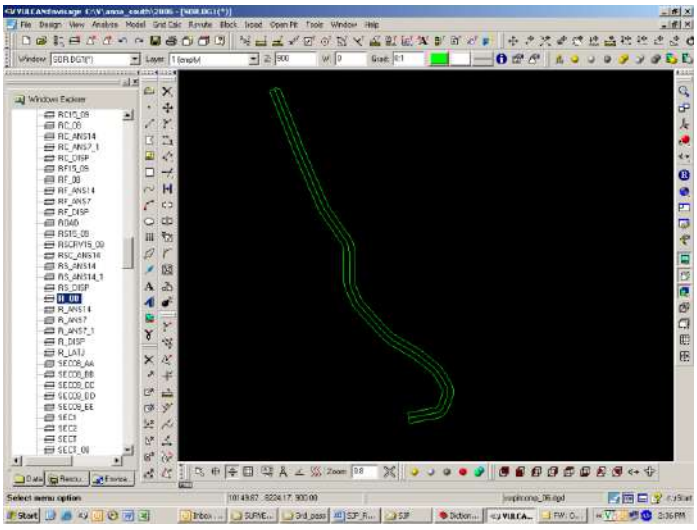
Keep the first centre line (layer CL_LAT-ANS) original (without curve).

6. Create left and right side road; go to open pit > ramps > build road > click centre line > fill width of road cell = 25 m (as road standard dimension PT. Inco) > OK > retain road > OK.

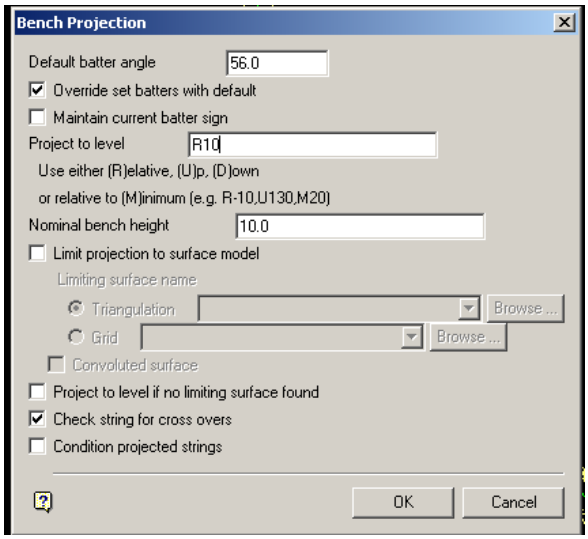




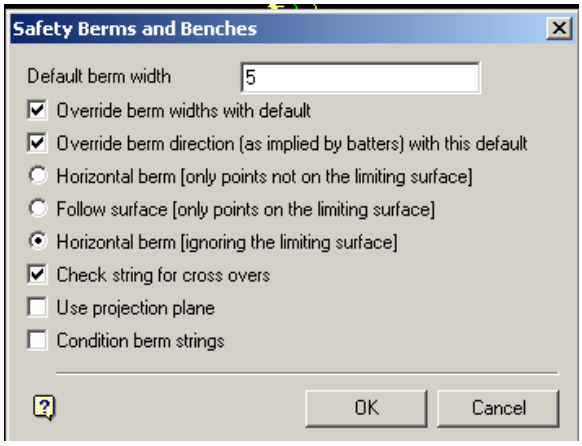
7. Join the left and right line at layer R _LAT-ANS being one polygon; go to design > object edit > join lines > click point > replace object > OK after that go to design > object edit > connection > select object > connect > OK

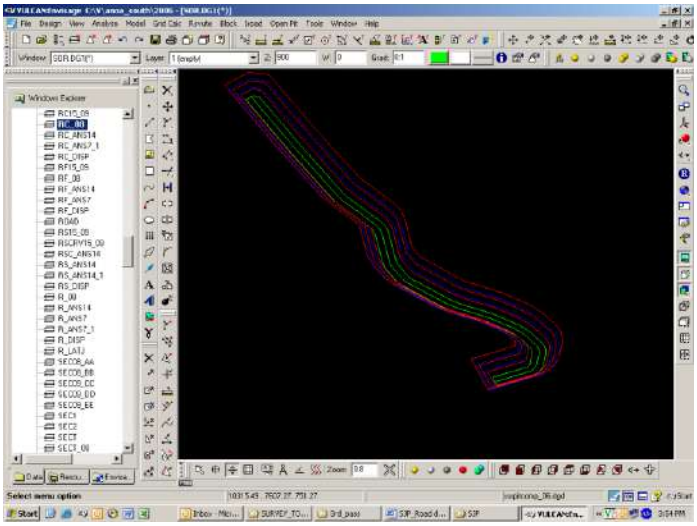


8. Project the polygon up and down; go to open pit > open cut design > project string > click the polygon > fill angle cell (up = 56° & down = 45°) and project to level cell (R10 as road standard dimension PT. Inco, bench height for road is 10 m).

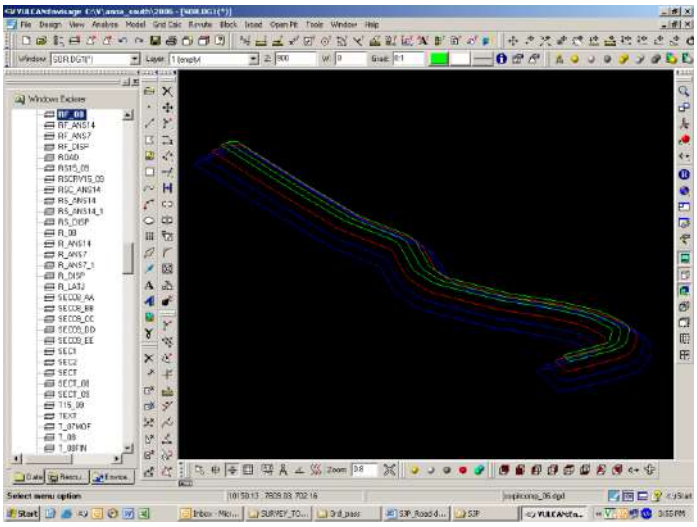


For cut are, you must implement berm with length 5 m; go to open pit > open cut design > berm > click road polygon > fill default berm width cell = 5 > OK



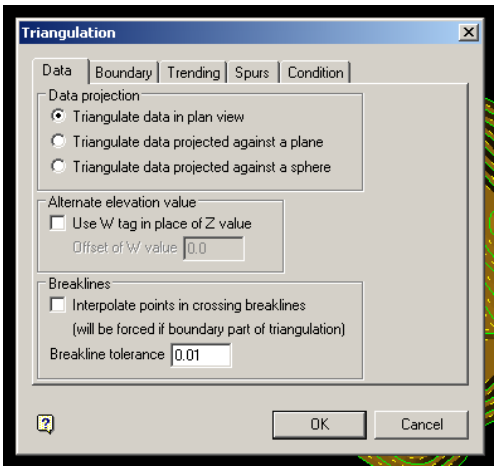


For fill area, you should not implement berm.

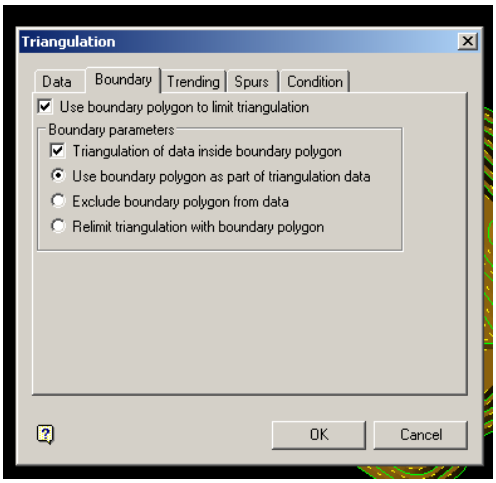


Save both layer with name RC_LAT-ANS for road cut layer and RF_LAT-ANS for road fill layer go to design > layer edit > copy.

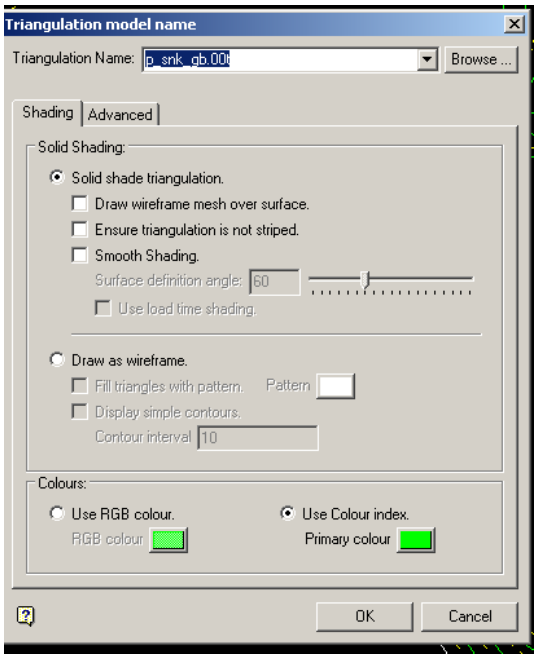
9. Create triangulation for both layer; go to model > triangulation surface > create > click Data (Triangulate data in plan view)

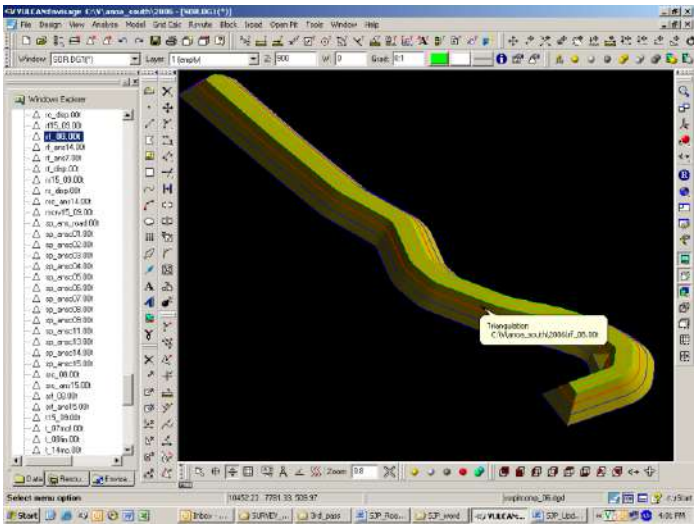


> click Boundary (use boundary polygon to limit triangulation)

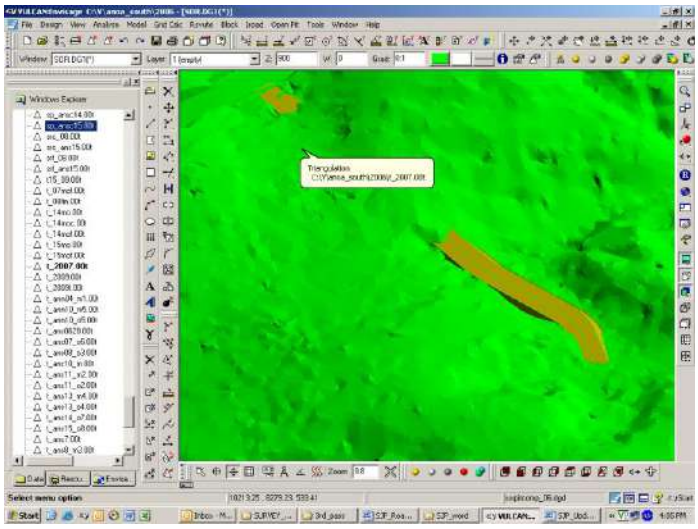


> OK > Select Boundary polygon > Triangulate > fill triangulation name cell (same with layer name).

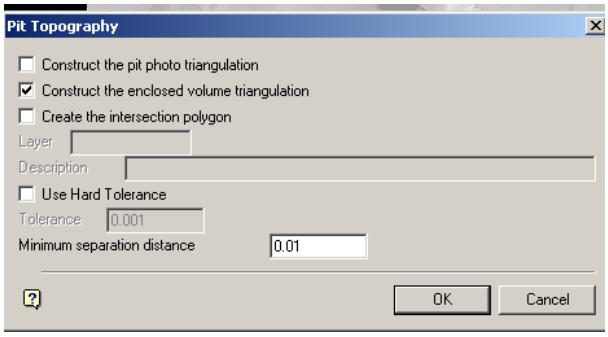




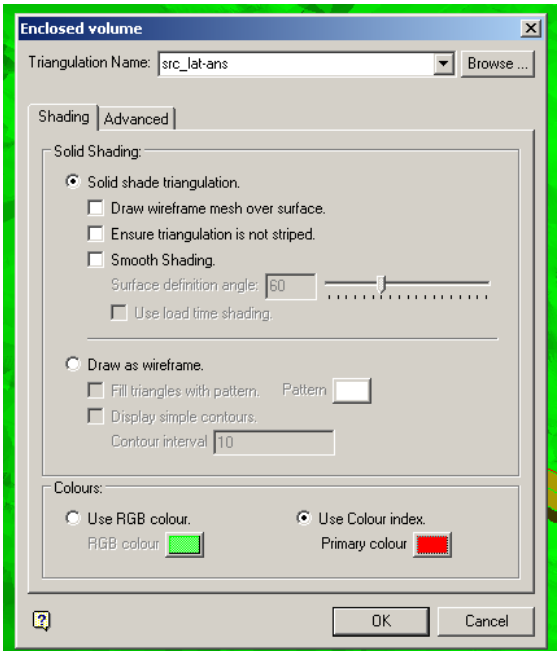
Create solid to calculate cut & fill volume to build the road; load topo triangulation & cut or fill triangulation

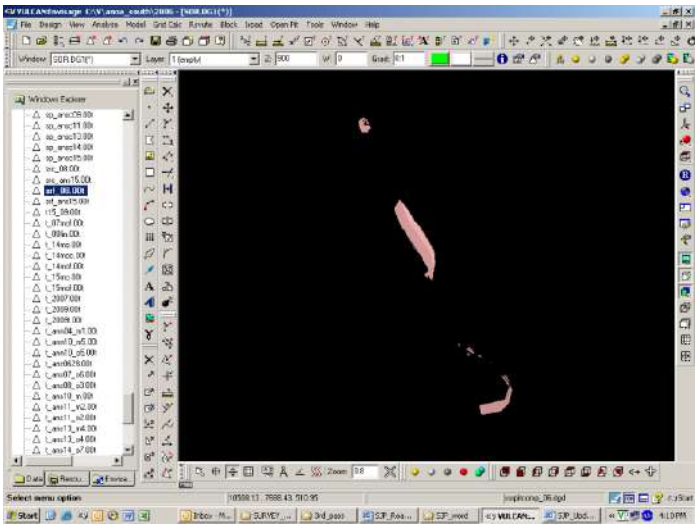


After that go to open pit > open cut design > pit topography > > click construct the enclosed volume triangulation > OK

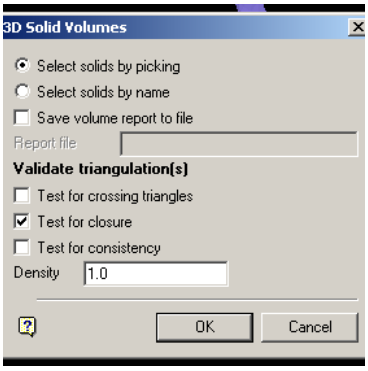


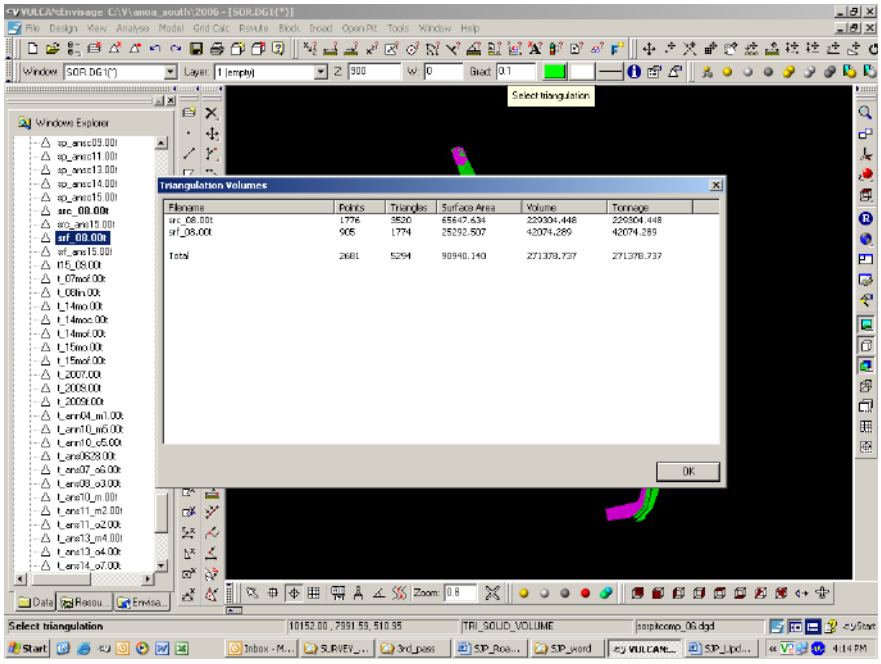
> Fill triangulation name cell for example srf_lat-ans (solid road cut_LAT-ANS) >OK





10. Calculate solid volume (both cut & fill colume); go to model > triangle solid > volume > pick all solid > OK





LAMPIRAN J

KARTU KONSULTASI

Lampiran B 10

Kartu Konsultasi Tugas Akhir

JUDUL: Perencanaan Jangka Panjang Area Pit Compartment 2, Eli Blok Bahodopi PT Vale Indonesia Tbk, Provinsi Sulawesi Tengah

(Konsultasi minimal 8 kali)

TANGGAL	MATERI KONSULTASI	PARAF DOSEN
1 April 2022	- Format penulisan laporan - pergantian Judul - BAB II (Penulisan bahasa asing tidak dicetak miring)	
15 April 2022	- kesalahan format penulisan - BAB II (penulisan bahasa asing, kata hubung tidk sesuai) - BAB III (Penulisan bahasa asing, kata hubung ~~tidak~~ sesuai) - Bagan Alir Penelitian	
20 April 2022	- kesalahan format penulisan - BAB II (Penulisan bahasa asing, Penggunaan huruf kapital) - BAB III (kata hubung tidak sesuai - Bagan Alir penelitian	
27 Mei 2022	- kesalahan format gambar - BAB II (Menggunakan kata kerja diawal kalimat) - BAB III (Penulisan bahasa asing) - BAB IV (penggunaan huruf kapital tidak tepat)	
9 Juni 2022	- kesalahan format penulisan - BAB II (Tambahi referensi) - BAB III (Penulisan bahasa asing, kata hubung tidak sesuai - Bagan alir penelitian	
15 Juni 2022	- kesalahan format penulisan - BAB I (Penakaian bahasa yang kurang tepat) - BAB II (kesalahan penulisan bahasa asing) - BAB IV (penggunaan huruf kapital tidak sesuai)	
19 Juni 2022	- kesalahan format penulisan - BAB IV (penggunaan huruf kapital tidak sesuai, penggunaan bahasa tidak tepat)	

TANGGAL	MATERI KONSULTASI	PARAF DOSEN
29 Juni 2022	- Kesalahan format penulisan - BAB IV (penggunaan bahasa tidak tepat) - BAB V (penggunaan bahasa tidak tepat)	
5 Juli 2022	- Format penulisan - BAB I (penggunaan bahasa tidak tepat) - BAB II (Penulisan bahasa asing, Penggunaan huruf kapital) - BAB III (penggunaan spasi yang salah antara gambar) - BAB IV (Penggunaan huruf kapital tidak tepat) - BAB V (penggunaan bahasa tidak tepat	
7 Juli 2022	- BAB II (Penggunaan kata yang kurang tepat) - BAB V (penggunaan kata yang kurang tepat) - Daftar pustaka	
8 Juli 2022	kesalahan Penulisan daftar pustaka	
20 Juli 2022	-Penggunaan kata hubung tidak sesuai -Penggunaan huruf kapital / huruf kecil tidak sesuai - penggunaan bahasa asing tidak dicetak miring - Penulisan kata di dan ke sebagai kata depan dan kata sambung - Tidak menuliskan nama penulis yang dirujuk dalam daftar pustaka - penggunaan / penulisan tanda baca tidak / kurang tepat - Bentuk tabel dan penulisan kata pada tabel tidak sesuai - penulisan kata tidak baku	
27 Juli 2022	- Penulisan bahasa asing tidak dicetak miring - penggunaan / penulisan tanda baca kurang tepat - Tidak menuliskan nama penulis yang dirujuk dalam daftar pustaka - Penulisan kata tidak baku	

TANGGAL	MATERI KONSULTASI	PARAF DOSEN
7 Agustus 2022	- perhitungan cashflow yang belum sesuai - penulisan angka desimal dalam bahasa Indonesia - perhitungan analisis sensitivitas yang belum sesuai - penulisan kata tidak baku	
7 Agustus 2022	ACC	
1 September 2022	- penggunaan kata yang kurang tepat - penulisan bahasa asing yang kurang tepat - perhitungan cashflow diperbaiki - penulisan rumus diperbaiki - penulisan bahasa asing yang tidak sesuai (tidak dicetak miring).	
13 September 2022	- penggunaan kata yang kurang tepat - penulisan bahasa asing yang tidak sesuai (tidak dicetak miring). - format gambar yang belum sesuai - penggunaan kata yang kurang tepat pada cash flow	
16 September 2022	- penggunaan kalimat yang belum sesuai - penulisan bahasa asing yang belum sesuai (tidak dicetak miring)	
20 September 2022	- penulisan bahasa asing yang belum sesuai (tidak dicetak miring) - penggunaan huruf kapital yang tidak tepat	

Catatan: Lembar konsultasi asli dilampirkan pada satu dokumen skripsi.

TANGGAL	MATERI KONSULTASI	PARAF DOSEN
23 Sept 2022	- Penggunaan kalimat yang kurang tepat - Penulisan halaman pada daftar isi dan daftar tabel yang kurang tepat	
23 Sept 2022	ACC	

Catatan: Lembar konsultasi asli dilampirkan pada satu dokumen skripsi.