

10. Rockfall survey and analysis

3. 8 Rockfall Survey

3. 8. 1 Rockfall site identification

(1) RF001 (0+150~0+350)

The basaltic slope where cracks have developed increases its height toward the end. Rockfalls in large blocks are not observed; however, the bed rock with cracks has loosened. In addition, at the foot of the slope, a number of rocks about 30cm in diameter were observed which had exfoliated from the slope surface.

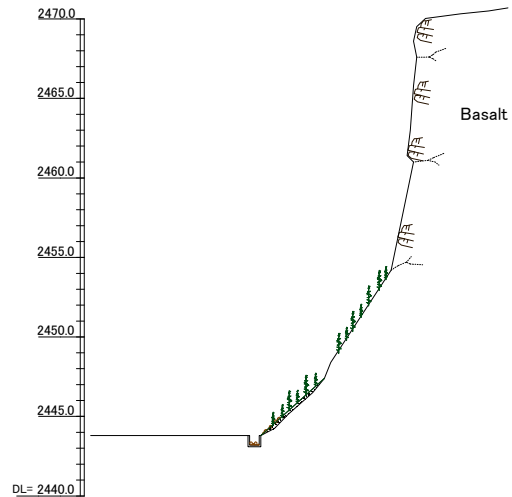


Figure 3. 8.1 Representative section (STA.0+340)

This section extends for 200m width, which is relatively short compared to the others. However, the slope is steep and very close to the road, so that Rockfall has a significant impact on the lives of local people.



Photo 3. 8.1 Entire picture of section RF001 (taken from the section start point)



Photo 3. 8.2 Entire picture of section RF001 (taken from the section end point)

(2) RF002 (0+720~1+140)

This section, located in the landslide area, is composed of the bed rock which mainly consists of basalt.

Cracks have developed on this slope head which has been temporarily monitored in the past. In August 2009, Rockfalls occurred from the slope head.

Constructions of drainage works and of roadbed works are currently underway on the road side. Basaltic detached rocks are also distributed on the slope head, and basaltic cliff walls are consecutively observed behind the slope head section. As cracks have developed on the slope top which reaches 30m or higher, the possibility of unstable basaltic loose rocks falling is high.

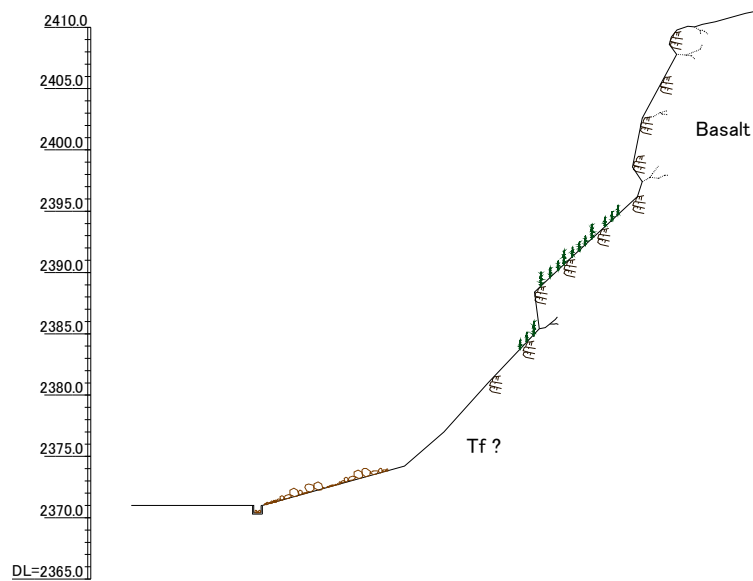


Figure 3. 8.2 Representative section (STA.0+930)



Photo 3. 8.3 Construction work being done by ERA (wastewater work construction and roadbed construction, STA.0+88 – 1+880)



Photo 3. 8.4 Basaltic cliff wall behind the slope head

(3) RF003 (1+160~2+000)

The basaltic cliff wall that continues from section RF002 are the source of Rockfalls.

Large basaltic rocks are distributed at the bottom part of the cliff; the maximum diameter of those blocks is about 3m. These boulders scattered around in this area could be from toppling.

A number of box culverts and debris stoppers have been installed in this section, where small collapse has also been recognized.

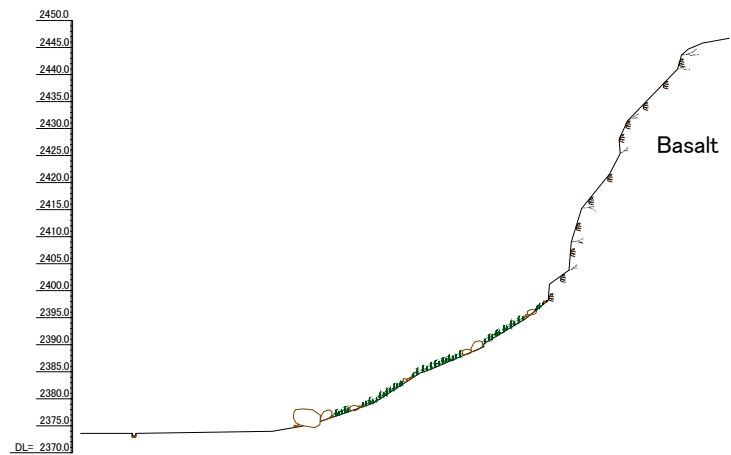


Figure 3. 8.3 Representative section (STA.1+300)

The average slope gradient is 30° to 50° while slope height being 60m or higher. When rock mass failure occurs, fallen rocks would certainly reach the road.



Photo 3. 8.5 Fallen rocks distributed at the bottom (1m – 3m in diameter)



Photo 3. 8.6 Entire picture of section RF003 (taken from the section end)

(4) RF004 (2+080~2+760)

Cut slopes continue in this section, where basaltic blocks with cracks in cubes.

Although the fallen rocks are small in diameter, scattered rocks around the slope foot indicate intensive Rockfalls in the past. Additionally, there are unstable detached rocks on the upper part.

Concave slope where gullies have developed are recognized towards the section end. Small collapses and shallow landslides occur. As weathering progresses on the cut slope while cracks, there is a possibility of Rockfalls by intensive rainfall. For the cut slope is adjacent to the road, even small scale Rockfall would have an impact on the road.

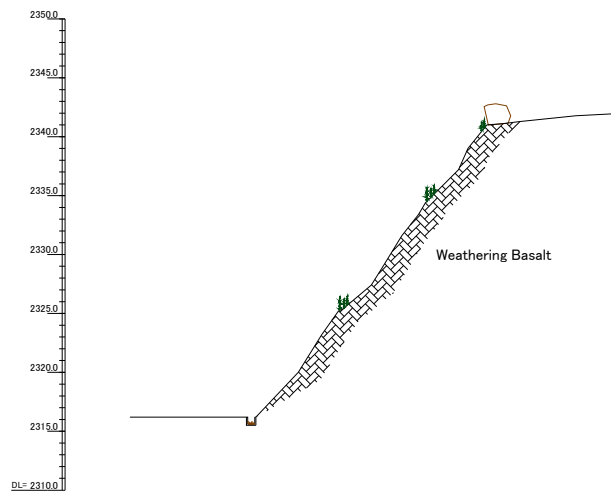


Figure 3. 8.4 Representative section (STA.2+400)

At the end point, gabions are installed as countermeasures for shallow landslides which have occurred in previous years.



Photo 3. 8.7 Entire picture of section RF004 (taken from the section end)



Photo 3. 8.8 Conditions of joints and cracks developing on the cut slope

(5) RF005 (3+850~4+900)

In this section, steep slopes consist mainly of basaltic rocks that are the source of Rockfalls. Here, rocks are currently carved in the section start point (around STA.3+900) where basaltic outcrops continues toward the section's end.

Basaltic cliff walls are distributed in this section located near the road side. Loose rocks and detached rocks also exist on the slopes. If a rock topple occurs, its scale would be significant with the possibility of blocking the road.

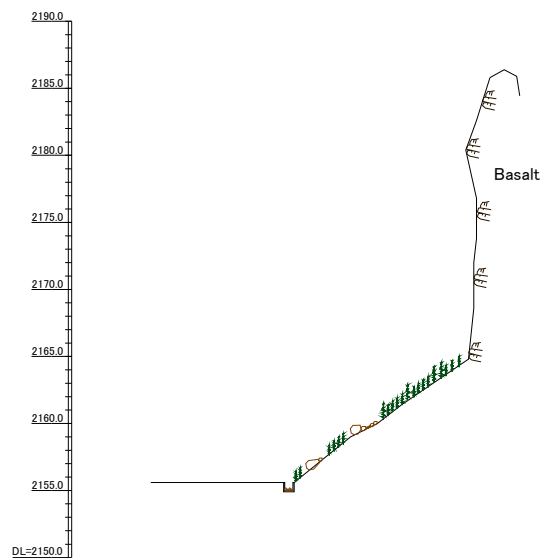


Figure 3. 8.5 Representative section (STA.4+320)



Photo 3. 8.9 Unstable basaltic outcroppings



Photo 3. 8.10 Unstable basaltic outcroppings



Photo 3. 8.11 Unstable basaltic outcroppings



Photo 3. 8.12 Fallen rocks distributed on the slope bottom

(6) RF006 (5+400~5+900)

This section has consecutive slopes consisting mainly of limestone, and unstable detached rocks are distributed on the slopes. Cracks develop in the bed rock, where some rocks have become loose and detached from the cliff.

Weathering has progressed on the lower part in which the soft layers have weathered into small debris. The slope gradient on the lower slope is relatively moderate and vegetation can be seen on the surface.

The lower bed rock on the slope around STA.5+480 exfoliates like sheet form, and the relatively un-weathered layers are overhanging. Further exfoliation and detachment poses a threat of the overhanging to fall.

There exist clusters of fallen rocks on the slopes of the lower side of the road indicating that Rockfalls have repeatedly occurred in the past.

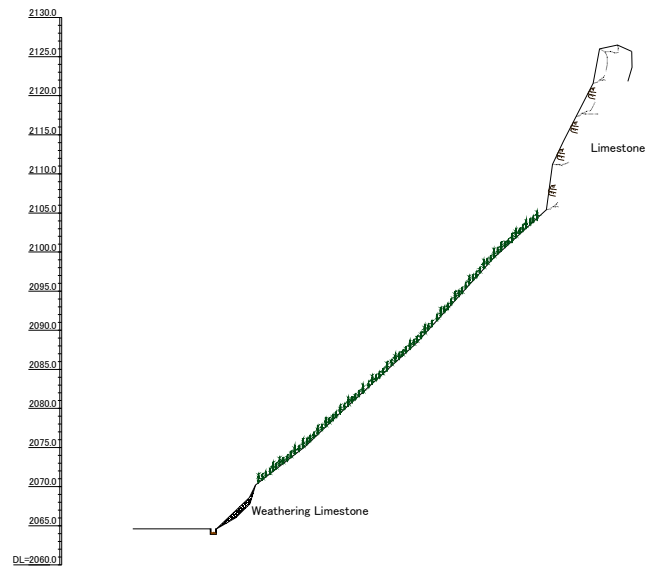


Figure 3. 8.6 Representative section (STA.5+680)

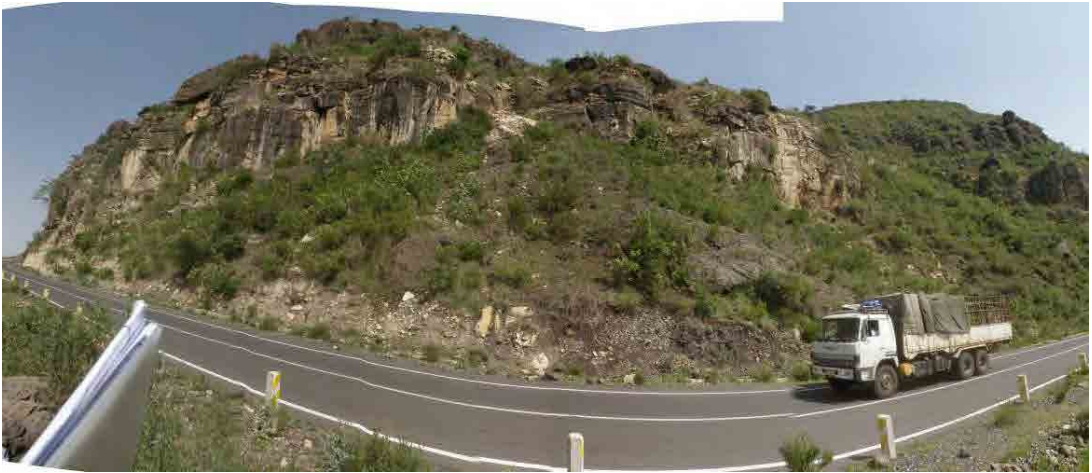


Photo 3. 8.13 Limestone cliff walls on the upper part



Photo 3. 8.14 Clusters of fallen rocks distributed on the slopes of the lower side of the road

(7) RF007 (13+500~13+650)

This section is mostly slopes consisting of talus deposits. Meanwhile, slope heights are mostly low.

The surface is bare for the most part, and there are many detached rocks on the slope.

A number of fallen rocks with 50cm or smaller in diameter are distributed at the foot of the slopes, while gravels are scattered along the road.

The scale of Rockfall is small; however, there is a possibility of Rockfall occurrence due to erosion.

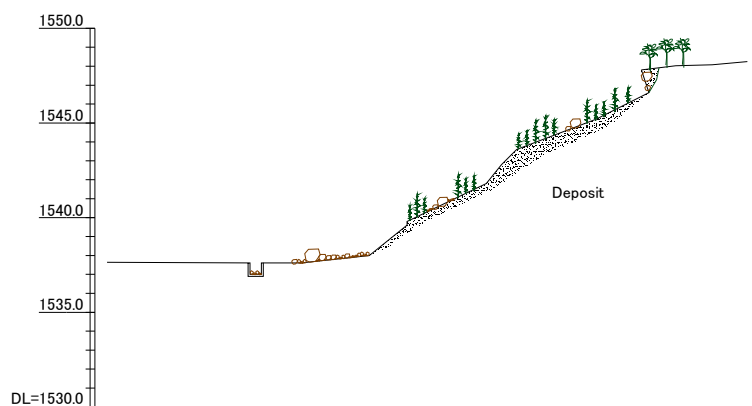


Figure 3. 8.7 Representative section (STA.13+540)



Photo 3. 8.15 Detached rocks distributed on the slopes



Photo 3. 8.16 Fallen rocks deposited at the slope bottom

(8) RF008 (13+650~14+100)

Retaining walls (1.5m high and 100m width) have been installed in this section. The section is cut slopes $40^\circ - 60^\circ$ in gradient and 30m – 50m in height.

The bed rock is composed of weathered limestone; colluviums and fallen rocks deposits are observed at the back of the retaining walls. Many fallen rocks 0.5m to 1m in diameter are distributed on the small steps of the cut slopes. This shows the possibility of Rockfall risk.

Retaining walls are installed in two locations, and natural slopes continue between both of the walls. Detailed observation cannot be done at the upper part due to vegetation; however, gravels are distributed on the lower parts and a spring water is also observed.

There are fallen rocks 1.5m in diameter on the road side of the retaining wall toward the section end. Behind the retaining wall, there is a large amount of fallen rocks and colluviums. The rocks deposited here are large diameters compared to those near the retaining wall at the beginning of the section; hence, the risk of Rockfall is greater toward the end.

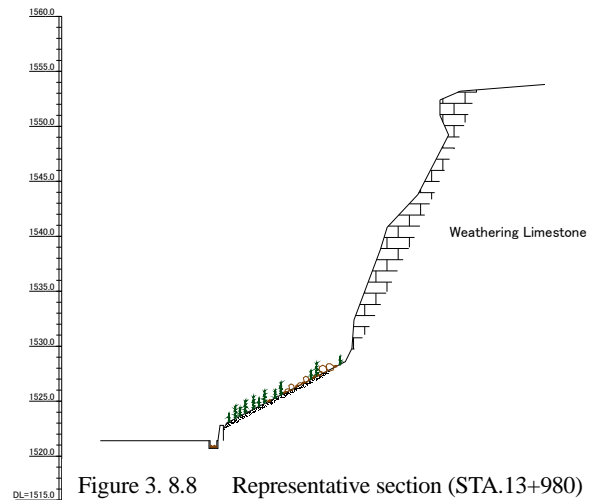


Figure 3. 8.8 Representative section (STA.13+980)



Photo 3. 8.17 Retaining wall on the section start side (1.5m high, extending 100m)



Photo 3. 8.18 Natural slope between both of the retaining walls (a spring can be observed at the layer border)



Photo 3. 8.19 Retaining wall on the section end side (fallen rocks are distributed on the retaining wall side)

(9) RF009 (16+650~18+850)

This section is approximately 2.2km width, which is the longest in the relevant route. The geology consist of alternate layers of sandstone and siltstone. The slope elevation at the section end becomes 100m or higher.

The upper part is a cliff wall, while the lower part has a moderate gradient. The surface of the upper part is rough where loose rocks exfoliate and detach. Talus deposits including fallen rocks are distributed around the lower part, and the bed rocks are broke down to debris from weathering.

Most of the fallen rocks along the road are 0.5m to 1.0m in diameter; some fallen rocks with maximum of 3m are also observed.

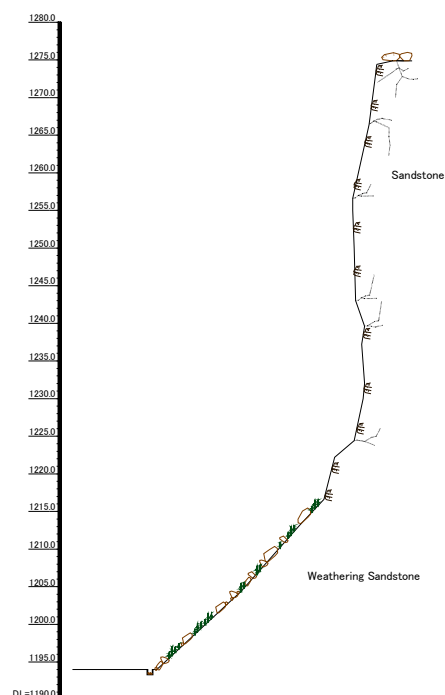


Figure 3. 8.9 Representative section (STA.17+630)
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Rockfalls have occurred in STA.17+650 and STA.+18+530 in the past. Rockfalls frequently occur in this section.



Photo 3. 8.20 Sandston and siltstone outcroppings



Photo 3. 8.21 Fallen rocks distributed along the roadside



Photo 3. 8.22 Talus deposits distributed on the lower part

(10) RF010 (20+000~20+520)

This section has similar geological and topographic conditions, and Rockfall characteristics compared to section RF009.

The Rockfall source is the upper part consisting of consecutive sandstone and siltstone. Near the starting point, the area is vegetated with trees, where is high below the cliffs. Detached rocks about 1m in diameter are observed on the slope surface.

Consecutive overhanging bed rocks exist on the upper part causing unstable slope condition. In some part, the overhanging is partially breaking and falling off.

The lower part consists of weathered soft sandstone. On these slope surfaces developed gullies and colluviums were observed. Unstabilized rock blocks due to erosion are distributed on the upper side resembling the form of “the fall-off type Rockfall”.

In this section, Rockfalls have occurred around STA.20+400 in the past.

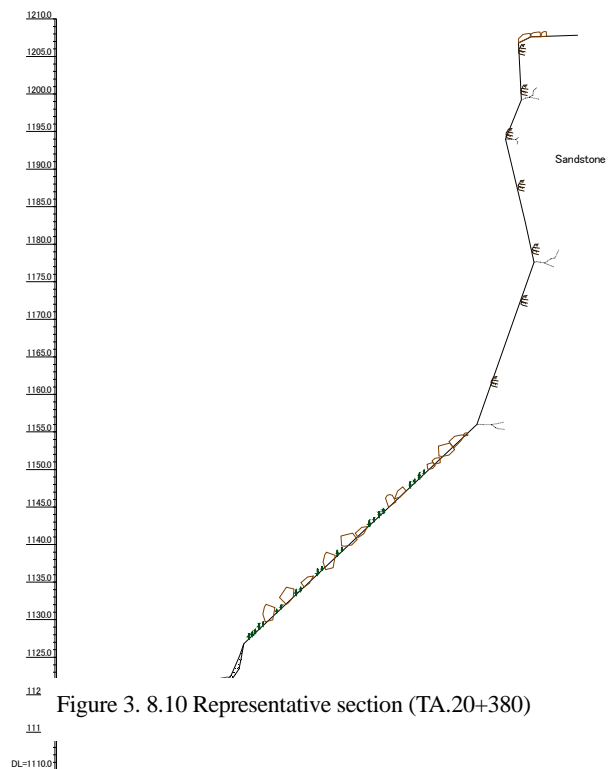


Figure 3. 8.10 Representative section (TA.20+380)



Photo 3. 8.23 Overhanging of upper part



Photo 3. 8.24 Cut slopes softened due to weathering

(11) RF011 (20+540~20+960)

Sources of Rockfalls in this section include the cliff walls continuing from the previous section and the detached rocks scattered around the cut slopes.

The bed rocks with cracks consisted of tight sandstone and siltstone, and destabilized loose rocks exfoliate and detach from the upper part. Many detached rocks are also distributed on the moderate slope at the bottom of the cliffs.

The gradient of the cut slopes is about 60%, and the surfaces are covered with colluviums. In some parts, detached rocks are observed, which have become unstable due to erosion.

Large fallen rocks 2m to 3m in diameter are distributed along the road in this section. This indicates a large scale of Rockfalls.

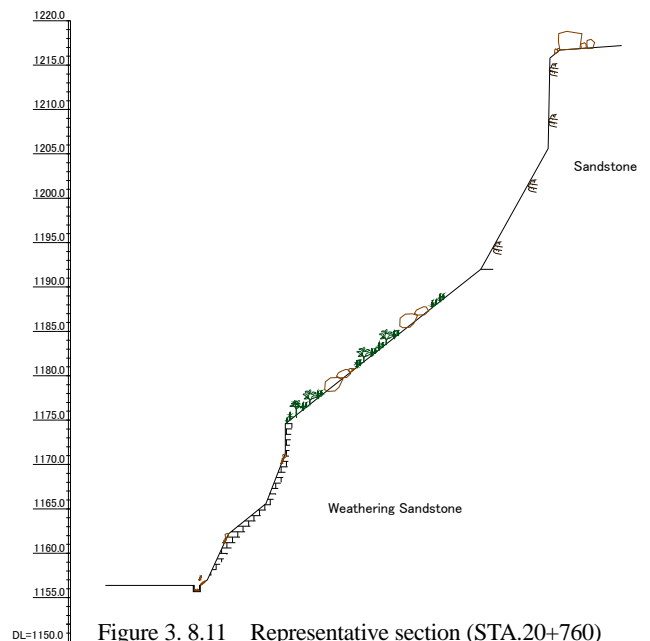


Figure 3. 8.11 Representative section (STA.20+760)



Photo 3. 8.25 Entire picture of section RF0011 (taken from the section start point)



Photo 3. 8.26 Fallen rocks around STA.20+800m



Photo 3. 8.27 A fallen rock 2.5m in diameter

(12) RF012 (20+980~21+400)

This section is a cut slope consisting mainly of sandstone, where a number of unstable detached rocks are observed in the area. They are also distributed on the slope.

The cut slope is composed of tight sandstone overhanging; about 1-m detached rocks are observed on the road side.

Shallow landslides are observed in the slopes on the section end, so that gabions have been installed.

In this section, Rockfalls have occurred around STA.21+400 in the past.

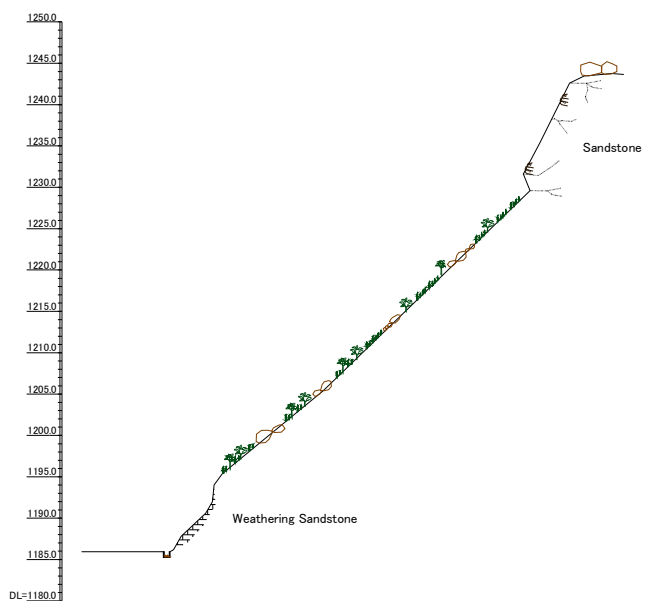


Figure 3. 8.12 Representative section (STA.21+000)



Photo 3. 8.28 Detached rocks distributing on cut slopes



Photo 3. 8.29 Overhanging cut slope (around STA.21+300)

(13) RF013 (30+450~30+650)

This section is located on the landslide portion. From STA.30+400 toward the section end, consecutive cliffs have been formed.

With the 30m slope height and steep gradient, the bed rock is mainly composed of limestone. Cracks have developed in the entire limestone, and loose rocks around the cracks exfoliate and detach from the surface.

At the foot of the cliffs, fallen rocks of about 50cm in diameter are scattered around, while some of them are distributed on the road.

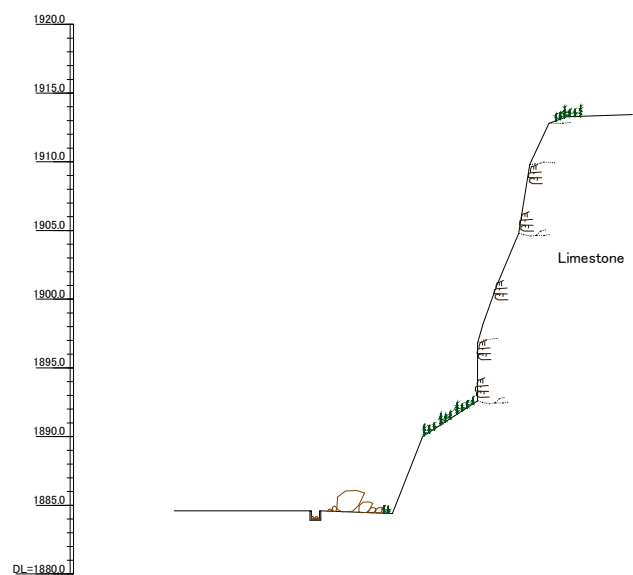


Figure 3. 8.13 Representative section (STA.30+500)

This section is short width and is farther off the road. As Rockfalls have occurred around STA.30+500 in the past, the section has a Rockfall hazard potential.



Photo 3. 8.30 Entire picture of section RF0013 (taken from the section start point)



Photo 3. 8.31 Fallen rocks distributed on the bottom of the cliffs

(14) RF014 (31+00~31+200)

This section has mostly moderate slopes with a gradient of approximately 35° and a 20m height. The slopes consist mainly of talus deposits.

Many detached rocks are observed on the slopes and most of them are about 1.0m in diameter.

Although this section has a short width and sizes of detached rocks are relatively small, several Rockfalls have been reported around STA.31+000 in the past.

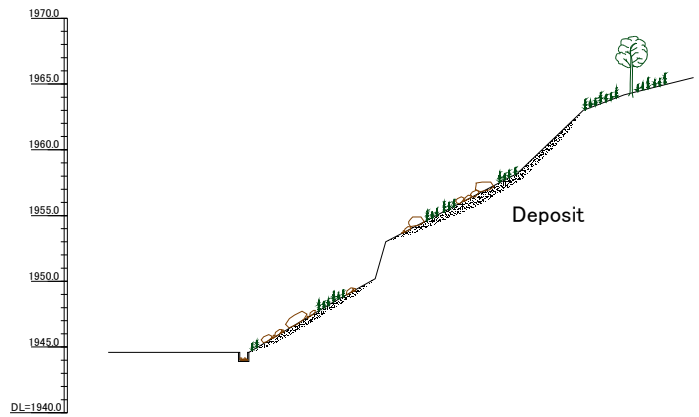


Figure 3. 8.14 Representative section (STA.31+040)



Photo 3. 8.32 Entire picture of section RF0013 (taken from the section end point)



Photo 3. 8.33 Detached rocks distributed on the slopes

(15) RF015 (32+00~32+400)

This cut slopes consist of limestone.

The slope is 20m or lower in height, and steep. Weathering progresses on the entire slope while small loose rocks exfoliate and detach from the surface. Fallen rocks accumulate in the gutters, which causes blockage in some parts.

Most of fallen rocks are 30cm or smaller in diameter, which are also scattered on the road.

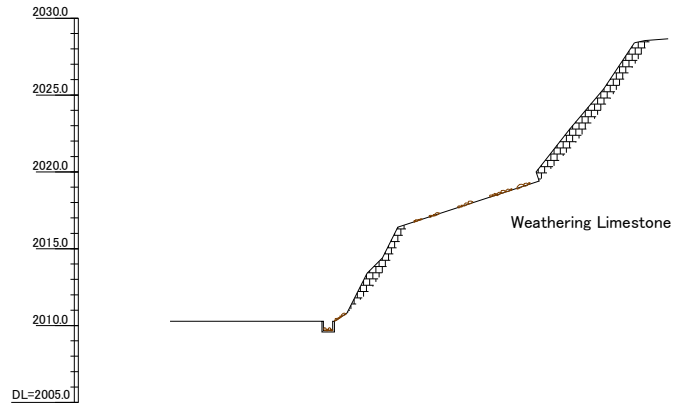


Photo 3. 8.34 fallen rocks distributed at the bottom of the cut slope

Figure 3. 8.15 Representative section (STA.32+040)



Photo 3. 8.35 Weathered limestone cut slope

(16) RF016 (34+000~34+500)

In this section, loose rocks and detached rocks on the cut slope are the source of Rockfalls.

The slope consists of weathered basaltic rocks with developed cracks. The gradient is steep. Similar to the case of RF004, basaltic blocks exfoliate and detach as in cubic forms.

Natural slopes continue on the upper part, where vegetation grows thickly. Many loose rocks about 50cm in diameter are distributed on the slopes, while unstable loose rocks fall from the ridges.

The section is about 500 m width and fallen rocks are distributed in the gutter and on the road. Rockfalls have occurred near STA.34+300 and STA.34+440 in the past.

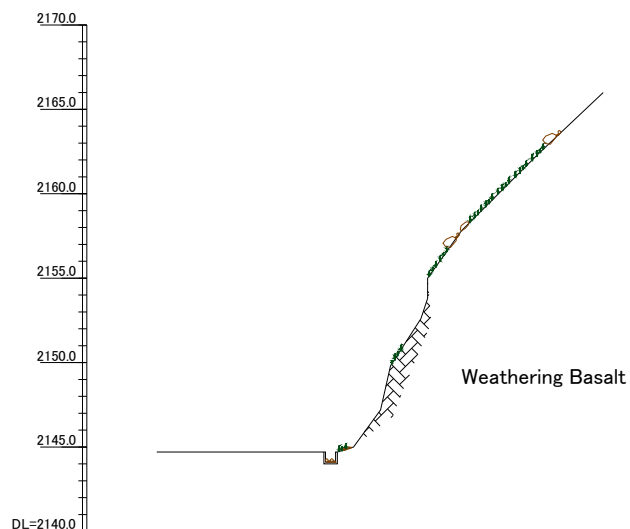


Figure 3. 8.16 Representative section (STA.34+380)



Photo 3. 8.36 Weathered basaltic cut slope



Photo 3. 8.37 Fallen rocks from the cut slope

(17) RF017 (35+300~35+600)

In this section, similarly to RF016, basaltic outcrops with developed cracks appear on the cut slopes. On the other hand, the upper part is moderate compared to the previous one; hence the slope is the source of Rockfalls.

Loose rocks exfoliate and detach from the surface where columnar joints develop. Detached rocks with 30cm or smaller in diameter are scattered around the end of the slope as well as on the road.

In the gutter, many fallen rocks have accumulated which clogged the gutter.



Photo 3. 8.38 Weathered basaltic cut slopes



Photo 3. 8.39 Fallen rocks from the cut slope (the section end side was taken from around area STA.35+350)

Rock Fall Survey



STA.	0+340
Section.No.	1
Boulder stone	
unsteady stone	○
Diameter(m)	0.1~1.5
Figure	square
Geology	Bs
Crack	many



STA.	0+930
Section.No.	2
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~0.5
Figure	square
Geology	Bs
Crack	many



STA.	1+180
Section.No.	3
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~2.6
Figure	square
Geology	Bs
Crack	many



STA.	1+300
Section.No.	4
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~3.0
Figure	square
Geology	Bs
Crack	many



STA.	1+760
Section.No.	5
Boulder stone	
unsteady stone	○
Diameter(m)	0.1~2.1
Figure	square
Geology	Bs
Crack	many

Rock Fall Survey



STA	2+400
Section.No.	6
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~0.3
Figure	square
Geology	Bs
Crack	many



STA	2+660
Section.No.	7
Boulder stone	
unsteady stone	○
Diameter(m)	0.1~0.3
Figure	square
Geology	Bs
Crack	many



STA	4+020
Section.No.	8
Boulder stone	
unsteady stone	○
Diameter(m)	0.1~0.5
Figure	square
Geology	Bs
Crack	many



STA	4+200
Section.No.	9
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~2.0
Figure	square
Geology	Bs
Crack	many



STA	4+280
Section.No.	10
Boulder stone	
unsteady stone	○
Diameter(m)	0.1~0.7
Figure	square
Geology	Bs
Crack	opening crack

Rock Fall Survey



STA.	4+320
Section.No.	11
Boulder stone	
unsteady stone	○
Diameter(m)	0.1~2.4
Figure	square
Geology	Bs
Crack	opening crack



STA.	4+580
Section.No.	12
Boulder stone	
unsteady stone	○
Diameter(m)	0.1~0.5
Figure	square
Geology	Bs
Crack	opening crack



STA.	4+700
Section.No.	13
Boulder stone	
unsteady stone	○
Diameter(m)	0.1~3.1
Figure	square
Geology	Bs
Crack	opening crack



STA.	4+850
Section.No.	14
Boulder stone	
unsteady stone	○
Diameter(m)	0.1~0.6
Figure	square
Geology	Bs
Crack	opening crack



STA.	5+480
Section.No.	15
Boulder stone	
unsteady stone	○
Diameter(m)	0.1~1.3
Figure	square
Geology	Lm
Crack	opening crack

Rock Fall Survey



STA.	5+600
Section.No.	16
Boulder stone	
unsteady stone	○
Diameter(m)	0.1~1.5
Figure	square
Geology	Lm
Crack	many



STA.	5+680
Section.No.	17
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~2.1
Figure	square
Geology	Lm
Crack	many



STA.	5+750
Section.No.	18
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~1.4
Figure	square
Geology	Lm
Crack	many



STA.	5+900
Section.No.	19
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~4.5
Figure	square
Geology	Lm
Crack	many



STA.	13+540
Section.No.	20
Boulder stone	○
unsteady stone	
Diameter(m)	0.1~0.7
Figure	sphere
Geology	Dp
Crack	-

Rock Fall Survey



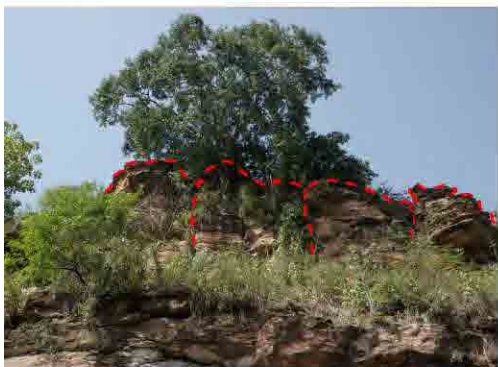
STA.	13+840
Section.No.	21
Boulder stone	
unsteady stone	○
Diameter(m)	0.1~1.2
Figure	square
Geology	Lm
Crack	many



STA.	13+980
Section.No.	22
Boulder stone	
unsteady stone	○
Diameter(m)	0.1~0.7
Figure	square
Geology	Lm
Crack	many



STA.	14+000
Section.No.	23
Boulder stone	
unsteady stone	○
Diameter(m)	0.1~1.5
Figure	square
Geology	Lm
Crack	many



STA.	16+840
Section.No.	24
Boulder stone	
unsteady stone	○
Diameter(m)	0.1~0.6
Figure	square
Geology	Ss
Crack	many



STA.	17+100
Section.No.	25
Boulder stone	
unsteady stone	○
Diameter(m)	0.1~0.4
Figure	square
Geology	Ss
Crack	many

Rock Fall Survey



STA.	17+460
Section.No.	26
Boulder stone	
unsteady stone	○
Diameter(m)	0.1~1.2
Figure	square
Geology	Ss
Crack	many



STA.	17+500
Section.No.	27
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~3.5
Figure	square
Geology	Ss
Crack	many



STA.	17+630
Section.No.	28
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~1.4
Figure	square
Geology	Ss
Crack	many



STA.	17+720
Section.No.	29
Boulder stone	
unsteady stone	○
Diameter(m)	0.1~1.5
Figure	square
Geology	Ss
Crack	many



STA.	17+880
Section.No.	30
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~1.6
Figure	square
Geology	Ss
Crack	many

Rock Fall Survey



STA.	17+940
Section.No.	31
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~2.1
Figure	square
Geology	Ss
Crack	many



STA.	18+080
Section.No.	32
Boulder stone	
unsteady stone	○
Diameter(m)	0.1~1.5
Figure	square
Geology	Ss
Crack	many



STA.	18+480
Section.No.	33
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~1.7
Figure	square
Geology	Ss
Crack	many



STA.	18+640
Section.No.	34
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~1.0
Figure	square
Geology	Ss
Crack	many



STA.	18+720
Section.No.	35
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~2.1
Figure	square
Geology	Ss
Crack	many

Rock Fall Survey



STA.	18+800
Section.No.	36
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~0.3
Figure	square
Geology	Ss
Crack	many



STA.	18+840
Section.No.	37
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~3.5
Figure	square
Geology	Ss
Crack	many



STA.	20+050
Section.No.	38
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~1.4
Figure	square
Geology	Ss
Crack	many



STA.	20+240
Section.No.	39
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~2.1
Figure	square
Geology	Ss
Crack	many



STA.	20+380
Section.No.	40
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~3.6
Figure	square
Geology	Ss
Crack	many

Rock Fall Survey



STA.	20+480
Section.No.	41
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~1.0
Figure	square
Geology	Ss
Crack	many



STA.	20+660
Section.No.	42
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~1.5
Figure	square
Geology	Ss
Crack	many



STA.	20+700
Section.No.	43
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~2.8
Figure	square
Geology	Ss
Crack	many



STA.	20+760
Section.No.	44
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~2.1
Figure	square
Geology	Ss
Crack	many



STA.	20+920
Section.No.	45
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~0.8
Figure	square
Geology	Ss
Crack	many

Rock Fall Survey



STA.	21+000
Section.No.	46
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~1.5
Figure	square
Geology	Lm
Crack	many



STA.	30+500
Section.No.	47
Boulder stone	
unsteady stone	○
Diameter(m)	0.1~0.6
Figure	square
Geology	Lm
Crack	many



STA.	31+040
Section.No.	48
Boulder stone	○
unsteady stone	
Diameter(m)	0.1~2.1
Figure	square
Geology	Dp
Crack	-

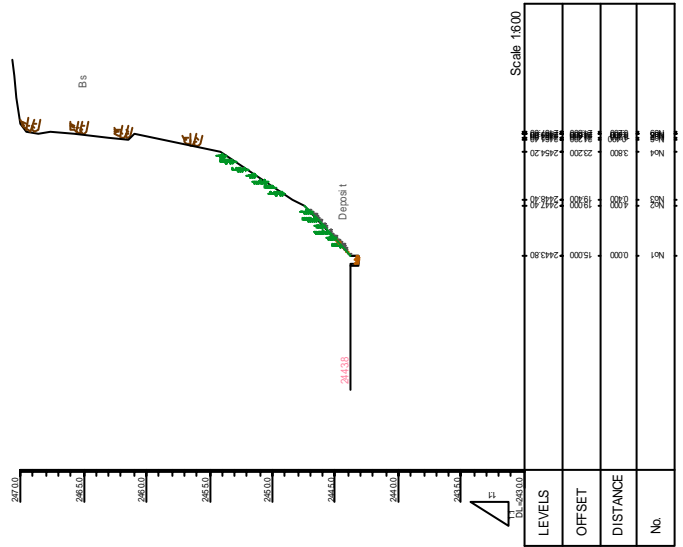


STA.	32+040
Section.No.	49
Boulder stone	
unsteady stone	○
Diameter(m)	0.1~0.6
Figure	square
Geology	Lm
Crack	many

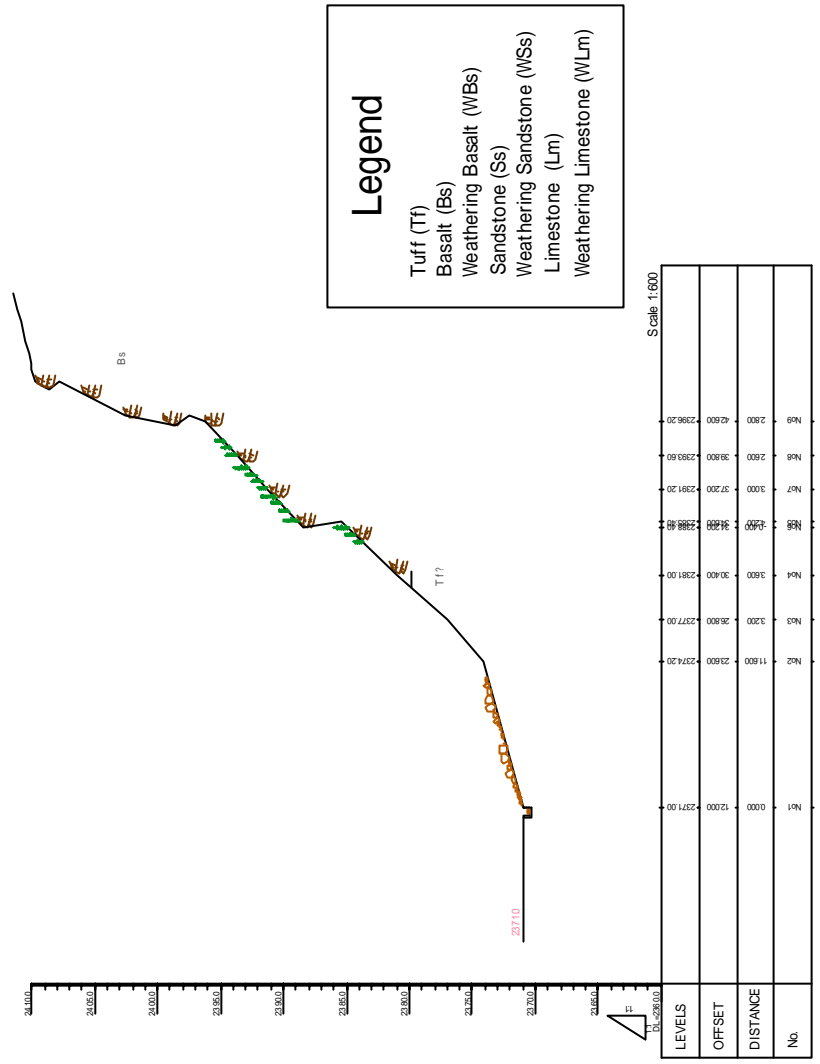


STA.	34+380
Section.No.	50
Boulder stone	○
unsteady stone	○
Diameter(m)	0.1~0.7
Figure	square
Geology	Bs
Crack	many

RF001 (STA.0+340)
(Section 1/50)



RF002 (STA.0+930)
(Section 2/50)

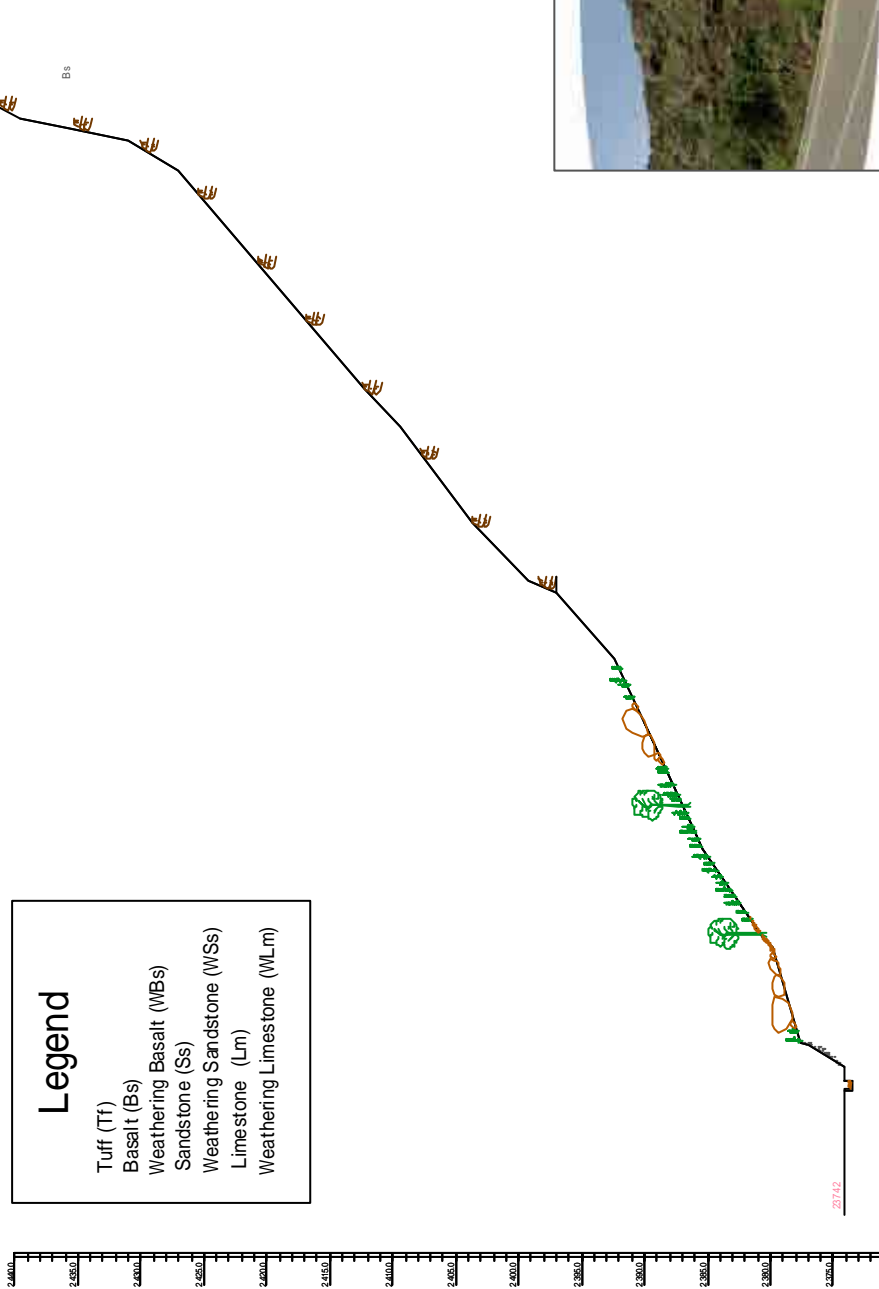


Offset value is set as 0 (zero) which is the standing point when the surveyor measure the slope height and distance by the measurement device.

This is a image section of site conditions.

RF003 (STA.1+180)

(Section 3/50)

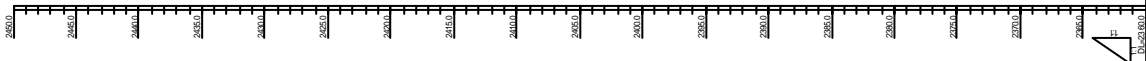


Scale 1:600

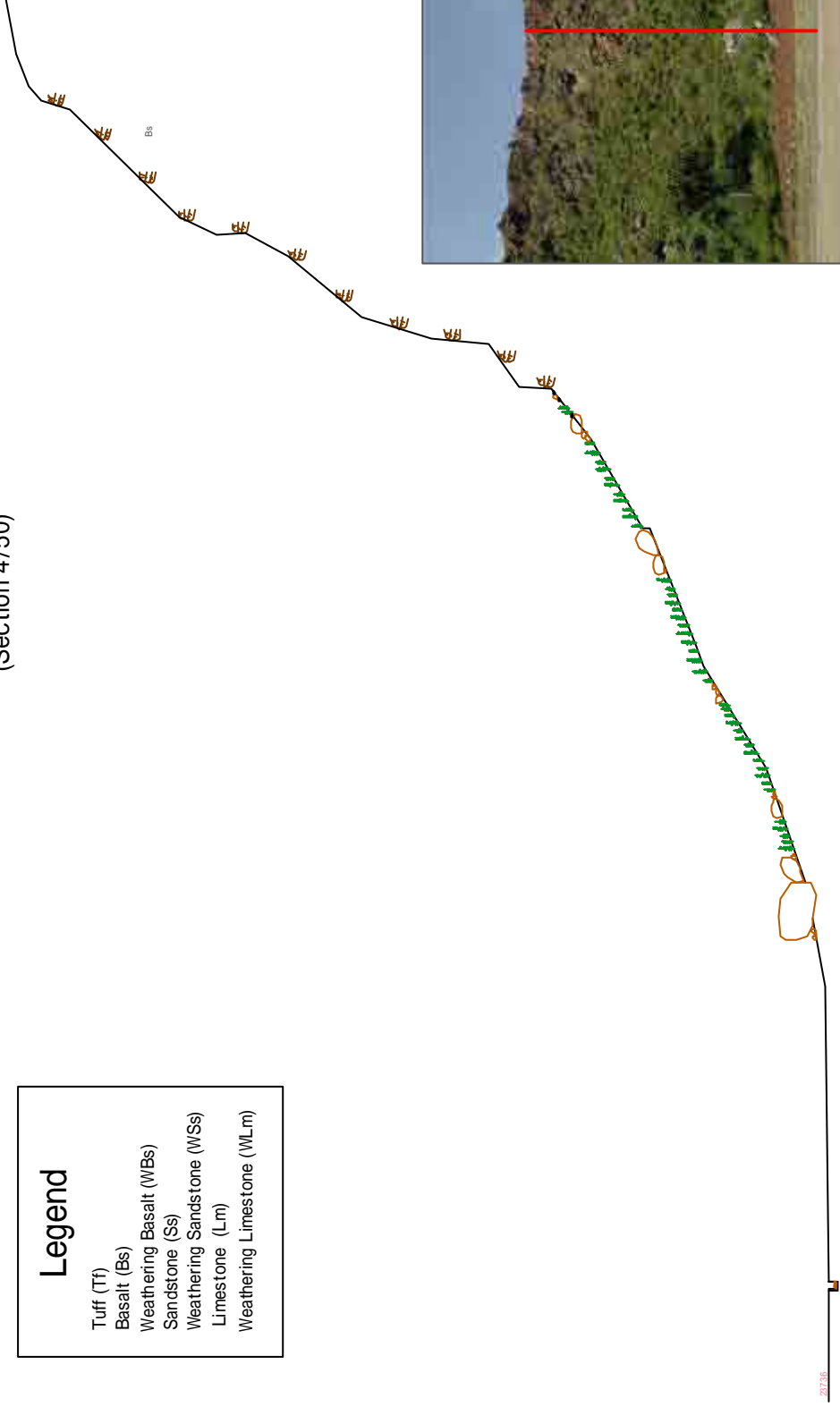
LEVELS	OFFSET	DISTANCE	No.
2377.80	14.88	0.00	No. 1
2374.20	12.80	0.00	No. 2
2379.80	22.00	0.80	No. 3
2380.60	22.20	0.80	No. 4
2387.70	14.88	0.00	No. 5
2386.40	30.20	7.00	No. 6
2386.00	31.60	1.40	No. 7
2390.00	40.20	8.60	No. 8
2392.40	45.20	5.00	No. 9
2397.00	51.40	6.20	No. 10
2403.60	56.00	4.60	No. 11
2409.40	63.60	7.60	No. 12
2412.20	66.60	3.00	No. 13
2427.00	84.00	17.40	No. 14
2431.00	88.00	4.00	No. 15
2436.60	93.60	5.60	No. 16
2439.60	96.60	3.00	No. 17
2456.60	113.60	17.00	No. 18
2460.00	117.00	3.40	No. 19

This is a image section of site conditions.

RF003 (STA.1+300)
(Section 4/50)



Legend	
Tuff (Tf)	
Basalt (Bs)	
Weathering Basalt (WBs)	
Sandstone (Ss)	
Weathering Sandstone (W/Ss)	
Limestone (Lm)	
Weathering Limestone (WLm)	

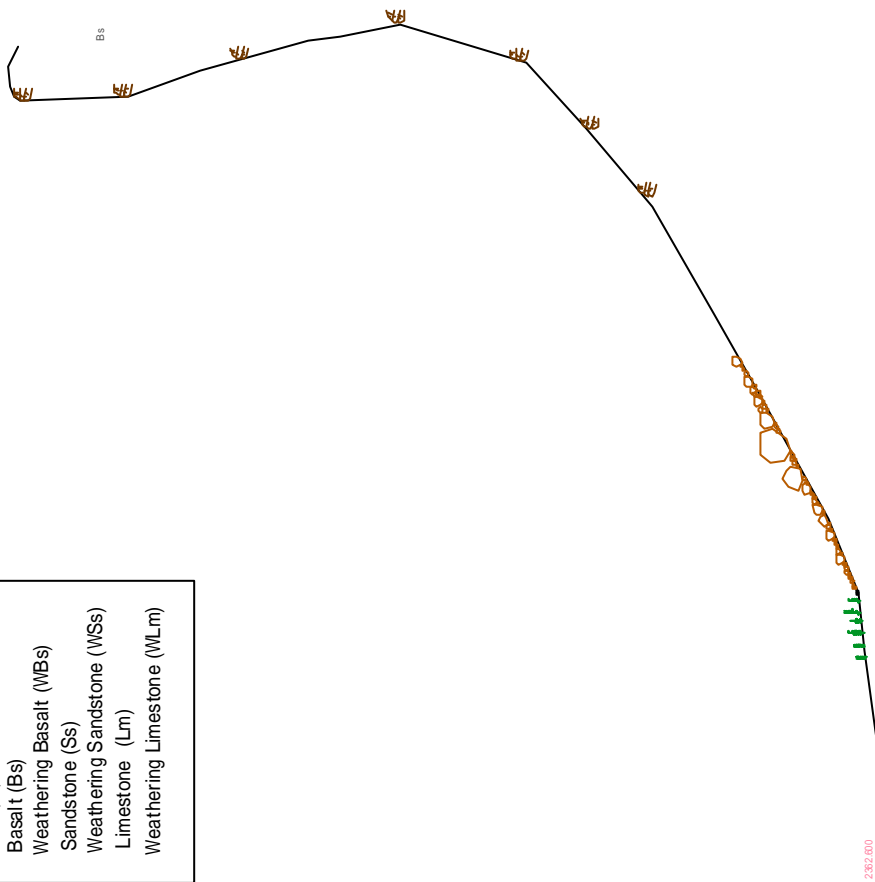


LEVELS	OFFSET	DISTANCE	No.
2373.00	10.00	2374.00	N1
2374.00	0.00	2374.00	N2
2375.00	0.00	2375.00	N3
2376.00	0.00	2376.00	N4
2377.00	0.00	2377.00	N5
2378.00	0.00	2378.00	N6
2379.00	0.00	2379.00	N7
2380.00	0.00	2380.00	N8
2381.00	0.00	2381.00	N9
2382.00	0.00	2382.00	N10
2383.00	0.00	2383.00	N11
2384.00	0.00	2384.00	N12
2385.00	0.00	2385.00	N13
2386.00	0.00	2386.00	N14
2387.00	0.00	2387.00	N15
2388.00	0.00	2388.00	N16
2389.00	0.00	2389.00	N17
2390.00	0.00	2390.00	N18
2391.00	0.00	2391.00	N19
2392.00	0.00	2392.00	N20
2393.00	0.00	2393.00	N21
2394.00	0.00	2394.00	N22
2395.00	0.00	2395.00	N23
2396.00	0.00	2396.00	N24
2397.00	0.00	2397.00	N25
2398.00	0.00	2398.00	N26
2399.00	0.00	2399.00	N27
2400.00	0.00	2400.00	N28
2401.00	0.00	2401.00	N29
2402.00	0.00	2402.00	N30
2403.00	0.00	2403.00	N31
2404.00	0.00	2404.00	N32
2405.00	0.00	2405.00	N33
2406.00	0.00	2406.00	N34
2407.00	0.00	2407.00	N35
2408.00	0.00	2408.00	N36
2409.00	0.00	2409.00	N37
2410.00	0.00	2410.00	N38
2411.00	0.00	2411.00	N39
2412.00	0.00	2412.00	N40
2413.00	0.00	2413.00	N41
2414.00	0.00	2414.00	N42
2415.00	0.00	2415.00	N43
2416.00	0.00	2416.00	N44
2417.00	0.00	2417.00	N45
2418.00	0.00	2418.00	N46
2419.00	0.00	2419.00	N47
2420.00	0.00	2420.00	N48
2421.00	0.00	2421.00	N49
2422.00	0.00	2422.00	N50
2423.00	0.00	2423.00	N51
2424.00	0.00	2424.00	N52
2425.00	0.00	2425.00	N53
2426.00	0.00	2426.00	N54
2427.00	0.00	2427.00	N55
2428.00	0.00	2428.00	N56
2429.00	0.00	2429.00	N57
2430.00	0.00	2430.00	N58
2431.00	0.00	2431.00	N59
2432.00	0.00	2432.00	N60
2433.00	0.00	2433.00	N61
2434.00	0.00	2434.00	N62
2435.00	0.00	2435.00	N63
2436.00	0.00	2436.00	N64
2437.00	0.00	2437.00	N65
2438.00	0.00	2438.00	N66
2439.00	0.00	2439.00	N67
2440.00	0.00	2440.00	N68
2441.00	0.00	2441.00	N69
2442.00	0.00	2442.00	N70
2443.00	0.00	2443.00	N71
2444.00	0.00	2444.00	N72
2445.00	0.00	2445.00	N73
2446.00	0.00	2446.00	N74
2447.00	0.00	2447.00	N75
2448.00	0.00	2448.00	N76
2449.00	0.00	2449.00	N77
2450.00	0.00	2450.00	N78
2451.00	0.00	2451.00	N79
2452.00	0.00	2452.00	N80
2453.00	0.00	2453.00	N81
2454.00	0.00	2454.00	N82
2455.00	0.00	2455.00	N83
2456.00	0.00	2456.00	N84
2457.00	0.00	2457.00	N85
2458.00	0.00	2458.00	N86
2459.00	0.00	2459.00	N87
2460.00	0.00	2460.00	N88

This is a image section of site conditions.

RF003 (STA.1+760) (Section 5/50)

Legend	
Tuff (Tf)	
Basalt (Bs)	
Weathering Basalt (WBs)	
Sandstone (Ss)	
Weathering Sandstone (WSs)	
Limestone (Lm)	
Weathering Limestone (WLM)	

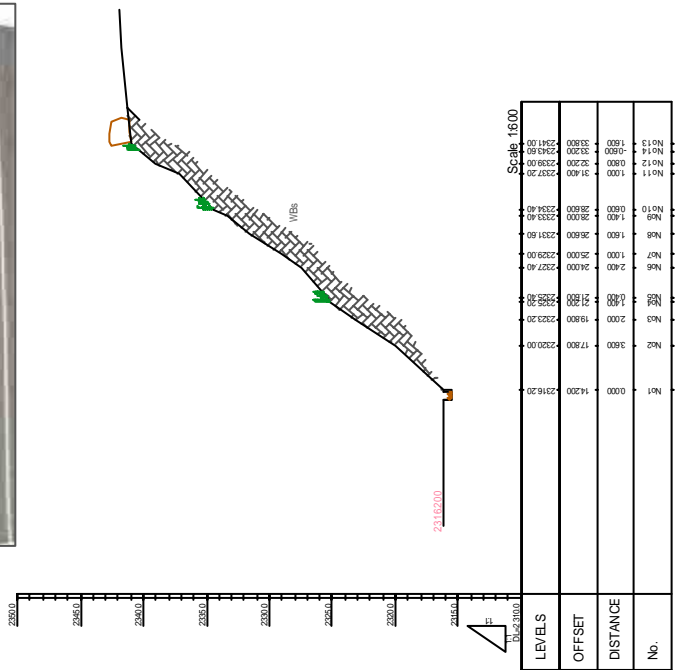


Scale 1:600

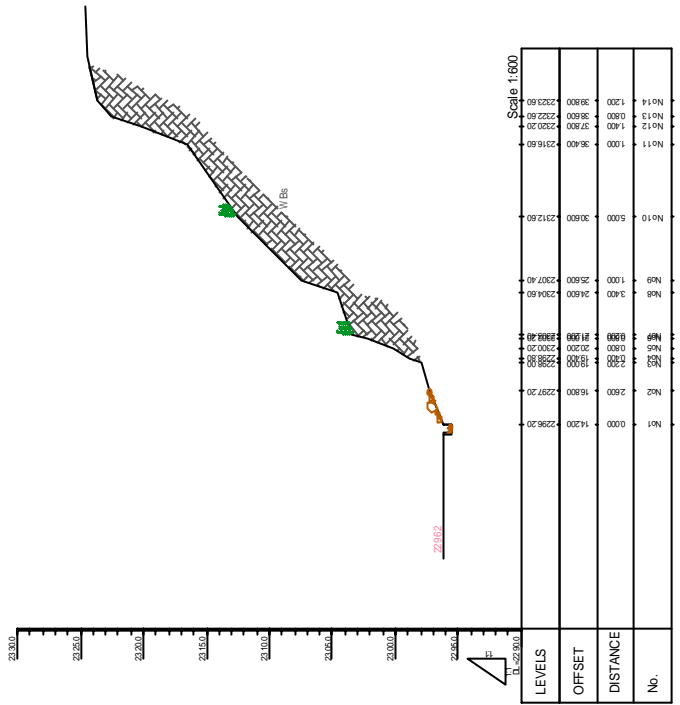
LEVELS	OFFSET	DISTANCE	No.
2262.60	14.00	0.00	N1
2262.60	21.00	7.00	N2
2262.60	28.00	14.00	N3
2262.60	31.00	17.00	N4
2262.60	42.00	28.00	N5
2262.60	46.00	31.00	N6
2262.60	56.00	34.00	N7
2262.60	62.00	40.00	N8
2262.60	67.00	45.00	N9
2262.60	71.00	49.00	N10

This is a image section of site conditions.

RF004 (STA.2+400)
(Section 6/50)

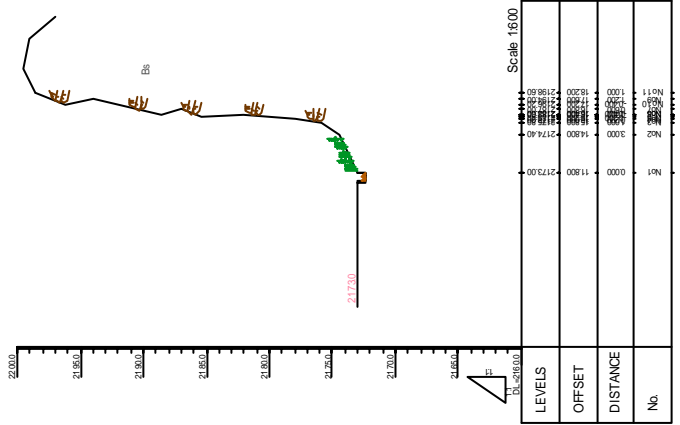


RF004 (STA.2+660)
(Section 7/50)



This is a image section of site conditions.

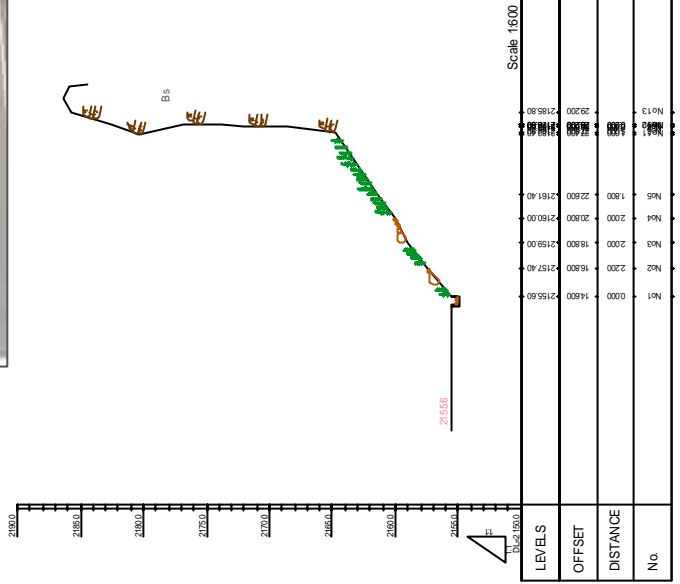
RF005 (STA. 4+280)
(Section 10/50)



Legend

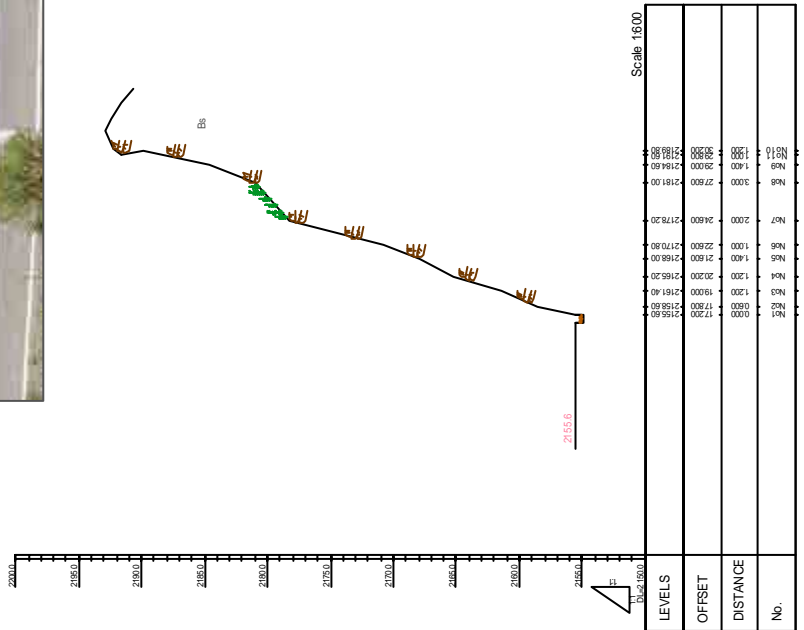
- Tuff (Tf)
- Basalt (Bs)
- Weathering Basalt (WBS)
- Sandstone (Ss)
- Weathering Sandstone (WSs)
- Limestone (Lm)
- Weathering Limestone (WLM)

RF005 (STA. 4+320)
(Section 11/50)

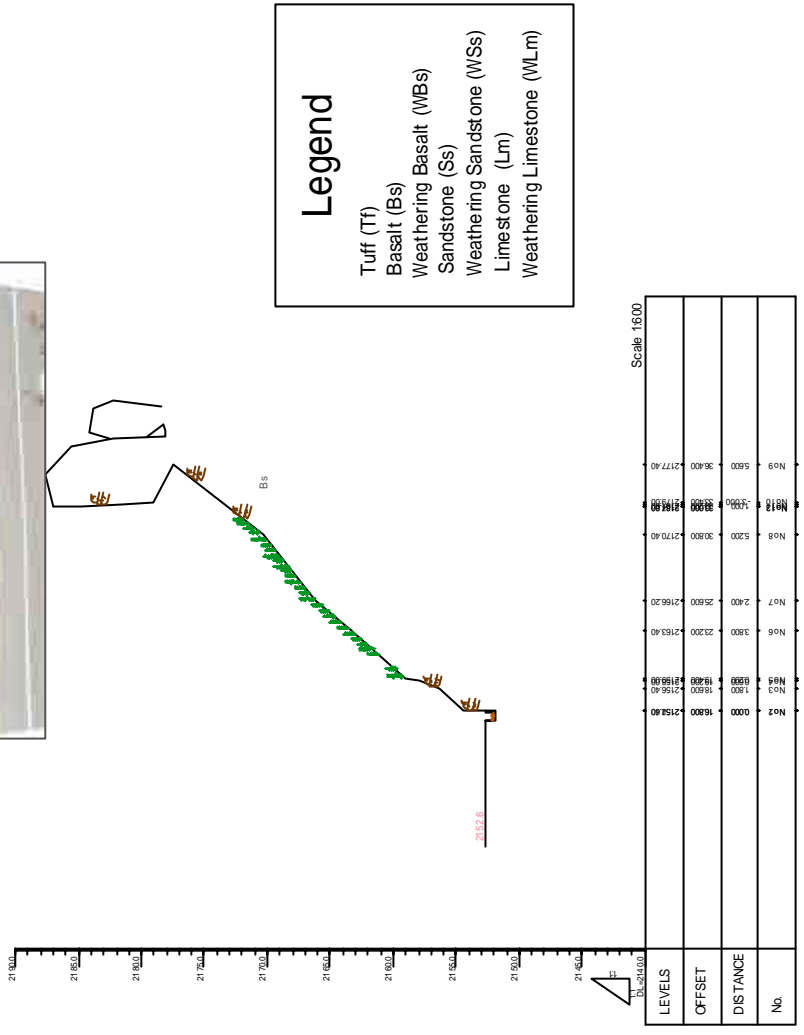


This is a image section of site conditions.

RF005 (STA.4+580)
(Section 12/50)

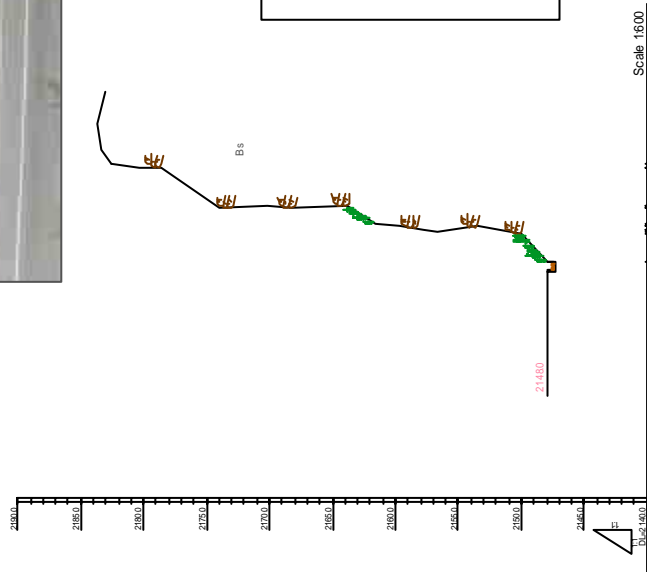


RF005 (STA.4+700)
(Section 13/50)



This is a image section of site conditions.

RF005 (STA.4+850)
(Section 14/50)

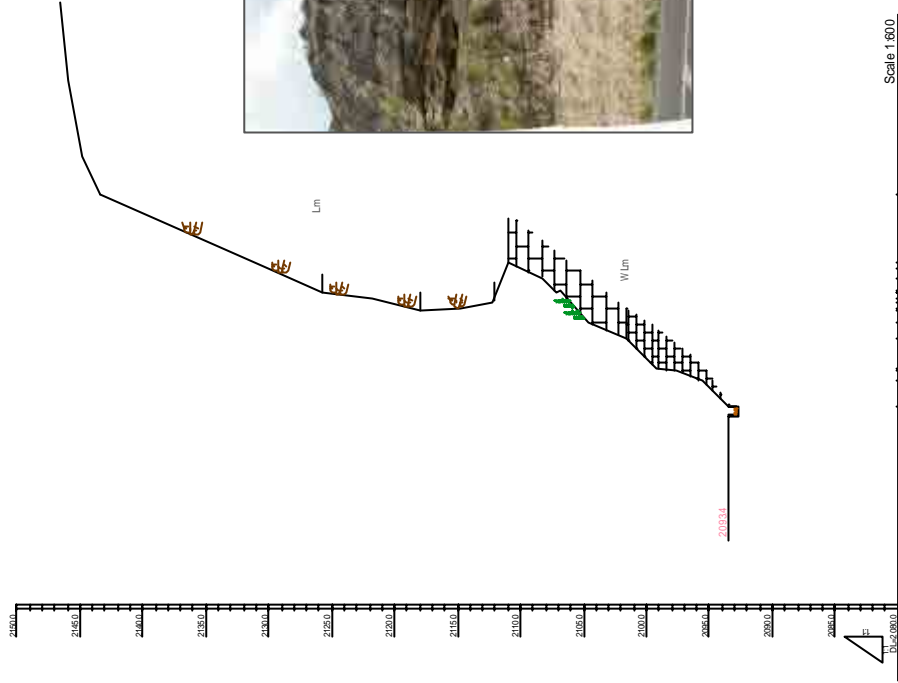


Legend

- Tuff (Tf)
- Basalt (Bs)
- Weathering Basalt (WBs)
- Sandstone (Ss)
- Weathering Sandstone (WSSs)
- Limestone (Lm)
- Weathering Limestone (WLM)

LEVELS	OFFSET	DISTANCE	No.
2195.00	0.00	0.00	N15
2190.00	0.00	0.00	N16
2185.00	0.00	0.00	N17
2180.00	0.00	0.00	N18
2175.00	0.00	0.00	N19
2170.00	0.00	0.00	N20
2165.00	0.00	0.00	N21
2160.00	0.00	0.00	N22
2155.00	0.00	0.00	N23
2150.00	0.00	0.00	N24
2145.00	0.00	0.00	N25

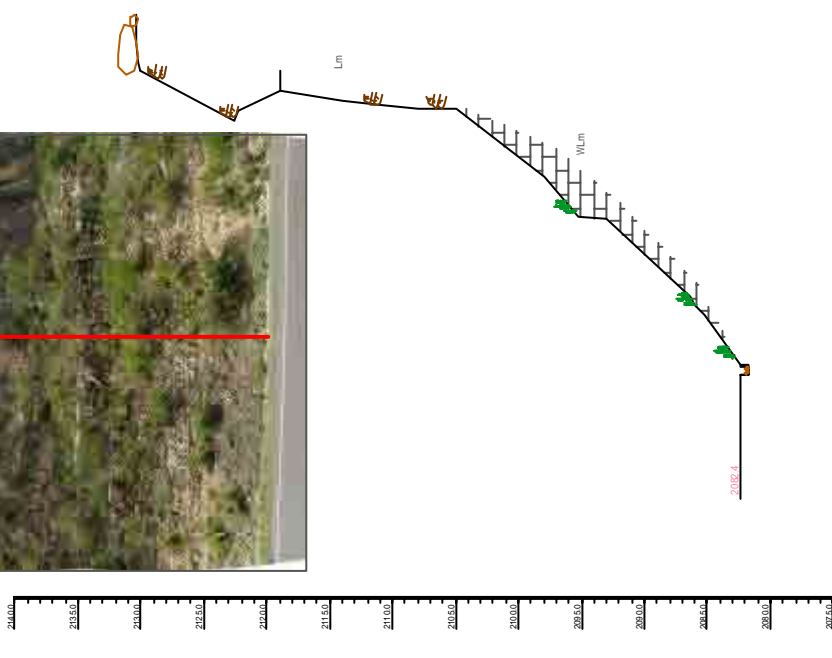
RF006 (STA.5+480)
(Section 15/50)



LEVELS	OFFSET	DISTANCE	No.
2450.00	0.00	0.00	N17
2445.00	0.00	0.00	N18
2440.00	0.00	0.00	N19
2435.00	0.00	0.00	N20
2430.00	0.00	0.00	N21
2425.00	0.00	0.00	N22
2420.00	0.00	0.00	N23
2415.00	0.00	0.00	N24
2410.00	0.00	0.00	N25
2405.00	0.00	0.00	N26
2400.00	0.00	0.00	N27
2395.00	0.00	0.00	N28
2390.00	0.00	0.00	N29
2385.00	0.00	0.00	N30
2380.00	0.00	0.00	N31
2375.00	0.00	0.00	N32
2370.00	0.00	0.00	N33
2365.00	0.00	0.00	N34
2360.00	0.00	0.00	N35
2355.00	0.00	0.00	N36
2350.00	0.00	0.00	N37
2345.00	0.00	0.00	N38
2340.00	0.00	0.00	N39
2335.00	0.00	0.00	N40
2330.00	0.00	0.00	N41
2325.00	0.00	0.00	N42
2320.00	0.00	0.00	N43
2315.00	0.00	0.00	N44
2310.00	0.00	0.00	N45
2305.00	0.00	0.00	N46
2300.00	0.00	0.00	N47
2295.00	0.00	0.00	N48
2290.00	0.00	0.00	N49
2285.00	0.00	0.00	N50
2280.00	0.00	0.00	N51
2275.00	0.00	0.00	N52
2270.00	0.00	0.00	N53
2265.00	0.00	0.00	N54
2260.00	0.00	0.00	N55
2255.00	0.00	0.00	N56
2250.00	0.00	0.00	N57
2245.00	0.00	0.00	N58
2240.00	0.00	0.00	N59
2235.00	0.00	0.00	N60
2230.00	0.00	0.00	N61
2225.00	0.00	0.00	N62
2220.00	0.00	0.00	N63
2215.00	0.00	0.00	N64
2210.00	0.00	0.00	N65
2205.00	0.00	0.00	N66
2200.00	0.00	0.00	N67
2195.00	0.00	0.00	N68
2190.00	0.00	0.00	N69
2185.00	0.00	0.00	N70
2180.00	0.00	0.00	N71
2175.00	0.00	0.00	N72
2170.00	0.00	0.00	N73
2165.00	0.00	0.00	N74
2160.00	0.00	0.00	N75
2155.00	0.00	0.00	N76
2150.00	0.00	0.00	N77
2145.00	0.00	0.00	N78
2140.00	0.00	0.00	N79
2135.00	0.00	0.00	N80
2130.00	0.00	0.00	N81
2125.00	0.00	0.00	N82
2120.00	0.00	0.00	N83
2115.00	0.00	0.00	N84
2110.00	0.00	0.00	N85
2105.00	0.00	0.00	N86
2100.00	0.00	0.00	N87
2095.00	0.00	0.00	N88
2090.00	0.00	0.00	N89
2085.00	0.00	0.00	N90

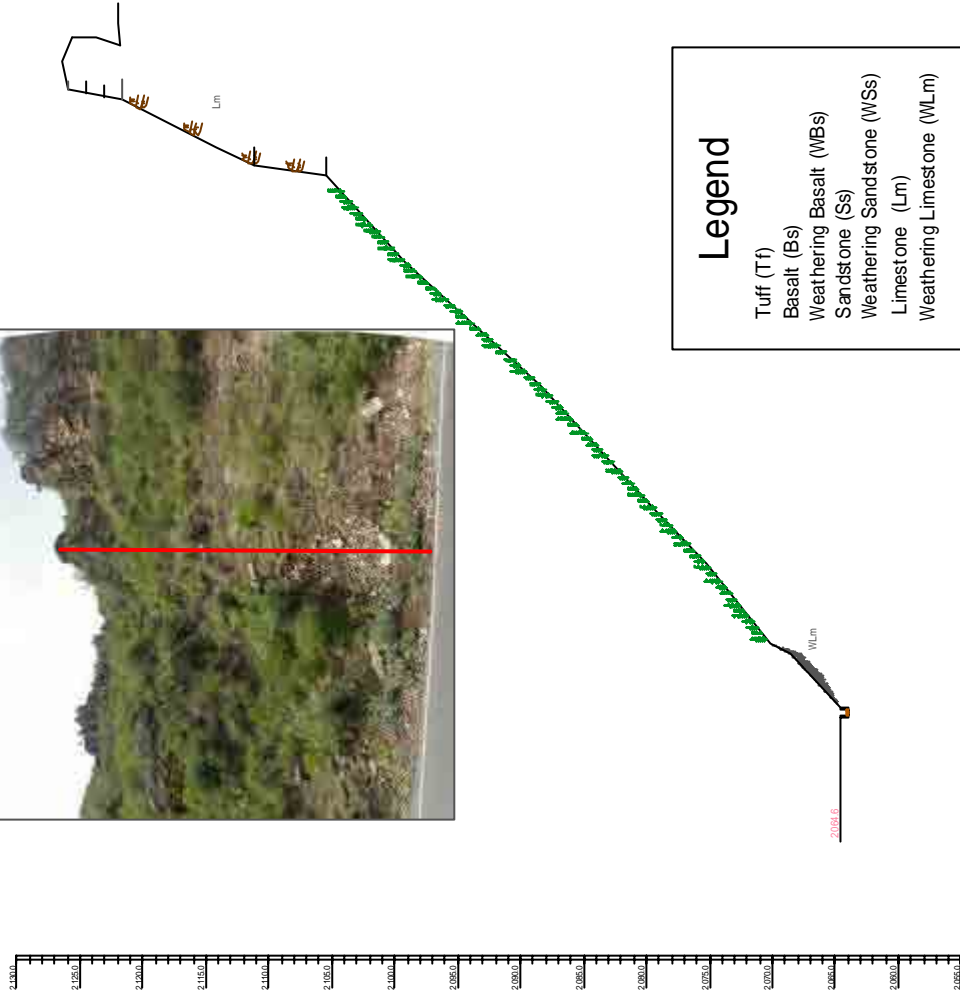
This is a image section of site conditions.

RF006 (STA.5+600)
(Section 16/50)



LEVELS	OFFSET	DISTANCE	No.
240.00	0.00	0.00	N1
238.00	0.00	0.00	N2
236.00	0.00	0.00	N3
234.00	0.00	0.00	N4
232.00	0.00	0.00	N5
230.00	0.00	0.00	N6
228.00	0.00	0.00	N7
226.00	0.00	0.00	N8
224.00	0.00	0.00	N9
222.00	0.00	0.00	N10
220.00	0.00	0.00	N11
218.00	0.00	0.00	N12
216.00	0.00	0.00	N13
214.00	0.00	0.00	N14
212.00	0.00	0.00	N15

RF006 (STA.5+680)
(Section 17/50)



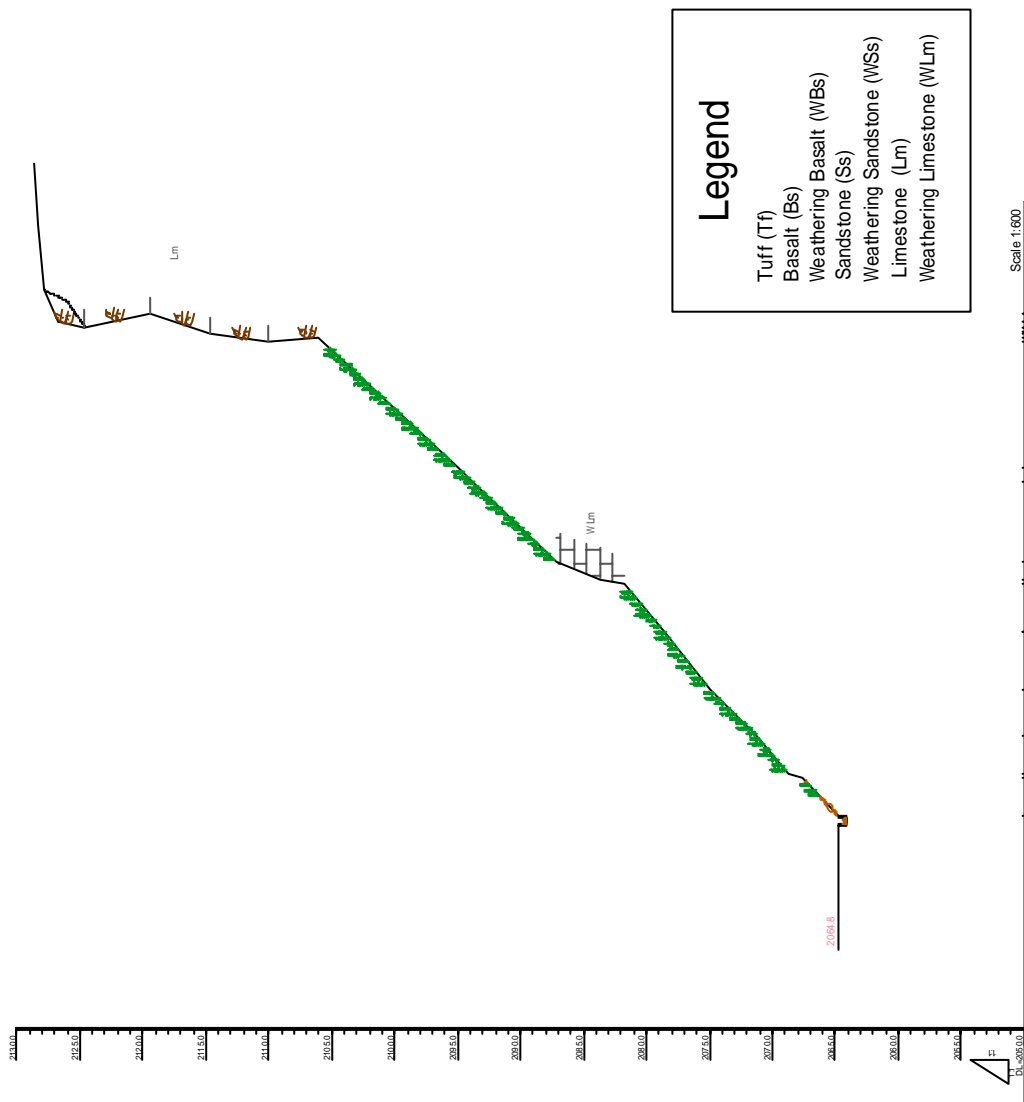
Legend

- Tuff (Tf)
- Basalt (Bs)
- Weathering Basalt (WBS)
- Sandstone (Ss)
- Weathering Sandstone (WSS)
- Limestone (Lm)
- Weathering Limestone (W/Lm)

LEVELS	OFFSET	DISTANCE	No.
240.00	0.00	0.00	N1
238.00	0.00	0.00	N2
236.00	0.00	0.00	N3
234.00	0.00	0.00	N4
232.00	0.00	0.00	N5
230.00	0.00	0.00	N6
228.00	0.00	0.00	N7
226.00	0.00	0.00	N8
224.00	0.00	0.00	N9
222.00	0.00	0.00	N10
220.00	0.00	0.00	N11
218.00	0.00	0.00	N12
216.00	0.00	0.00	N13
214.00	0.00	0.00	N14
212.00	0.00	0.00	N15

This is a image section of site conditions.

RF006 (STA.5+750)
(Section 18/50)



LEVELS	OFFSET	DISTANCE	No.
2430.00	0.00	0.00	N1
2425.00	5.00	14.00	N2
2420.00	10.00	28.00	N3
2415.00	15.00	42.00	N4
2410.00	20.00	56.00	N5
2405.00	25.00	70.00	N6
2400.00	30.00	84.00	N7
2395.00	35.00	98.00	N8
2390.00	40.00	112.00	N9
2385.00	45.00	126.00	N10
2380.00	50.00	140.00	N11
2375.00	55.00	154.00	N12

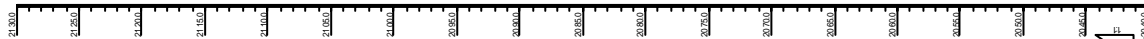


This is a image section of site conditions.

RF006 (STA.5+900)
(Section 19/50)

Legend

- Tuff (Tf)
- Basalt (Bs)
- Weathering Basalt (WBs)
- Sandstone (Ss)
- Weathering Sandstone (WSs)
- Limestone (Lm)
- Weathering Limestone (WLm)

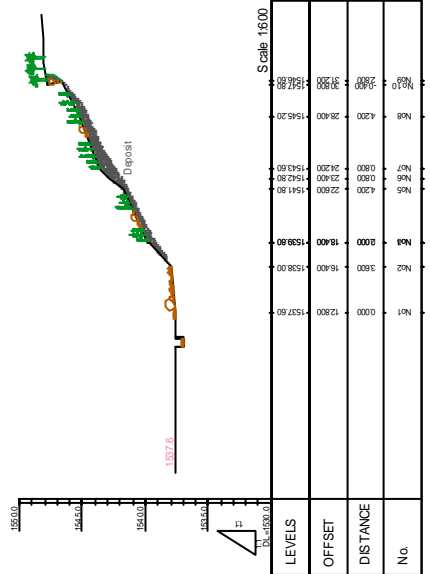


Scale 1:600

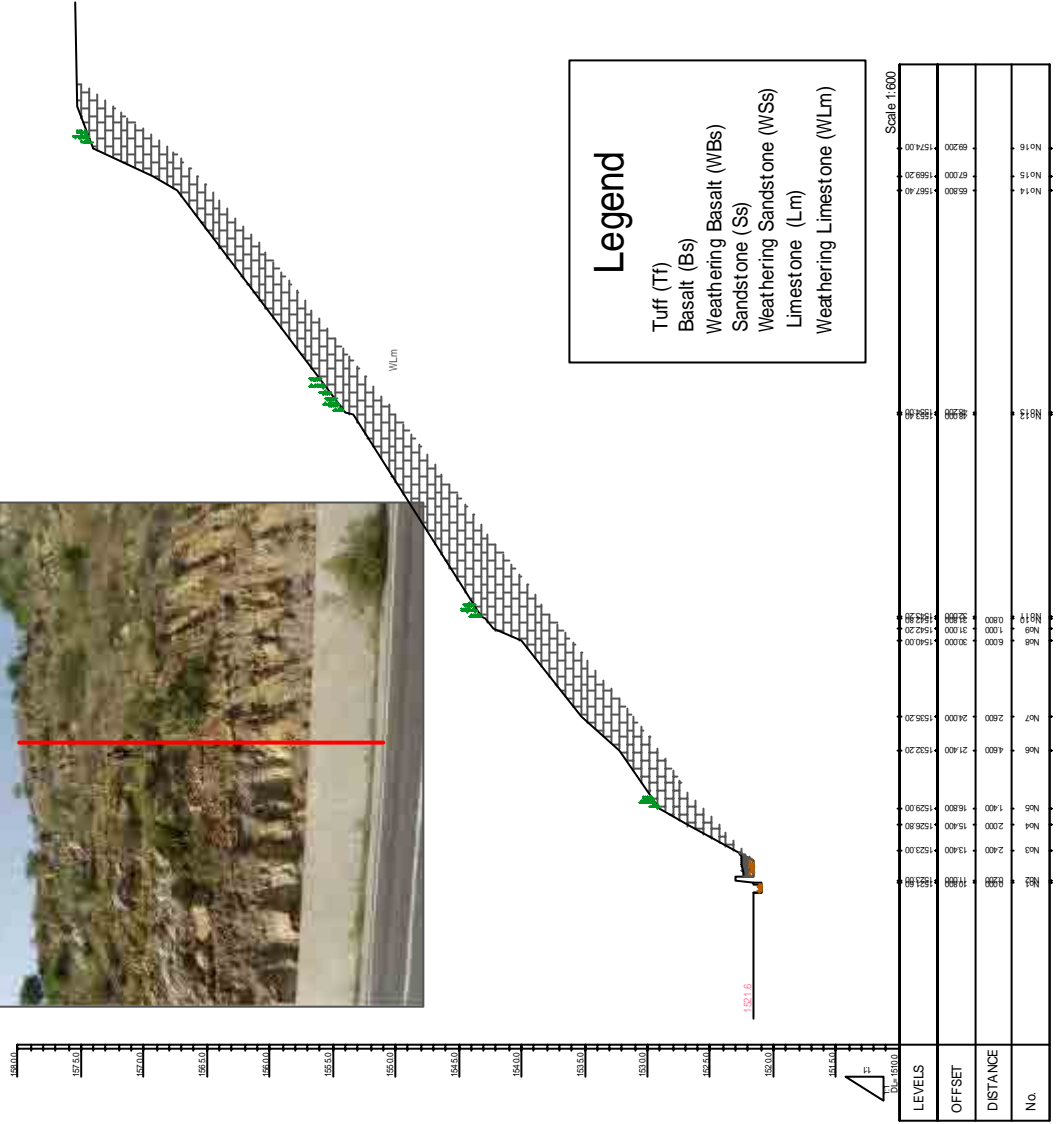
LEVELS	OFFSET	DISTANCE	No.
212.20	0.00	0.00	N16
212.00	0.00	0.00	N15
211.80	0.00	0.00	N14
211.60	0.00	0.00	N13
211.40	0.00	0.00	N12
211.20	0.00	0.00	N11
211.00	0.00	0.00	N10
210.80	0.00	0.00	N9
210.60	0.00	0.00	N8
210.40	0.00	0.00	N7
210.20	0.00	0.00	N6
210.00	0.00	0.00	N5
209.80	0.00	0.00	N4
209.60	0.00	0.00	N3
209.40	0.00	0.00	N2
209.20	0.00	0.00	N1

This is a image section of site conditions.

RF007 (STA.13+540)
(Section 20/50)



RF008 (STA.13+840)
(Section 21/50)

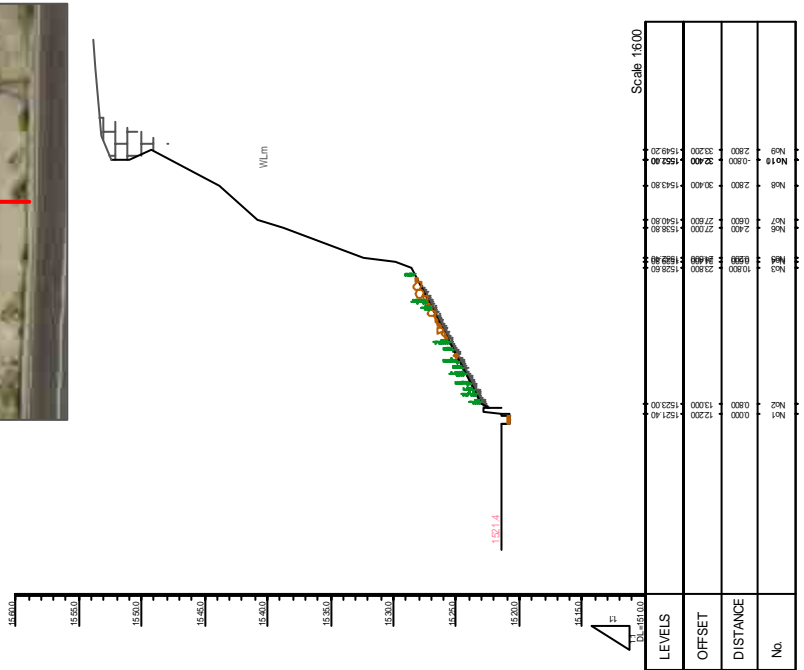


Legend

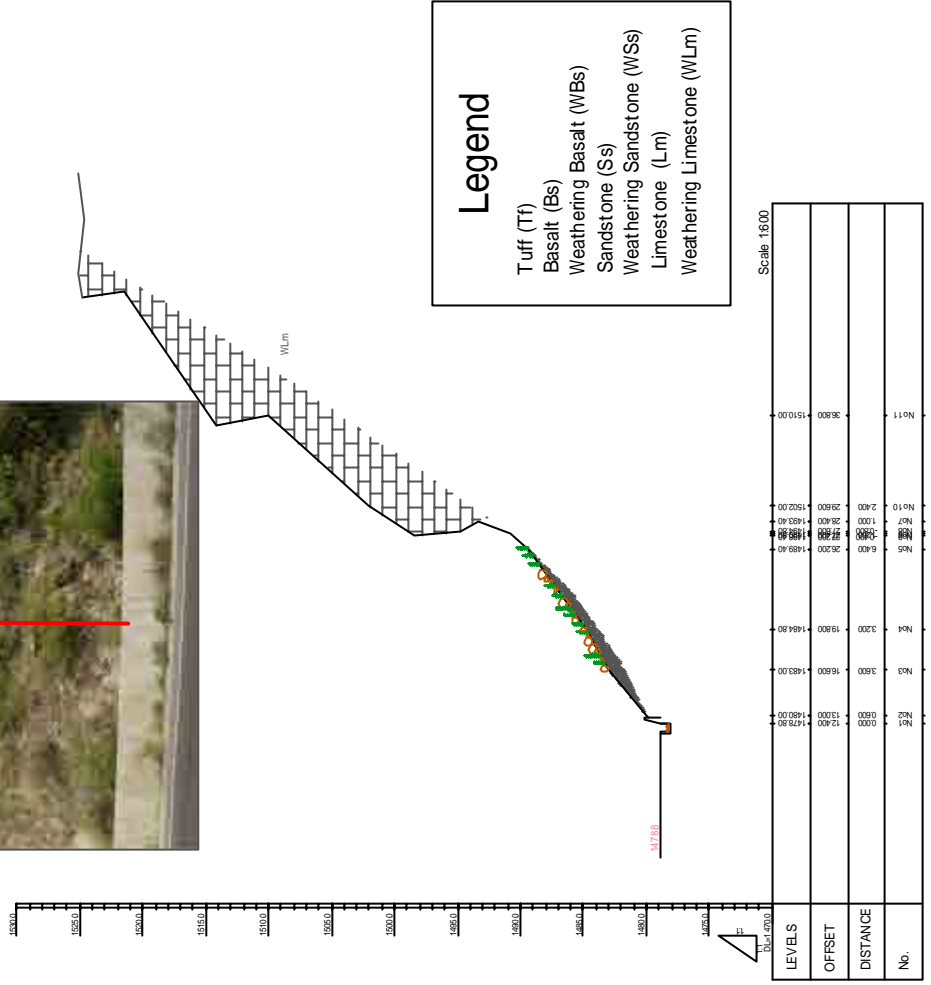
- Tuff (Tf)
- Basalt (Bs)
- Weathering Basalt (WBs)
- Sandstone (Ss)
- Weathering Sandstone (WSs)
- Limestone (Lm)
- Weathering Limestone (WLm)

This is a image section of site conditions.

RF008 (STA.13+980)
(Section 22/50)



RF008 (STA.14+000)
(Section 23/50)

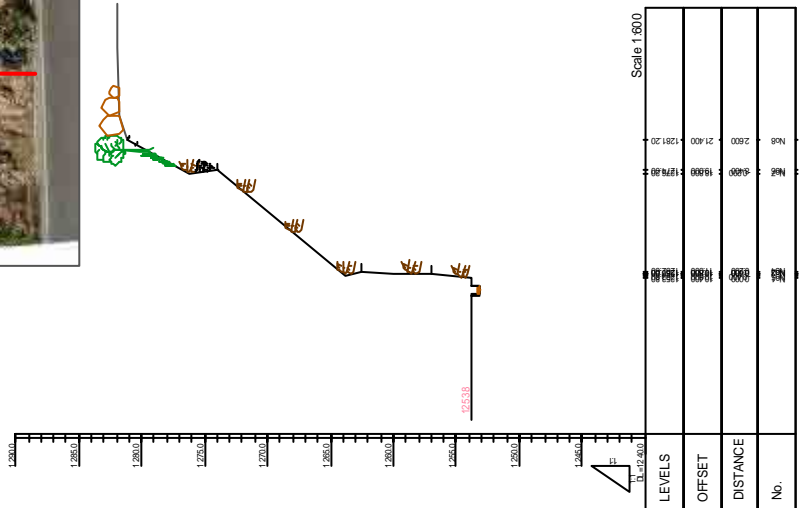


Legend

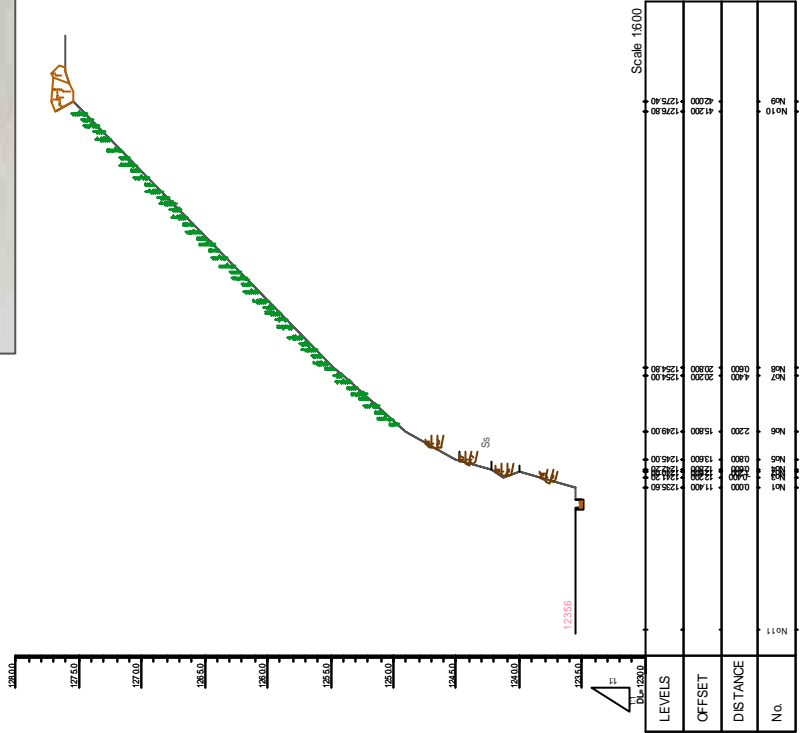
- Tuff (Tf)
- Basalt (Bs)
- Weathering Basalt (WBs)
- Sandstone (Ss)
- Weathering Sandstone (WSs)
- Limestone (Lm)
- Weathering Limestone (WLm)

This is a image section of site conditions.

RF009 (STA.16+840)
(Section 24/50)



RF009 (STA.17+100)
(Section 25/50)



Legend

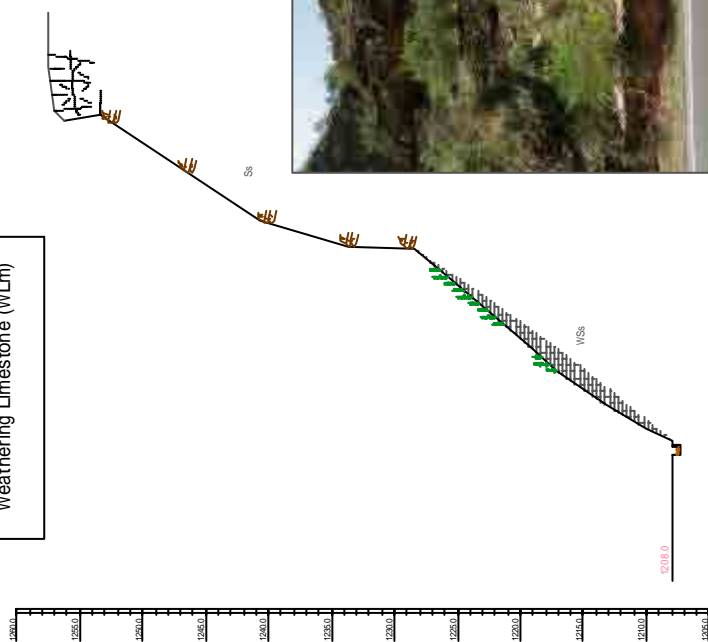
- Tuff (Tt)
- Basalt (Bs)
- Weathering Basalt (WBs)
- Sandstone (Ss)
- Weathering Sandstone (WSS)
- Limestone (Lm)
- Weathering Limestone (WLM)

This is a image section of site conditions.

RF009 (STA.17+460)
(Section 26/50)

Legend

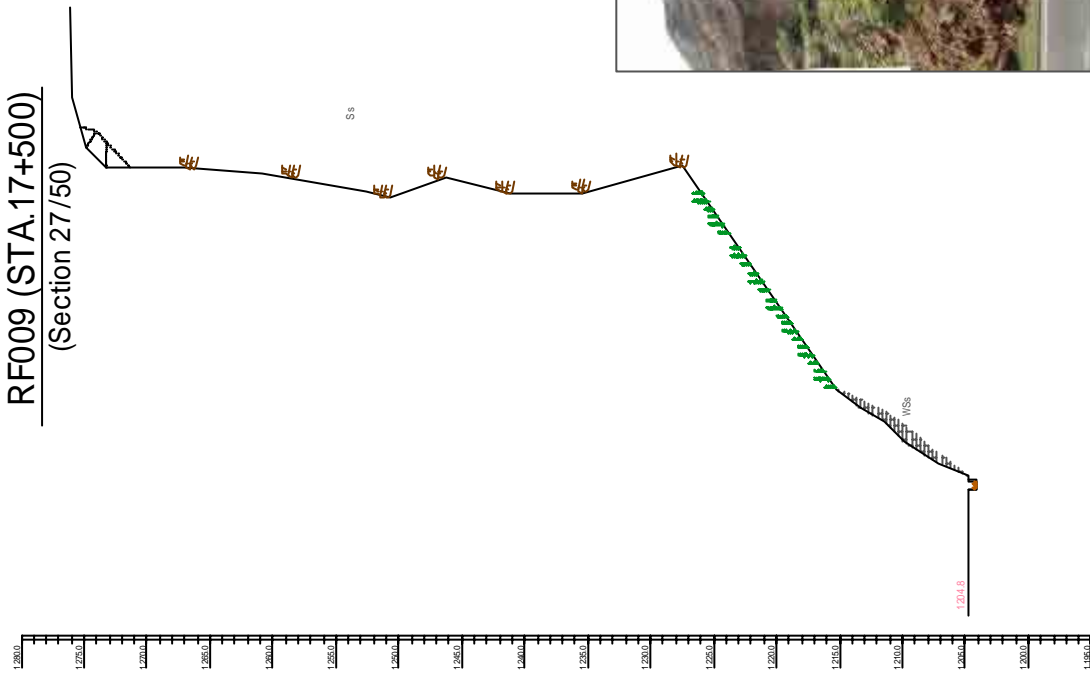
- Tuff (Tf)
- Basalt (Bs)
- Weathering Basalt (MBs)
- Sandstone (Ss)
- Weathering Sandstone (WSs)
- Limestone (Lm)
- Weathering Limestone (WLm)



Scale 1:600

LEVELS	OFFSET	DISTANCE	No.
1280.00	0.00	1268.40	N816
1278.00	0.00	1268.40	N815
1268.00	0.00	1240.60	N809
1258.00	0.00	1238.80	N808
1248.00	0.00	1225.60	N806
1238.00	0.00	1219.20	N805
1228.00	0.00	1217.20	N804
1218.00	0.00	1213.20	N803
1208.00	0.00	1210.00	N801
1200.00	0.00	1140.00	N800
1190.00	0.00	1120.00	N799
1180.00	0.00	1100.00	N798
1170.00	0.00	1080.00	N797
1160.00	0.00	1060.00	N796
1150.00	0.00	1040.00	N795
1140.00	0.00	1020.00	N794
1130.00	0.00	1000.00	N793
1120.00	0.00	980.00	N792
1110.00	0.00	960.00	N791
1100.00	0.00	940.00	N790
1090.00	0.00	920.00	N789
1080.00	0.00	900.00	N788
1070.00	0.00	880.00	N787
1060.00	0.00	860.00	N786
1050.00	0.00	840.00	N785
1040.00	0.00	820.00	N784
1030.00	0.00	800.00	N783
1020.00	0.00	780.00	N782
1010.00	0.00	760.00	N781
1000.00	0.00	740.00	N780
990.00	0.00	720.00	N779
980.00	0.00	700.00	N778
970.00	0.00	680.00	N777
960.00	0.00	660.00	N776
950.00	0.00	640.00	N775
940.00	0.00	620.00	N774
930.00	0.00	600.00	N773
920.00	0.00	580.00	N772
910.00	0.00	560.00	N771
900.00	0.00	540.00	N770
890.00	0.00	520.00	N769
880.00	0.00	500.00	N768
870.00	0.00	480.00	N767
860.00	0.00	460.00	N766
850.00	0.00	440.00	N765
840.00	0.00	420.00	N764
830.00	0.00	400.00	N763
820.00	0.00	380.00	N762
810.00	0.00	360.00	N761
800.00	0.00	340.00	N760
790.00	0.00	320.00	N759
780.00	0.00	300.00	N758
770.00	0.00	280.00	N757
760.00	0.00	260.00	N756
750.00	0.00	240.00	N755
740.00	0.00	220.00	N754
730.00	0.00	200.00	N753
720.00	0.00	180.00	N752
710.00	0.00	160.00	N751
700.00	0.00	140.00	N750
690.00	0.00	120.00	N749
680.00	0.00	100.00	N748
670.00	0.00	80.00	N747
660.00	0.00	60.00	N746
650.00	0.00	40.00	N745
640.00	0.00	20.00	N744
630.00	0.00	0.00	N743

RF009 (STA.17+500)
(Section 27/50)



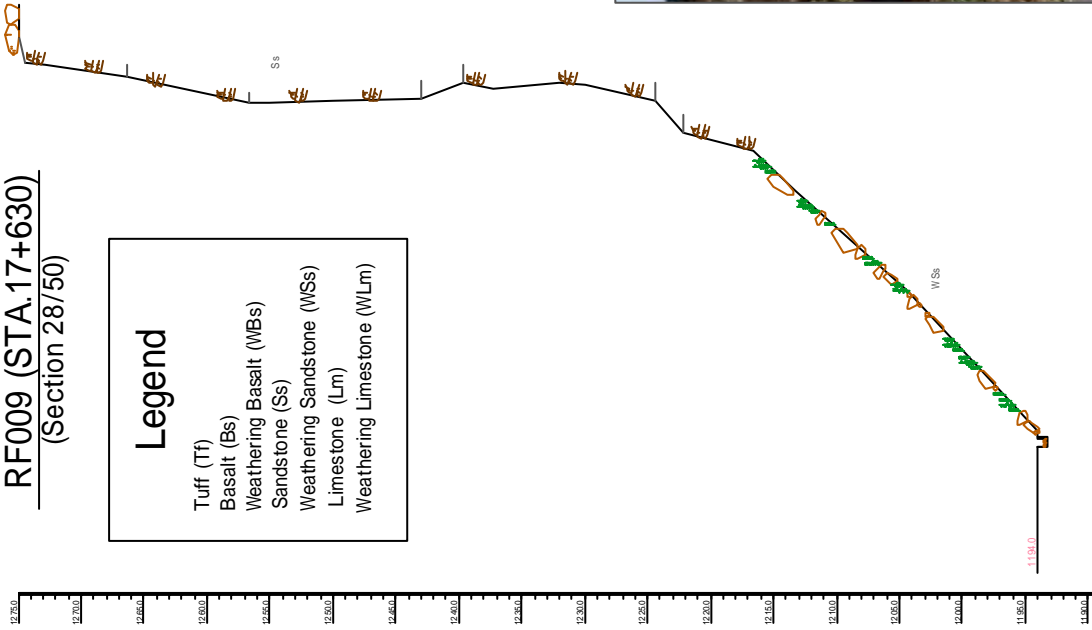
Scale 1:600

LEVELS	OFFSET	DISTANCE	No.
1280.00	0.00	1268.40	N816
1278.00	0.00	1268.40	N815
1268.00	0.00	1240.60	N809
1258.00	0.00	1238.80	N808
1248.00	0.00	1225.60	N806
1238.00	0.00	1219.20	N805
1228.00	0.00	1217.20	N804
1218.00	0.00	1213.20	N803
1208.00	0.00	1210.00	N801
1200.00	0.00	1140.00	N800
1190.00	0.00	1120.00	N799
1180.00	0.00	1100.00	N798
1170.00	0.00	1080.00	N797
1160.00	0.00	1060.00	N796
1150.00	0.00	1040.00	N795
1140.00	0.00	1020.00	N794
1130.00	0.00	1000.00	N793
1120.00	0.00	980.00	N792
1110.00	0.00	960.00	N791
1100.00	0.00	940.00	N790
1090.00	0.00	920.00	N789
1080.00	0.00	900.00	N788
1070.00	0.00	880.00	N787
1060.00	0.00	860.00	N786
1050.00	0.00	840.00	N785
1040.00	0.00	820.00	N784
1030.00	0.00	800.00	N783
1020.00	0.00	780.00	N782
1010.00	0.00	760.00	N781
1000.00	0.00	740.00	N780
990.00	0.00	720.00	N779
980.00	0.00	700.00	N778
970.00	0.00	680.00	N777
960.00	0.00	660.00	N776
950.00	0.00	640.00	N775
940.00	0.00	620.00	N774
930.00	0.00	600.00	N773
920.00	0.00	580.00	N772
910.00	0.00	560.00	N771
900.00	0.00	540.00	N770
890.00	0.00	520.00	N769
880.00	0.00	500.00	N768
870.00	0.00	480.00	N767
860.00	0.00	460.00	N766
850.00	0.00	440.00	N765
840.00	0.00	420.00	N764
830.00	0.00	400.00	N763
820.00	0.00	380.00	N762
810.00	0.00	360.00	N761
800.00	0.00	340.00	N760
790.00	0.00	320.00	N759
780.00	0.00	300.00	N758
770.00	0.00	280.00	N757
760.00	0.00	260.00	N756
750.00	0.00	240.00	N755
740.00	0.00	220.00	N754
730.00	0.00	200.00	N753
720.00	0.00	180.00	N752
710.00	0.00	160.00	N751
700.00	0.00	140.00	N750
690.00	0.00	120.00	N749
680.00	0.00	100.00	N748
670.00	0.00	80.00	N747
660.00	0.00	60.00	N746
650.00	0.00	40.00	N745
640.00	0.00	20.00	N744
630.00	0.00	0.00	N743

This is a image section of site conditions.

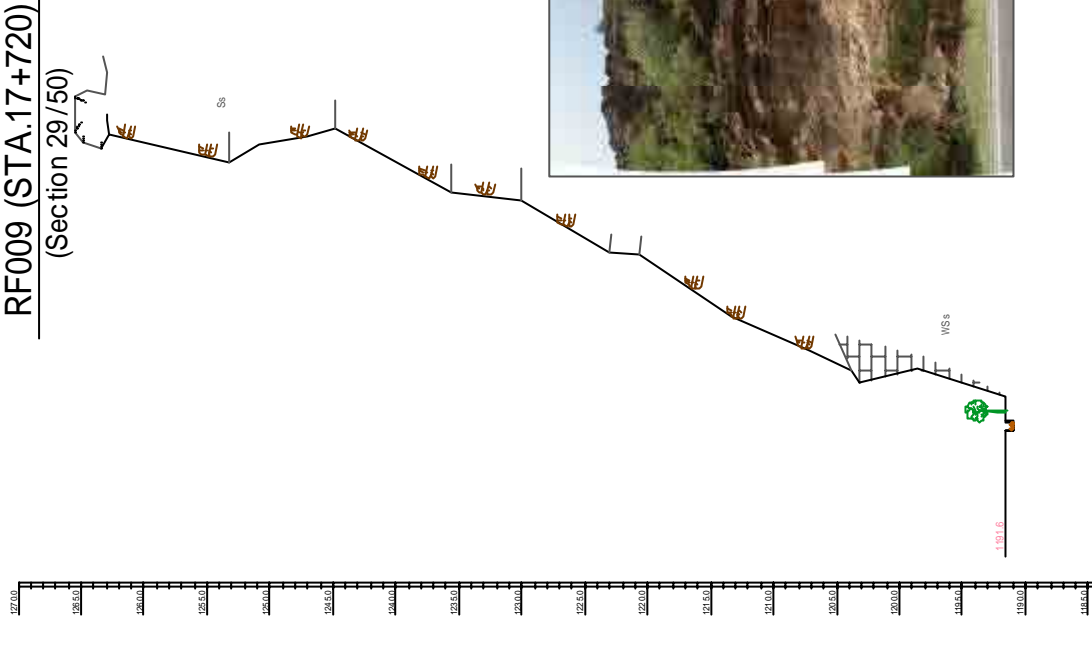
RF009 (STA.17+630)
(Section 28/50)

Legend	
Tuff (Tf)	
Basalt (Bs)	
Weathering Basalt (WBs)	
Sandstone (Ss)	
Weathering Sandstone (WSs)	
Limestone (Lm)	
Weathering Limestone (WLM)	



LEVELS	OFFSET	DISTANCE	No.
1194.00	10.800	0.000	N01
1204.40	11.200	22.000	N02
1213.20	7.800	29.800	N03
1216.60	3.000	34.000	N04
1222.20	1.400	34.000	N05
1225.40	1.800	30.000	N015
1226.80	1.800	28.000	N016
1227.40	1.800	26.000	N017
1228.00	1.800	24.000	N018
1228.60	1.800	22.000	N019
1229.20	1.800	20.000	N020
1230.00	1.800	18.000	N021
1230.80	1.800	16.000	N022
1231.60	1.800	14.000	N023
1232.40	1.800	12.000	N024
1233.20	1.800	10.000	N025
1234.00	1.800	8.000	N026
1234.80	1.800	6.000	N027
1235.00	1.800	4.000	N028
1235.20	1.800	2.000	N029
1235.40	1.800	0.000	N030

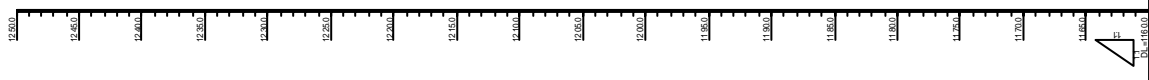
RF009 (STA.17+720)
(Section 29/50)



LEVELS	OFFSET	DISTANCE	No.
1191.60	12.800	0.000	N01
1198.80	15.800	2.000	N02
1200.00	16.000	4.000	N03
1202.20	15.000	6.000	N04
1207.20	16.400	8.000	N05
1213.40	19.200	10.000	N06
1220.80	24.200	12.000	N07
1225.80	29.200	14.000	N08
1230.00	34.000	16.000	N09
1232.20	36.200	18.000	N10
1233.40	37.400	20.000	N11
1234.60	38.600	22.000	N12
1235.80	39.800	24.000	N13
1237.00	41.000	26.000	N14
1238.20	42.200	28.000	N15
1239.40	43.400	30.000	N16
1240.60	44.600	32.000	N17
1241.80	45.800	34.000	N18
1243.00	47.000	36.000	N19
1244.20	48.200	38.000	N20
1245.40	49.400	40.000	N21
1246.60	50.600	42.000	N22
1247.80	51.800	44.000	N23
1249.00	53.000	46.000	N24
1250.20	54.200	48.000	N25
1251.40	55.400	50.000	N26
1252.60	56.600	52.000	N27
1253.80	57.800	54.000	N28
1255.00	59.000	56.000	N29
1256.20	60.200	58.000	N30

This is a image section of site conditions.

RF009 (STA. 17+880)
(Section 30/50)

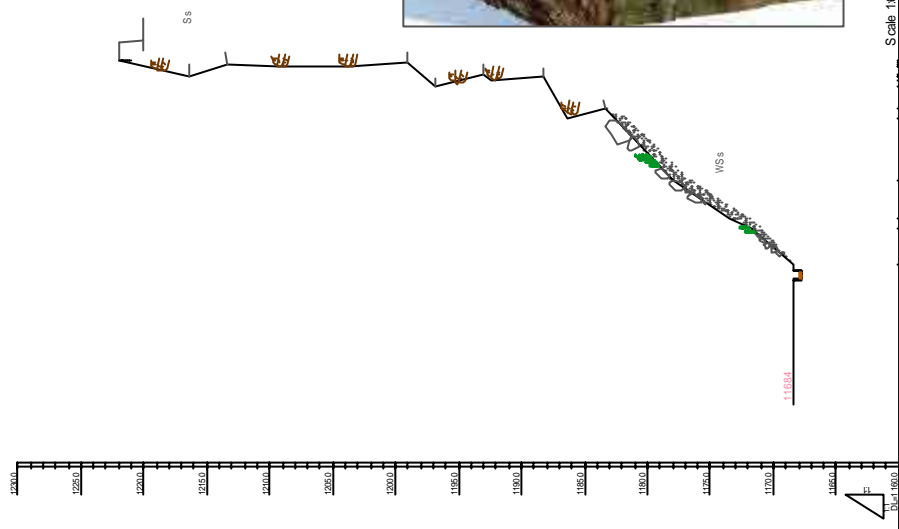


Scale 1:500

LEVELS	OFFSET	DISTANCE	No.
1170.00	0.00	0.00	N01
1172.00	0.00	0.00	N02
1174.00	0.00	0.00	N03
1176.00	0.00	0.00	N04
1178.00	0.00	0.00	N05
1180.00	0.00	0.00	N06
1182.00	0.00	0.00	N07
1184.00	0.00	0.00	N08
1186.00	0.00	0.00	N09
1188.00	0.00	0.00	N10
1190.00	0.00	0.00	N11
1192.00	0.00	0.00	N12
1194.00	0.00	0.00	N13
1196.00	0.00	0.00	N14
1198.00	0.00	0.00	N15
1200.00	0.00	0.00	N16
1202.00	0.00	0.00	N17
1204.00	0.00	0.00	N18
1206.00	0.00	0.00	N19
1208.00	0.00	0.00	N20
1210.00	0.00	0.00	N21
1212.00	0.00	0.00	N22
1214.00	0.00	0.00	N23
1216.00	0.00	0.00	N24
1218.00	0.00	0.00	N25
1220.00	0.00	0.00	N26
1222.00	0.00	0.00	N27
1224.00	0.00	0.00	N28
1226.00	0.00	0.00	N29
1228.00	0.00	0.00	N30
1230.00	0.00	0.00	N31
1232.00	0.00	0.00	N32
1234.00	0.00	0.00	N33
1236.00	0.00	0.00	N34
1238.00	0.00	0.00	N35
1240.00	0.00	0.00	N36
1242.00	0.00	0.00	N37
1244.00	0.00	0.00	N38
1246.00	0.00	0.00	N39
1248.00	0.00	0.00	N40
1250.00	0.00	0.00	N41
1252.00	0.00	0.00	N42
1254.00	0.00	0.00	N43
1256.00	0.00	0.00	N44
1258.00	0.00	0.00	N45
1260.00	0.00	0.00	N46

RF009 (STA. 17+940)
(Section 31/50)

- Legend**
- Tuff (Tf)
 - Basalt (Bs)
 - Weathering Basalt (WBs)
 - Sandstone (Ss)
 - Weathering Sandstone (WSs)
 - Limestone (Lm)
 - Weathering Limestone (WLm)

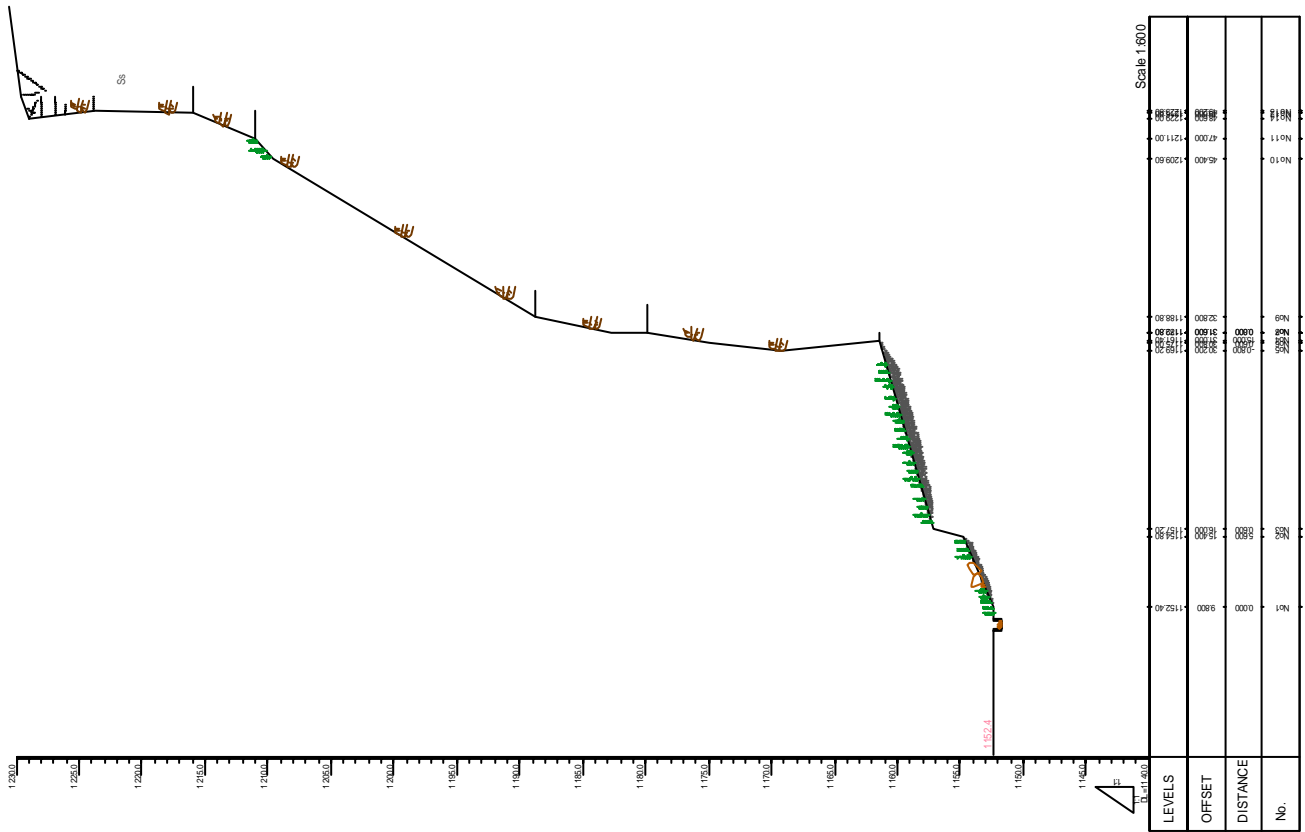


Scale 1:500

LEVELS	OFFSET	DISTANCE	No.
1160.00	0.00	0.00	N01
1162.00	0.00	0.00	N02
1164.00	0.00	0.00	N03
1166.00	0.00	0.00	N04
1168.00	0.00	0.00	N05
1170.00	0.00	0.00	N06
1172.00	0.00	0.00	N07
1174.00	0.00	0.00	N08
1176.00	0.00	0.00	N09
1178.00	0.00	0.00	N10
1180.00	0.00	0.00	N11
1182.00	0.00	0.00	N12
1184.00	0.00	0.00	N13
1186.00	0.00	0.00	N14
1188.00	0.00	0.00	N15
1190.00	0.00	0.00	N16
1192.00	0.00	0.00	N17
1194.00	0.00	0.00	N18
1196.00	0.00	0.00	N19
1198.00	0.00	0.00	N20
1200.00	0.00	0.00	N21
1202.00	0.00	0.00	N22
1204.00	0.00	0.00	N23
1206.00	0.00	0.00	N24
1208.00	0.00	0.00	N25
1210.00	0.00	0.00	N26
1212.00	0.00	0.00	N27
1214.00	0.00	0.00	N28
1216.00	0.00	0.00	N29
1218.00	0.00	0.00	N30
1220.00	0.00	0.00	N31
1222.00	0.00	0.00	N32
1224.00	0.00	0.00	N33
1226.00	0.00	0.00	N34
1228.00	0.00	0.00	N35
1230.00	0.00	0.00	N36

This is a image section of site conditions.

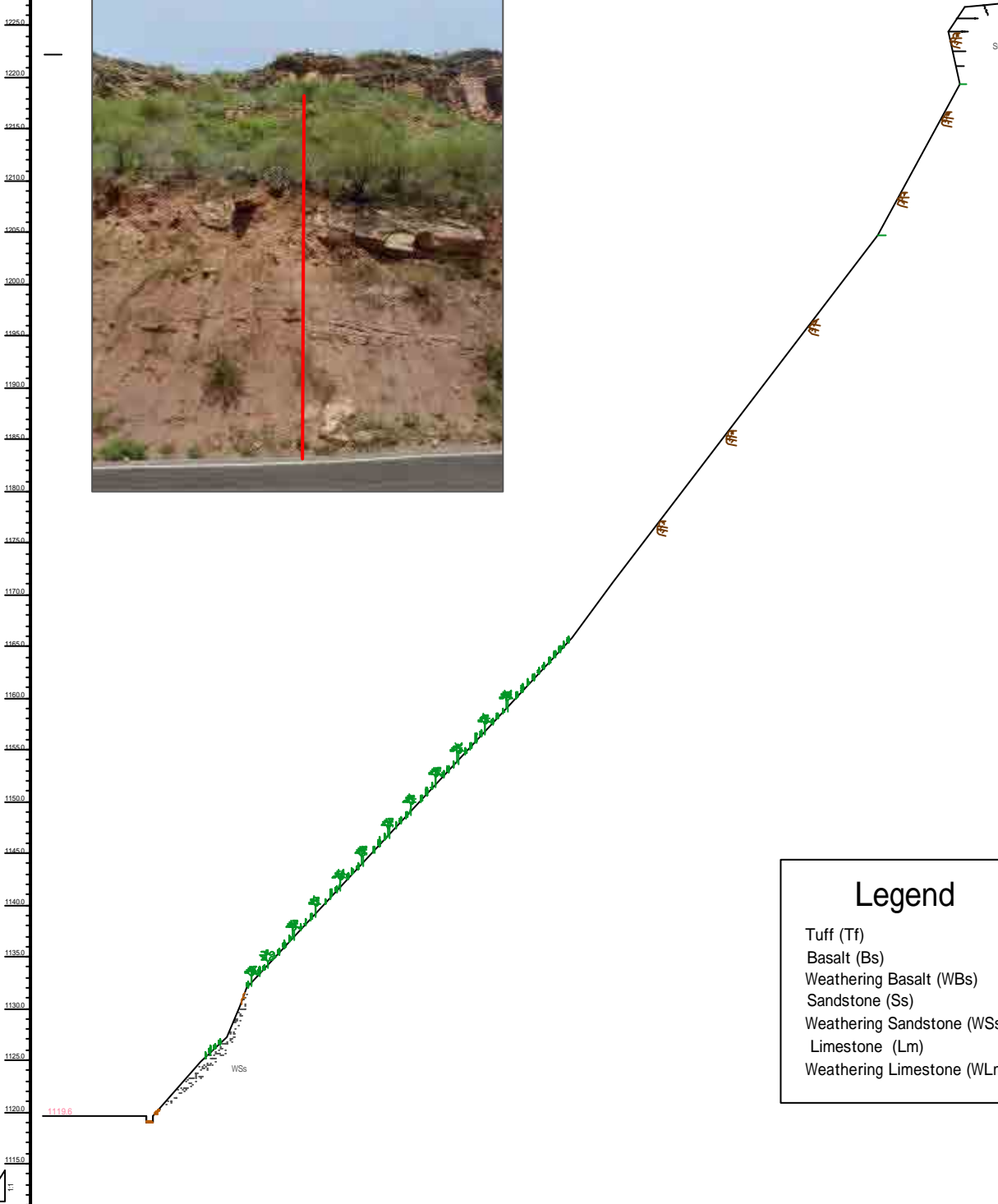
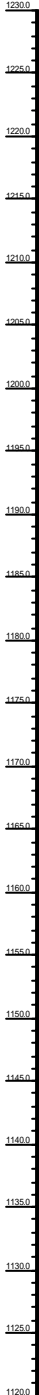
RF009 (STA. 18+080)
(Section 32/50)



- Legend**
- Tuff (Tf)
 - Basalt (Bs)
 - Weathering Basalt (WBS)
 - Sandstone (Ss)
 - Weathering Sandstone (WSs)
 - Limestone (Lm)
 - Weathering Limestone (WLM)

This is a image section of site conditions.

RF009 (STA.18+480)
(Section 33/50)



Legend	
Tuff (Tf)	
Basalt (Bs)	
Weathering Basalt (WBs)	
Sandstone (Ss)	
Weathering Sandstone (WSs)	
Limestone (Lm)	
Weathering Limestone (WLM)	

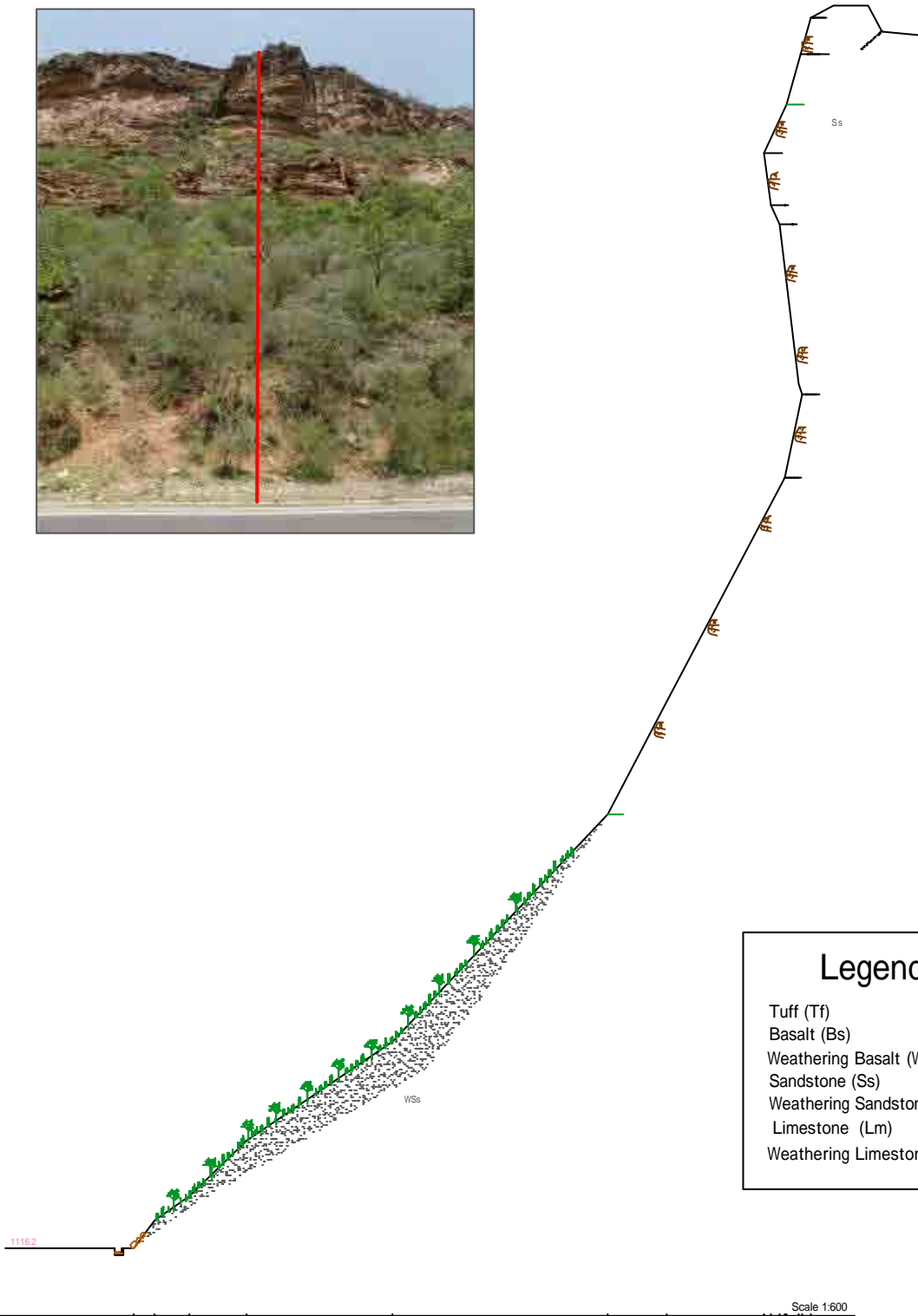


LEVELS	OFFSET	DISTANCE	No.
	9800	0100	N01
	14400	4600	N02
	16800	2400	N03
	18200	1400	N04
	19300	6000	N05
	31400	30200	N06
	56200	4000	N07
	79800	25600	N08
	129400	86800	N010
	129400	86800	N09

Scale 1:600

This is a image section of site conditions.

RF009 (STA.18+640)
(Section 34/50)



Legend	
Tuff (Tf)	
Basalt (Bs)	
Weathering Basalt (WBs)	
Sandstone (Ss)	
Weathering Sandstone (WSs)	
Limestone (Lm)	
Weathering Limestone (WLM)	

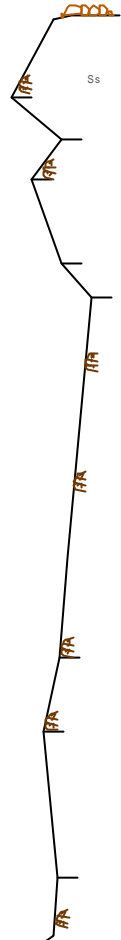
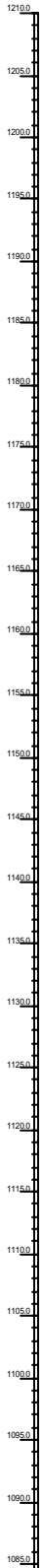


LEVELS	1115.0	1120.0	1125.0	1130.0	1135.0	1140.0	1145.0	1150.0	1155.0	1160.0	1165.0	1170.0	1175.0	1180.0	1185.0	1190.0	1195.0	1200.0	1205.0	1210.0	1215.0	1220.0	1225.0	1230.0	
OFFSET																									
DISTANCE																									
No.		N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13	N14	N15	N16	N17	N18	N19	N20	N21	N22	N23	N24

Scale 1:600

This is a image section of site conditions.

RF009 (STA.18+720)
(Section 35/50)



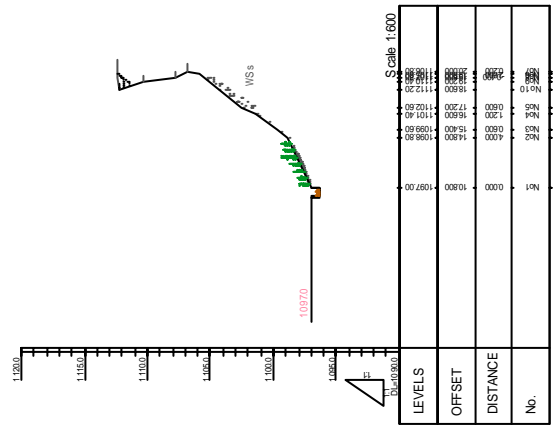
Legend

- Tuff (Tf)
- Basalt (Bs)
- Weathering Basalt (WBs)
- Sandstone (Ss)
- Weathering Sandstone (WSs)
- Limestone (Lm)
- Weathering Limestone (WLM)

	Scale 1:600												
LEVELS													
OFFSET													
DISTANCE													
No.	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13
	0100	4200	2300	1400	11400	11600	10600	10540	11980	11980	2000	8220	119740

This is a image section of site conditions.

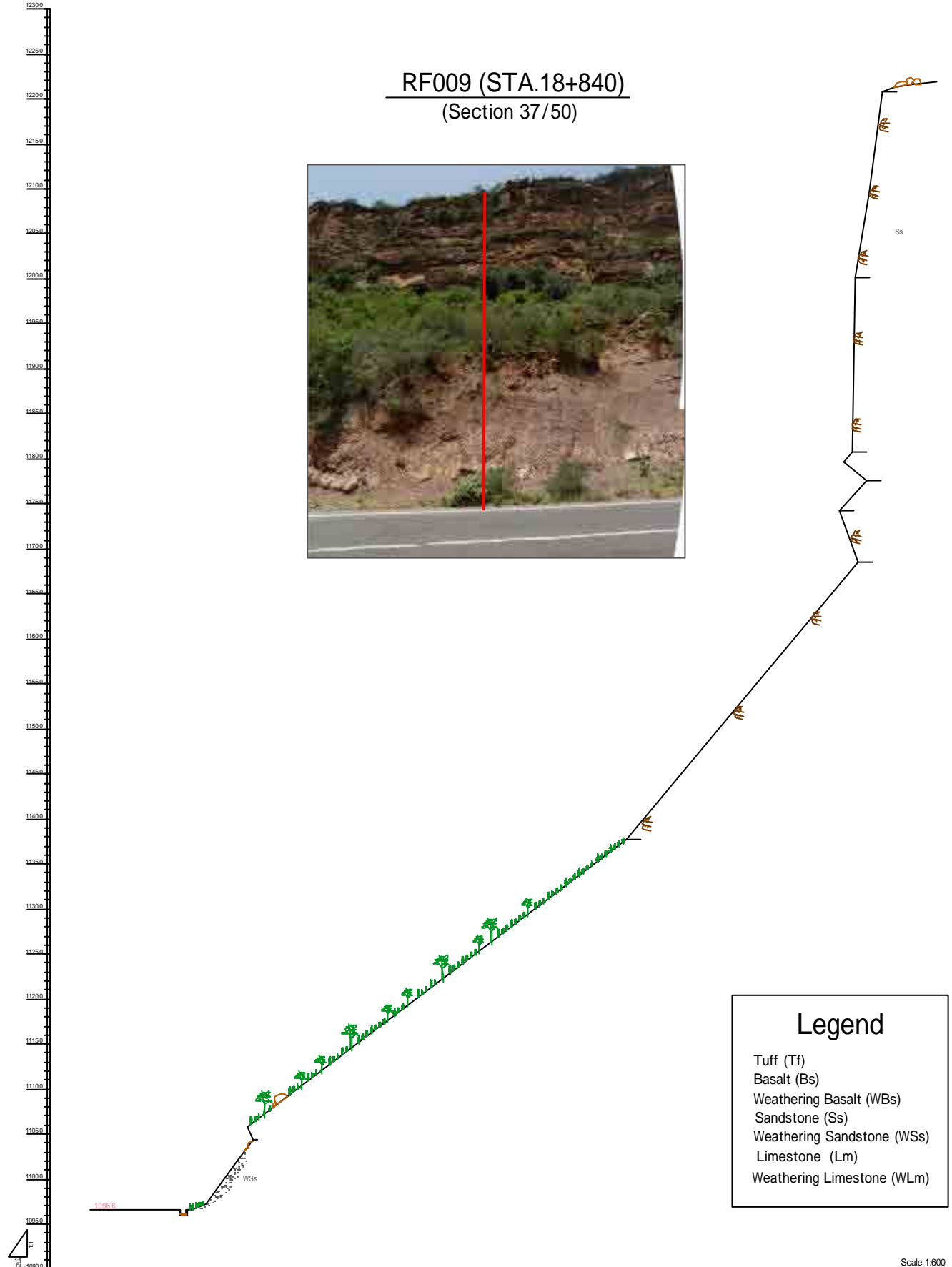
RF009 (STA. 18+800)
(Section 36 / 50)



- Legend**
- Tuff (Tf)
 - Basalt (Bs)
 - Weathering Basalt (WBs)
 - Sandstone (Ss)
 - Weathering Sandstone (WSs)
 - Limestone (Lm)
 - Weathering Limestone (WLM)

This is a image section of site conditions.

RF009 (STA.18+840)
(Section 37/50)



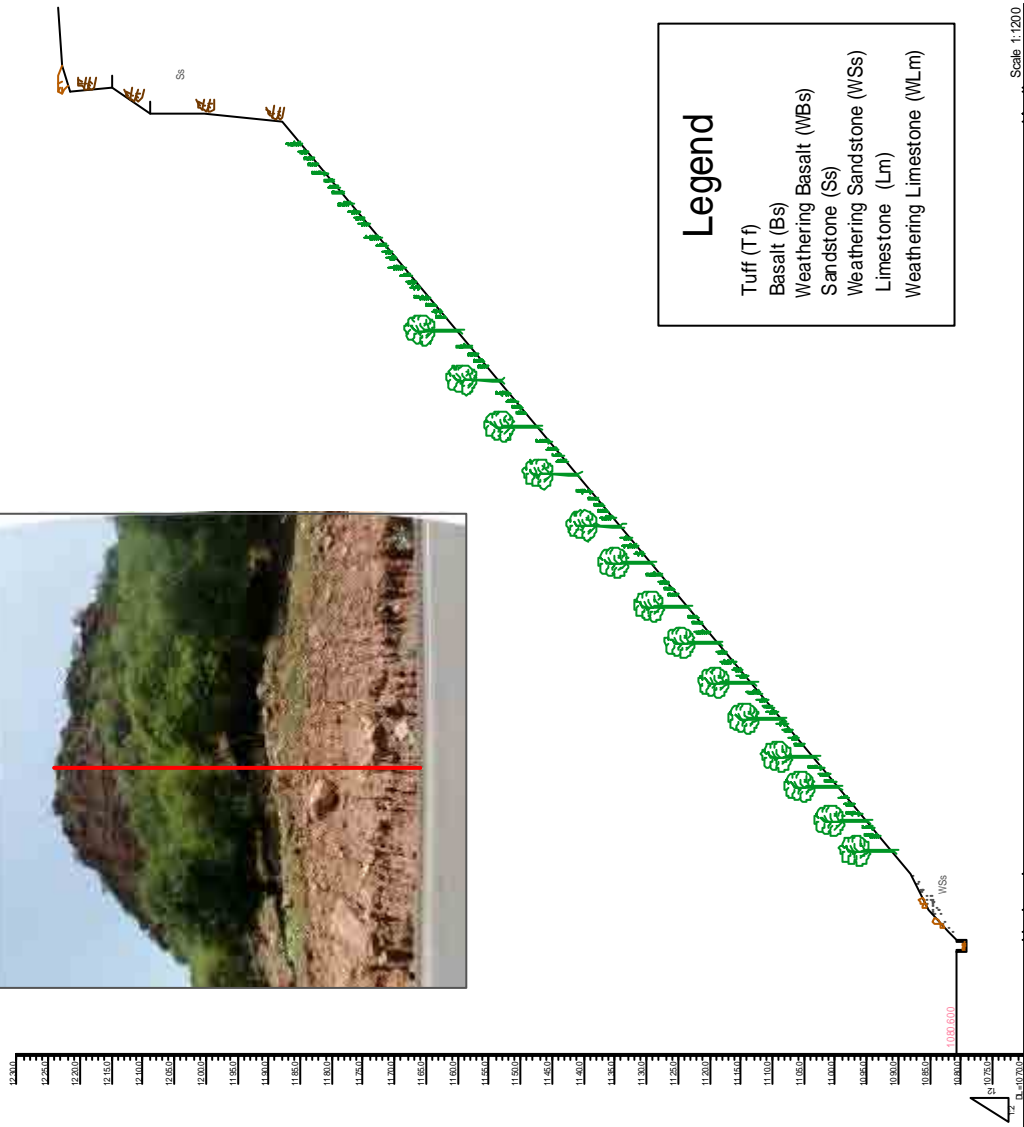
Legend

- Tuff (Tf)
- Basalt (Bs)
- Weathering Basalt (WBs)
- Sandstone (Ss)
- Weathering Sandstone (WSs)
- Limestone (Lm)
- Weathering Limestone (WLm)

LEVELS		13800	109600								
OFFSET		13800	15400	18800	110800						
DISTANCE		0000	1600	3400	17800	42200	62200	117800			
No.		N1	N2	N3	N4	N6	N7	N8	N9	N10	N14

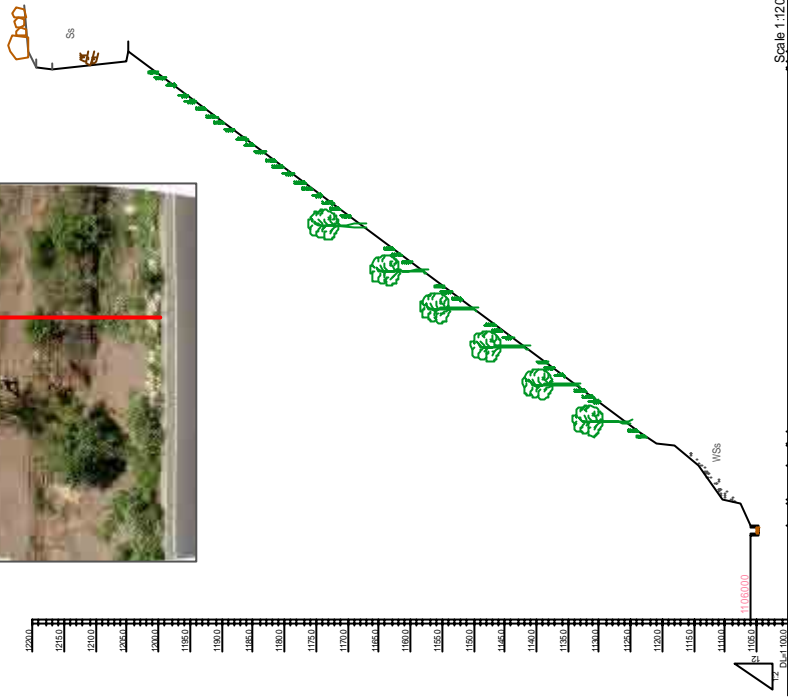
This is a image section of site conditions.

RF010 (STA.20+050)
(Section 38/50)



LEVELS	OFFSET	DISTANCE	No.
11800.00	15.000	0.000	1
11802.00	15.000	20.000	2
11805.20	15.000	30.000	3
11810.00	15.000	40.000	4
11820.00	15.000	50.000	5
11830.00	15.000	60.000	6
11840.00	15.000	70.000	7
11850.00	15.000	80.000	8
11860.00	15.000	90.000	9
11870.00	15.000	100.000	10
11880.00	15.000	110.000	11
11890.00	15.000	120.000	12
11900.00	15.000	130.000	13
11910.00	15.000	140.000	14
11920.00	15.000	150.000	15
11930.00	15.000	160.000	16
11940.00	15.000	170.000	17
11950.00	15.000	180.000	18
11960.00	15.000	190.000	19
11970.00	15.000	200.000	20
11980.00	15.000	210.000	21
11990.00	15.000	220.000	22
12000.00	15.000	230.000	23
12010.00	15.000	240.000	24
12020.00	15.000	250.000	25
12030.00	15.000	260.000	26
12040.00	15.000	270.000	27
12050.00	15.000	280.000	28
12060.00	15.000	290.000	29
12070.00	15.000	300.000	30
12080.00	15.000	310.000	31
12090.00	15.000	320.000	32
12100.00	15.000	330.000	33
12110.00	15.000	340.000	34
12120.00	15.000	350.000	35
12130.00	15.000	360.000	36
12140.00	15.000	370.000	37
12150.00	15.000	380.000	38
12160.00	15.000	390.000	39
12170.00	15.000	400.000	40
12180.00	15.000	410.000	41
12190.00	15.000	420.000	42
12200.00	15.000	430.000	43
12210.00	15.000	440.000	44
12220.00	15.000	450.000	45
12230.00	15.000	460.000	46
12240.00	15.000	470.000	47
12250.00	15.000	480.000	48
12260.00	15.000	490.000	49
12270.00	15.000	500.000	50

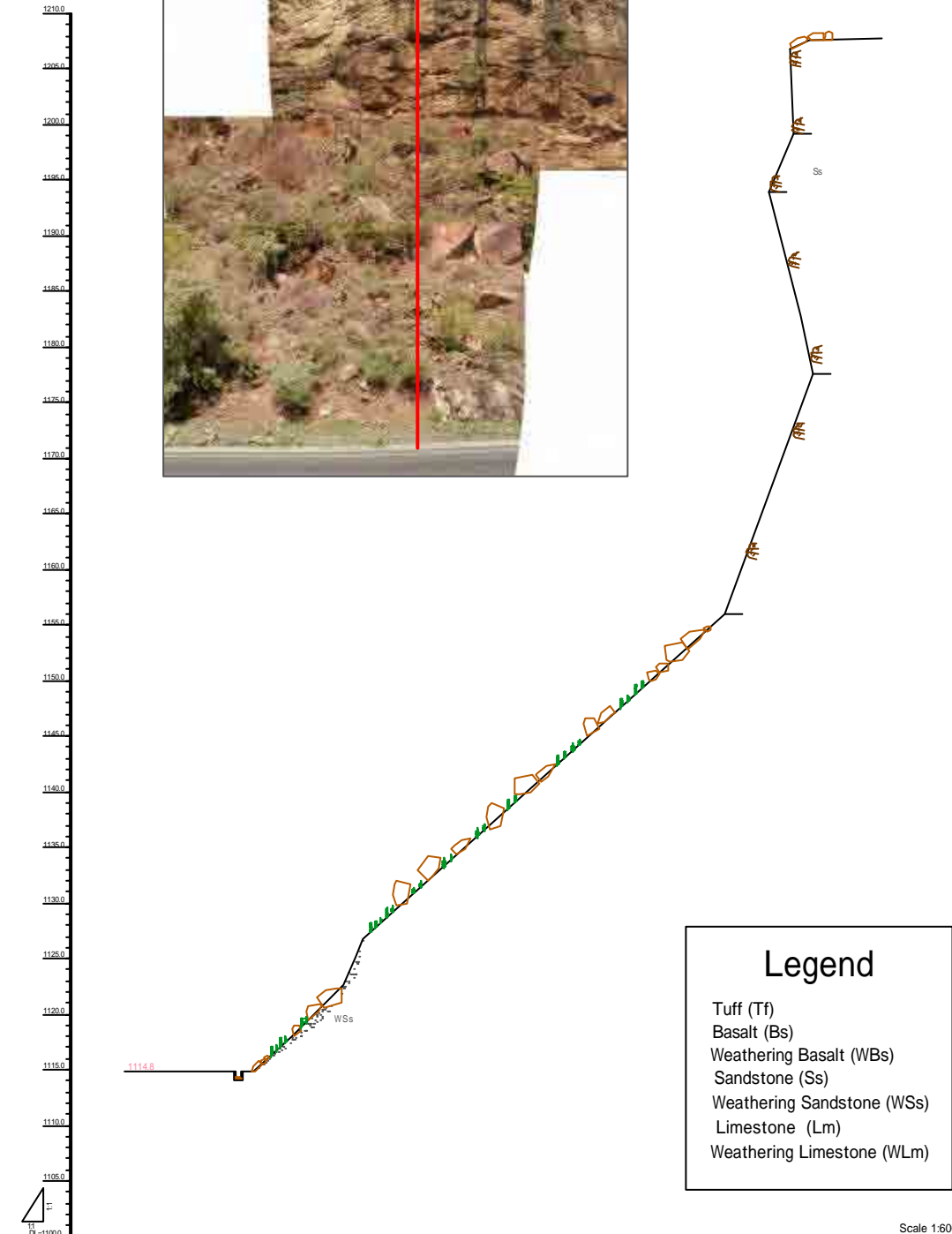
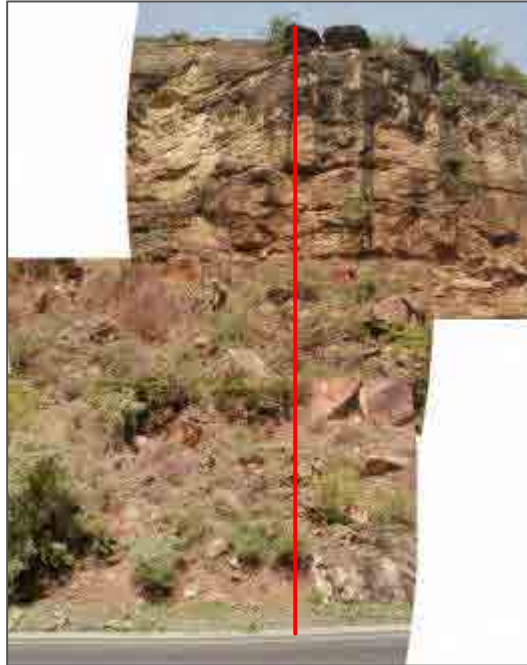
RF010 (STA.20+240)
(Section 39/50)



LEVELS	OFFSET	DISTANCE	No.
11800.00	15.000	0.000	1
11802.00	15.000	20.000	2
11805.20	15.000	30.000	3
11810.00	15.000	40.000	4
11820.00	15.000	50.000	5
11830.00	15.000	60.000	6
11840.00	15.000	70.000	7
11850.00	15.000	80.000	8
11860.00	15.000	90.000	9
11870.00	15.000	100.000	10
11880.00	15.000	110.000	11
11890.00	15.000	120.000	12
11900.00	15.000	130.000	13
11910.00	15.000	140.000	14
11920.00	15.000	150.000	15
11930.00	15.000	160.000	16
11940.00	15.000	170.000	17
11950.00	15.000	180.000	18
11960.00	15.000	190.000	19
11970.00	15.000	200.000	20
11980.00	15.000	210.000	21
11990.00	15.000	220.000	22
12000.00	15.000	230.000	23
12010.00	15.000	240.000	24
12020.00	15.000	250.000	25
12030.00	15.000	260.000	26
12040.00	15.000	270.000	27
12050.00	15.000	280.000	28
12060.00	15.000	290.000	29
12070.00	15.000	300.000	30
12080.00	15.000	310.000	31
12090.00	15.000	320.000	32
12100.00	15.000	330.000	33
12110.00	15.000	340.000	34
12120.00	15.000	350.000	35
12130.00	15.000	360.000	36
12140.00	15.000	370.000	37
12150.00	15.000	380.000	38
12160.00	15.000	390.000	39
12170.00	15.000	400.000	40
12180.00	15.000	410.000	41
12190.00	15.000	420.000	42
12200.00	15.000	430.000	43
12210.00	15.000	440.000	44
12220.00	15.000	450.000	45
12230.00	15.000	460.000	46
12240.00	15.000	470.000	47
12250.00	15.000	480.000	48
12260.00	15.000	490.000	49
12270.00	15.000	500.000	50

This is a image section of site conditions.

RF010 (STA.20+380)
(Section 40/50)



Legend

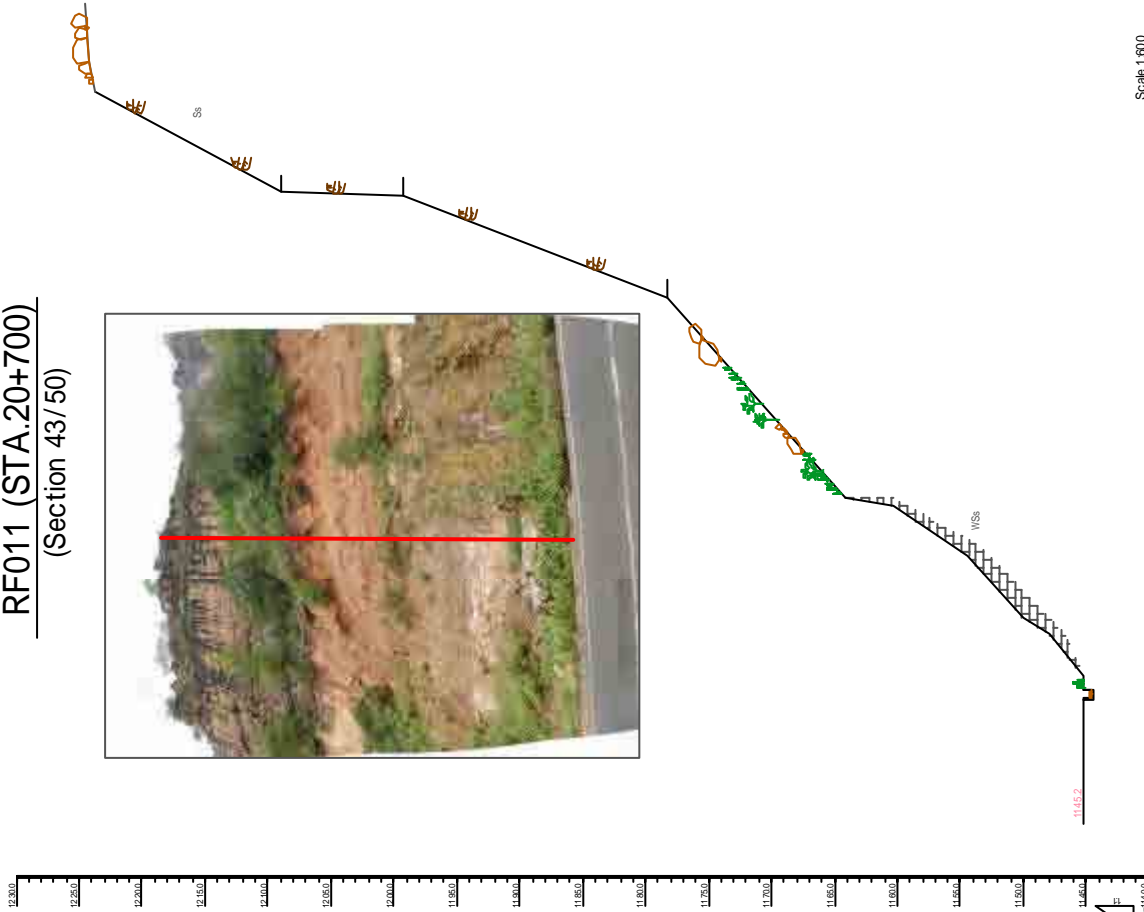
- Tuff (Tf)
- Basalt (Bs)
- Weathering Basalt (WBs)
- Sandstone (Ss)
- Weathering Sandstone (WSs)
- Limestone (Lm)
- Weathering Limestone (WLM)

Scale 1:600

LEVELS									
OFFSET									
DISTANCE									
No.									

This is a image section of site conditions.

RF011 (STA.20+700)
(Section 43/50)



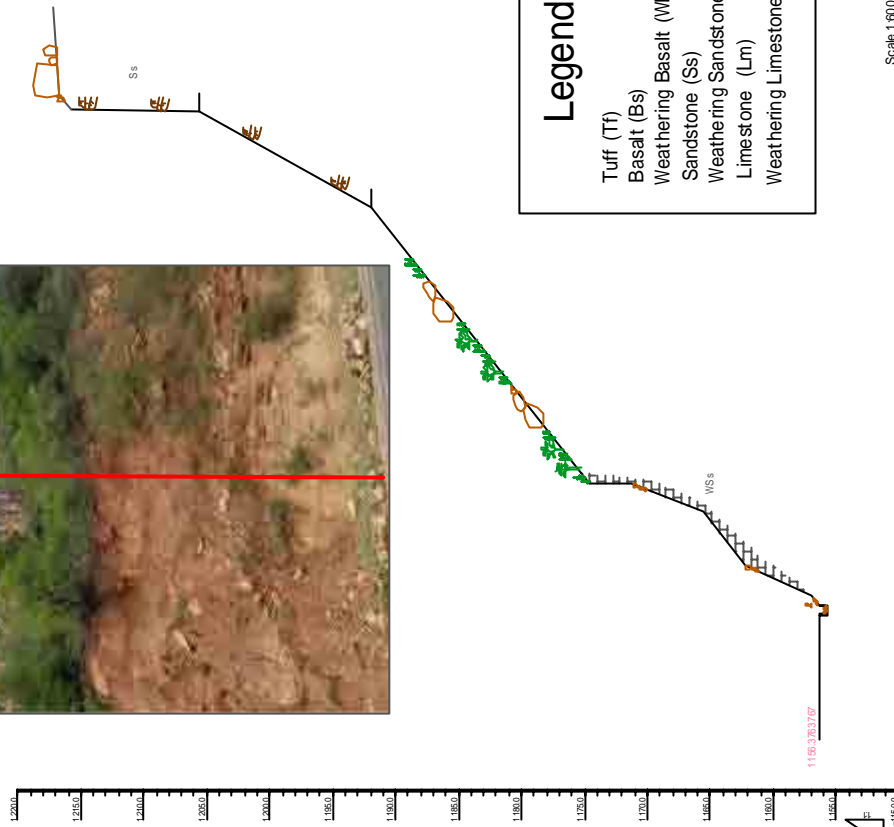
LEVELS	OFFSET	DISTANCE	No.
11450.00	13800	0000	N01
11500.00	17200	3400	N02
11540.40	18400	4000	N03
11544.40	23400	5000	N04
11642.20	27400	10000	N05
11699.80	32000	14600	N06
11782.20	43800	26400	N07
11998.80	52800	35400	N08
12232.80	60200	42800	N010

LEVELS	OFFSET	DISTANCE	No.
1157.00	13400	0000	N01
1162.20	15800	2400	N02
1165.60	20000	6600	N03
1174.80	22200	8800	N04
1192.00	44200	30200	N06
1206.80	46800	32800	N08

Legend

- Tuff (Tf)
- Basalt (Bs)
- Weathering Basalt (WBs)
- Sandstone (Ss)
- Weathering Sandstone (WSs)
- Limestone (Lm)
- Weathering Limestone (WLm)

RF011 (STA.20+760)
(Section 44/50)



LEVELS	OFFSET	DISTANCE	No.
1157.00	13400	0000	N01
1162.20	15800	2400	N02
1165.60	20000	6600	N03
1174.80	22200	8800	N04
1192.00	44200	30200	N06
1206.80	46800	32800	N08

This is a image section of site conditions.

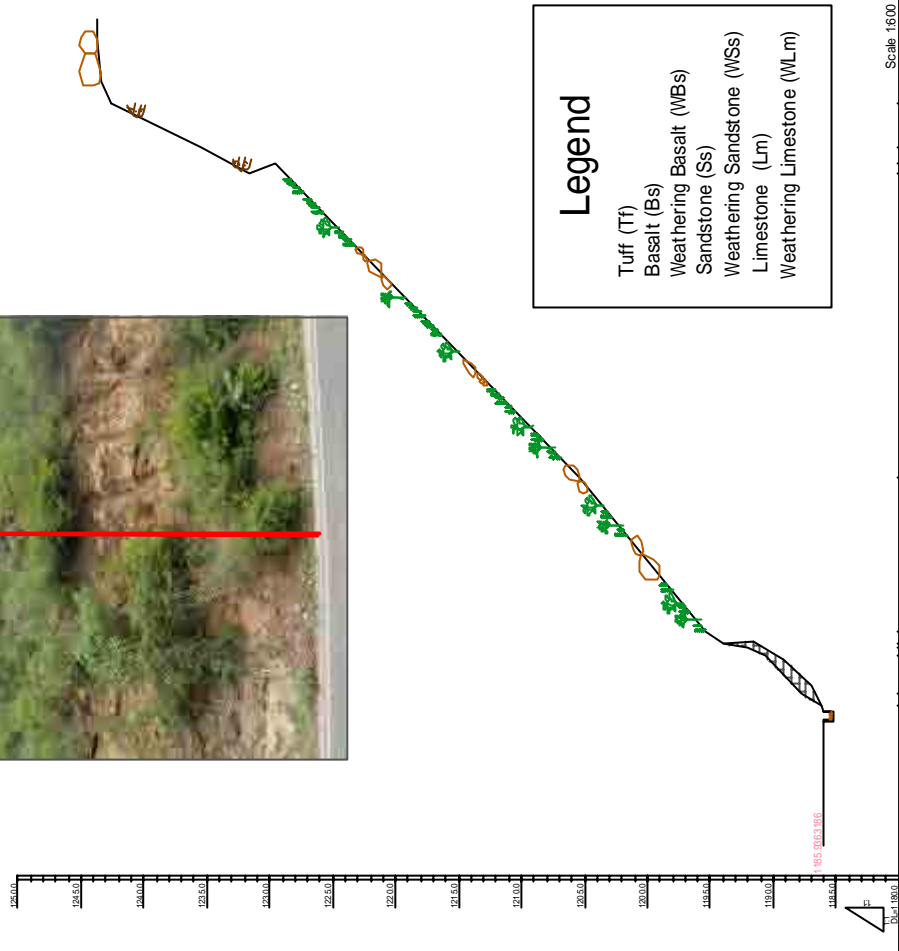
RF011 (STA.20+920)
(Section 45/50)



Scale 1:600

LEVELS	OFFSET	DISTANCE	No.
1175.00	0.00	12.00	N1
1180.20	0.80	12.80	N2
1185.00	1.50	13.50	N3
1188.80	2.00	14.00	N4
1192.50	2.50	14.50	N5
1193.40	2.70	14.70	N6
1198.40	3.60	15.60	N7
1213.40	5.60	17.60	N8
1213.40	5.60	17.60	N9

RF012 (STA.21+000)
(Section 46/50)

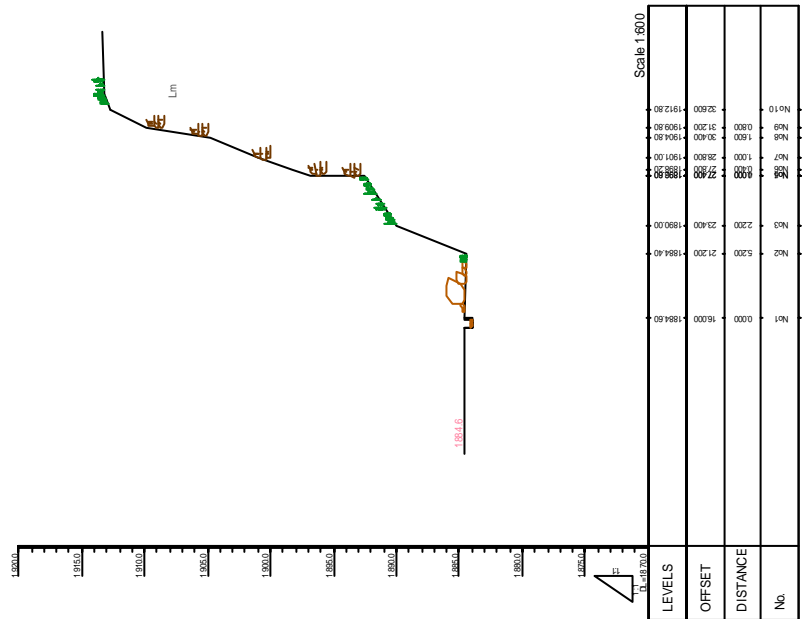


Scale 1:600

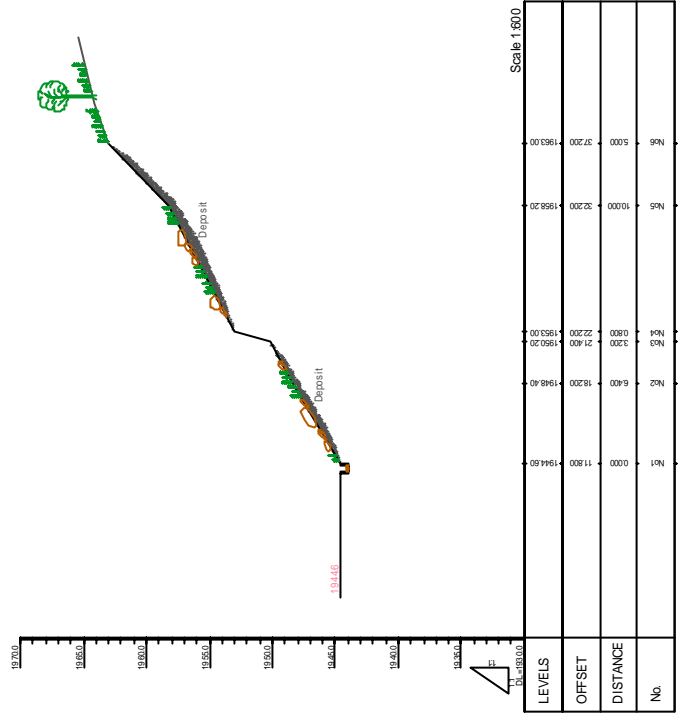
LEVELS	OFFSET	DISTANCE	No.
1185.20	0.00	11.50	N1
1187.80	0.90	12.40	N2
1192.50	1.80	13.30	N3
1195.40	2.70	14.20	N4
1199.00	3.60	15.10	N5
1200.00	3.90	15.40	N6
1205.40	4.80	16.30	N7
1205.40	4.80	16.30	N8
1211.50	5.70	17.20	N9
1211.50	5.70	17.20	N10
1215.80	6.60	18.10	N11
1215.80	6.60	18.10	N12
1219.00	7.50	19.00	N13
1225.40	8.40	19.90	N14
1225.40	8.40	19.90	N15
1231.50	9.30	20.80	N16
1231.50	9.30	20.80	N17
1235.80	10.20	21.70	N18
1235.80	10.20	21.70	N19
1242.50	11.10	22.60	N20
1242.50	11.10	22.60	N21

This is a image section of site conditions.

RF013 (STA.30+500)
(Section 47/50)

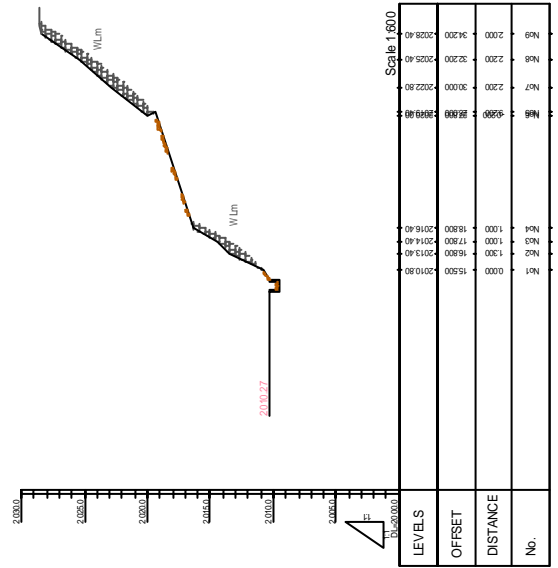


RF014 (STA.31+040)
(Section 48/50)

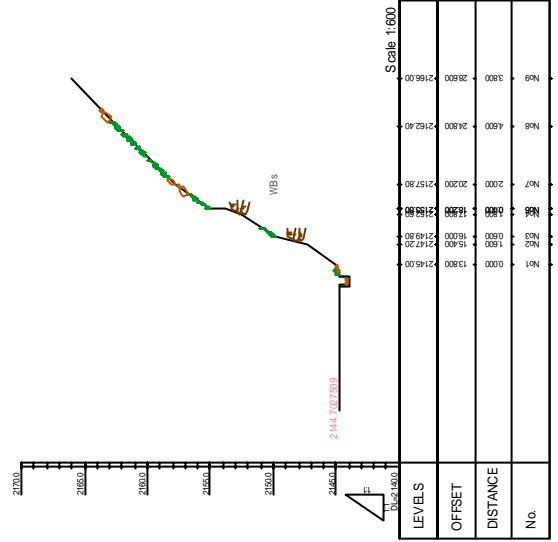


This is a image section of site conditions.

RF015 (STA.32+040)
(Section 49/50)



RF016 (STA.34+380)
(Section 50/50)



Legend

- Tuff (Tf)
- Basalt (Bs)
- Weathering Basalt (WBs)
- Sandstone (Ss)
- Weathering Sandstone (WSs)
- Limestone (Lm)
- Weathering Limestone (WLM)

This is a image section of site conditions.



Rockfall 7.1
Dr. Spang GmbH, Witten
 Westfalenstr. 5-9, D-58455 Witten

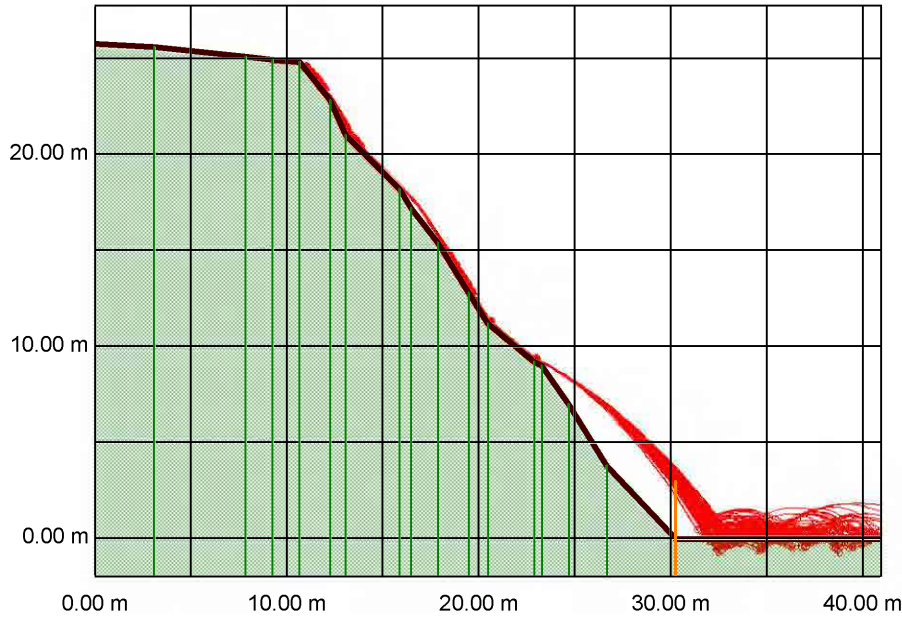
DR. SPANG

Projekt Nr. : Phase2
 Projektname : Abay River Gorge
 Profil Nr. : Section No.6
 Datum : 25.02.2011
 Bemerkung : Vergleichsrechnung

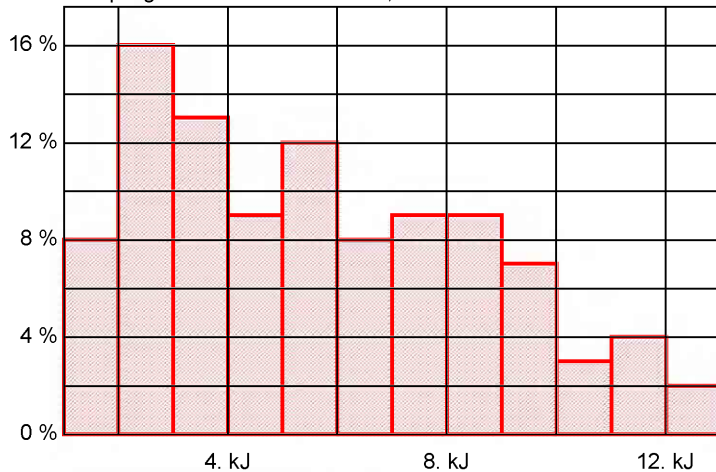
Bearbeiter : KOKUSAI KOGYO CO.,LTD .& JCE CO.,LTD.

Anlage Nr. :

Rockfall Path

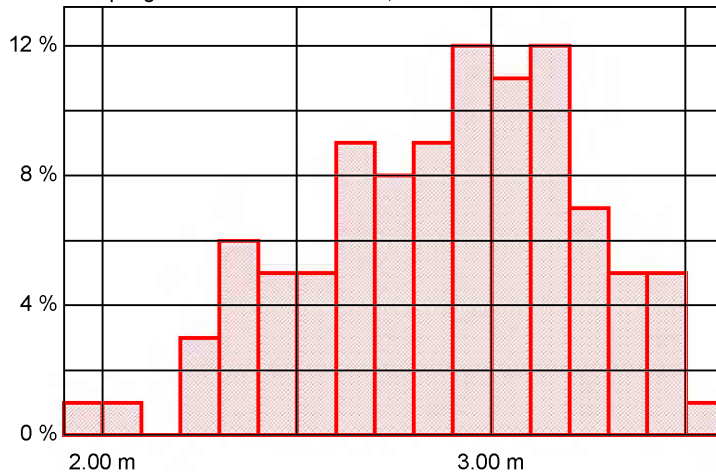


Sampling Section 1 at 30.28 m ; rocks: 100 of 100



total kinetic energy
 Class range : 1.kJ
 Minimum value : 2.kJ
 Maximum value : 12.kJ
 Mean value : 6.kJ
 Standard dev. : 3.kJ
 98 % Max : 12.kJ
 95 % Max : 11.kJ
 50 % Max : 5.kJ

Sampling Section 1 at 30.28 m ; rocks: 100 of 100



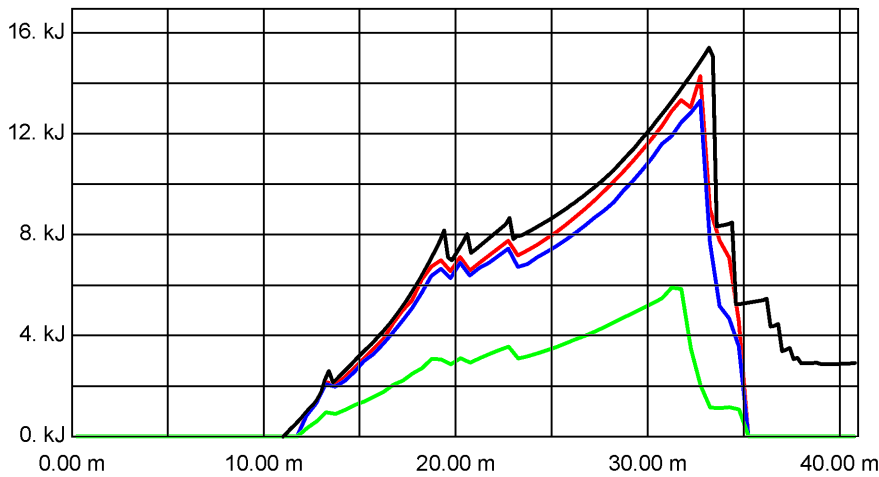
bounce height
 Class range : 0.10m
 Minimum value : 1.98m
 Maximum value : 3.54m
 Mean value : 2.89m
 Standard dev. : 0.35m
 98 % Max : 3.47m
 95 % Max : 3.43m
 50 % Max : 2.93m



Rockfall Path

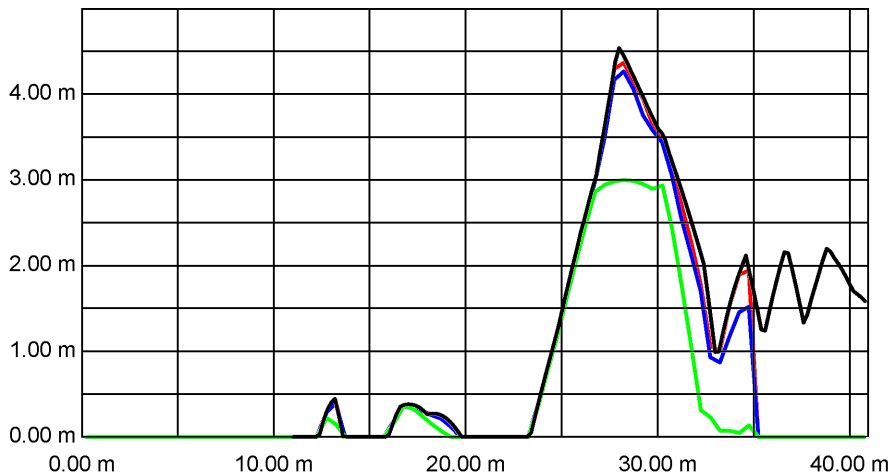


Envelope Curves: Energy



- 100 % Fraktile
- 98 % Fraktile
- 95 % Fraktile
- 50 % Fraktile

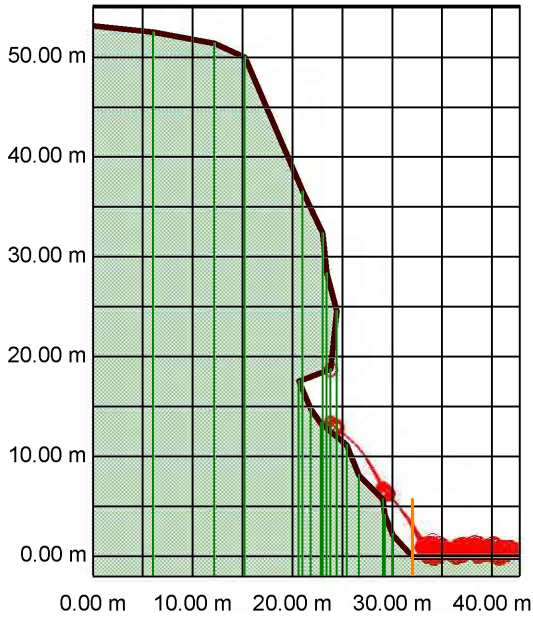
Envelope Curves: Bounce Height



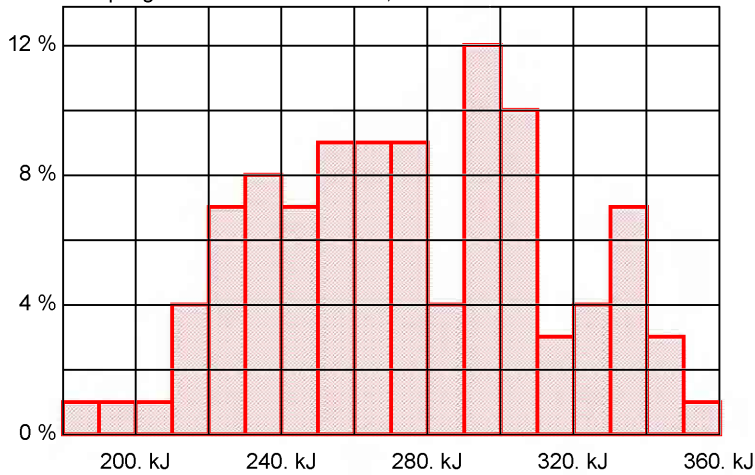
- 100 % Fraktile
- 98 % Fraktile
- 95 % Fraktile
- 50 % Fraktile



Rockfall Path

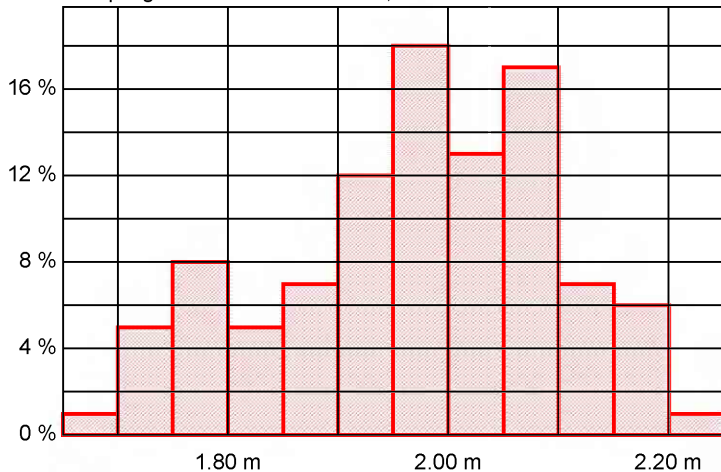


Sampling Section 1 at 32.04 m ; rocks: 100 of 100



total kinetic energy	:	
Class range	:	10.kJ
Minimum value	:	186.kJ
Maximum value	:	352.kJ
Mean value	:	274.kJ
Standard dev.	:	39.kJ
98 % Max	:	350.kJ
95 % Max	:	338.kJ
50 % Max	:	276.kJ

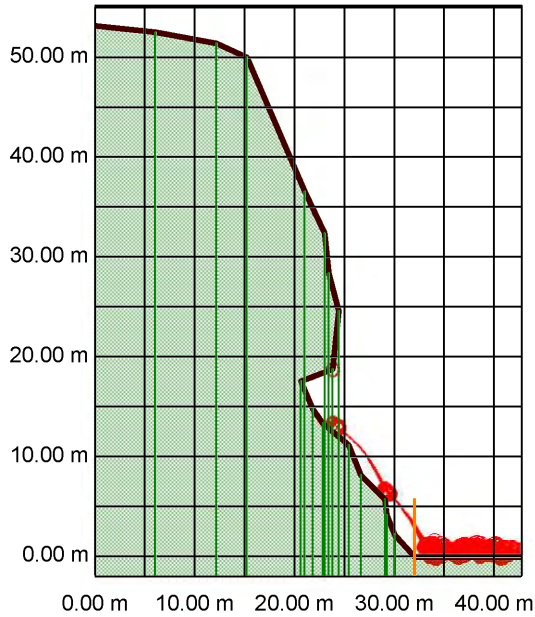
Sampling Section 1 at 32.04 m ; rocks: 100 of 100



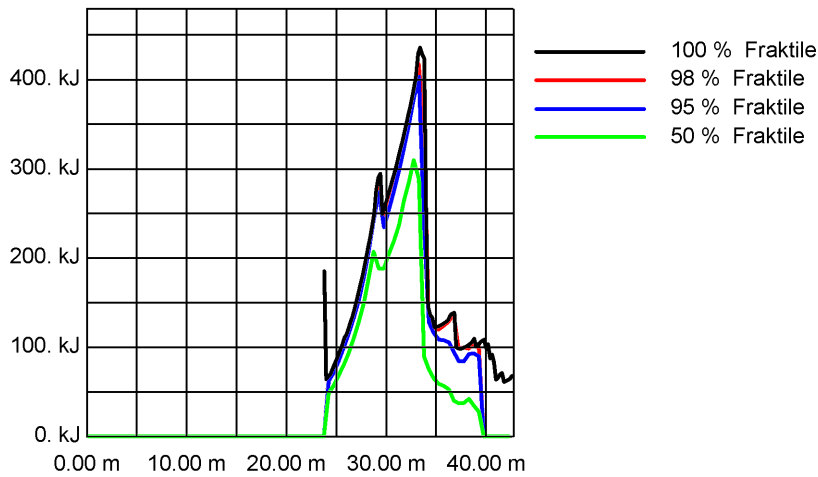
bounce height	:	
Class range	:	0.05m
Minimum value	:	1.69m
Maximum value	:	2.23m
Mean value	:	1.97m
Standard dev.	:	0.13m
98 % Max	:	2.19m
95 % Max	:	2.16m
50 % Max	:	2.00m



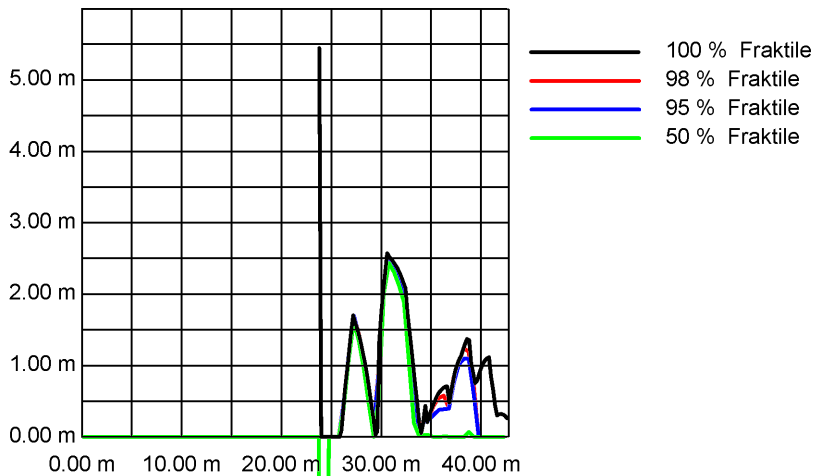
Rockfall Path



Envelope Curves: Energy



Envelope Curves: Bounce Height





Rockfall 7.1
Dr. Spang GmbH, Witten
 Westfalenstr. 5-9, D-58455 Witten

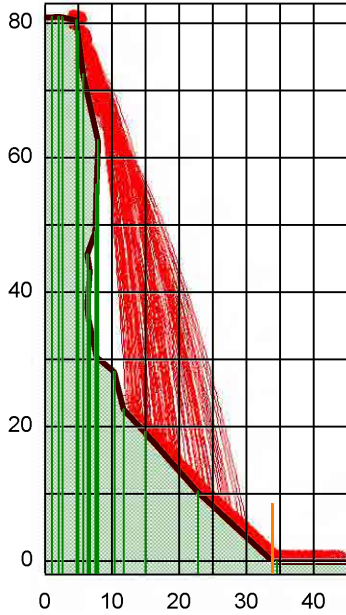
DR. SPANG

Projekt Nr. : Phase2
 Projektname : Abay River Gorge
 Profil Nr. : Section 28
 Datum : 25.02.2011
 Bemerkung : Vergleichsrechnung

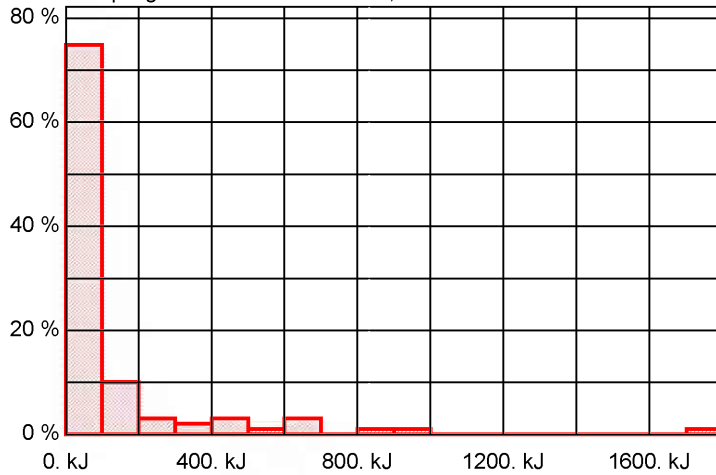
Bearbeiter : KOKUSAI KOGYO CO.,LTD & JCE CO.,LTD

Anlage Nr. :

Rockfall Path

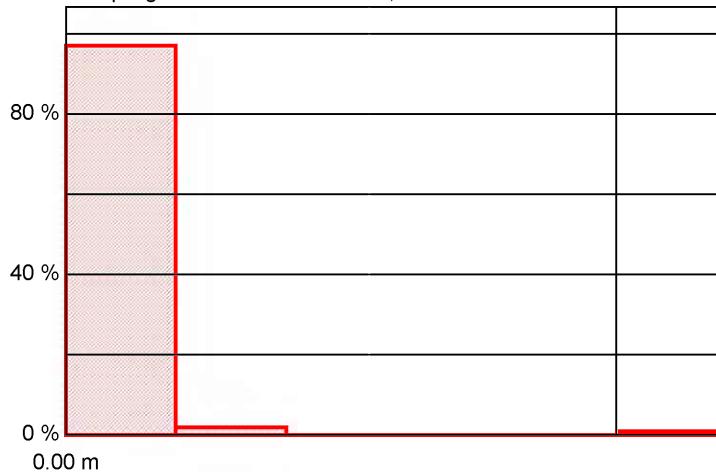


Sampling Section 1 at 33.90 m ; rocks: 99 of 300



total kinetic energy
 Class range : 100.kJ
 Minimum value : 26.kJ
 Maximum value : 1754.kJ
 Mean value : 147.kJ
 Standard dev. : 241.kJ
 98 % Max : 927.kJ
 95 % Max : 672.kJ
 50 % Max : 66.kJ

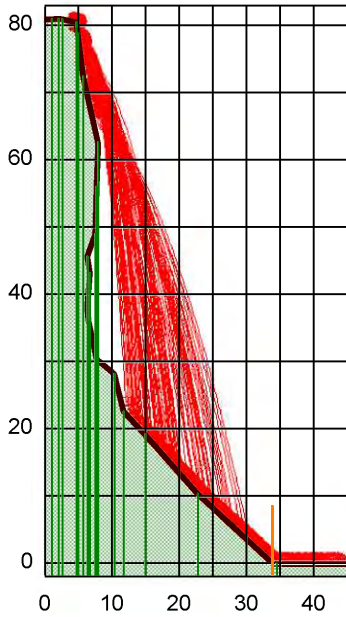
Sampling Section 1 at 33.90 m ; rocks: 99 of 300



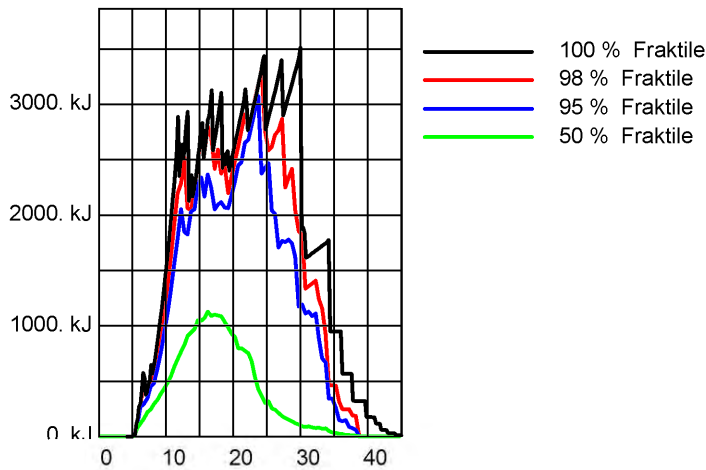
bounce height
 Class range : 0.02m
 Minimum value : 0.00m
 Maximum value : 0.11m
 Mean value : 0.00m
 Standard dev. : 0.01m
 98 % Max : 0.03m
 95 % Max : 0.01m
 50 % Max : 0.00m



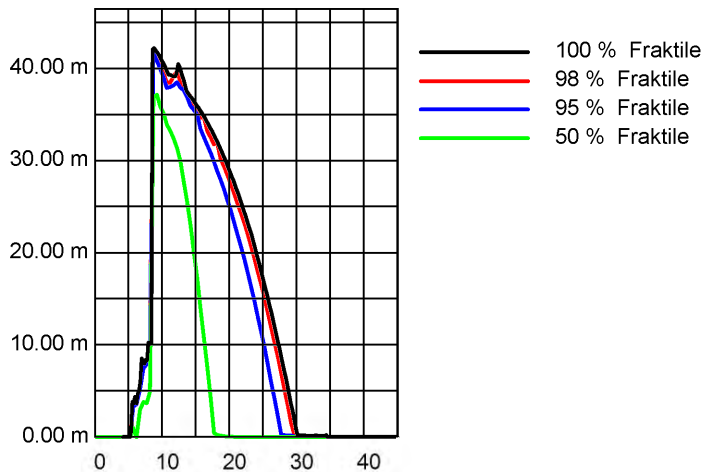
Rockfall Path



Envelope Curves: Energy

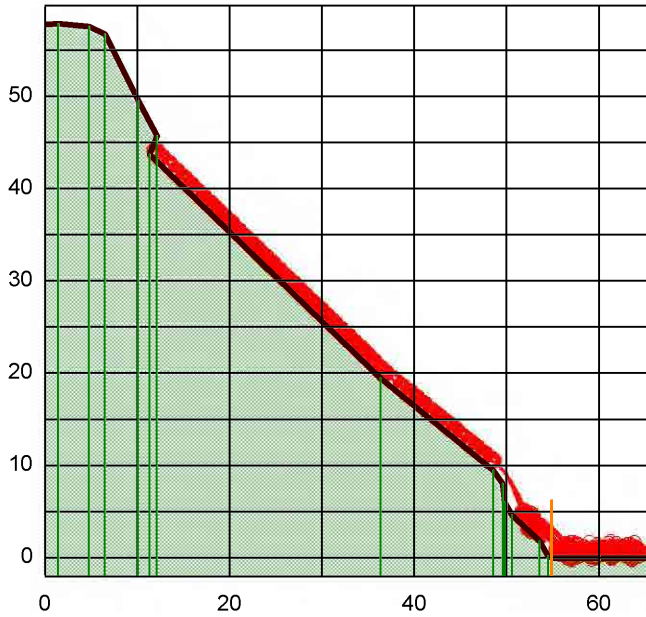


Envelope Curves: Bounce Height

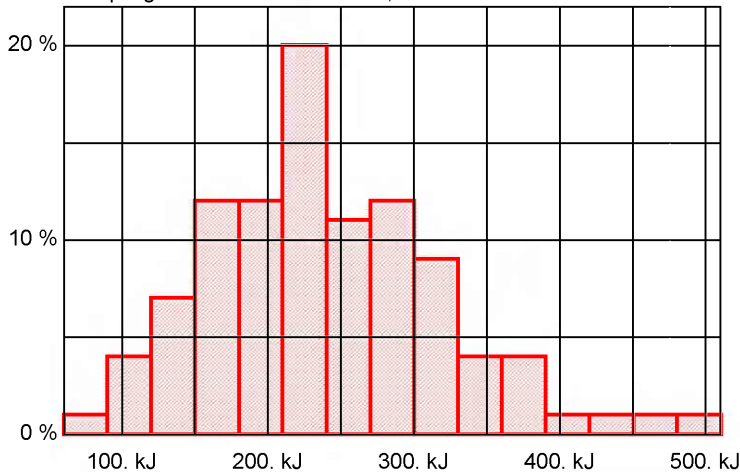




Rockfall Path

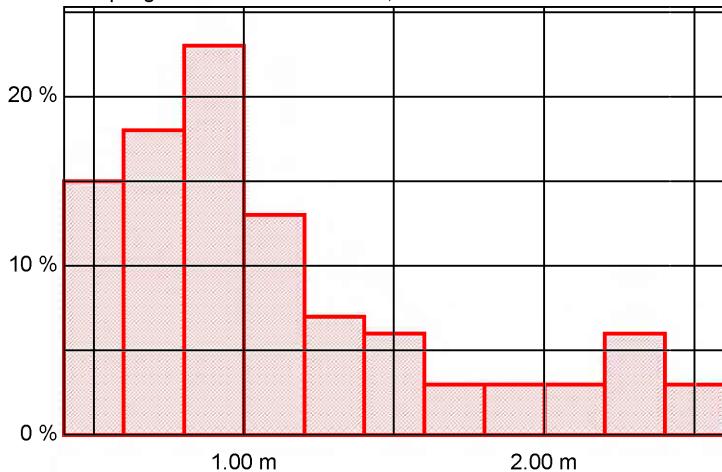


Sampling Section 1 at 54.88 m ; rocks: 100 of 100



total kinetic energy	:	
Class range	:	30.kJ
Minimum value	:	89.kJ
Maximum value	:	492.kJ
Mean value	:	240.kJ
Standard dev.	:	80.kJ
98 % Max	:	439.kJ
95 % Max	:	390.kJ
50 % Max	:	224.kJ

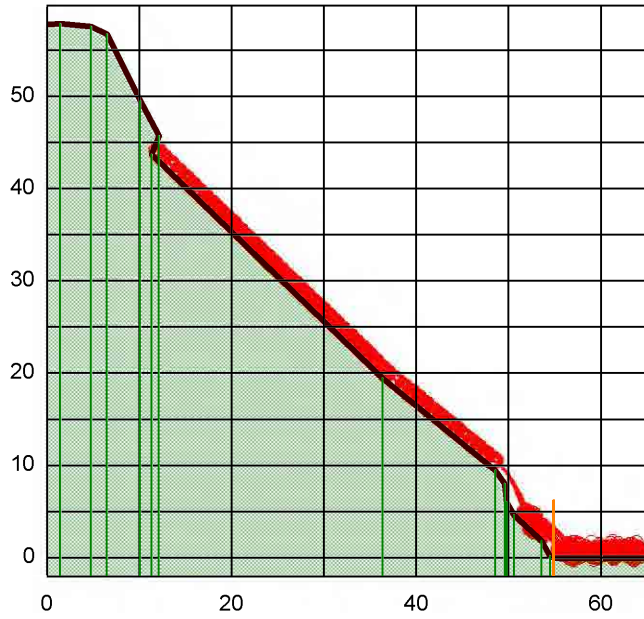
Sampling Section 1 at 54.88 m ; rocks: 100 of 100



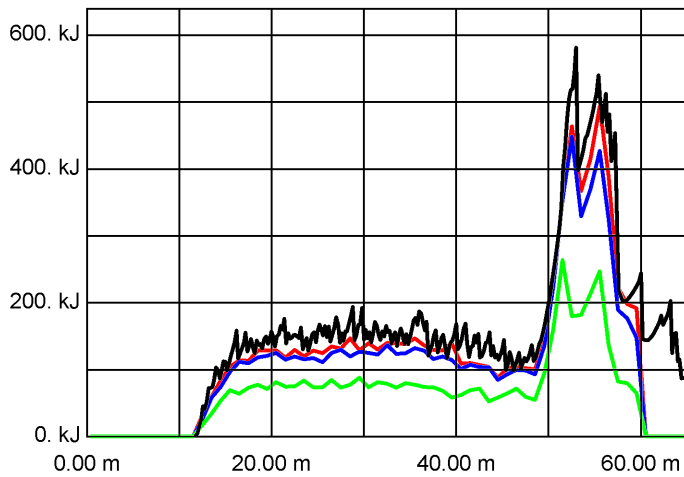
bounce height	:	
Class range	:	0.20m
Minimum value	:	0.41m
Maximum value	:	2.46m
Mean value	:	1.11m
Standard dev.	:	0.54m
98 % Max	:	2.43m
95 % Max	:	2.33m
50 % Max	:	0.98m



Rockfall Path

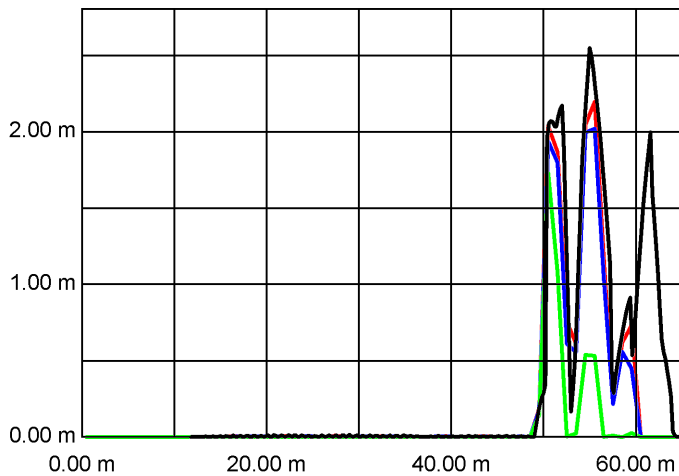


Envelope Curves: Energy



- 100 % Fraktile
- 98 % Fraktile
- 95 % Fraktile
- 50 % Fraktile

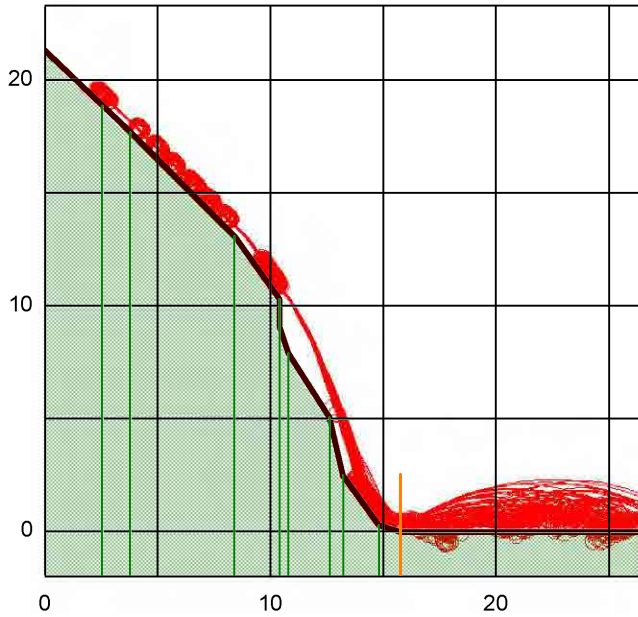
Envelope Curves: Bounce Height



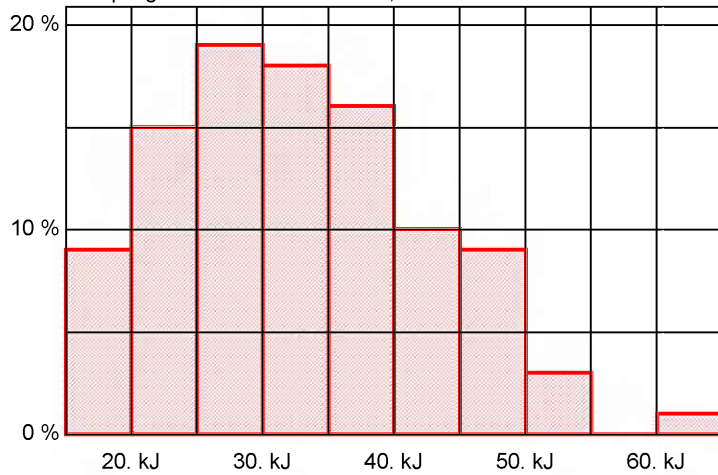
- 100 % Fraktile
- 98 % Fraktile
- 95 % Fraktile
- 50 % Fraktile



Rockfall Path

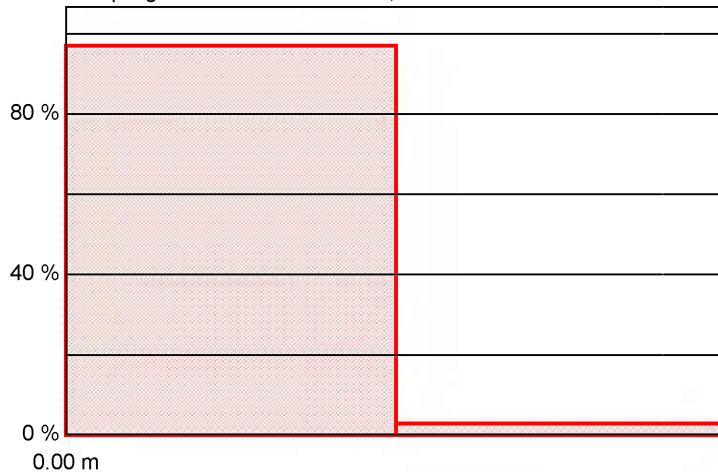


Sampling Section 1 at 15.75 m ; rocks: 100 of 100



total kinetic energy	:	
Class range	:	5. kJ
Minimum value	:	17. kJ
Maximum value	:	64. kJ
Mean value	:	33. kJ
Standard dev.	:	10. kJ
98 % Max	:	54. kJ
95 % Max	:	49. kJ
50 % Max	:	32. kJ

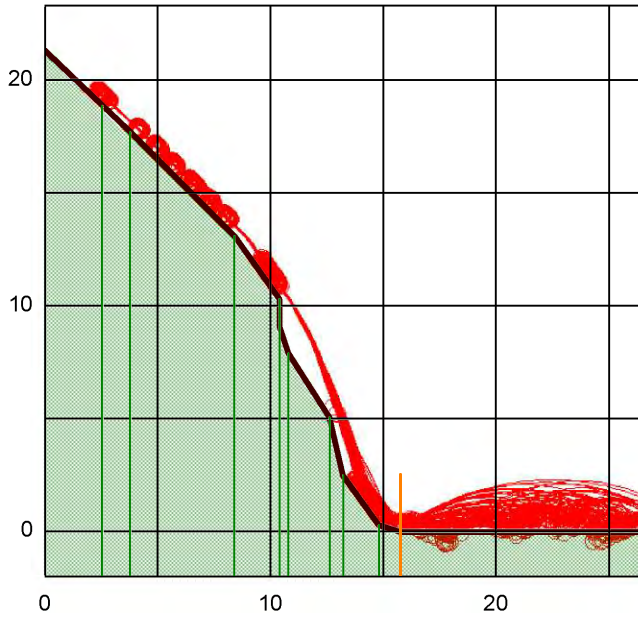
Sampling Section 1 at 15.75 m ; rocks: 100 of 100



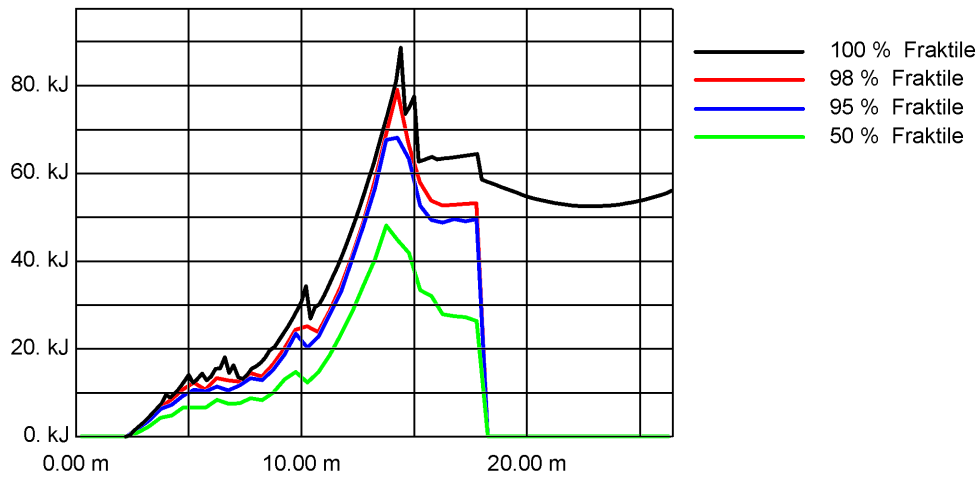
bounce height	:	
Class range	:	0.02m
Minimum value	:	0.00m
Maximum value	:	0.03m
Mean value	:	0.00m
Standard dev.	:	0.01m
98 % Max	:	0.02m
95 % Max	:	0.01m
50 % Max	:	0.00m



Rockfall Path



Envelope Curves: Energy



Envelope Curves: Bounce Height

