NORTH GOONYELLA – STRUCTURAL CONTROLS ON PERMEABILITY

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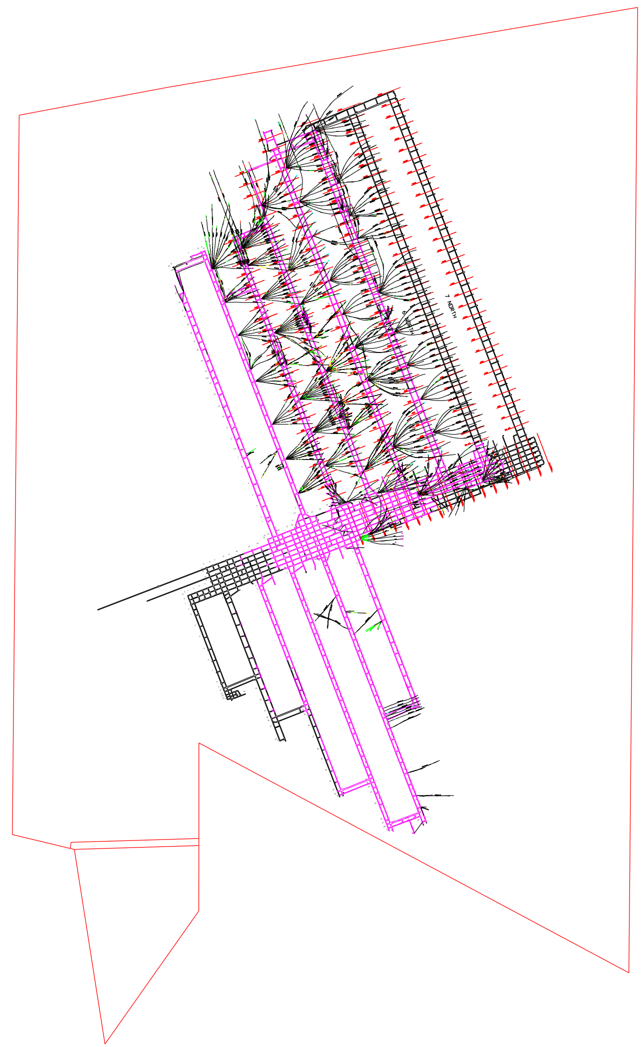
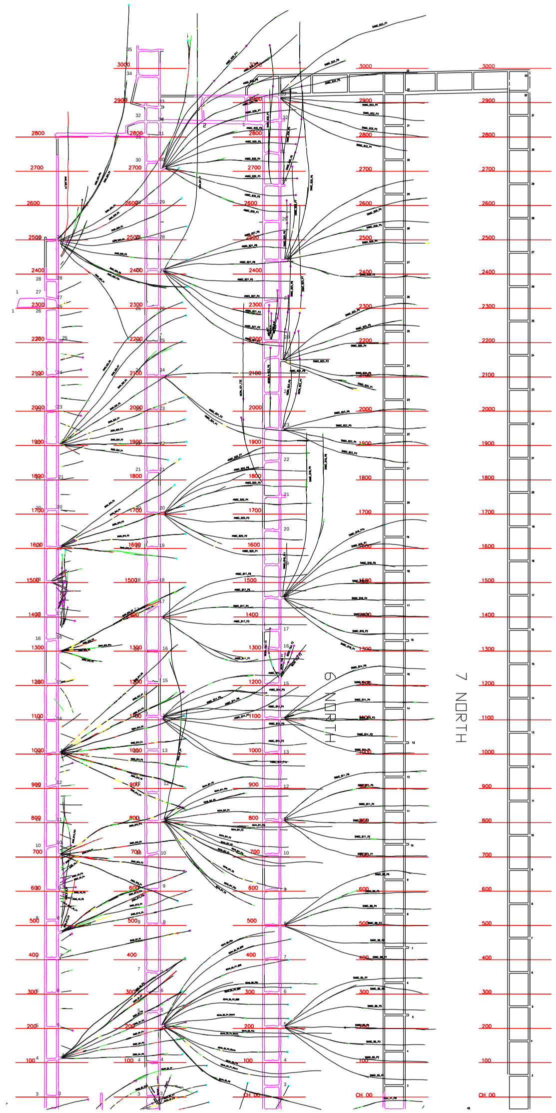
North Goonyella lease, mineplan and extent of inseam gas drainage



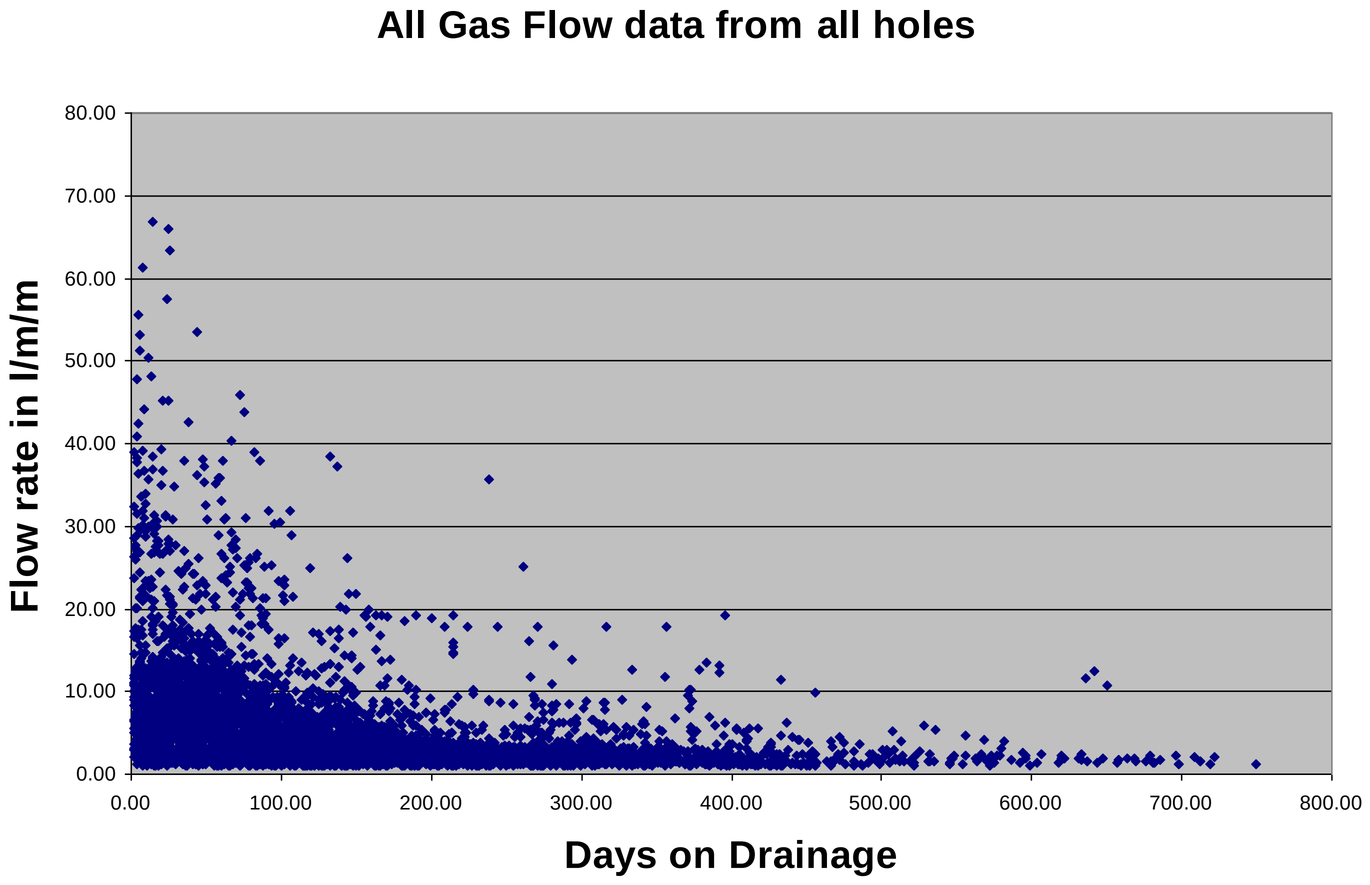


Close up of inseam drainage holes MG3N, MG4N and MG5N. Note fan pattern for MG3N and candelabra pattern for MG4N & MG5N

Before an attempt was made to address the structural controls on permeability, it had to be determined what was a typical hole flow.

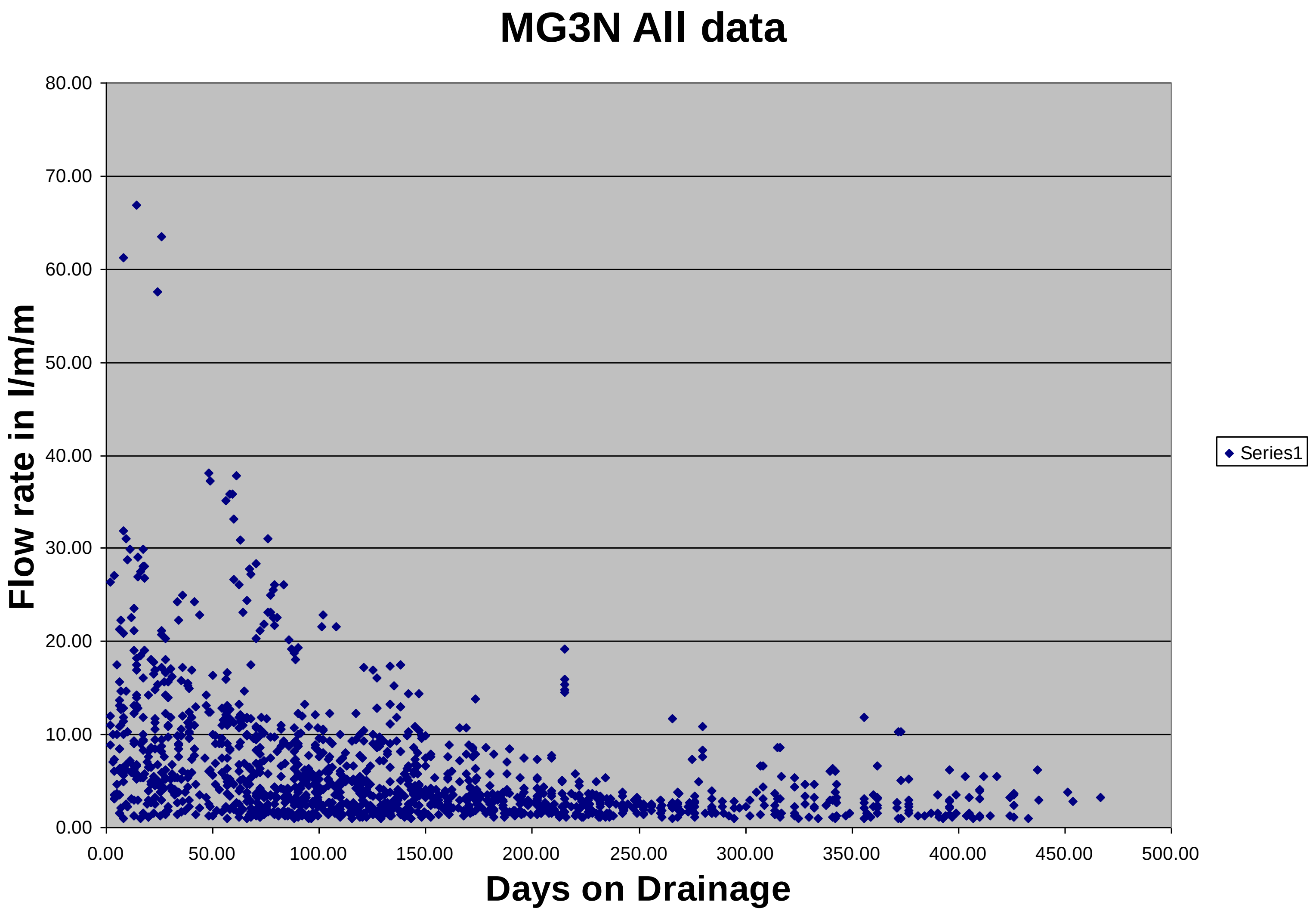
How were hole flows classified?

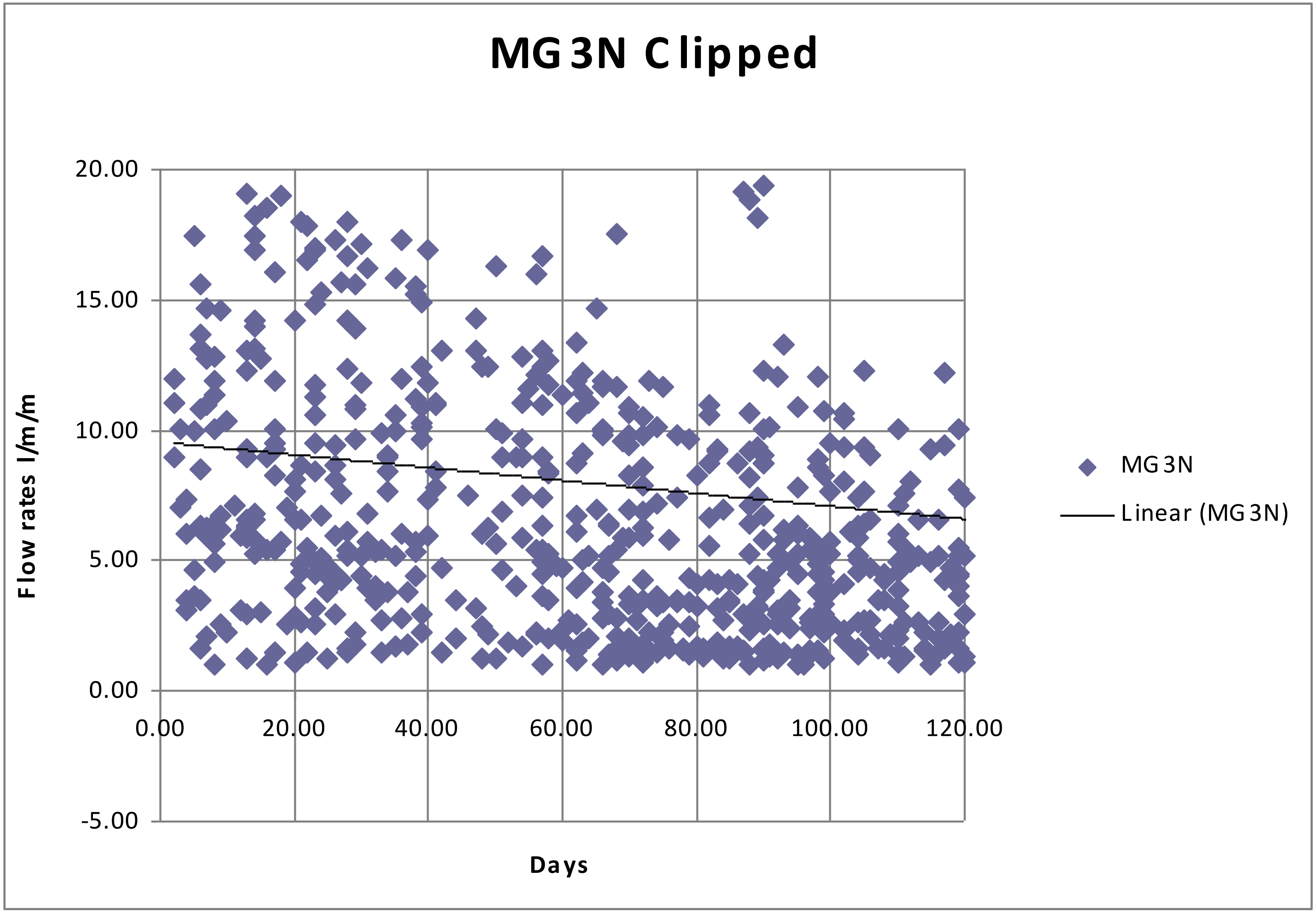
All the hole flow charts for inseam drainage holes drilled from MG3N, MG4N & MG5N were studied, and a datum chosen. The life span of a hole had to be taken into account and therefore the flow at Day 20 was taken to be about the peak time.



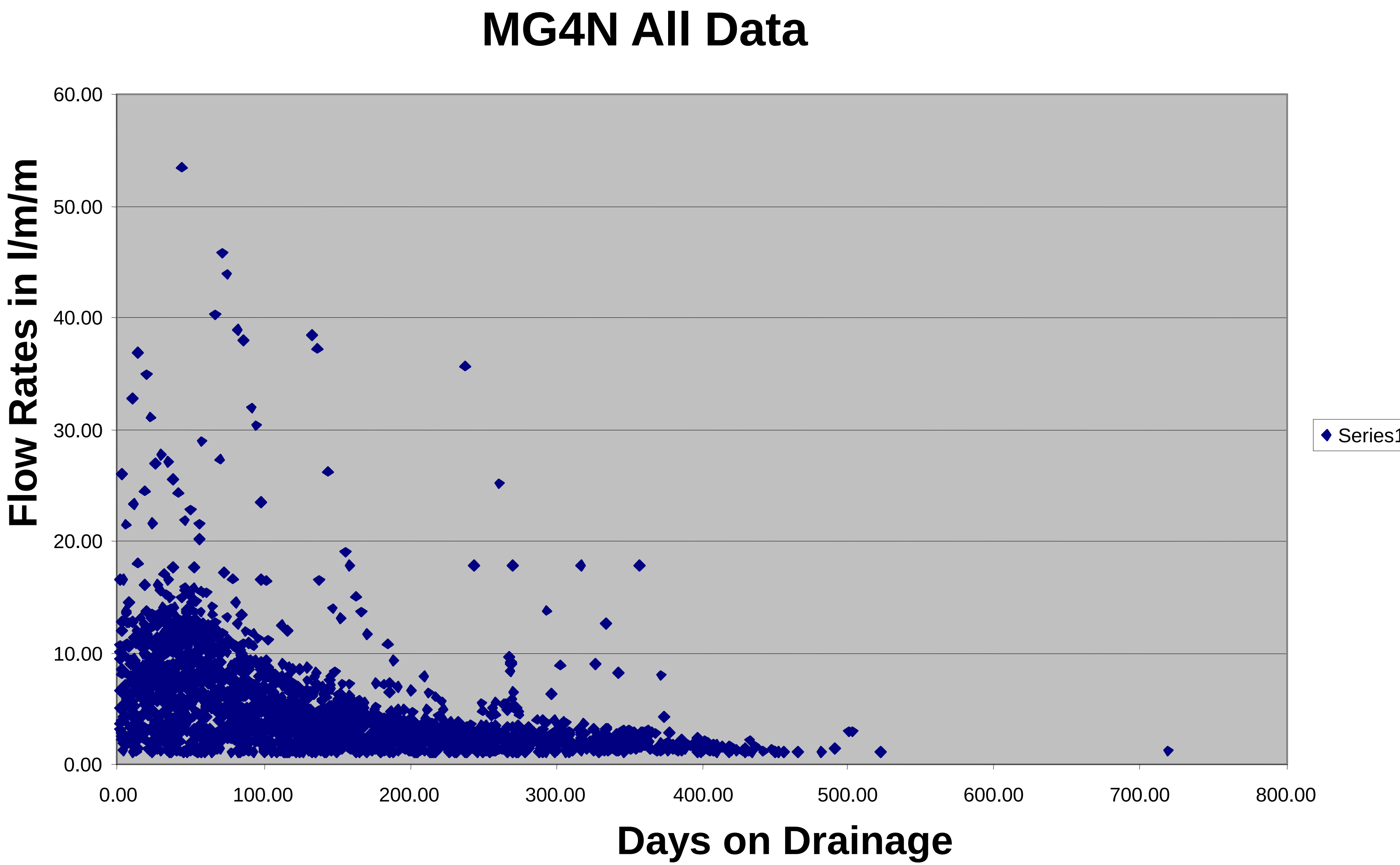
All Gas Flow data from all holes
Flow rate in l/m/m
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
800.00
Days on Drainage

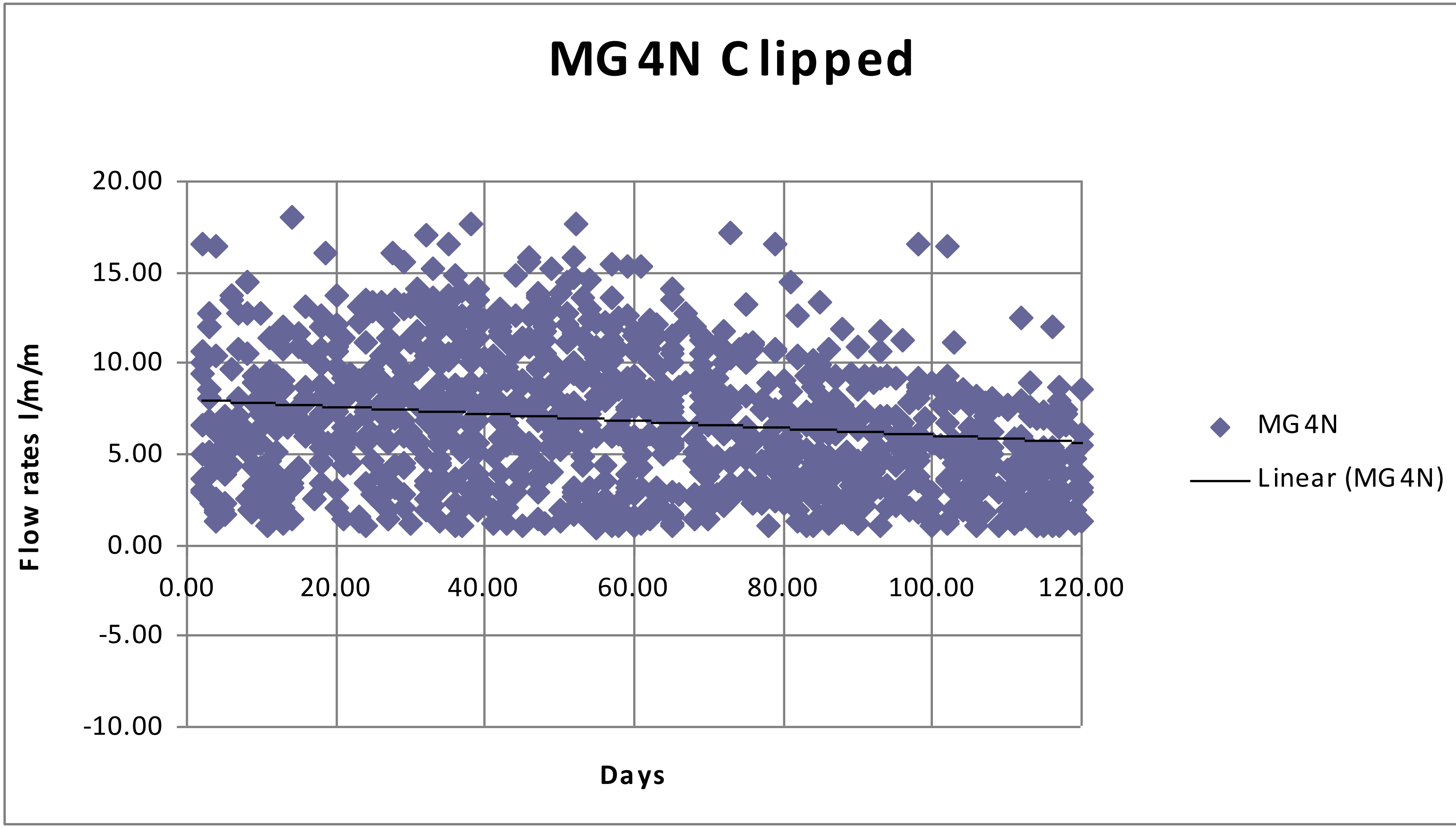
One of the big problems with looking at all the data was that nothing stood out as being obvious. The data was then sorted into MG3N,4N & 5N separately. The graphs were then clipped to show only drainage times to Day 120 and max flow of 20 l/m/m. This helped only marginally. A separate datum was chosen for each gate road being **Day 20 for MG3N**, **Day 30 for MG4N** and **Day 40 for MG5N**.

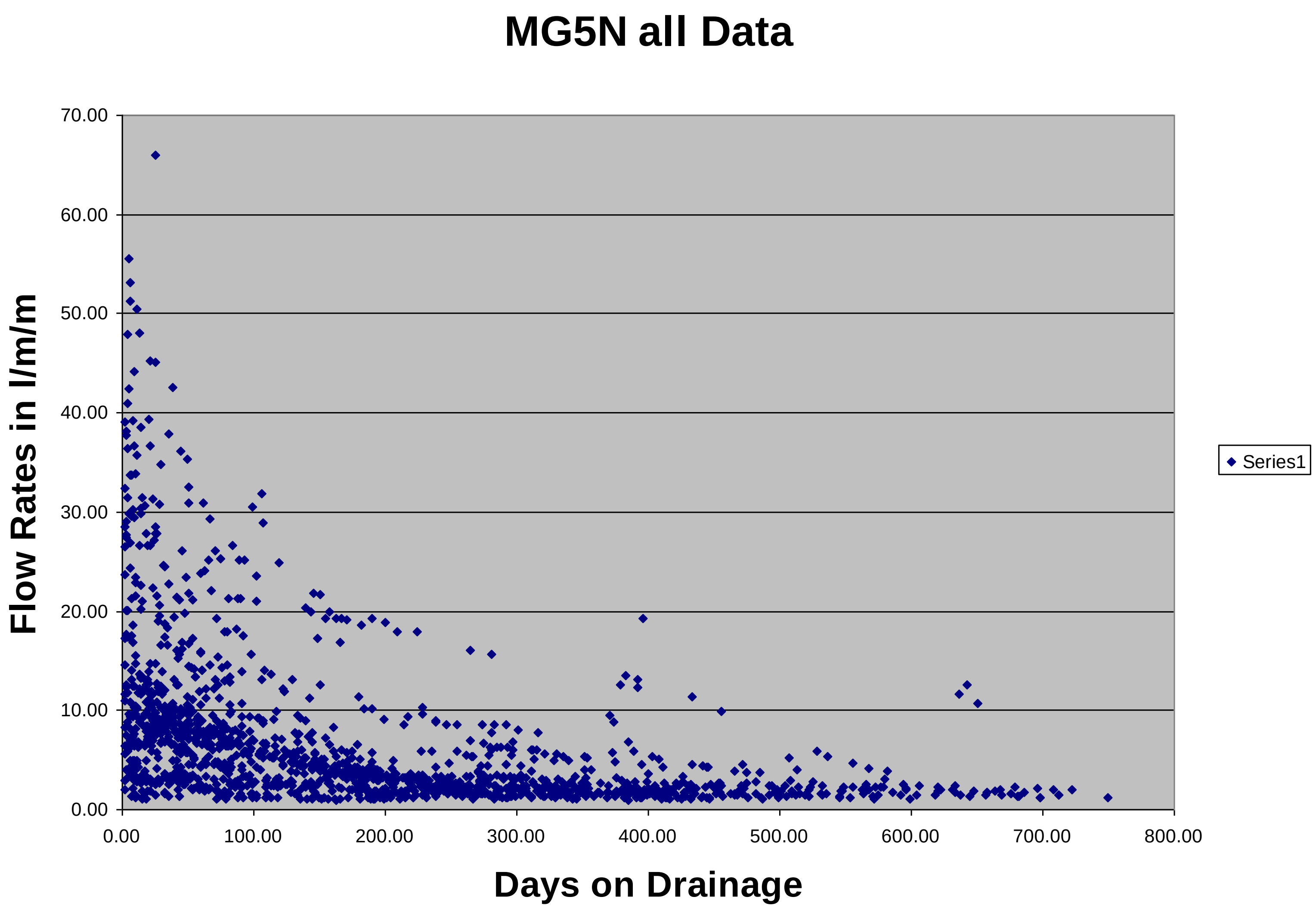

MG3N All data
Flow rate in l/m/m
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
400.00
450.00
500.00
Days on Drainage
Series1



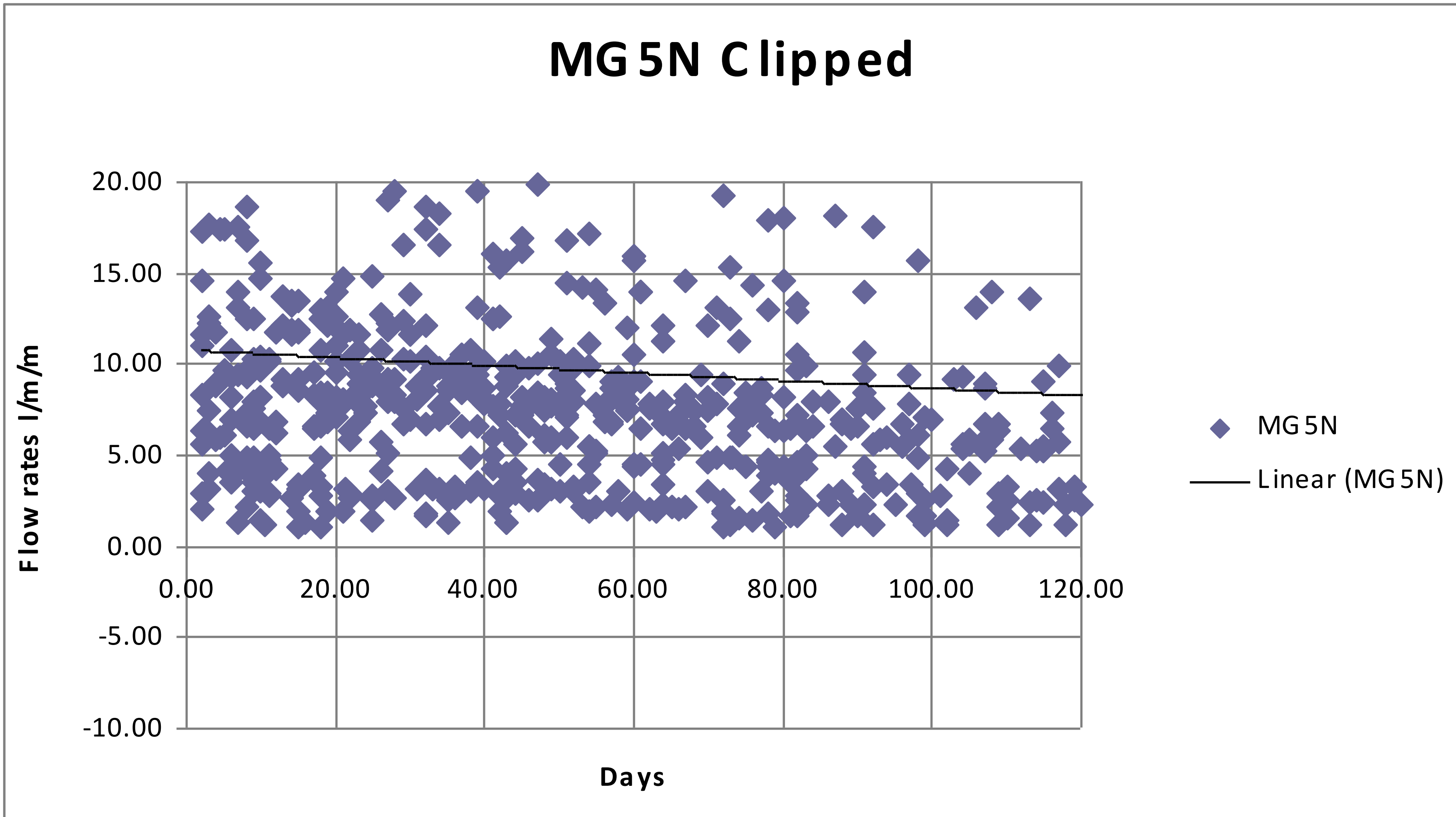
MG3N Clipped
20.00
15.00
10.00
5.00
0.00
-5.00
0.00
20.00
40.00
60.00
80.00
100.00
120.00
Flow rates l/m/m
Days
MG3N
Linear (MG3N)


MG4N All Data
Flow Rates in l/m/m
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
800.00
Days on Drainage
Series1


MG4N Clipped
Flow rates l/m/m
20.00
15.00
10.00
5.00
0.00
-5.00
-10.00
0.00
20.00
40.00
60.00
80.00
100.00
120.00
Days
MG4N
Linear (MG4N)



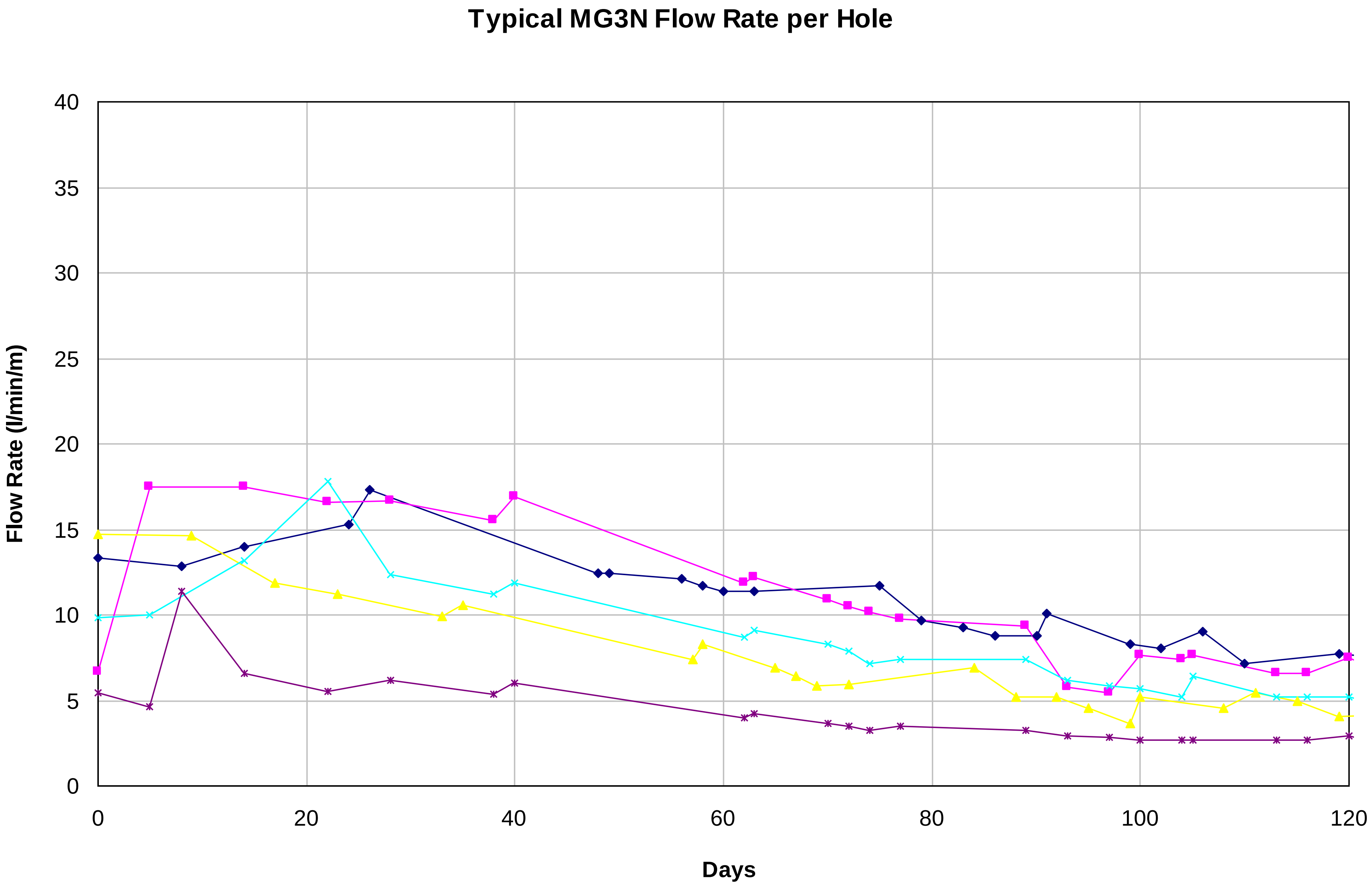
MG5N all Data
Flow Rates in l/m/m
Days on Drainage
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
800.00
Series1

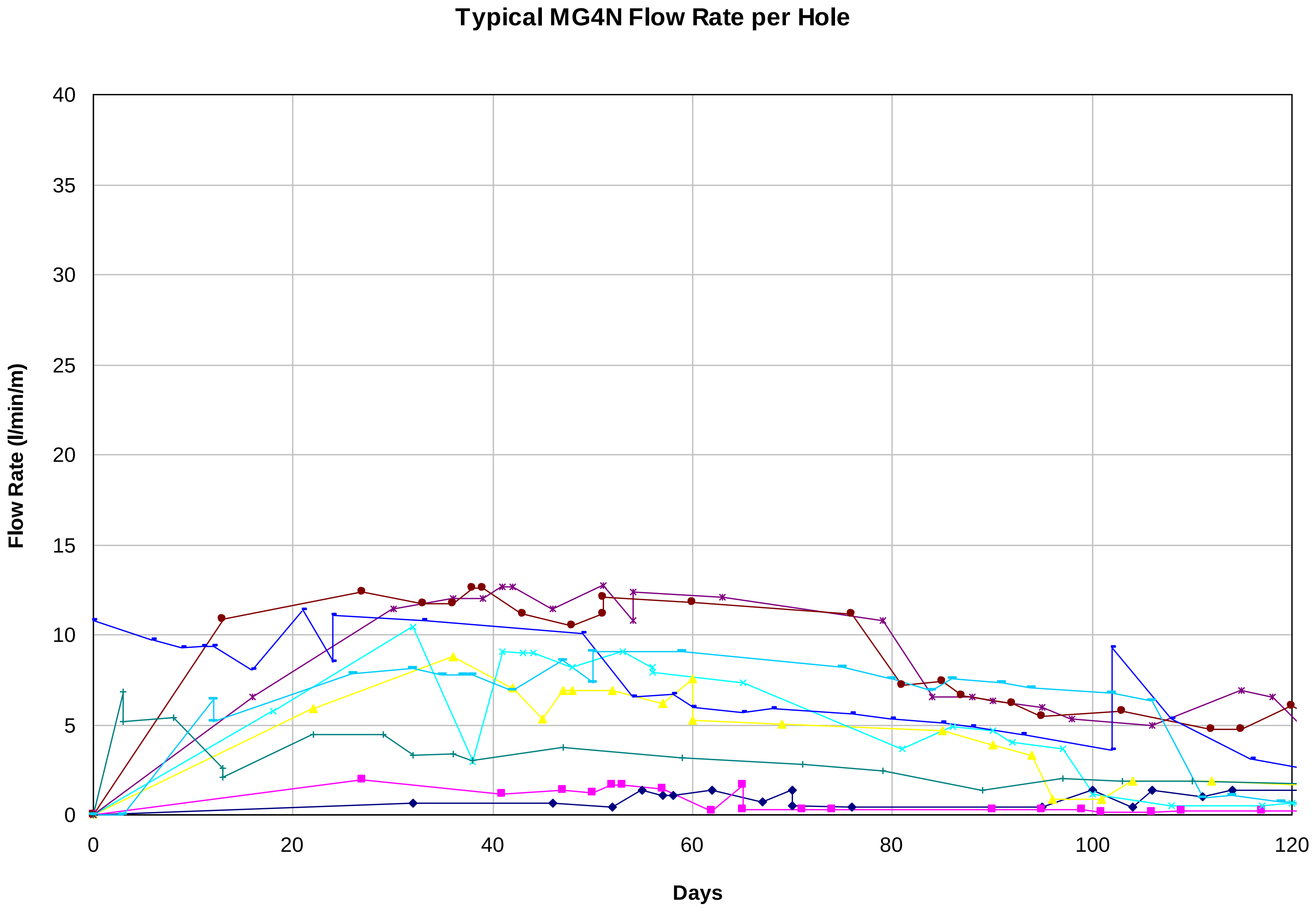


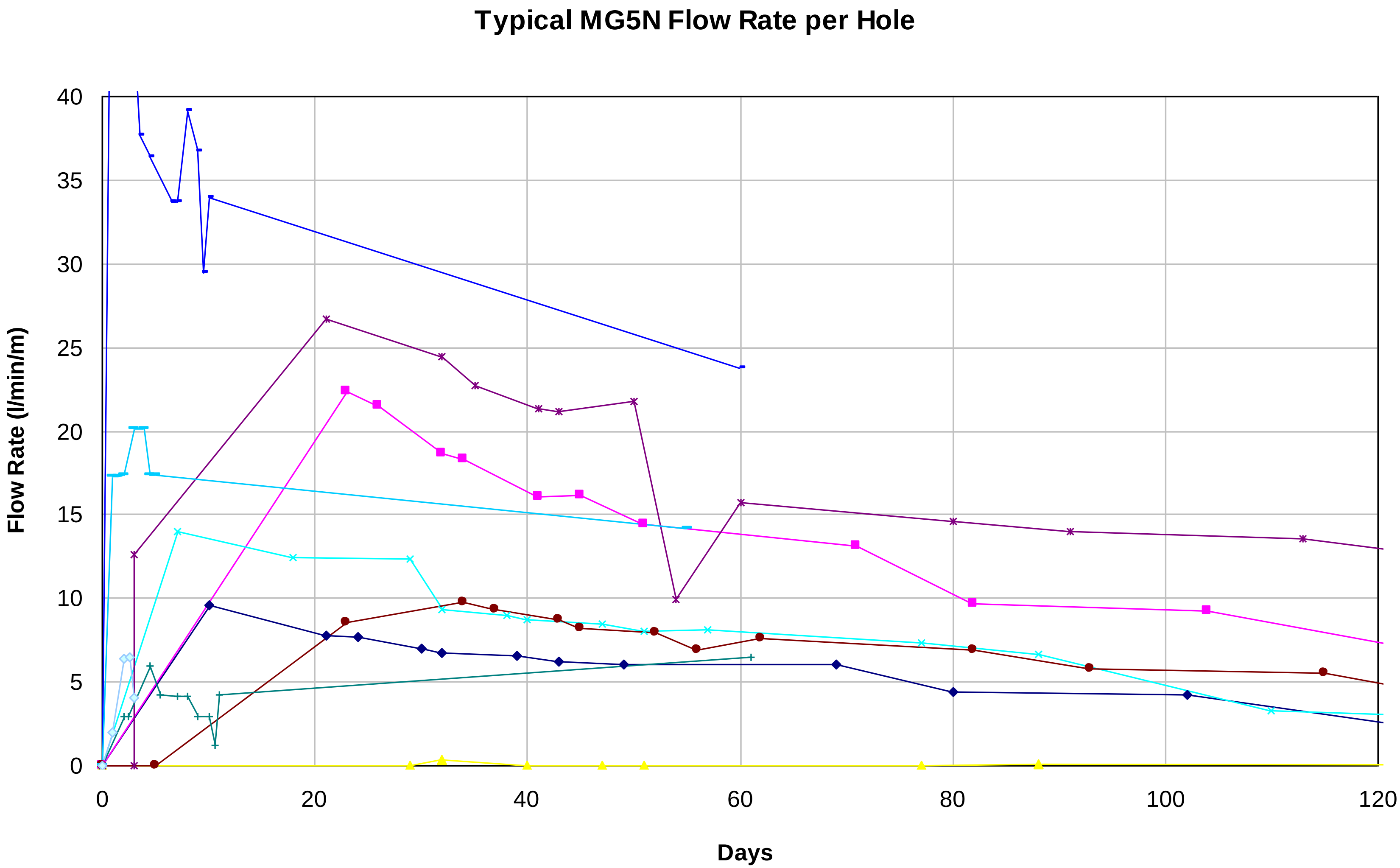
MG5N Clipped
20.00
15.00
10.00
5.00
0.00
-5.00
-10.00
0.00
20.00
40.00
60.00
80.00
100.00
120.00
Flow rates l/m/m
Days
MG5N
Linear (MG5N)

The hole flow graph from each inseam gas drainage hole was then viewed and the hole classified as either Poor, Good or Exceptional flowing.

Poor flowing <5 l/m/m
Good flowing 5-15 l/m/m
Exceptional flowing >15 l/m/m


Typical MG3N Flow Rate per Hole
Flow Rate (l/min/m)
0
5
10
15
20
25
30
35
40
0
20
40
60
80
100
120
Days

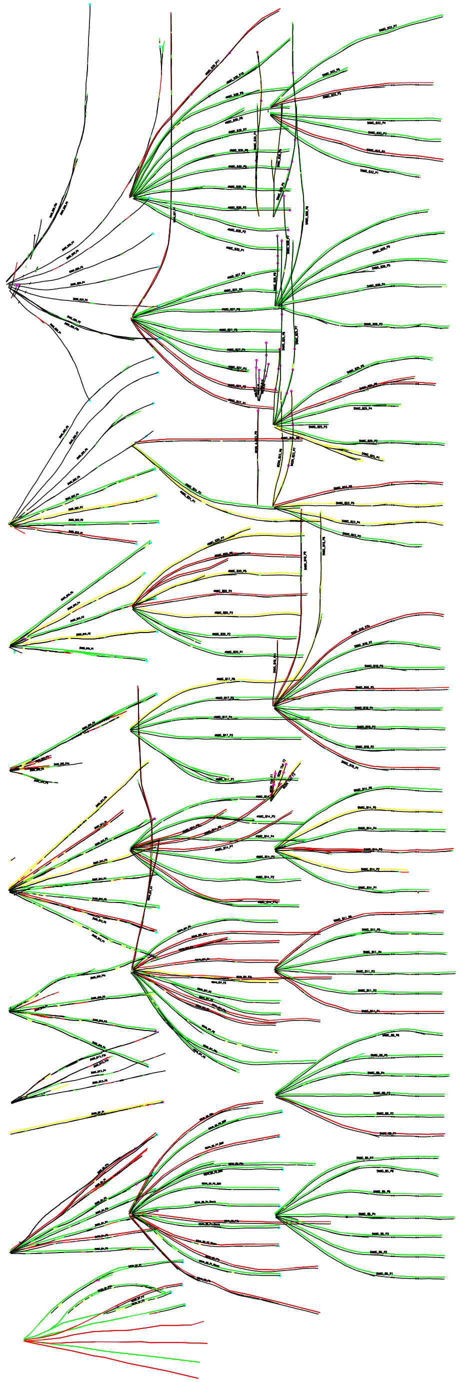

Typical MG4N Flow Rate per Hole
Flow Rate (l/min/m)
40
35
30
25
20
15
10
5
0
0
20
40
60
80
100
120
Days



Typical MG5N Flow Rate per Hole
Flow Rate (l/min/m)
Days
0
5
10
15
20
25
30
35
40
0
20
40
60
80
100
120

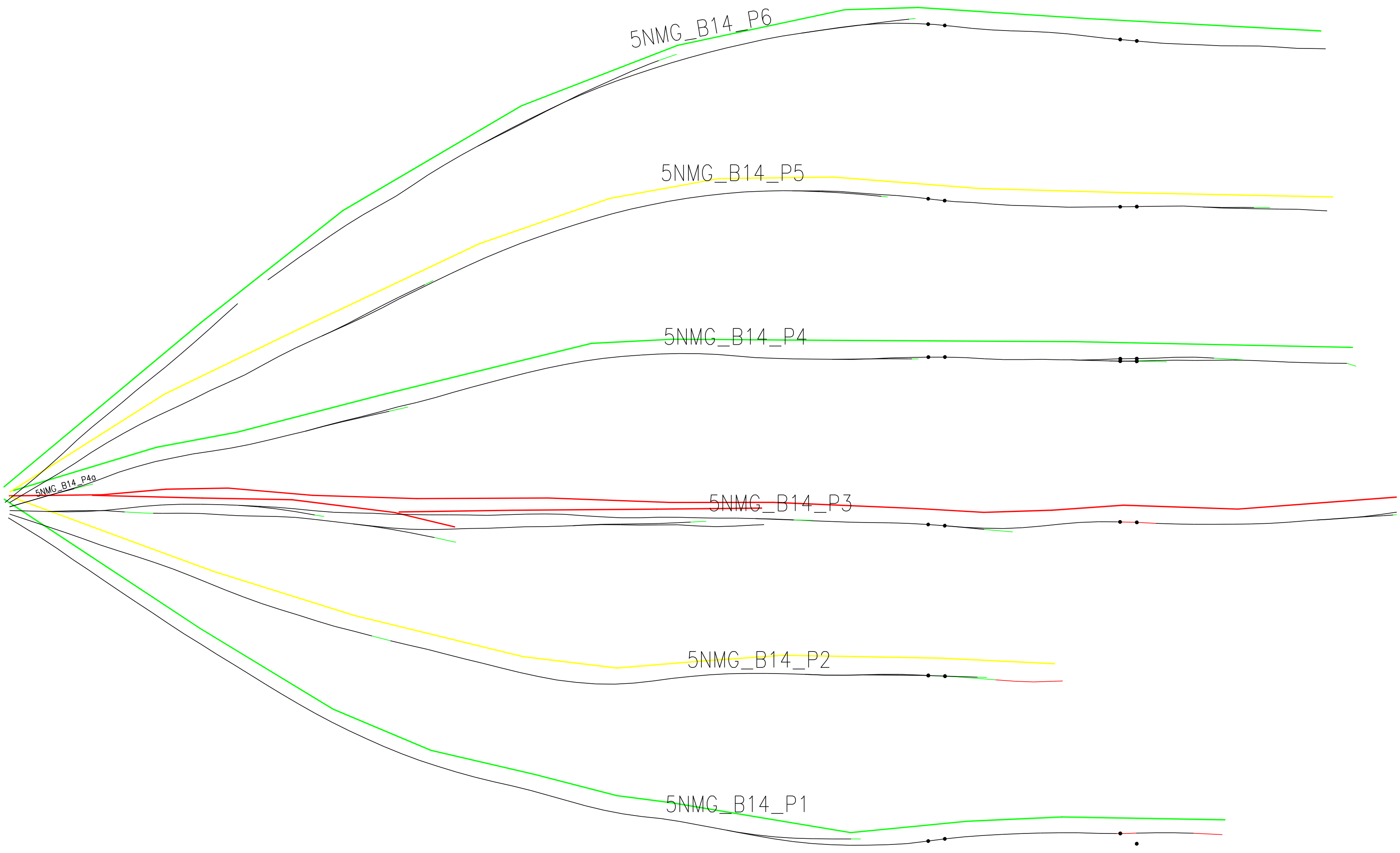
COLOR CODE USED FOR HOLE FLOWS. The length of the hole is plotted in the relative colour

- RED – Poor flowing hole, < 5 l/m/m
- Green – Good flowing hole, 5-15 l/m/m
- Yellow – Exceptional flowing hole, >15 l/m/m



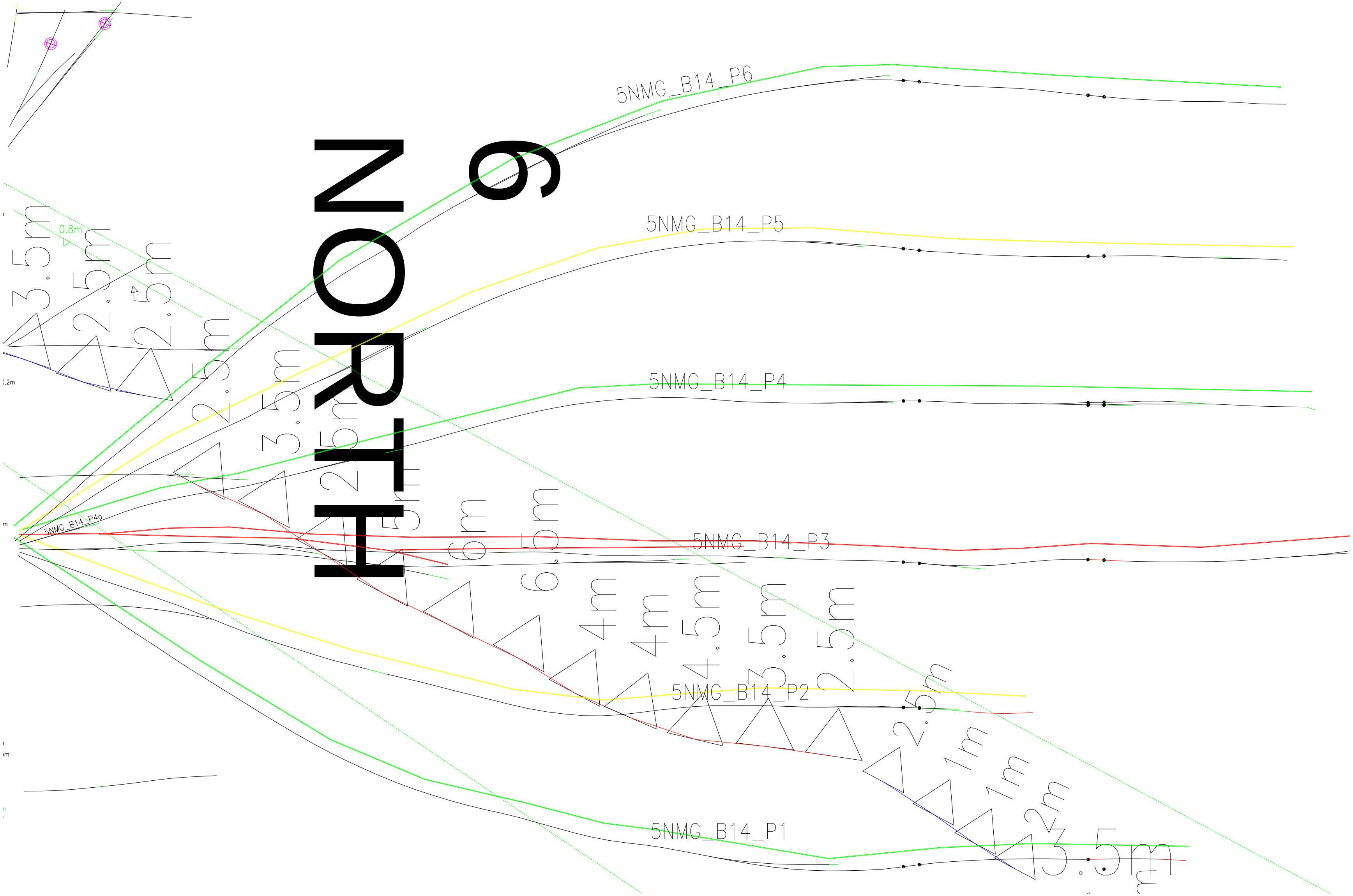
All the coloured hole flows are then plotted 5m North of the inseam holes so as not to overwrite the colour coded geology of the inseam hole

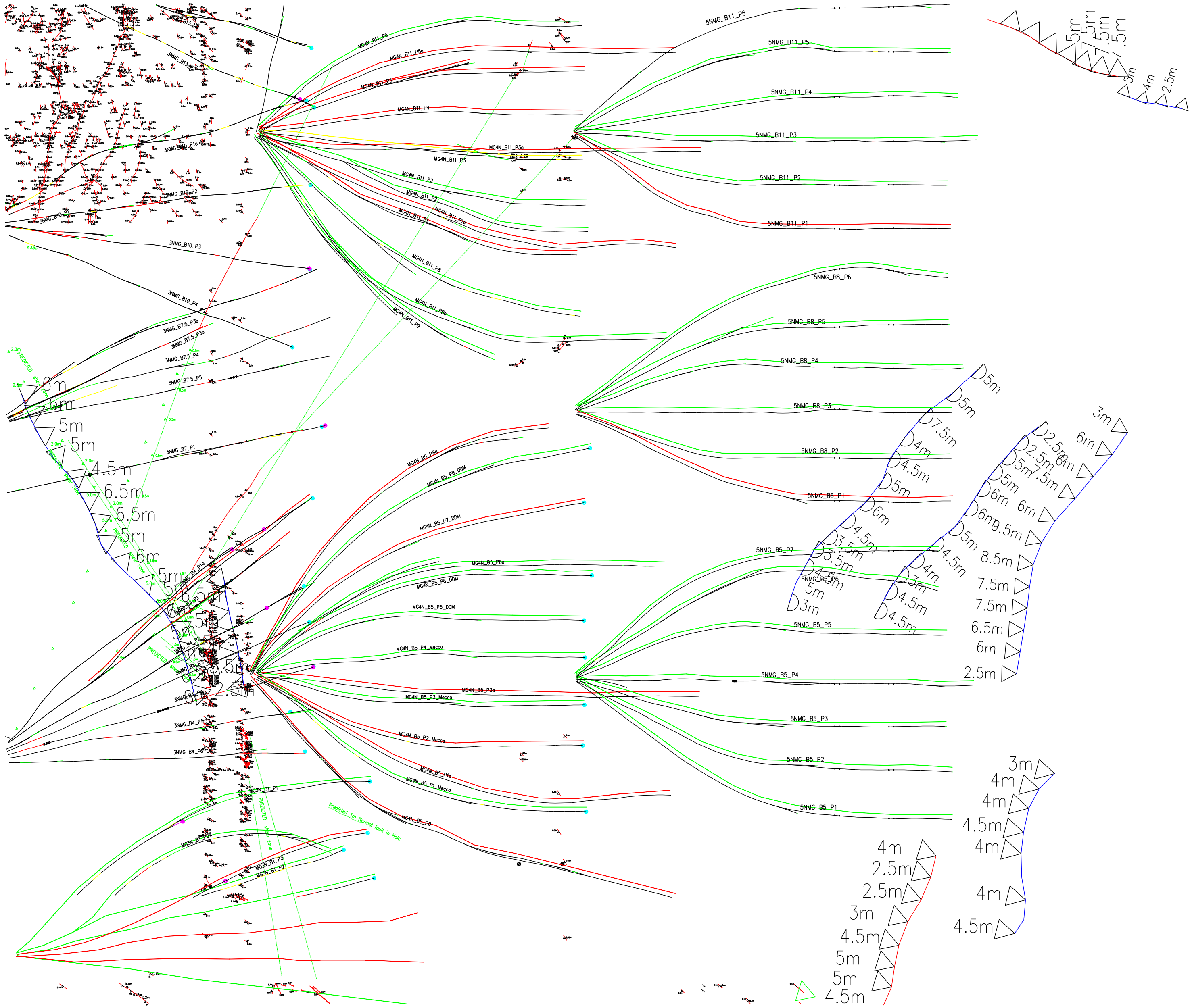
Stub pattern showing coloured flow plots together with coloured geology of inseam holes



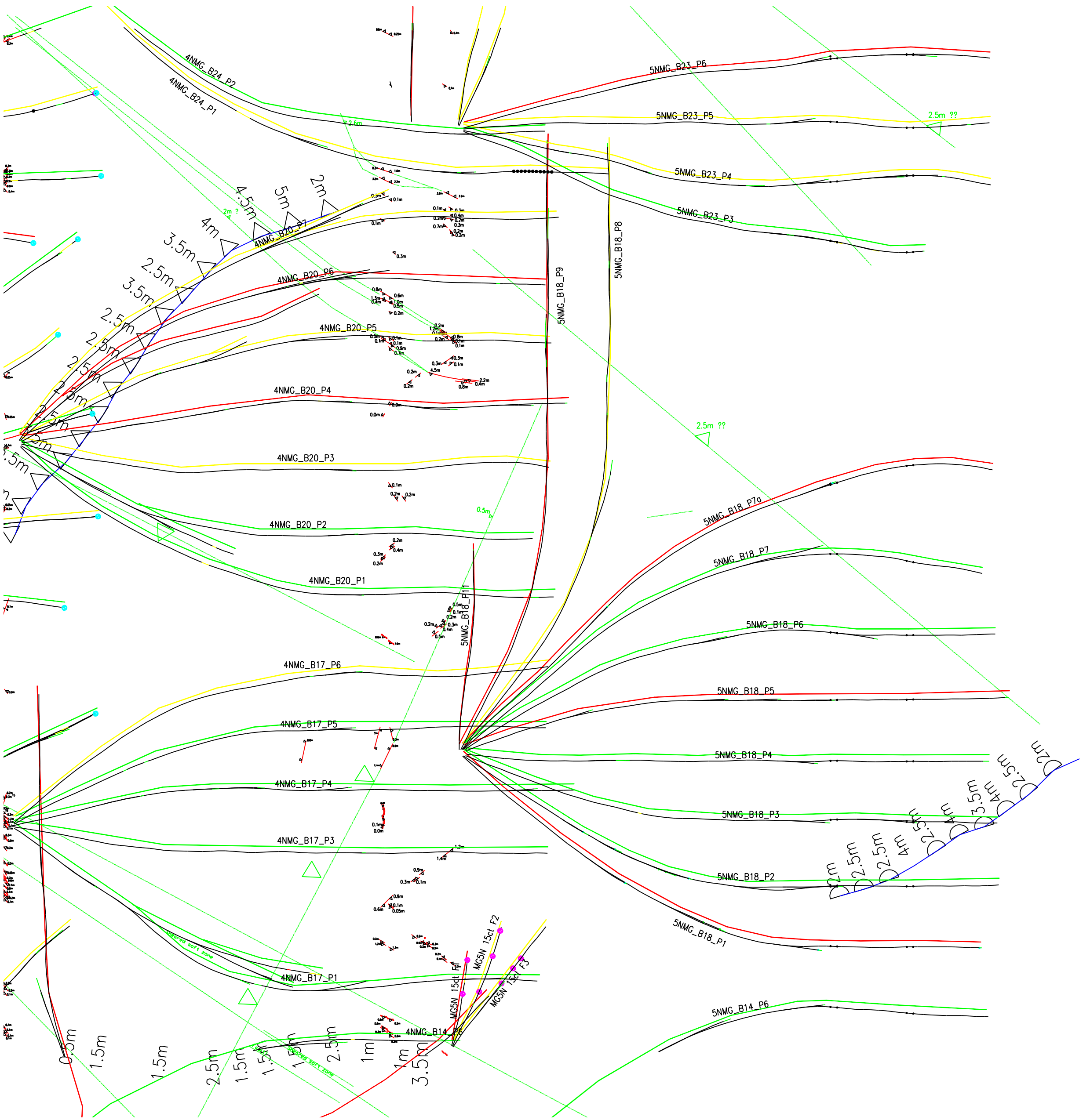
The time had now come to fit the last piece of the puzzle.

The “as mined” geology, interpreted and predicted faulting, seismic deduced faulting and other black magic was overlain on the coloured hole flows.

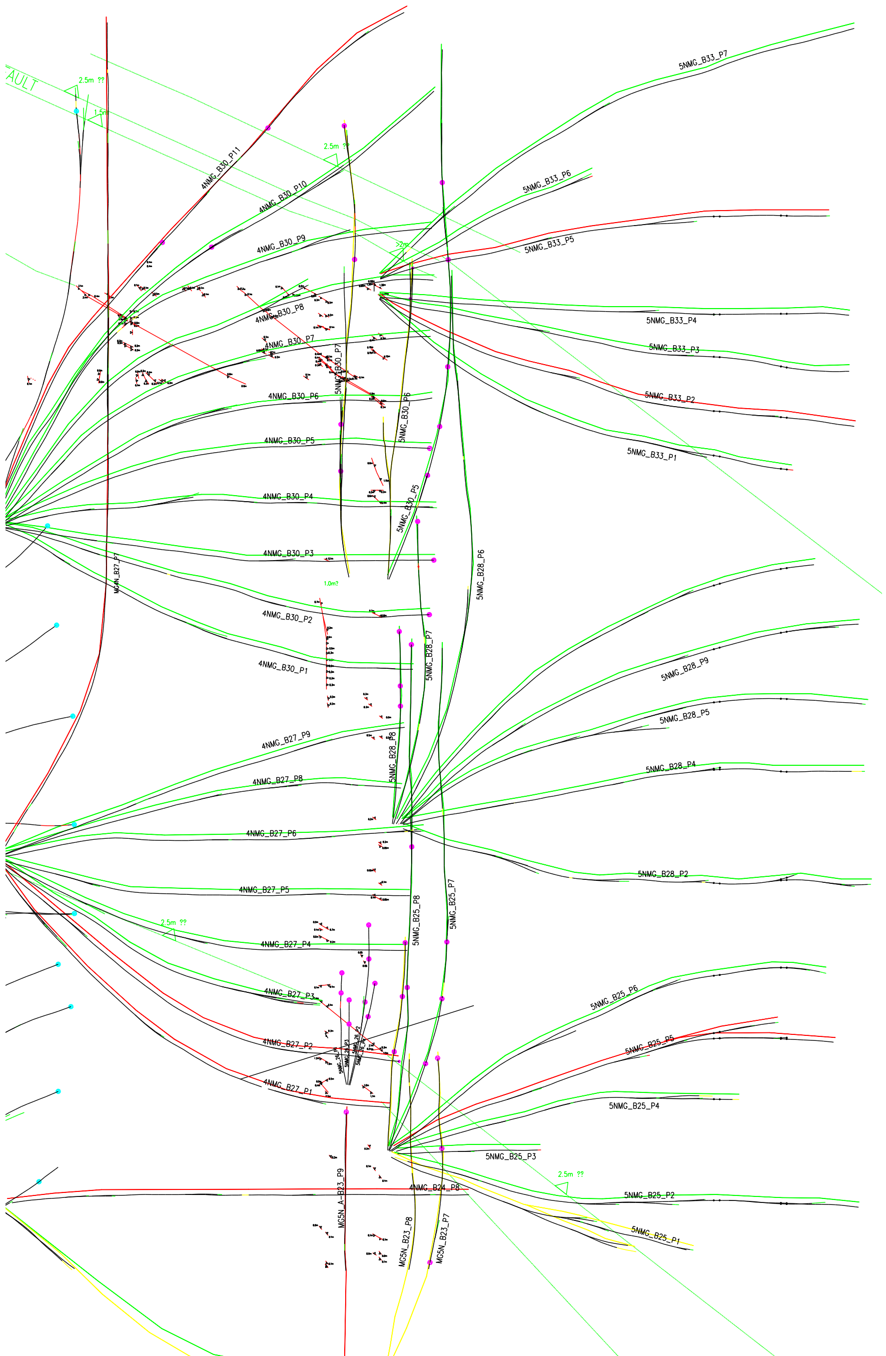

6
NORTH
5NMG_B14_P6
5NMG_B14_P5
5NMG_B14_P4
5NMG_B14_P4a
5NMG_B14_P3
5NMG_B14_P2
5NMG_B14_P1
0.8m



5NMG_B11_P6
5NMG_B11_P5
5NMG_B11_P4
5NMG_B11_P3
5NMG_B11_P2
5NMG_B11_P1
5NMG_B8_P6
5NMG_B8_P5
5NMG_B8_P4
5NMG_B8_P3
5NMG_B8_P2
5NMG_B8_P1
5NMG_B5_P7
5NMG_B5_P5
5NMG_B5_P4
5NMG_B5_P3
5NMG_B5_P2
5NMG_B5_P1
MC4N_B11_P4
MC4N_B11_P3
MC4N_B11_P2
MC4N_B5_P4_Mecco
MC4N_B5_P3_Mecco
MC4N_B5_P2_Mecco
MC4N_B5_P1_Mecco
3NMG_B10_P3
3NMG_B10_P4
3NMG_B7_P1



4NMG_B24_P2
4NMG_B24_P1
5NMG_B23_P6
5NMG_B23_P5
2.5m ??
5NMG_B23_P4
5NMG_B23_P3
4NMG_B20_P7
4NMG_B20_P6
4NMG_B20_P5
4NMG_B20_P4
4NMG_B20_P3
4NMG_B20_P2
4NMG_B20_P1
5NMG_B18_P9
5NMG_B18_P8
2.5m ??
5NMG_B18_P7a
5NMG_B18_P7
5NMG_B18_P6
5NMG_B18_P5
5NMG_B18_P4
5NMG_B18_P3
5NMG_B18_P2
5NMG_B18_P1
4NMG_B17_P6
4NMG_B17_P5
4NMG_B17_P4
4NMG_B17_P3
4NMG_B17_P1
4NMG_B14_P6
5NMG_B14_P6
MC5N 15cl F1
MC5N 15cl F2
MC5N 15cl F3



2.5m ??
5NMG_B33_P7
4NMG_B30_P11
4NMG_B30_P10
5NMG_B33_P6
4NMG_B30_P9
5NMG_B33_P5
5NMG_B33_P4
4NMG_B30_P8
4NMG_B30_P7
5NMG_B30_P7
5NMG_B33_P3
4NMG_B30_P6
5NMG_B30_P6
5NMG_B33_P2
4NMG_B30_P5
5NMG_B33_P1
4NMG_B30_P4
5NMG_B30_P5
4NMG_B30_P3
MG5N_B27_P7
5NMG_B28_P6
4NMG_B30_P2
4NMG_B30_P1
5NMG_B28_P7
5NMG_B28_P9
5NMG_B28_P5
4NMG_B27_P9
5NMG_B28_P8
4NMG_B27_P8
5NMG_B28_P4
4NMG_B27_P6
4NMG_B27_P5
5NMG_B28_P2
5NMG_B25_P8
5NMG_B25_P7
2.5m ??
4NMG_B27_P4
4NMG_B27_P3
5NMG_B25_P6
4NMG_B27_P2
5NMG_B25_P5
4NMG_B27_P1
5NMG_B25_P4
5NMG_B25_P3
2.5m ??
MG5N_A-B23_P9
4NMG_B24_P8
5NMG_B25_P2
5NMG_B25_P1
MG5N_B23_P8
MG5N_B23_P7

Bugger!

Where’s the obvious structural control on the hole flows?

A reasonable expectation would have been to have all the holes which cross a main fault to have similar flow characteristics.

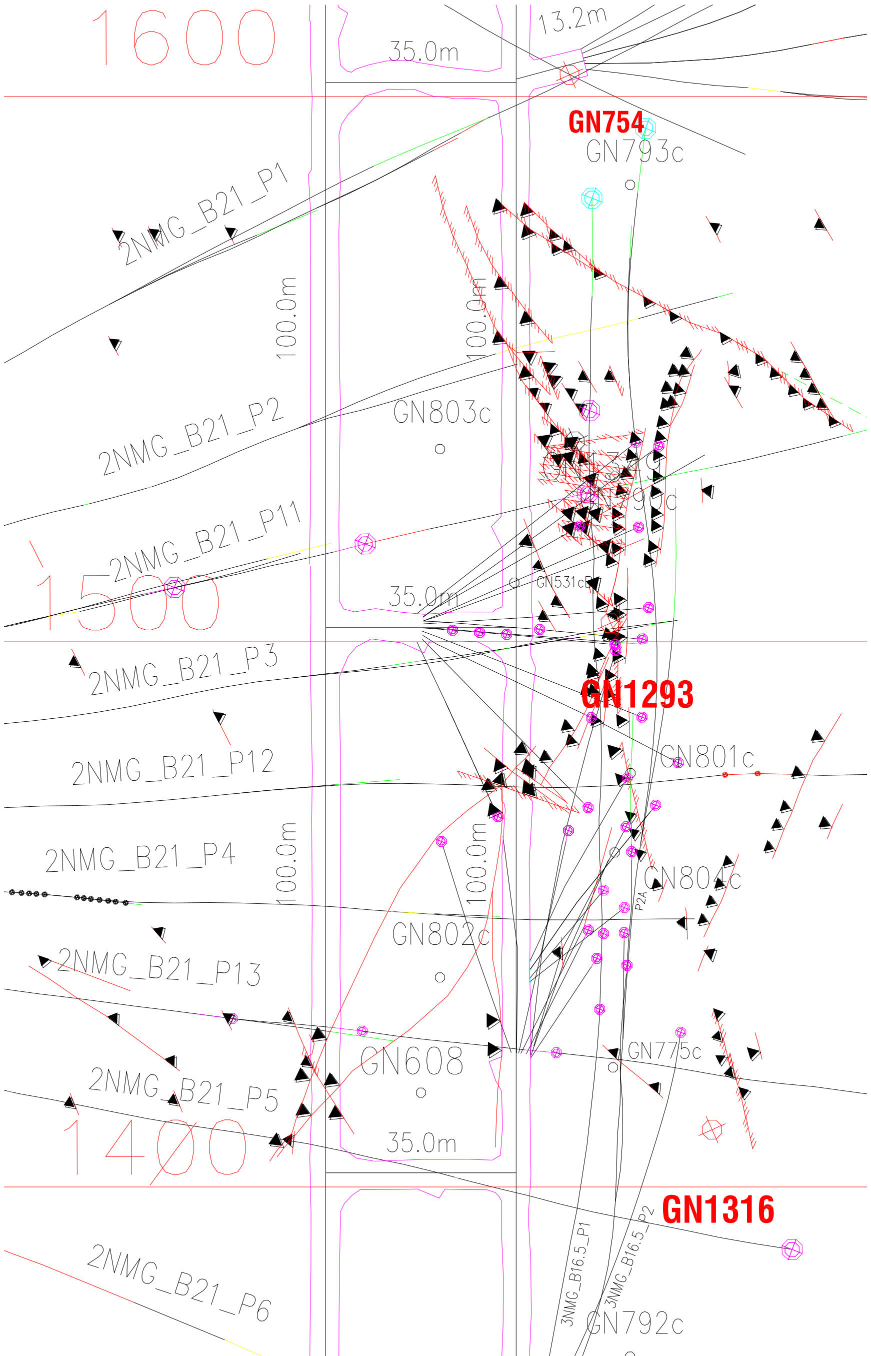
But No; some are good, some exceptional and some just plain dogs. The same split occurs in unfaulted stub patterns (if there is such a thing at NG).

Larger scale faulting does not seem to provide the uniform control on hole gas flows and therefore permeability.

What else is there?

From past experience at North Goonyella (and most other mines), shear zones which contain mylonite have created some degree of impermeable barriers to conventional wider spaced gas drainage.

Unfortunately these zones can result in the following; firstly they can release gas so strongly that hole completion and installation of dewatering lines is compromised meaning that the zone is not drained adequately with wider spaced drilling or; the hole is completed and lined, but the zone is so soft and weak that the fines clog the hole resulting in low drainage flow rates unless the hole is rigorously maintained and monitored.



Typical shear zone area showing the need to drill many close spaced short holes to drain the area of gas. The location of these zones is often only obvious when gas conformance cores are drilled to test the effectiveness of gas drainage

(and the cores fail!).

It would seem that the only real structural control on the effectiveness of gas drainage at North Goonyella is from the mylonite lined shear zones. Identification of these zones can be enhanced by colour coding the geology in the inseam holes and plotting them to give an estimate of the location and extent of these zones.

The ultimate test of the effectiveness of the gas drainage will still be by the placement of gas conformance cores in the "worst" locations. Good practice is to pick the worst spot, estimate what the gas core result should be based on the hole flows, and then see if the core matches the estimate.

If that doesn't work, then drill more holes and …..

NEVER GIVE UP !!!

- Complex areas are easier to visualize resulting in better structural interpretation