

David Garrett & Associates

Engineering and Geology



March 30, 2010

Messrs. Brian Wootton and John Murray
NCDENR – Division of Waste Management
Solid Waste Section
401 Oberlin Road, Suite 150
Raleigh, NC 27605

**RE: Post-Blast Survey Report
CMS Landfill-V (MSWLF) – Cell 2G
NCDENR Solid Waste Permit #13-04 (Cabarrus County)**

Dear Sirs:

It was recently brought to my attention that we had not followed up the approved blasting for the 2008 construction of Cell 2G with a formal report. First, please accept my apologies for the oversight. The results of seismic monitoring were conveyed to the Section in an e-mail dated May 5, 2008. The work was performed in accordance with a blasting plan approved by the Section in April 2008, which included two figures: **Figure 1** depicted the overall layout of Cell 2G in relation to Cell 2F and the nearest monitoring well, MW-33; **Figure 2** showed the rock outliers that were identified above approved base grades by the contractor.

Approval was sought (and received) from the Section to blast the outliers, with seismic monitoring points on MW-33 and the edge of the liner for Cell 2F. However, the blasted area turned out to be larger than shown in Figure 2, whereas the preliminary drilling – which was conducted on 50-foot centers – led us to believe we were out of the shallow rock. Another group of shallow outliers was discovered just beyond the limits of the preliminary drilling during preparation for the actual blasting, which involved drilling on 6-foot centers to depths of approximately 6 feet below approved grades.

Two monitored blasts were conducted on April 30, 2008 and May 2, 2008. John Murray of the Solid Waste Section and Mike Gurley of Republic Services (then Allied Waste Industries) were present along with myself for the May 2 shot. We did not observe the April 30 shot, but on May 2, 2008 we spent the better part of the day observing the preparations for the shot, including the shot pattern, blasting agents (ANFO), loads, and delays – please refer to the photos.

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919-418-4375 (Mobile) • 919-231-1818 (Office fax) • E-mail: david@davidgarrettpe.com*

After the May 2 shot, we had an opportunity to inspect the site to observe the residual shot rock (as we did on April 30). No damage to the liner was apparent from either shot. Observation of the May 2 shot, which was closer to the liner of Cell 2F than the earlier shot, clearly indicated that the blast energy was directed away from the edge of Cell 2F – this was evidenced by the uplift direction, which displaced the blasted material away from the edge of the Cell 2F liner. Please find attached the following documentation:

- 1) **Figure 3**, depicting the licensed surveyor's topographic grid of the pre-blast rock surfaces, approved grades, and post-blast rock surfaces;
- 2) **Figure 4**, depicting the post-blast rock surfaces in relation to the approved base liner grades, demonstrating the four feet of separation;
- 3) Seismograms of the April 30 and May 2, 2008 shots from the edge of the Cell 2F liner, which shows a maximum vertical acceleration of 0.12 inches per second;
- 4) A copy of the May 5, 2008 e-mail message to the Section that provides the accelerations measured on May 2 at the edge of the Cell 2F liner and MW-33;
- 5) Photographs of the April 30 and May 5, 2008 shots.
- 6) Eight small-scale drawings (**Sheets 1 – 8**) that allow close inspection of the pre-blasting and post-blasting survey data (enlargement of Figures 3 and 4).

In my professional opinion, the seismograph results confirm that peak particle velocities at the edge of Cell 2F and MW-33 were well under 1 inch per second, which is considered adequate to protect vibration-sensitive structures (e.g., non-flexible structures such as building foundations and pipelines). Based on the observations made after both shots, no visible blast-induced damage was observed which might indicate damage to the adjacent liner or to the monitoring well network or groundwater flow. I believe that the blasting was conducted in accordance with the approved blasting plan and that adequate care was taken to protect the adjacent structures.

Thank you for your attention on this matter. Please contact me if you have any questions.

Cordially yours,



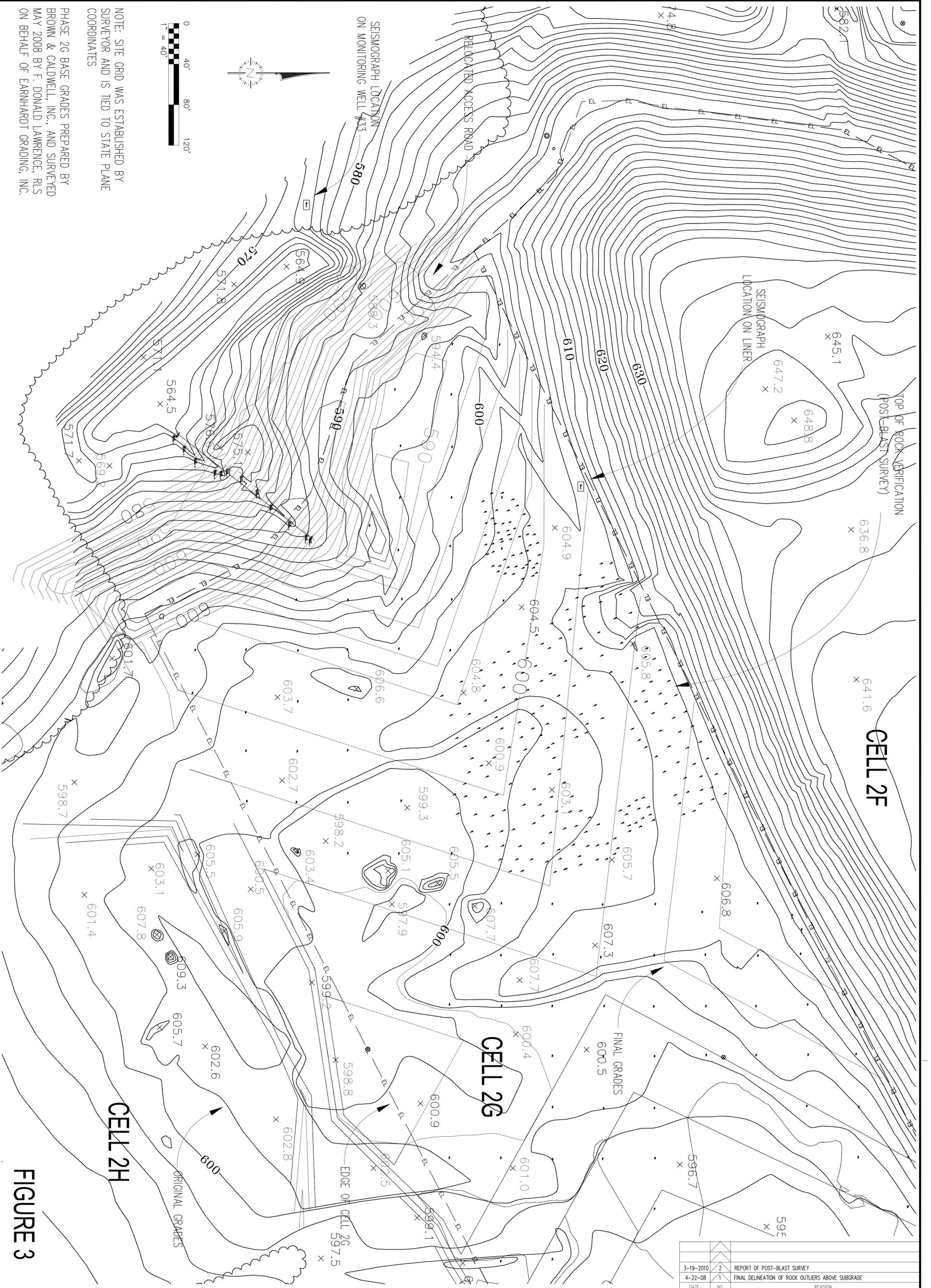
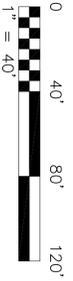
G. David Garrett, P.G., P.E.

cc: Mike Gurley, Environmental Manager – Republic Services
Fred Brown, Superintendent – Earnhardt Grading, Inc.
Ed Mussler, P.E., Permitting Branch – NCDENR Division of Waste Management

Attachments

NOTE: SITE GRID WAS ESTABLISHED BY SURVEYOR AND IS TIED TO STATE PLANE COORDINATES

PHASE 2G BASE GRADES PREPARED BY BROWN & CALDWELL, INC., AND SURVEYED MAY 2008 BY F. DONALD LAWRENCE, RIS ON BEHALF OF EARNHARDT GRADING, INC.



DATE	NO.	REVISION
3-19-2010	2	REPORT OF POST-BLAST SURVEY
4-22-08	1	FINAL DELINEATION OF ROCK OUTLIERS ABOVE SUBGRADE

FIGURE 3

CELL 2H

CELL 2G

CELL 2F

DRAWING TITLE:
POST-BLAST SURVEY FOR
PHASE 2, CELL 2G
WIDE AREA VIEW

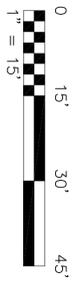
PROJECT TITLE:
BFI/ALLIED WASTE INDUSTRIES
CMS LANDFILL V
CABARRUS COUNTY, NC
NC DENR PERMIT #13-04

SEAL

SEAL

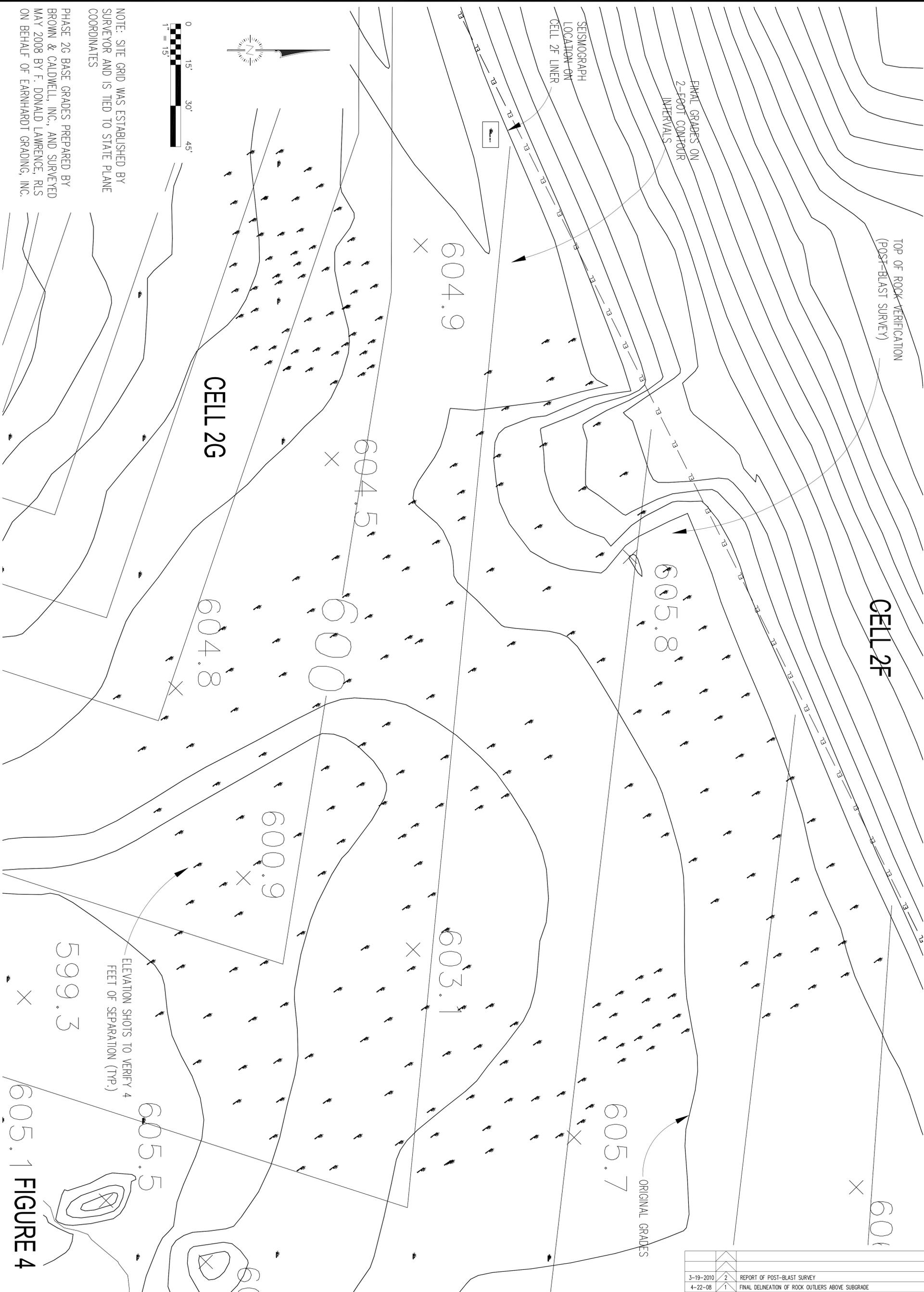
David Garrett & Associates
Engineering and Geology
5105 Harbour Towne Drive, Raleigh, North Carolina 27604
Email: david_garrett_pg@mindspring.com 919-231-1818 (Office and Fax) 919-418-4375 (mobile)

DESIGNED BY: G.D.G.	DRAWN BY: G.D.G.
CHECKED BY: B.S.B.	PROJECT NO.: CMS-2G
SCALE: AS SHOWN	DATE: MAY 2008
FILE NAME: CMS-00001A	SHEET NO.: 3A
SHEET NO.: 3A	DRAWING NO.: S3A



NOTE: SITE GRID WAS ESTABLISHED BY SURVEYOR AND IS TIED TO STATE PLANE COORDINATES

PHASE 2G BASE GRADES PREPARED BY BROWN & CALDWELL, INC., AND SURVEYED MAY 2008 BY F. DONALD LAWRENCE, PLS ON BEHALF OF EARNHARDT GRADING, INC.



DATE	NO.	REVISION
3-19-2010	2	REPORT OF POST-BLAST SURVEY
4-22-08	1	FINAL DELINEATION OF ROCK OUTLIERS ABOVE SUBGRADE

SHEET NO.	4A
DRAWING NO.	S4A

DRAWING TITLE:
 POST-BLAST SURVEY FOR
 PHASE 2, CELL 2G
 DETAIL AREA VIEW

PROJECT TITLE:
 BFI/ALLIED WASTE INDUSTRIES
 CMS LANDFILL V
 CABARRUS COUNTY, NC
 NC DENR PERMIT #13-04

SEAL

3-19-2010

SEAL

3-19-2010

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VIBRATIONS ANALYSIS REPORT

File name

NOMIS SEISMOGRAPHS

Tel : 205.592.2466

Unit # : NS5400I-2514

Date : 04/30/08 2:56

Customer : BFI LANDFILL

Location : CELL LINER N

Company : CAROLINA DRILLING

Operator : ANDREW MCNICHOLS

Event # 279

Record time: 5.0 sec

Sampling rate: 1024 E/s

Number of points: 5120

Distance (Ft): 460

Charge per delay (lbs): 15.00

Scaled Distance : 118.82

VIBRATIONS

Amplification: 1

Trigger (T): 0.05 in/s

Vector Sum (in/s): N

Channel	Radial	Transverse	Vertical
Velocity (in/s)	0.16	0.12	0.12
Frequency (Hz)	48.0	32.0	51.2
Acceleration (g)	0.060	0.060	0.187
Displacement (in)	0.0005	0.0006	0.0004
VMax/Trigger (ms) *	1445.3	1085.0	1108.4

ACOUSTIC

Amplification : 1

Trigger (dB) : N

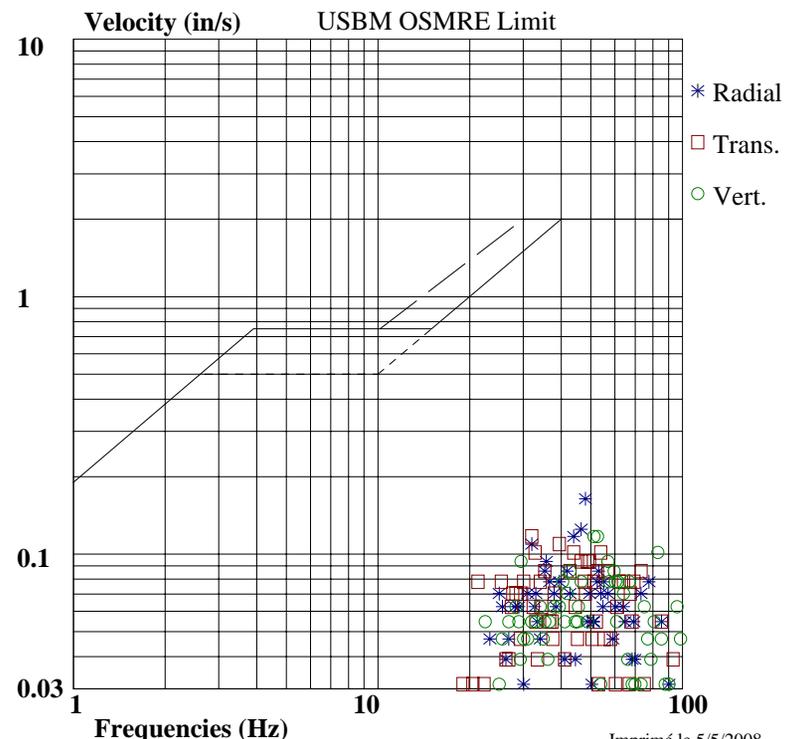
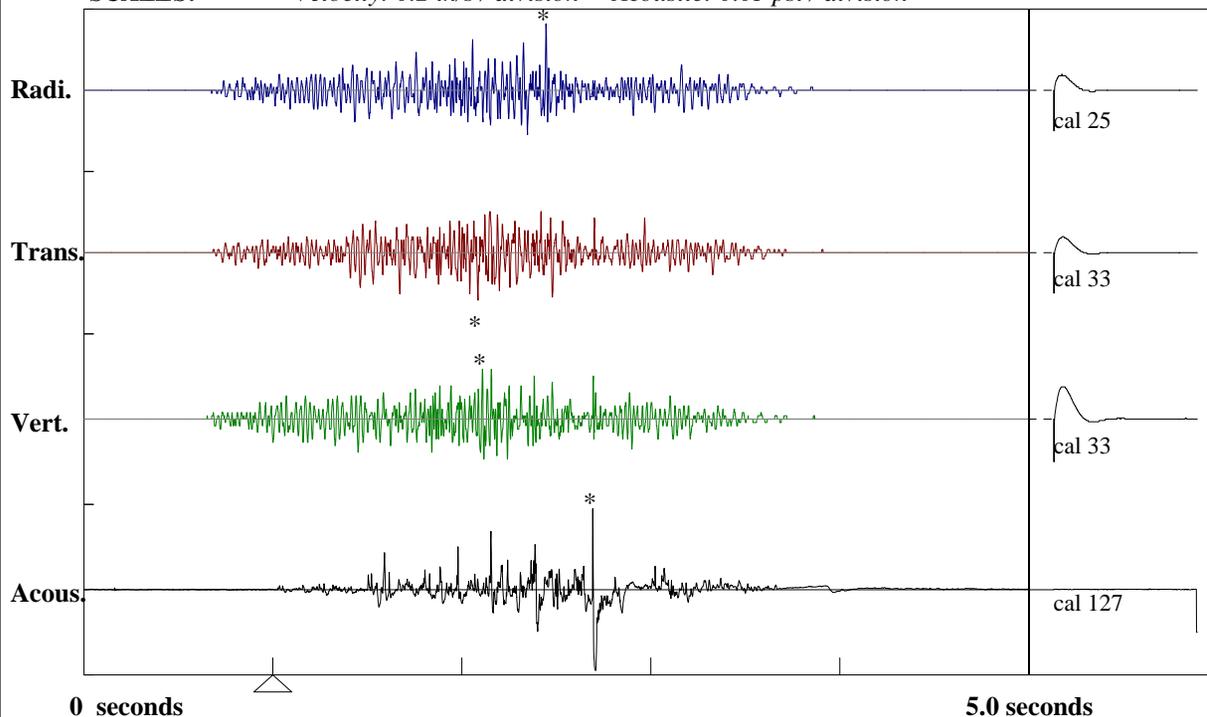
Parameters	Values	SMax/Trigger(*) :
Acoustic in psi	0.0281	1691.4 ms
Acoustic in dBF	139.7	104 Hz

Comments :

» SHOT LOC: N35 20 40.8 W80 39 36.6

AMPLITUDE GRAPHS & FREQUENCY vs VELOCITY GRAPHIC

SCALES: Velocity: 0.2 in/s / division Acoustic: 0.03 psi / division



VIBRATIONS ANALYSIS REPORT

File name 2280_015

NOMIS SEISMOGRAPHS
Tel: 205.592.2466

Unit #: NS54001-2514

Date : 05/02/08 3:13

Customer : BFI LANDFILL

Location : CELL LINER ORTH

Company : CAROLINA

Event # 280

Record time: 5.0 sec

Operator : ANDREW MCNICHOLS

Sampling rate: 1024 E/s

Number of points: 5120

Distance (Ft): 266

Charge per delay (lbs): 12

Scaled Distance : 76.78

VIBRATIONS

Channel	Radial	Transverse	Vertical
Velocity (in/s)	0.26	0.4	0.16
Frequency (Hz)	25.4	24.4	18.7
Acceleration (g)	0.142	0.183	0.145
Displacement (in)	0.0030	0.0033	0.0014
V _{Max} /Trigger (ms) *	1832.0	1929.7	1878.9

ACOUSTIC

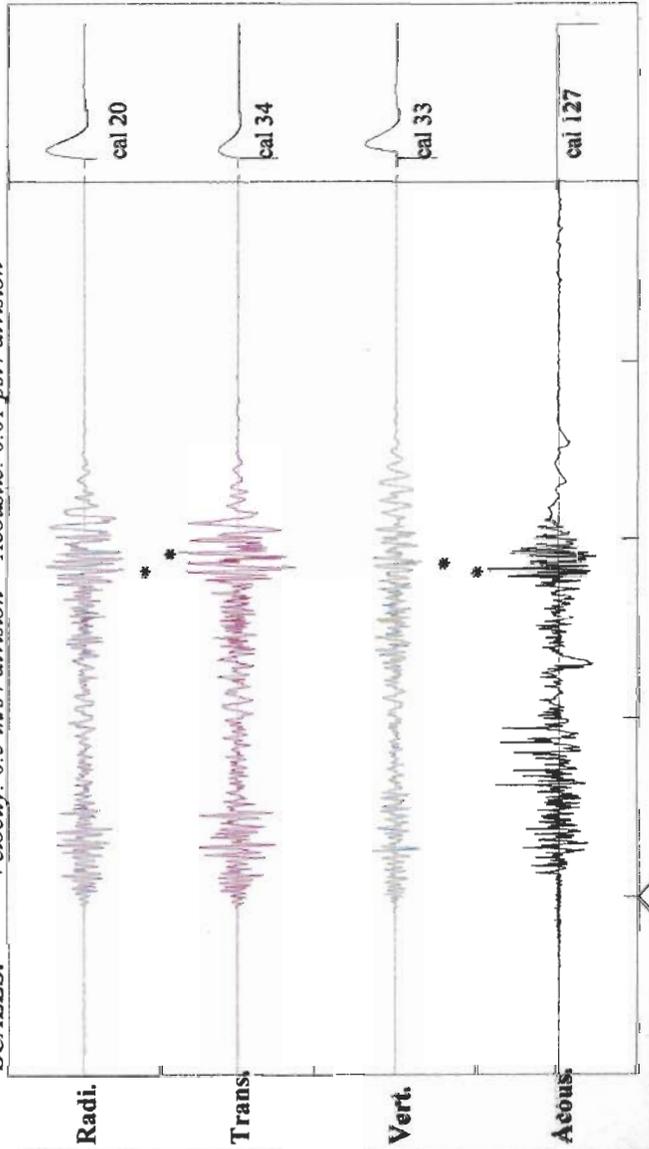
Parameters	Values
Acoustic in psi	0.0087
Acoustic in dBF	129.6
SMax/Trigger(*)	1831.1 ms
	38.2 Hz

Comments :

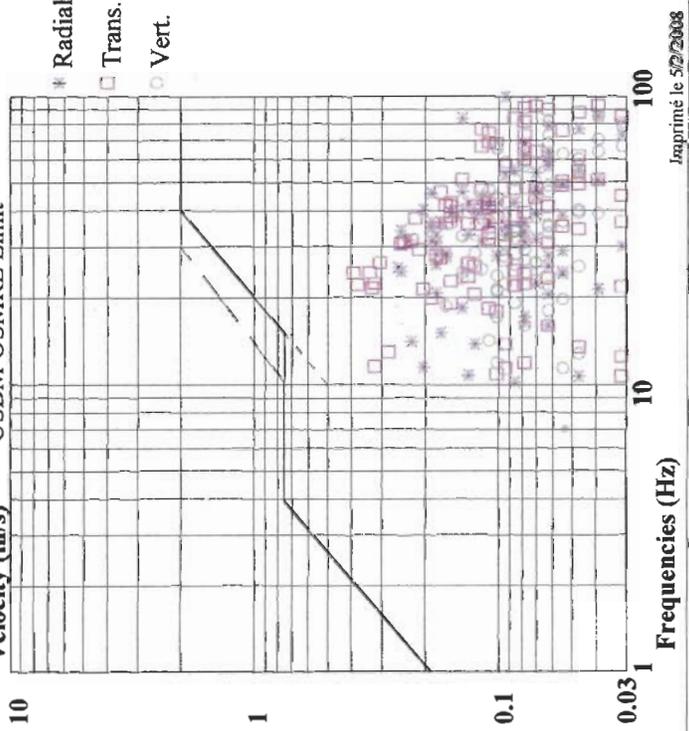
» SHOT LOC: N35 20 41.9 W80 39 36.3

AMPLITUDE GRAPHS & FREQUENCY vs VELOCITY GRAPHIC

SCALES: Velocity: 0.5 in/s / division Acoustic: 0.01 psi / division



Velocity (in/s) USBM OSMRE Limit



0 seconds

5.0 seconds

Frequencies (Hz)

VIBRATIONS ANALYSIS REPORT

File name 2770_045

NOMIS SEISMOGRAPHS

Tel: 205.592.2466

Unit #: NS54001-3021

Date: 05/02/08 3:13

Customer: BFI LANDFILL

Location: CELL LINER SOUTH

Company: CAROLINA

Event # 770

Record time: 5.0 sec

Operator: ANDREW MCNICHOLS

Sampling rate: 1024 E/s

Number of points: 5120

Distance (Ft): 340

Charge per delay (lbs): 12

Scaled Distance: 69.28

VIBRATIONS

Amplification: 1 Trigger (T): 0.05 in/s Vector Sum (in/s): N

Channel	Radial	Transverse	Vertical
Velocity (in/s)	0.31	0.36	0.44
Frequency (Hz)	31.8	26.0	41.0
Acceleration (g)	0.142	0.166	0.287
Displacement (in)	0.0015	0.0018	0.0017
VMax/Trigger (ms) *	1982.4	1432.6	1710.9

ACOUSTIC

Amplification: 1 Trigger (dB): N

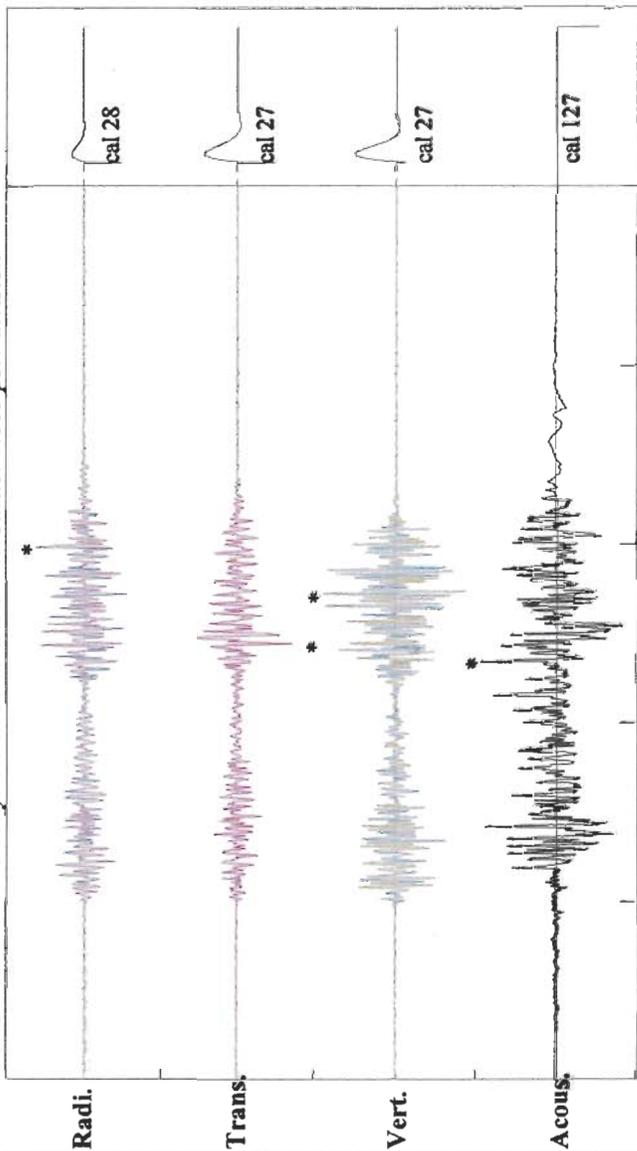
Parameters	Values	SMax/Trigger(*)
Acoustic in psi	0.0045	1338.9 ms
Acoustic in dBF	123.8	16.6 Hz

Comments:

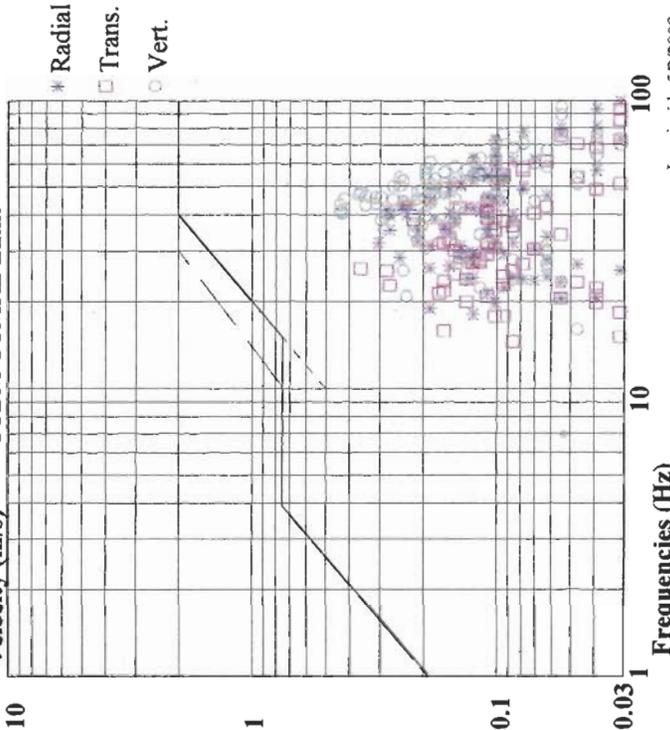
» SHOT LOC: N35 20 41.9 W80 39 36.3

AMPLITUDE GRAPHS & FREQUENCY vs VELOCITY GRAPHIC

SCALES: Velocity: 0.5 in/s / division Acoustic: 0.005 psi / division



Velocity (in/s) USBM OSMRE Limit



0 seconds

5.0 seconds

Frequencies (Hz)

10 100

VIBRATIONS ANALYSIS REPORT

File name 2009_010

NOMIS SEISMOGRAPHS
Tel: 205.592.2466

Unit #: NS5400I-2720

Date : 05/02/08 3:13

Customer : BFI LANDFILL

Location : GROUND WELL

Company : CAROLINA

Event # 009

Record time: 5.0 sec

Operator : ANDREW MCNICHOLS

Sampling rate: 1024 E/s

Number of points: 5120

Distance (Ft): 653

Charge per delay (lbs): 12

Scaled Distance : 188.5

VIBRATIONS

Amplification: 1 Trigger (T): 0.05 in/s Vector Sum (in/s): N

Channel	Radial	Transverse	Vertical
Velocity (in/s)	0.13	0.1	0.08
Frequency (Hz)	39.9	35.3	39.4
Acceleration (g)	0.017	0.017	0.017
Displacement (in)	0.0005	0.0004	0.0004
VMax/Trigger (ms) *	1574.2	1485.4	1324.2

ACOUSTIC

Amplification : 1 Trigger (dB) : N

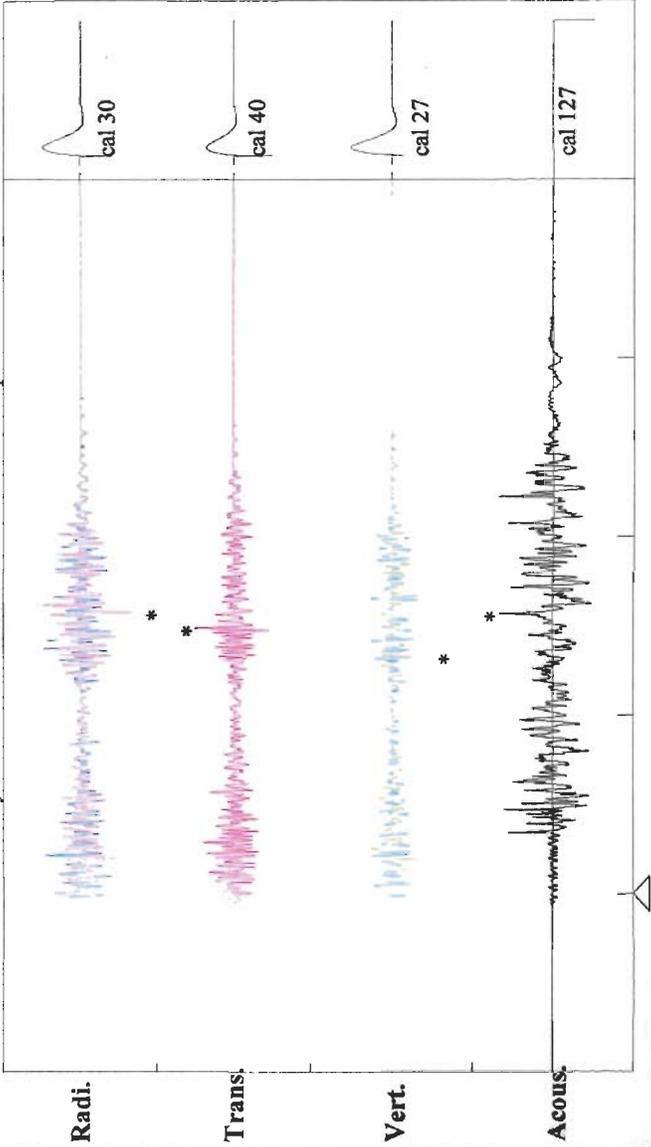
Parameters	Values	SMax/Trigger(*) :
Acoustic in psi	0.0013	1565.4 ms
Acoustic in dBF	113.0	32.0 Hz

Comments :

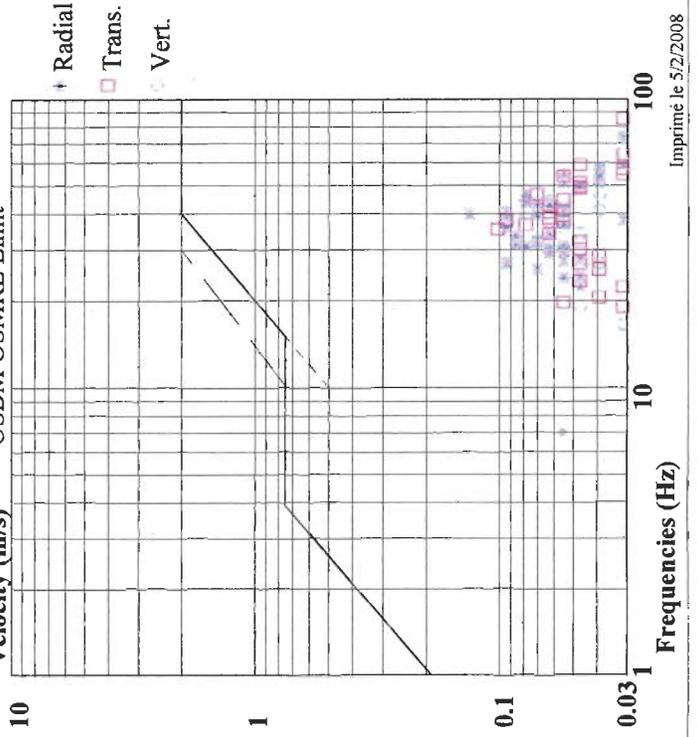
» SHOT LOC: N35 20 41.9 W80 39 36.3

AMPLITUDE GRAPHS & FREQUENCY vs VELOCITY GRAPHIC

SCALES: Velocity: 0.2 in/s / division Acoustic: 0.002 psi / division



Velocity (in/s) USBM OSMRE Limit



0 seconds

5.0 seconds

RE Blasting results letter

From: Wootton, Brian [brian.wootton@ncdenr.gov]
Sent: Wednesday, March 17, 2010 4:34 PM
To: David Garrett
Subject: RE: Blasting results letter

David,

Reminder - Per our conversation last week, I need to your conclusions in a letter, pertaining to the blasting results at CMS-MSWLF.

Thanks,

Brian

-----Original Message-----

From: David Garrett [mailto:david@davidgarrettpe.com]
Sent: Wednesday, February 24, 2010 4:00 PM
To: Wootton, Brian
Subject: RE: Blasting shot readings...FW: 4411.pdf - Adobe Reader

Thanks. I wonder if we never finished it up?

David Garrett, P.G., P.E.
David Garrett & Associates
5105 Harbour Towne Drive
Raleigh, NC 27604

Tel. 919-418-4375 (mobile)

-----Original Message-----

From: Wootton, Brian [mailto:brian.wootton@ncdenr.gov]
Sent: Wednesday, February 24, 2010 3:31 PM
To: David Garrett
Subject: Blasting shot readings...FW: 4411.pdf - Adobe Reader

David,

I found this e-mail about some of the blasting results..

Brian

-----Original Message-----

From: David Garrett, P.E., P.E. [mailto:davidgarrettpgpe@mindspring.com]
Sent: Monday, May 05, 2008 2:23 PM
To: John Murray; Mike Gurley; David Garrett, P.G., P.E.
Cc: Brian Wootton; Ed Mussler
Subject: Re: 4411.pdf - Adobe Reader

Gentlemen, the shots went well, we observed the results on both Wednesday and Friday shots (no visible damage to liners or wells). Friday's shot was a little closer to the cell than Wednesday's. Blasts were staged to direct energy propagation away from the existing liner - this could be seen in the direction of material offset - both shots achieved good lift.

Seismograph results of the shots follow:

Wed (north of shot on cell line) vertical 0.12 in/sec

Fri (north of shot on cell line) vertical 0.16 in/sec

RE Blasting results letter

Fri (south of shot on cell line) vertical 0.44 in/sec

Fri (monitoring well MW-33) vertical 0.08 in/sec

Typically, under 1 in/sec is not considered problematic for sensitive structures (e.g., masonry buildings), these readings indicate no problems anticipated for liner or wells.

A full report will follow when I have the survey information. Thank you.
dg

-----Original Message-----

>From: John Murray <john.murray@ncmail.net>

>Sent: May 5, 2008 11:21 AM

>To: Mike Gurlley <Mike.Gurlley@awin.com>, "David Garrett, P.G., P.E." <david_garrett_pg@mi ndspring.com>

>Cc: Brian Wootton <Brian.Wootton@ncmail.net>, Ed Mussler <Ed.Mussler@ncmail.net>

>Subject: 4411.pdf - Adobe Reader

>

>As per your request the attached letter from Ed Mussler allows the
>blasting plan and french drain as per the submittal by David Garrett
>and the comments by John Murray to be utilized for cell 2G construction
>at the Charlotte Motor Speedway Landfill 13-04.

David Garrett, PG, PE
Engineering and Geology
5105 Harbour Towne Drive
Raleigh, NC 27604
Tel. 919-418-4375 Direct



4-30-2008 After the shot, approx. 250 feet from edge of 2F liner in background



5-2-2008 Before the shot, showing drill pattern on 5-foot centers with minimum depths of 6 feet, nearest shot distance to liner is 30 feet (scale distance is 50)



5-2-2008 Loading ANFO into the shot holes with approx. 12-pound charges



5-2-2008 ANFO is charged with acetic acid at point of delivery to increase detonation velocity (14,000 fps) and delivered to shot hole in a precise manner



5-2-2008 Blasting cap and booster charge is set in bottom of shot hole below ANFO



5-2-2008 Shock cord with initiator, controls the delays between lines of shot holes; delays of 25 milliseconds were used between lines of shot holes



5-2-2008 Loaded shot holes are stemmed with quarry screenings (fine sandy gravel)



5-2-2008 Setting up one of three seismographs to monitor vibration, distances between the shot and nearest monitoring points are 100 feet northeast and 150 feet southwest along the Phase 2F liner; 300 feet to the monitoring well MW-33



5-2-2008 The shot progressed from left (south) indicated by white dust cloud to right (north) denoted by red nitrogen cloud; early displacement of material to the left directed blast energy away from the liner



5-2-2008 Ground displacement shows energy was directed away from Phase 2F liner



5-2-2008 Vertical delineation between shot (left) and undisturbed anchor berm (right)



5-2-2008 Uplift materials next to the Phase 2F liner was a stony soil mix, which dampens the energy – this location is approx. 100 feet from the north seismograph (located at the vehicles)



POST-BLAST SURVEY OF TOP OF ROCK
ELEVATION RELATIVE TO BASE GRADE
(SHOWS 4 FEET OF SEPARATION)

SHOT HOLE EXTENDED 4 FEET BELOW INDICATED
BASE GRADE ELEVATION, SHOWING PRE-BLAST
DEPTH TO ROCK OR NO ROCK ("NR") - DEPTHS
WERE TRACKED BY SURVEYOR AND BLASTER

ORIGINAL GROUND CONTOUR
(SEE LARGER SCALE MAP)

0 5 10 20
SCALE IN FEET

SHEET 1

BASE GRADE EL. 594

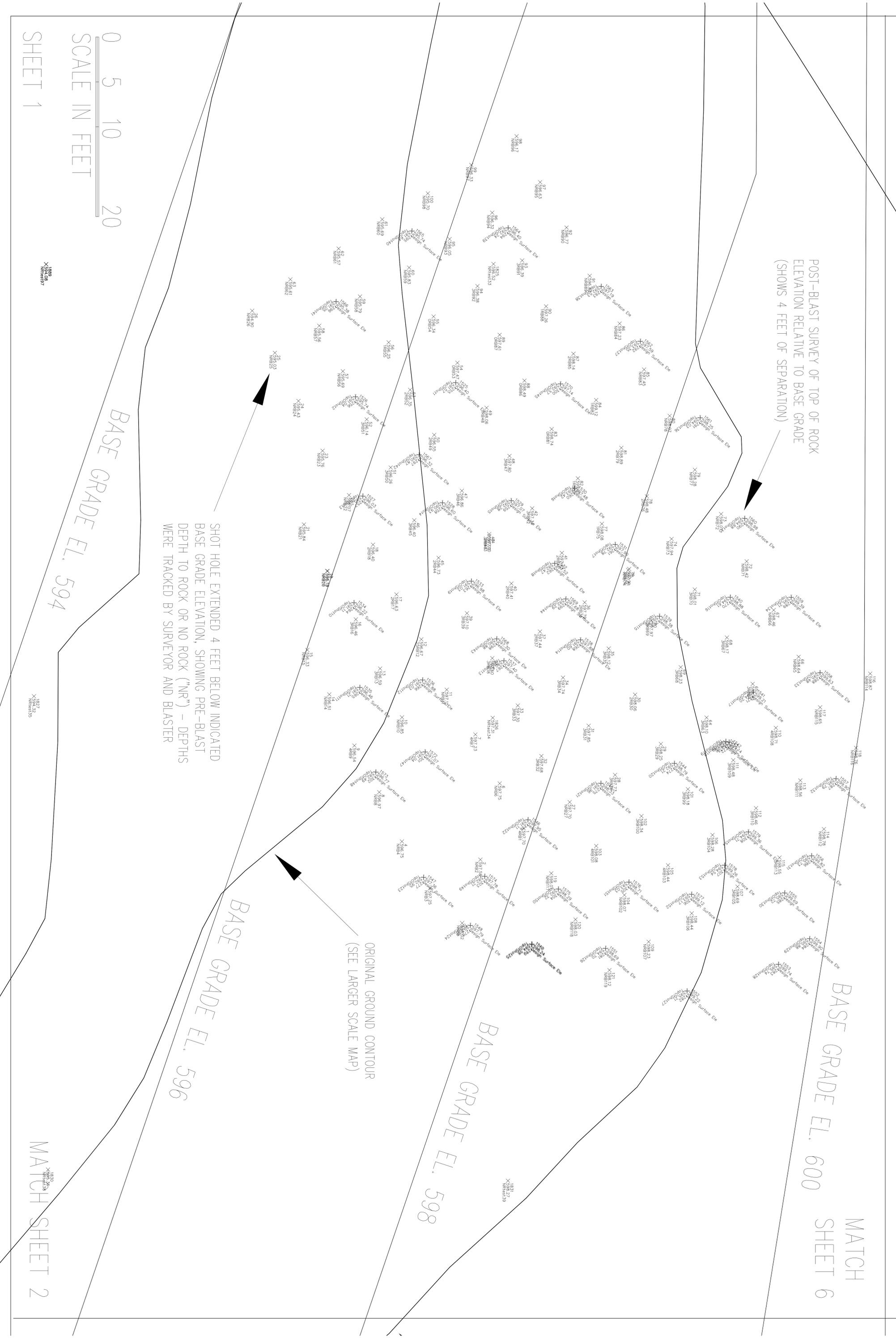
BASE GRADE EL. 596

BASE GRADE EL. 598

BASE GRADE EL. 600

MATCH
SHEET 6

MATCH SHEET 2



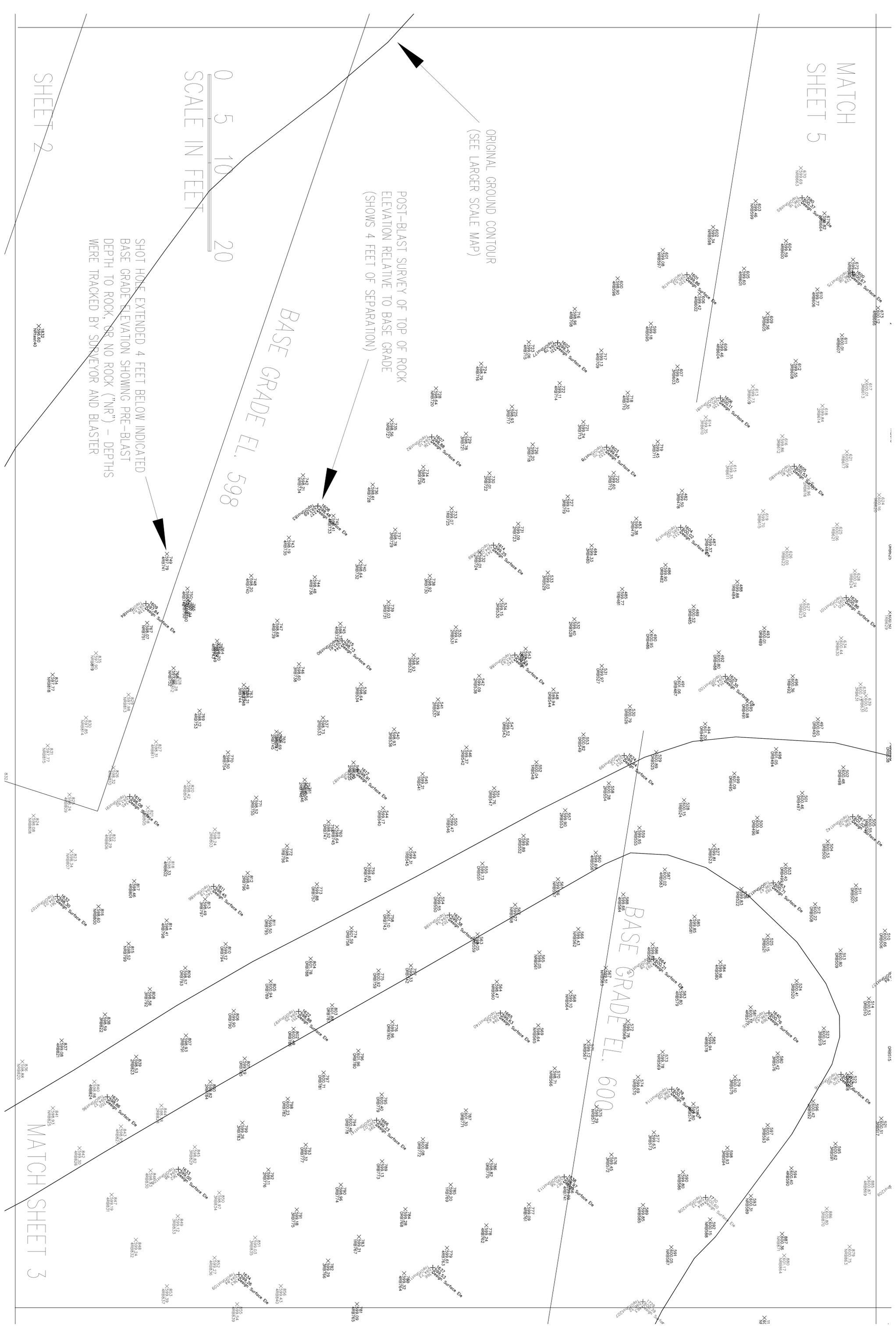
ORIGINAL GROUND CONTOUR
(SEE LARGER SCALE MAP)

POST-BLAST SURVEY OF TOP OF ROCK
ELEVATION RELATIVE TO BASE GRADE
(SHOWS 4 FEET OF SEPARATION)

0 5 10 20
SCALE IN FEET

BASE GRADE EL. 598

SHOT HOLE EXTENDED 4 FEET BELOW INDICATED
BASE GRADE ELEVATION SHOWING PRE-BLAST
DEPTH TO ROCK, OR NO ROCK ("NR") - DEPTHS
WERE TRACKED BY SURVEYOR AND BLASTER



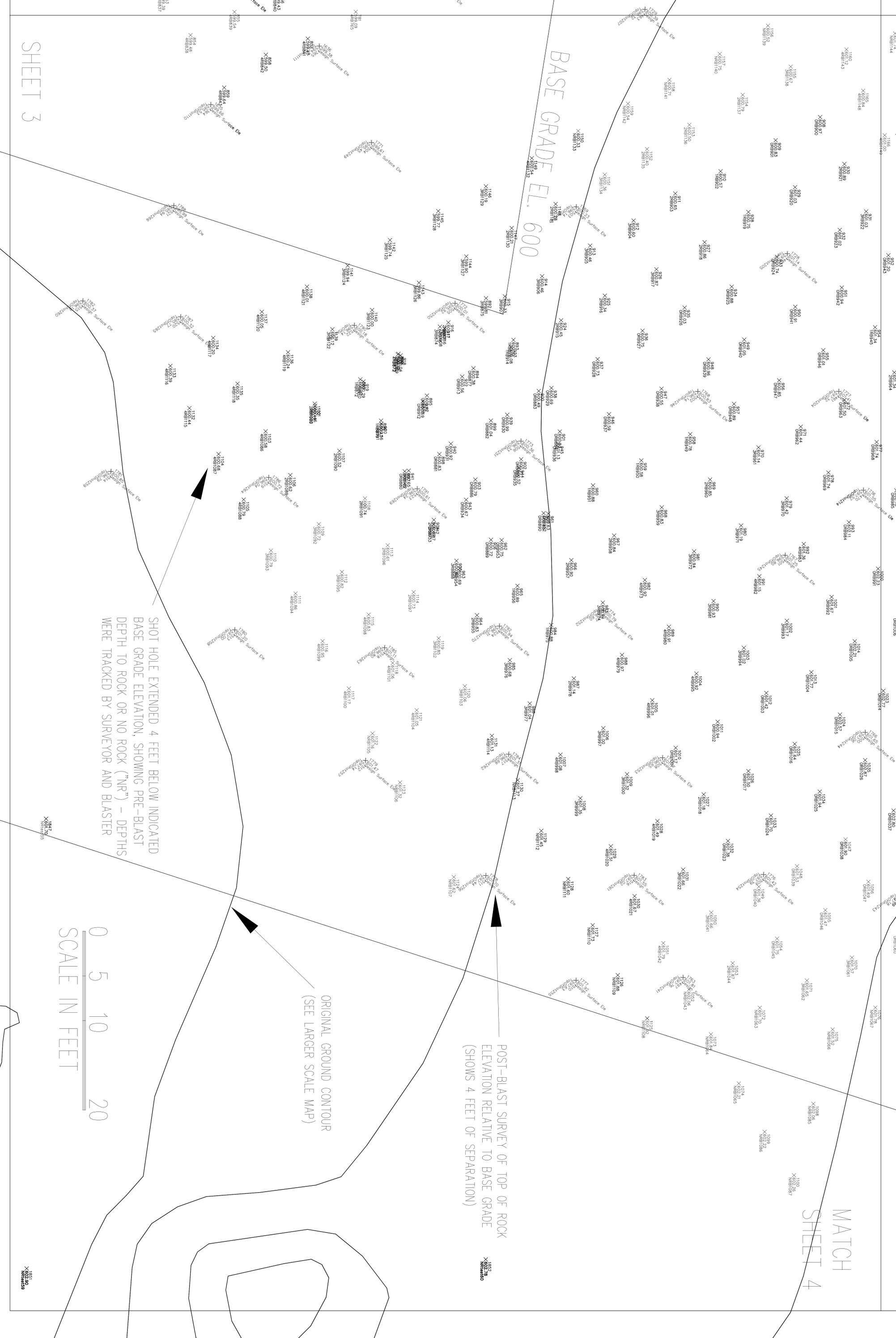
POST-BLAST SURVEY OF TOP OF ROCK ELEVATION RELATIVE TO BASE GRADE (SHOWS 4 FEET OF SEPARATION)

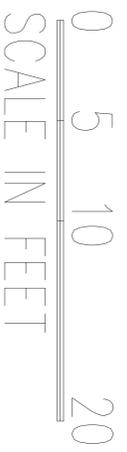
ORIGINAL GROUND CONTOUR (SEE LARGER SCALE MAP)

SHOT HOLE EXTENDED 4 FEET BELOW INDICATED BASE GRADE ELEVATION, SHOWING PRE-BLAST DEPTH TO ROCK OR NO ROCK ("NR") - DEPTHS WERE TRACKED BY SURVEYOR AND BLASTER



BASE GRADE EL. 600





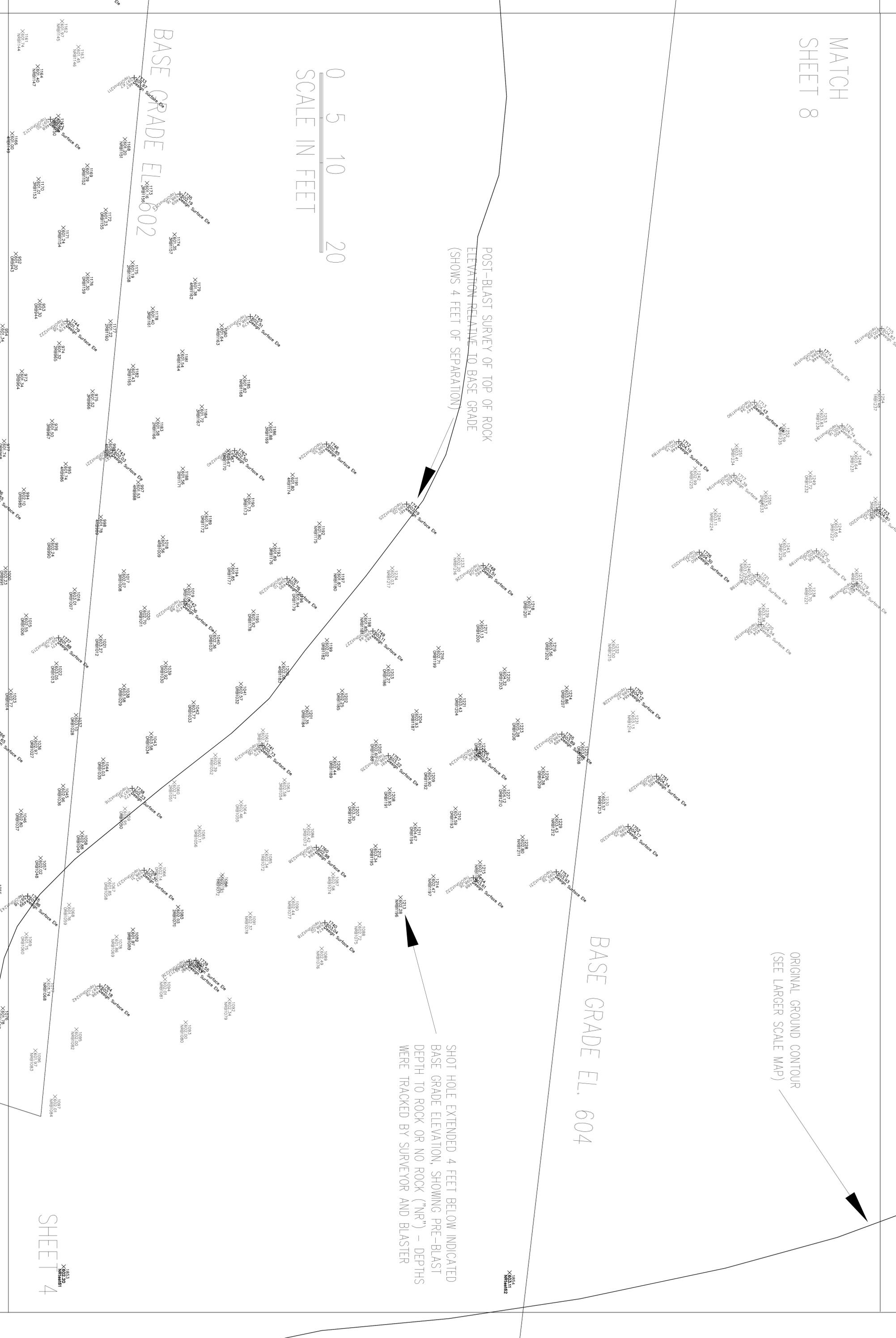
BASE GRADE EL. 602

POST-BLAST SURVEY OF TOP OF ROCK
ELEVATION RELATIVE TO BASE GRADE
(SHOWS 4 FEET OF SEPARATION)

BASE GRADE EL. 604

ORIGINAL GROUND CONTOUR
(SEE LARGER SCALE MAP)

SHOT HOLE EXTENDED 4 FEET BELOW INDICATED
BASE GRADE ELEVATION, SHOWING PRE-BLAST
DEPTH TO ROCK OR NO ROCK ("NR") - DEPTHS
WERE TRACKED BY SURVEYOR AND BLASTER



MATCH SHEET

SHEET 5

BASE GRADE EL. 602

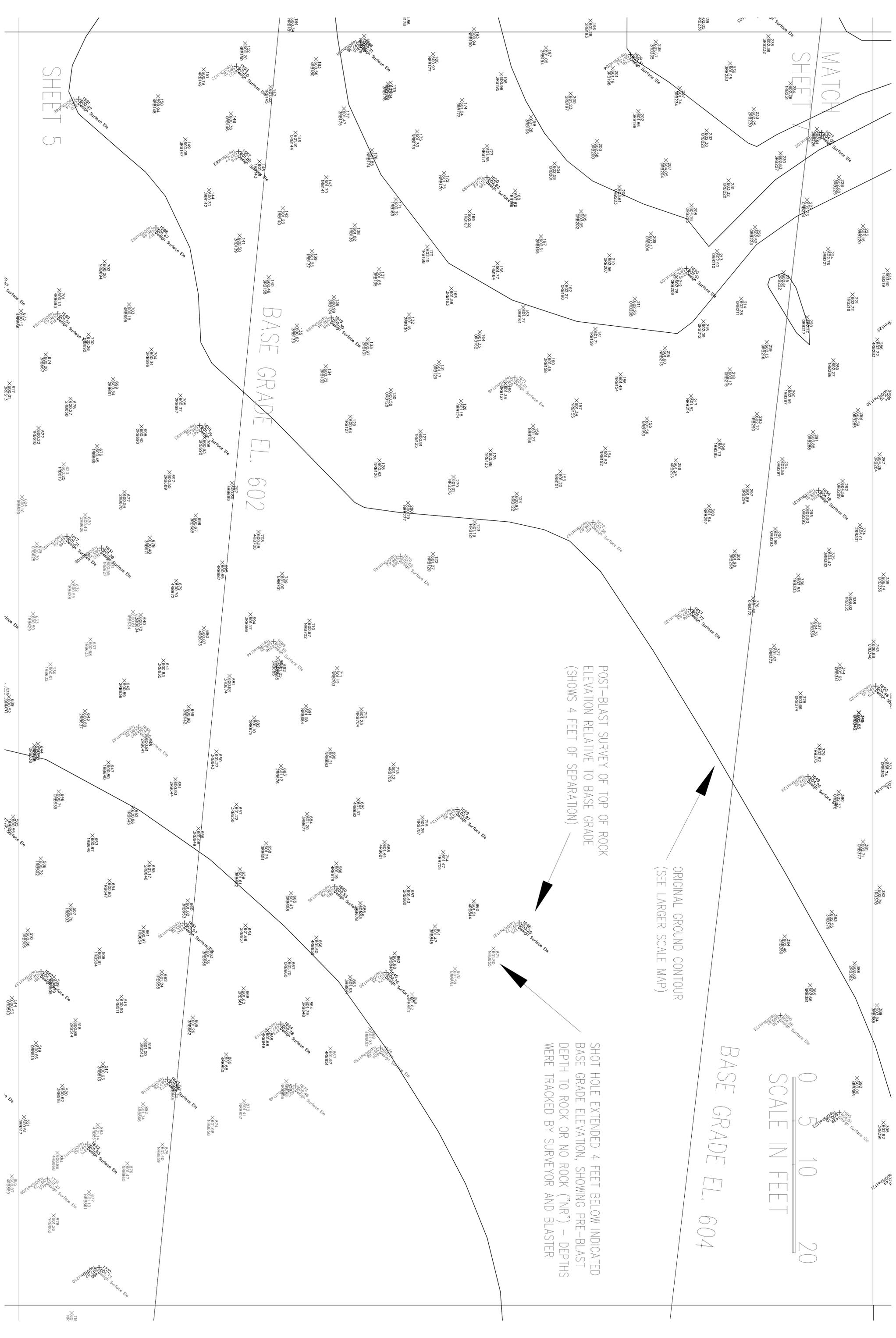
BASE GRADE EL. 604

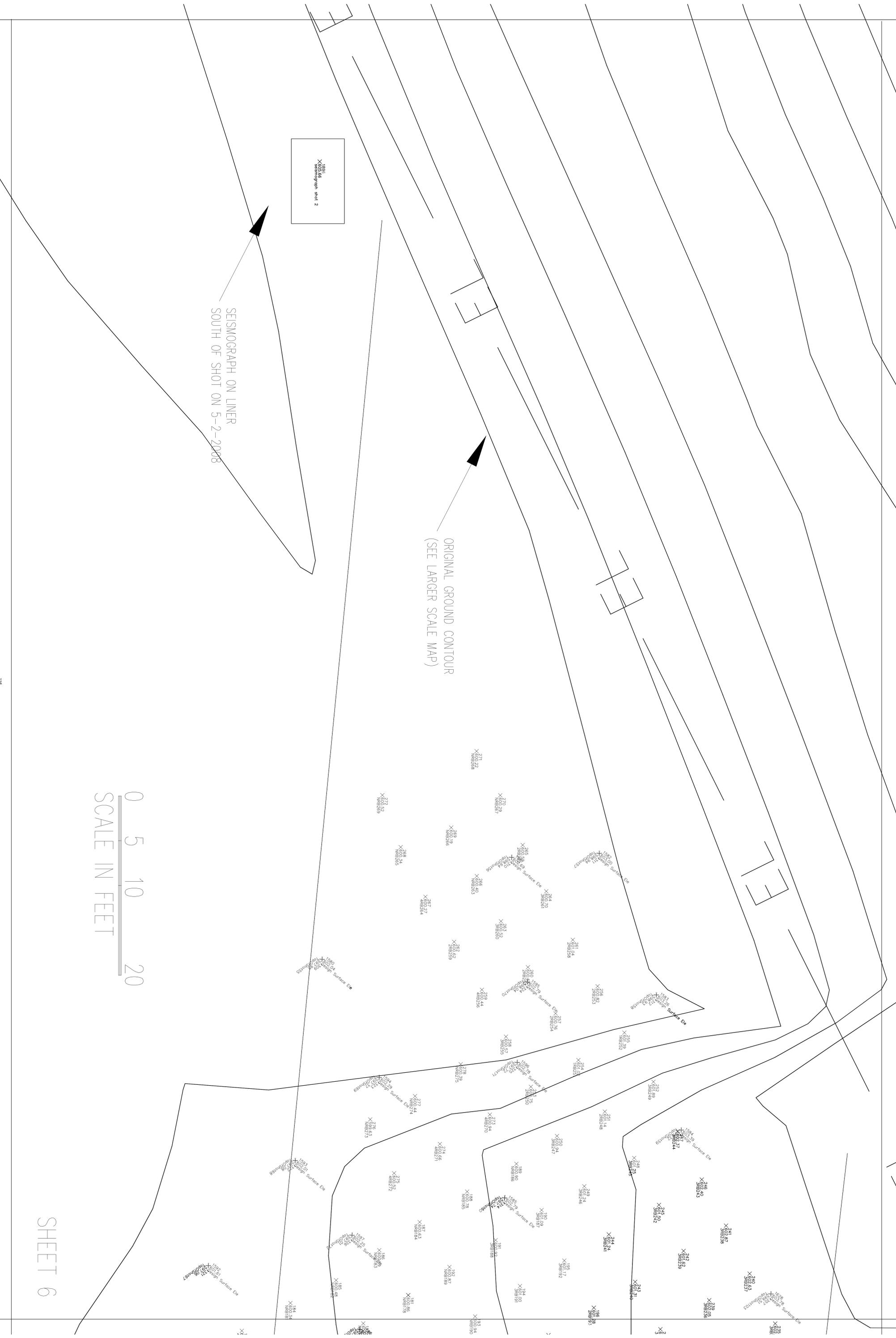
0 5 10 20
SCALE IN FEET

POST-BLAST SURVEY OF TOP OF ROCK
ELEVATION RELATIVE TO BASE GRADE
(SHOWS 4 FEET OF SEPARATION)

ORIGINAL GROUND CONTOUR
(SEE LARGER SCALE MAP)

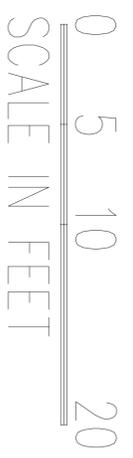
SHOT HOLE EXTENDED 4 FEET BELOW INDICATED
BASE GRADE ELEVATION, SHOWING PRE-BLAST
DEPTH TO ROCK OR NO ROCK ("NR") - DEPTHS
WERE TRACKED BY SURVEYOR AND BLASTER





ORIGINAL GROUND CONTOUR
(SEE LARGER SCALE MAP)

SEISMOGRAPH ON LINER
SOUTH OF SHOT ON 5-2-2008



Seismograph shot 2

POST-BLAST SURVEY OF TOP OF ROCK
ELEVATION RELATIVE TO BASE GRADE
(SHOWS 4 FEET OF SEPARATION)

SHOT HOLE EXTENDED 4 FEET BELOW INDICATED
BASE GRADE ELEVATION, SHOWING PRE-BLAST
DEPTH TO ROCK OR NO ROCK ("NR") - DEPTHS
WERE TRACKED BY SURVEYOR AND BLASTER

ORIGINAL GROUND CONTOUR
(SEE LARGER SCALE MAP)

BASE GRADE EL. 606

