



Muir Associates (UK) Limited

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Job No. 1132-22		
Sheet no. 1		
Date 21/11/22		
By MJ	Checked	Reviewed

MasterDrain
SW

Project
Knowsley East Hub

Title
Surface Water Drainage Design 1 in 100 + 40%

Using in-line restrictors
Return period = 100 yrs
Climate change factor = 40

PEAK hydrograph values printed
Storm duration = 15 mins
No offline storage

Mean rain intens. 131.00 mm/hr
Storm profile = Summer
Using FSR data

Peak rain intens. 513.52 mm/hr
Sample period = 7.5 secs.

Entry No.	SECT. No.	MANHOLE REF	PIPE CAPACITY l/s	RATE FLOW l/s	PIPE SIZE mm	CHAMBER DIAM/LxW mm	INVERT LEVEL m	WATER LEVEL m	GRND LEVEL m	SURCHARGE fract.	Depth	EXCESS FLOW l/s	FLOODED VOL m³	DRAINED AREA (m²) :x FACTOR :	STATUS
1	I	1.01 S-MH-01	42.1	32.5	225	1200	43.85	44.02	44.80	0.77	0.16	0.00	0.000	527	OK
2	I	1.02 S-MH-02	77.8	97.3	300	1200	43.58	44.01	44.80	1.25	0.43	19.48	0.000	1579	Surch.
3	I	1.03 S-MH-03	78.4	129.8	300	1200	43.43	44.07	44.80	1.66	0.64	51.38	0.000	2106	Surch.
4	I	1.04 S-MH-04	78.0	129.8	300	1500	43.30	43.82	44.60	1.66	0.52	51.78	0.000	2106	Surch.
5	B	2.01 S-MH-09	184.0	65.6	450	1500	43.08	43.25	44.35	0.36	0.17	0.00	0.000	1065	OK
6	B	2.02 S-MH-10	184.9	219.4	450	1500	42.99	43.59	44.35	1.19	0.60	34.41	0.000	3560	Surch.
7	B	2.03 S-MH-12	398.2	219.4	450	1500	42.87	43.11	44.35	0.55	0.24	0.00	0.000	3560	OK
8	I	1.05 S-MH-05	227.8	349.1	450	1500	42.79	43.76	44.42	1.53	0.97	121.36	0.000	5666	Surch.
9	B	3.01 S-MH-13	42.1	32.5	225	1200	43.90	44.06	44.80	0.77	0.16	0.00	0.000	527	OK
10	B	3.02 S-MH-14	95.8	97.5	300	1200	43.70	44.01	44.80	1.02	0.31	1.71	0.000	1582	Surch.
11	B	3.03 S-MH-15	298.4	130.0	300	1200	43.47	43.61	44.92	0.44	0.14	0.00	0.000	2109	OK
12	I	1.06 S-MH-06‡	14.6	4.8	150	1500	42.72	42.77	44.75	0.33	0.05	0.00	0.000	7775	OK
13	I	1.07 S-MH-07	14.6	0.0	150	1200	42.65	42.66	44.35	0.00	0.00	0.00	0.000	0	OK
14	I	1.08 S-MH-08	18.6	0.0	150	1200	42.40	42.40	44.46	0.00	0.00	0.00	0.000	0	OK



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Notes

Printout headings

- | | | |
|---|---|--|
| 1) Entry no - position in file | 2) Section no - pipe identifier | 3) Manhole ref - Manhole identifier |
| 4) Pipe cap - full bore capacity of that pipe | 5) Rate of flow - calculated flow rate (l/s) ± = flow restrictor. | 6) Pipe diam - outlet pipe diameter (mm) |
| 7) Chamber diam - chamber diam. at base of MH | 8) Invert level - invert level of manhole | 9) Water level - calculated peak water level. |
| 10) Grnd level - ground / cover level | 11) Surch. fract - calc.flow/pipe capacity | 12) Surch. depth - surcharge level above soffit |
| 13) Overflow - surcharged flow rate (l/s) | 14) Flooded vol - volume of water above cover | 15) Upstrm Vol - upstream pipe vol to previous manhole(s) |
| 16) Status - OK - outlet not surcharged | 17) Status - Surcharged - outlet surcharged | 18) Status - Warning - water level within 299mm of cover level |
| 19) Status - Flooded - cover over-topped | 20) § against diameter indicates throttle pipe used. | |

Title box

Hydrograph data

- | | | |
|---|--------------------------------------|--|
| 1) Ret. period - that used to calculate profile | 2) Duration - length of storm (mins) | 3) Profile - either Winter (75%) or Summer (50%) |
|---|--------------------------------------|--|

Flow restrictors

Manhole reference - S-MH-06

Restrictor flowrate - 4.83 l/s



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Job No.
1132-22

Sheet no.
3

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21/11/22

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MJ

Checked

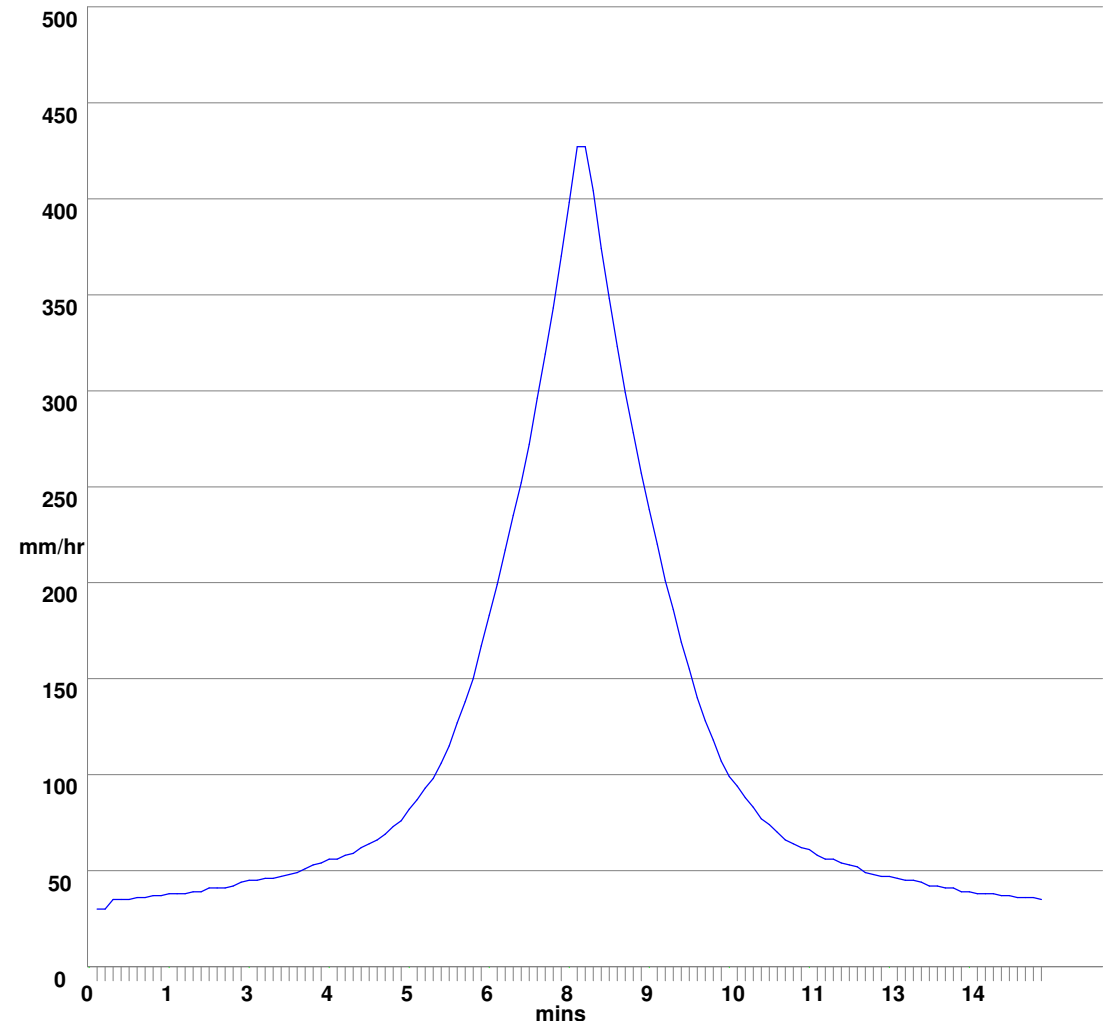
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Time mins	Rain mm/hr	Time mins	Rain mm/hr	Time mins	Rain mm/hr
0:08	30.47	5:08	87.06	10:08	93.59
0:15	30.47	5:15	92.51	10:15	88.15
0:22	34.83	5:22	97.95	10:22	82.71
0:30	34.83	5:30	105.57	10:30	77.27
0:38	34.83	5:38	115.36	10:38	74.01
0:45	35.91	5:45	127.33	10:45	69.65
0:52	35.91	5:52	138.22	10:52	66.39
1:00	37.00	6:00	150.19	11:00	64.21
1:08	37.00	6:08	166.51	11:08	62.03
1:15	38.09	6:15	182.84	11:15	60.95
1:22	38.09	6:22	199.16	11:22	57.68
1:30	38.09	6:30	216.57	11:30	55.50
1:38	39.18	6:38	235.07	11:38	55.50
1:45	39.18	6:45	252.49	11:45	54.42
1:52	41.36	6:52	272.08	11:52	53.33
2:00	41.36	7:00	296.02	12:00	52.24
2:08	41.36	7:08	318.87	12:08	48.97
2:15	42.44	7:15	342.82	12:15	47.89
2:22	43.53	7:22	370.03	12:22	46.80
2:30	44.62	7:30	398.32	12:30	46.80
2:38	44.62	7:38	426.62	12:38	45.71
2:45	45.71	7:45	426.62	12:45	44.62
2:52	45.71	7:52	403.76	12:52	44.62
3:00	46.80	8:00	374.38	13:00	43.53
3:08	47.89	8:08	348.26	13:08	42.44
3:15	48.97	8:15	323.23	13:15	42.44
3:22	51.15	8:22	299.29	13:22	41.36
3:30	53.33	8:30	277.52	13:30	41.36
3:38	54.42	8:38	256.84	13:38	39.18
3:45	55.50	8:45	238.34	13:45	39.18
3:52	55.50	8:52	219.84	13:52	38.09
4:00	57.68	9:00	201.34	14:00	38.09
4:08	58.77	9:08	186.10	14:08	38.09
4:15	62.03	9:15	168.69	14:15	37.00
4:22	64.21	9:22	154.54	14:22	37.00
4:30	66.39	9:30	140.39	14:30	35.91
4:38	68.56	9:38	128.42	14:38	35.91
4:45	72.92	9:45	117.54	14:45	35.91
4:52	76.18	9:52	106.65	14:52	34.83
5:00	81.62	10:00	99.04	15:00	34.83

Hydrograph profile derived from data in the Flood Studies Report

Return period= 100 yrs Duration= 15 mins Profile - summer





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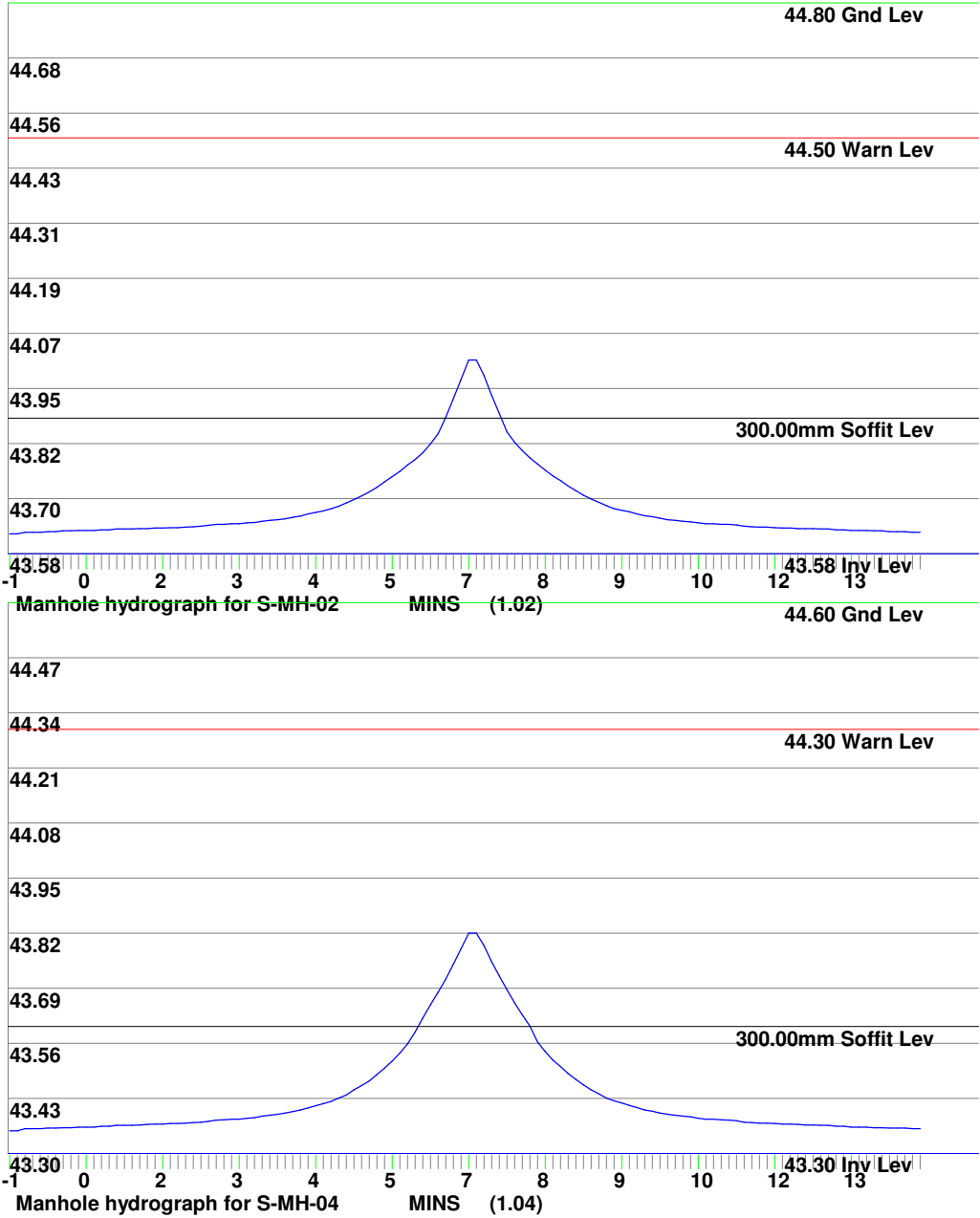
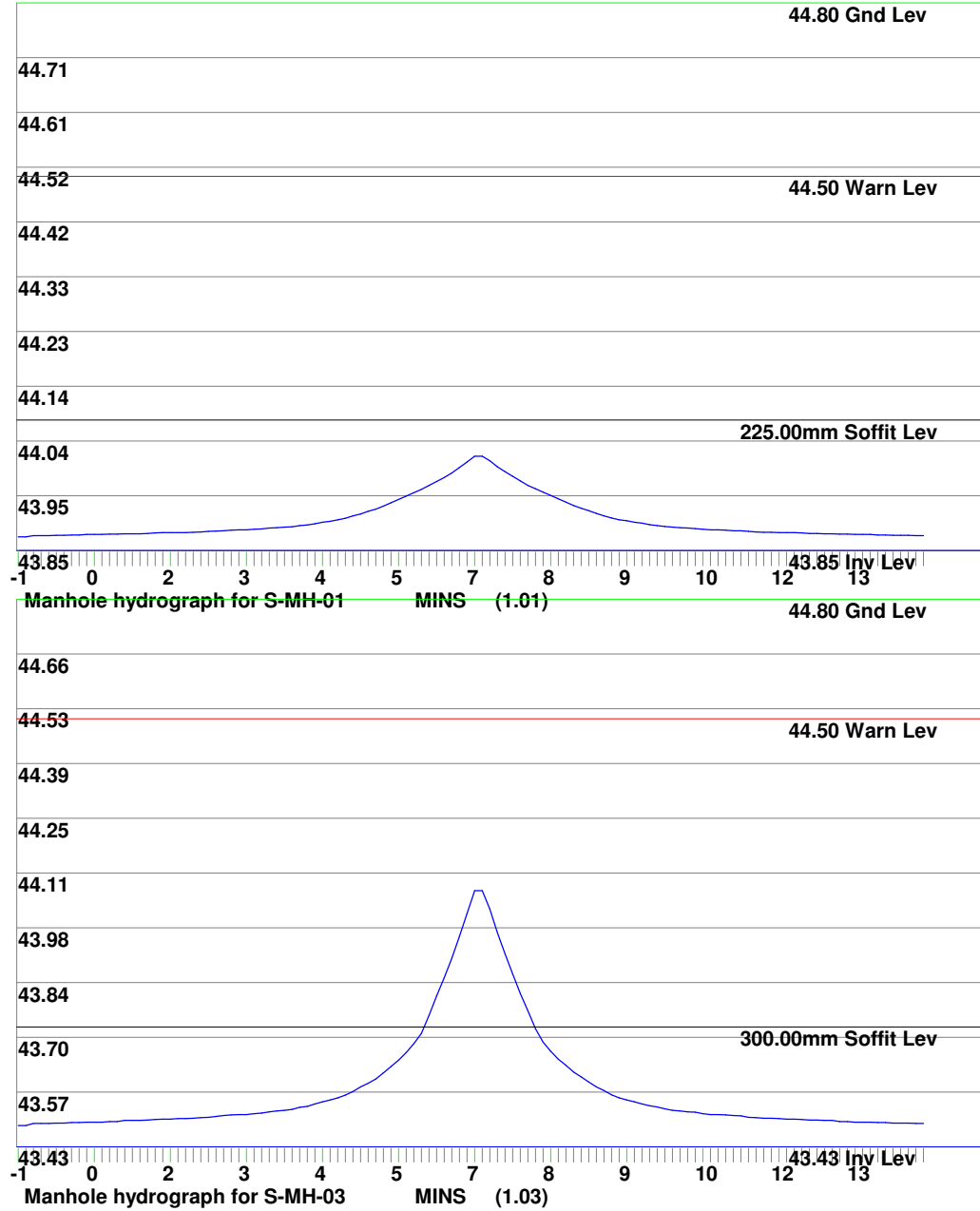
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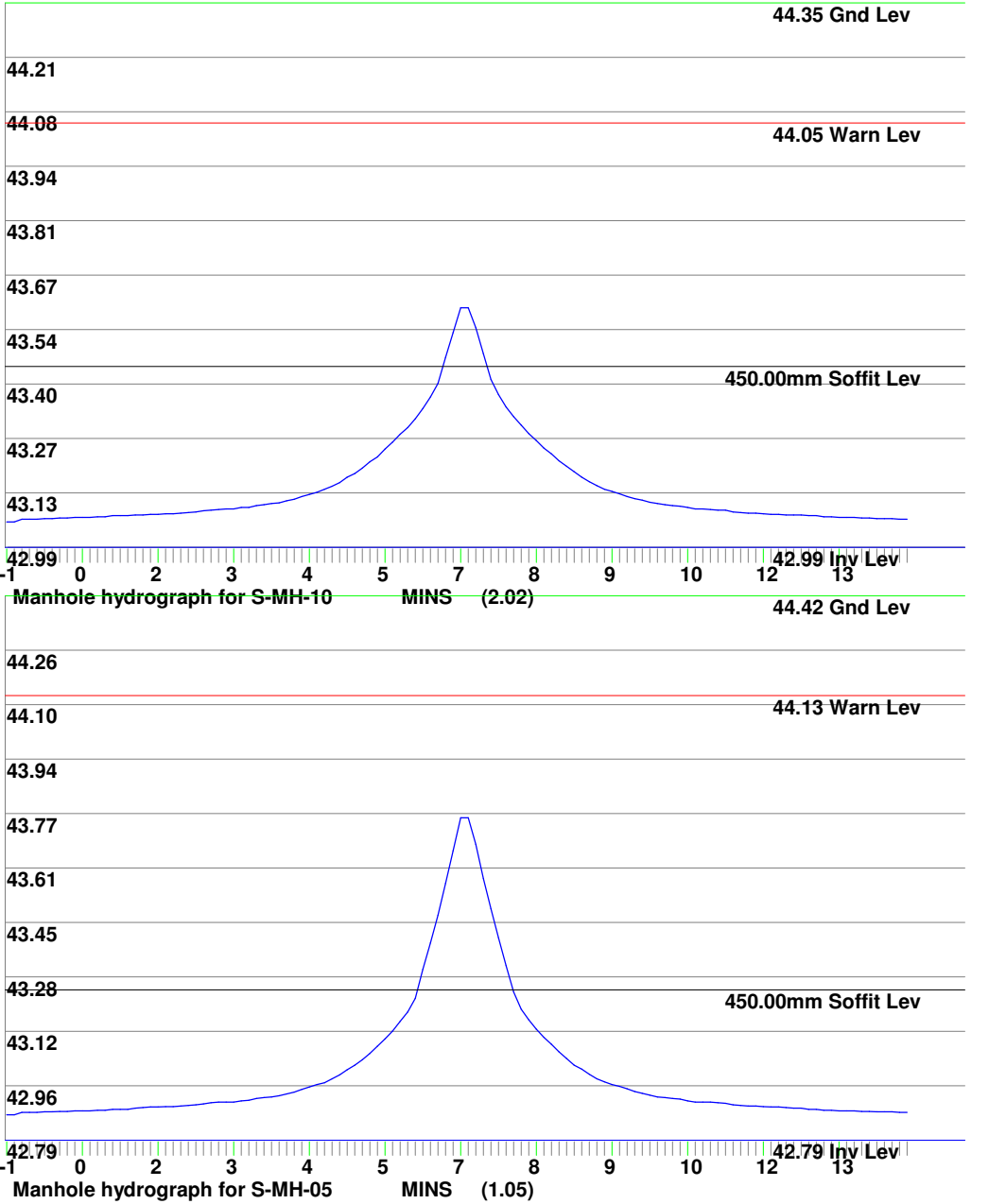
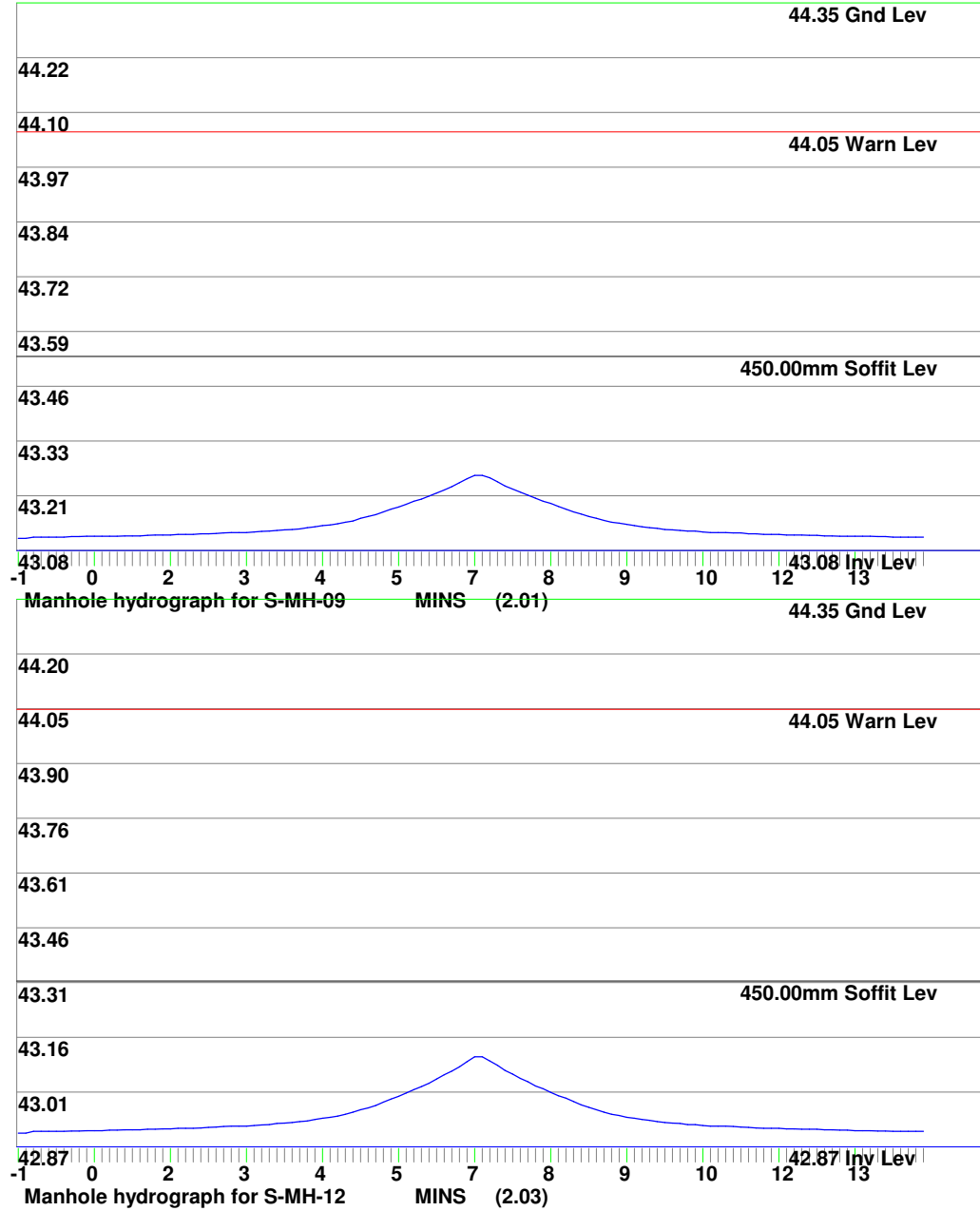
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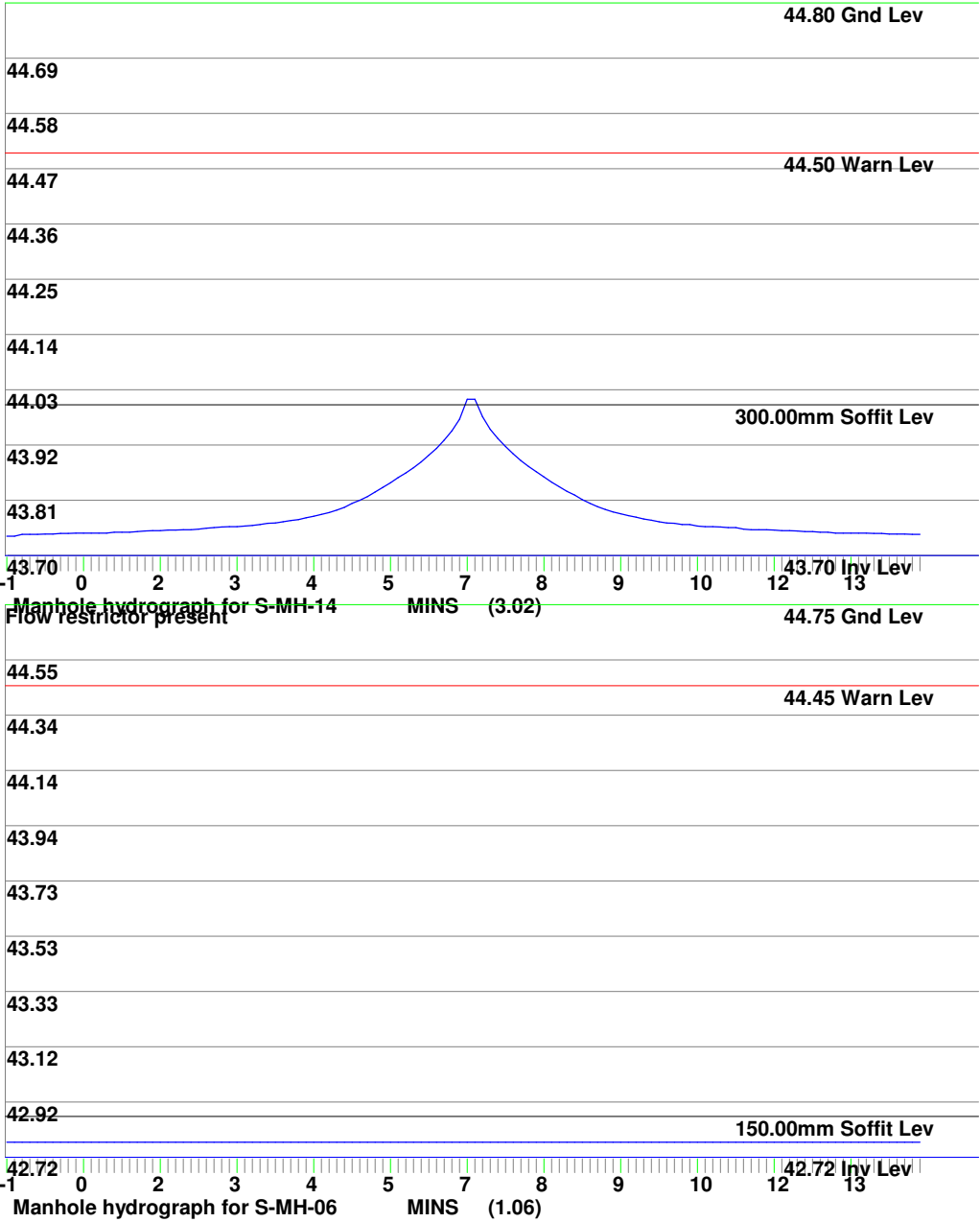
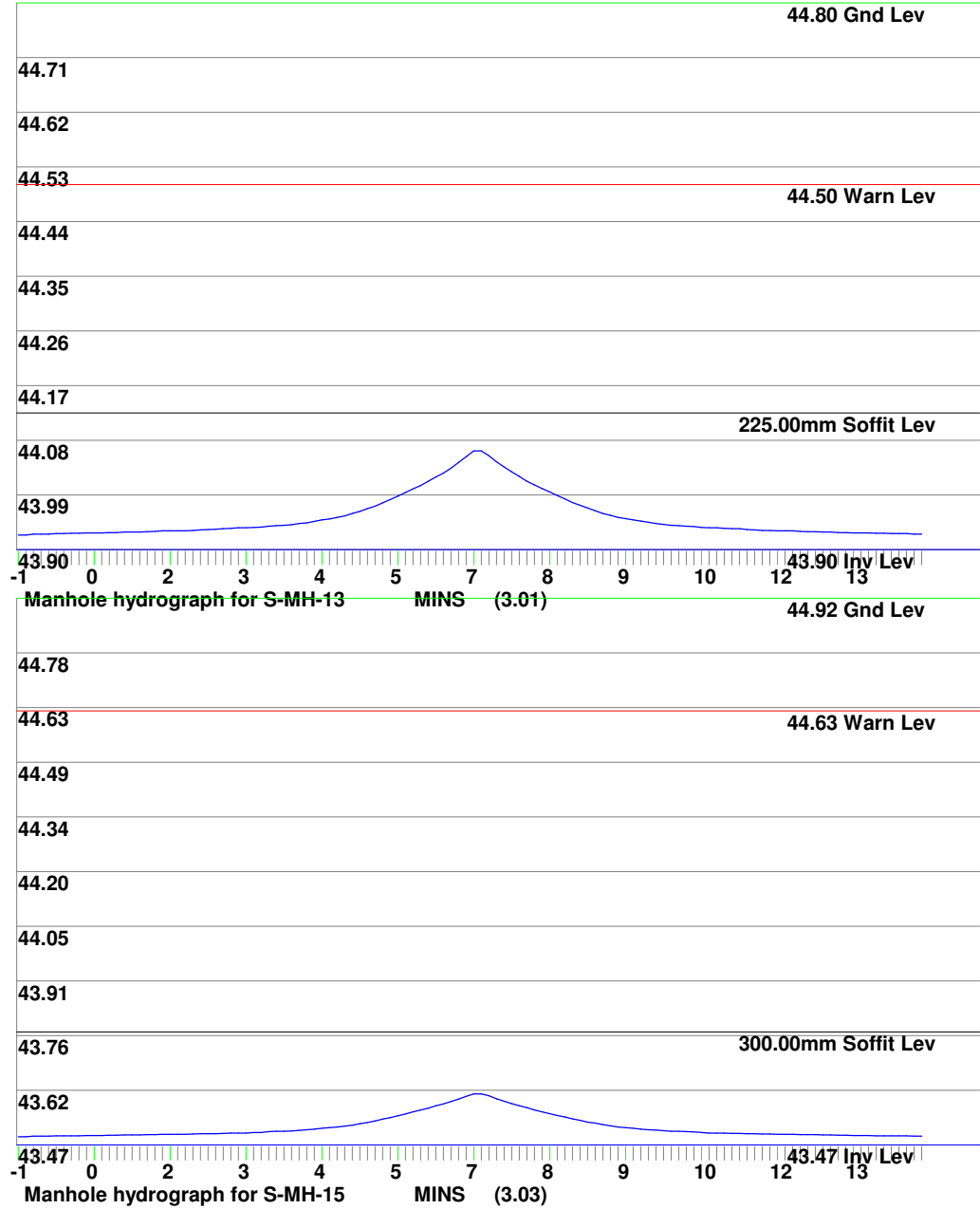
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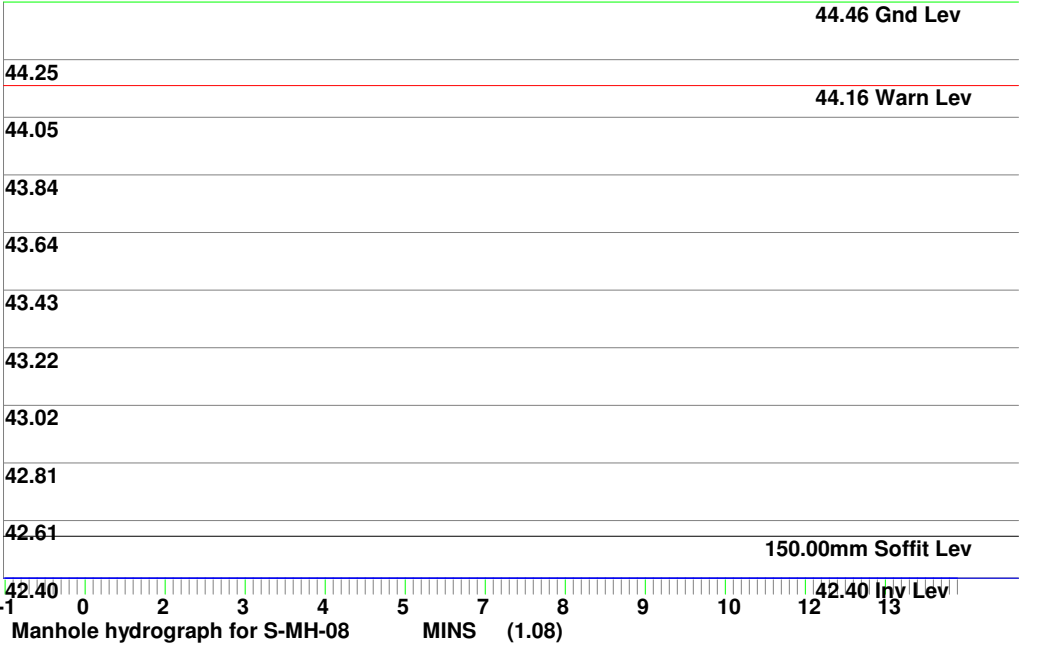
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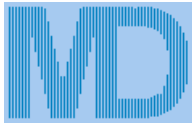
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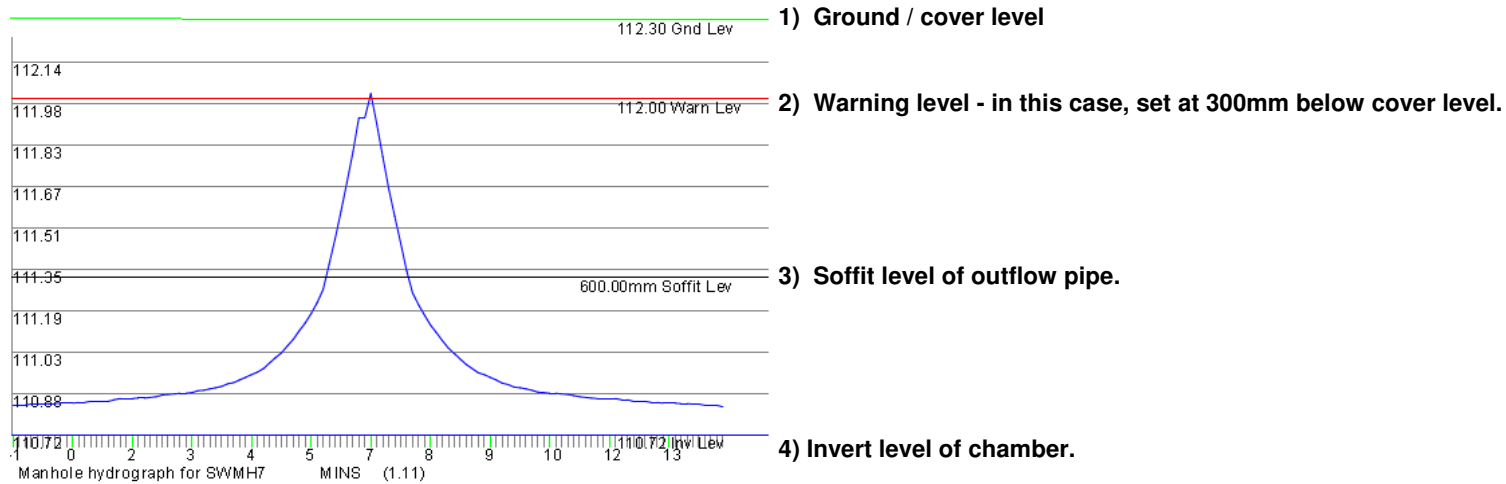
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- Notes**
- a) Lower section of the graph shows the water depth filling the channel. Channel is assumed to be a full pipe diameter in depth.
 - b) Upper section of the graph shows the water depth filling the chamber. Chamber has a greater width/diameter than the channel, so increases in depth are proportionally less.
 - c) The top of the graph clips the warning level and would be marked thus on the printout.
 - d) In many cases the invert of the offline storage is required to enter at the channel soffit level, meaning that the pipe will still surcharge but flooding risk reduced.
 - e) The diagram above is a general one and is not part of the current calculation.