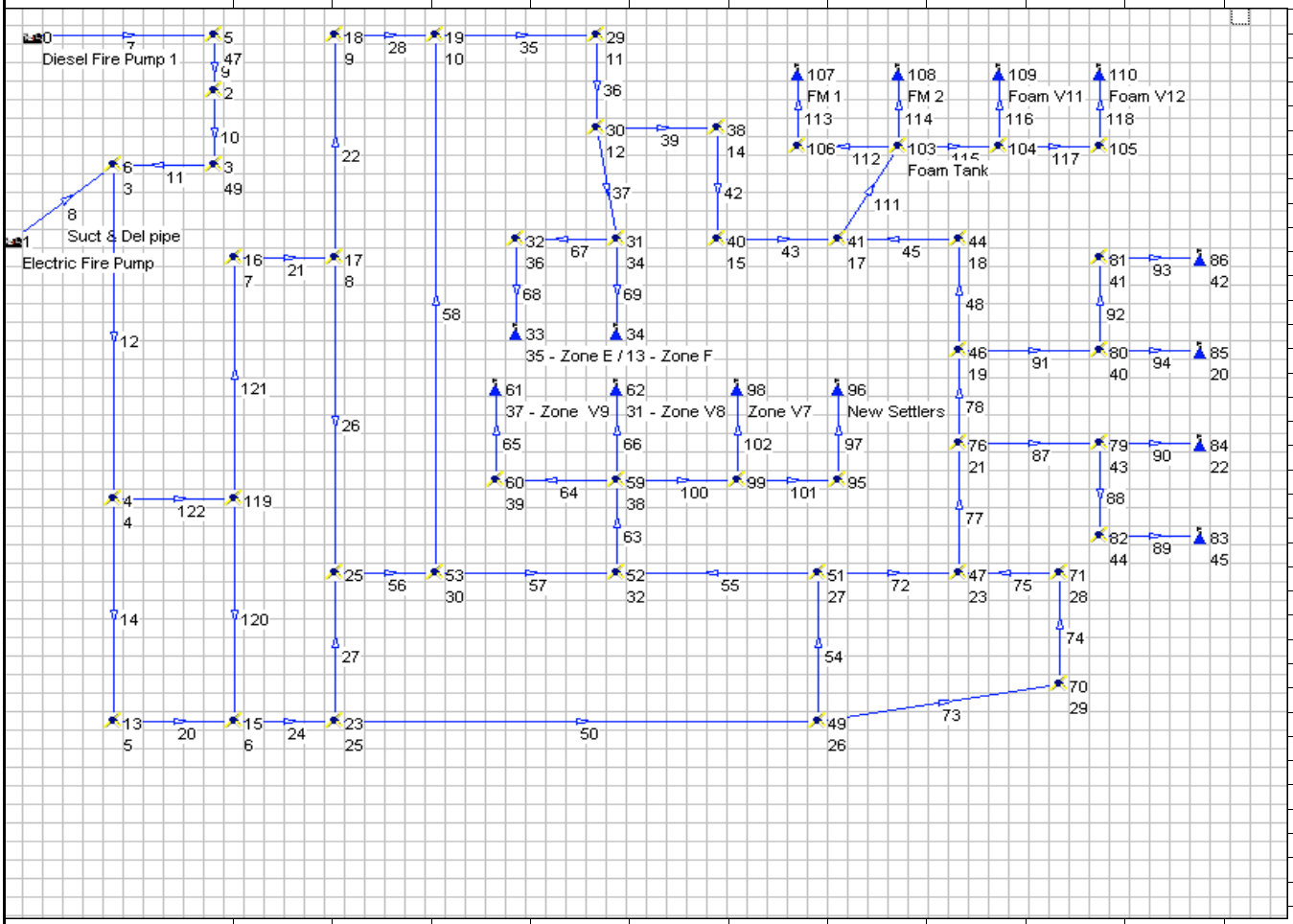
Helix Technologies	**Project No : PBK633**	Date	9-Mar-04							
Client	**Bulong Nickel Project**									
Prepared By	P.C Burrow			Rev P1						
Title	Fire Water Spray System Design Review - Scenario W1 with new pipe									



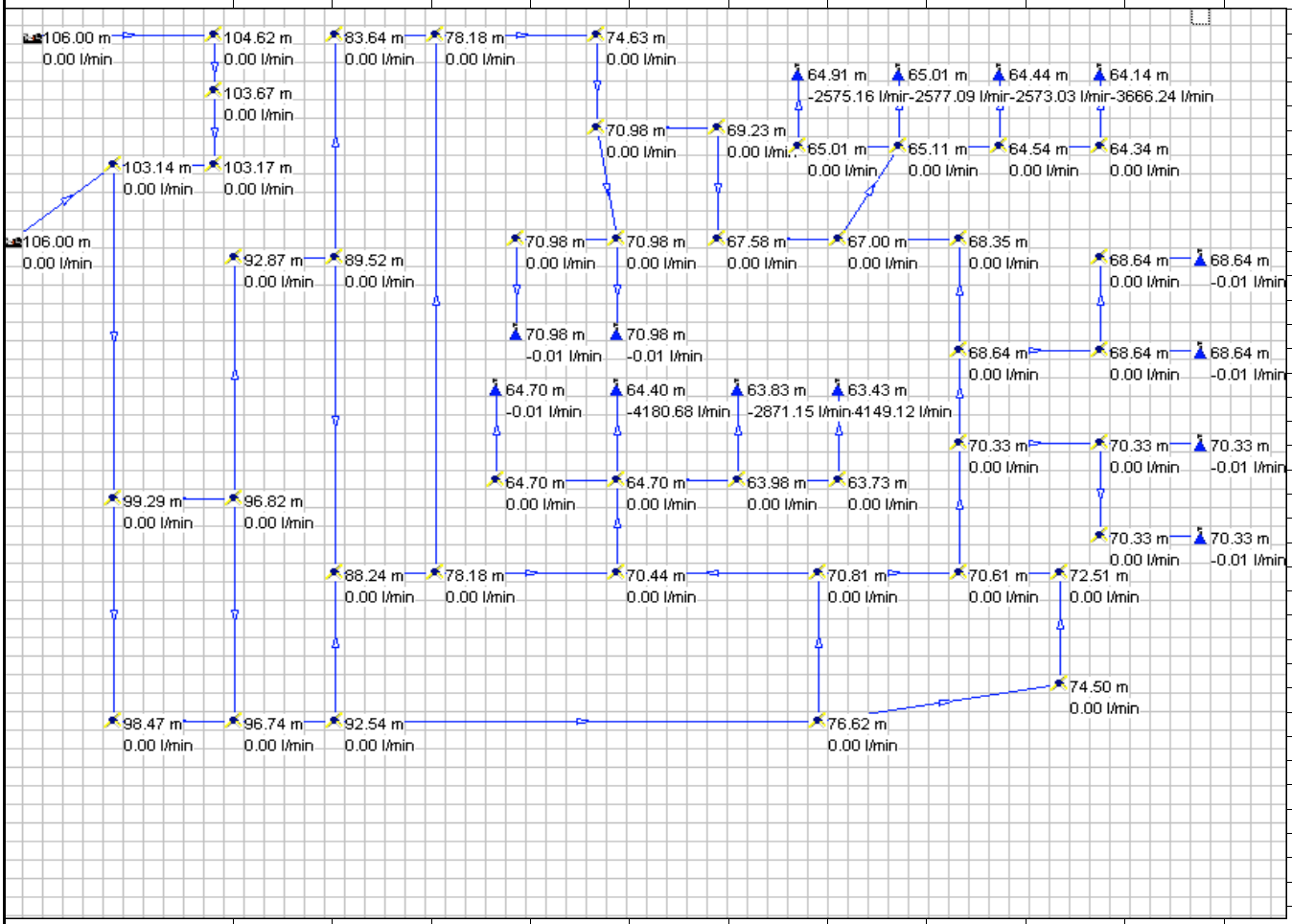
Designers Comments

Following Systems Operating :
Water Spray Valve V7
Water Spray Valve V8
Foam Zone 1 - V11
Foam Zone 2 - V12
Foam Monitor FM1
Foam Monitor FM2
1 x Electric & 1 x Diesel
Pump running in parallel

New pipe number 122 added from pumpstation pipe accross drain to main North / South fire main pipe. This modification improves head at Foam tank by 5m.

Pipes 22, 28 & 35 have high head loss

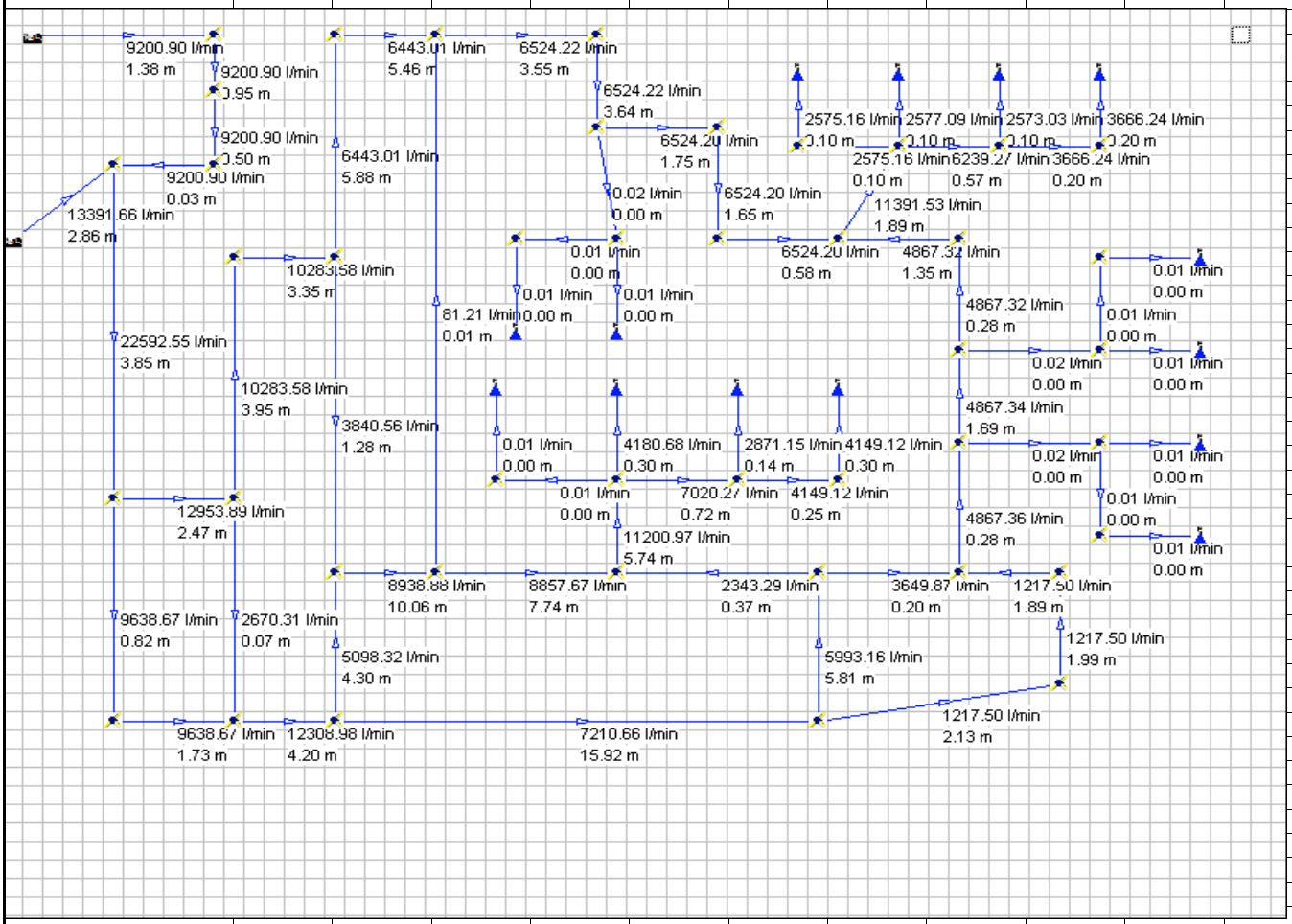
Helix Technologies	**Project No : PBK633**	Date	9-Mar-04	
Client	**Bulong Nickel Project**			
Prepared By	P.C Burrow			Rev P1
Title	Fire Water Spray System Design Review			



Designers Comments

Node Heads and External (Consumption) flow rates

Helix Technologies	**Project No : PBK633**	Date	9-Mar-04
Client	**Bulong Nickel Project**		
Prepared By	P.C Burrow		Rev P1
Title	Fire Water Spray System Design Review		



Designers Comments

Calculation verification run.
Netmate Calculation FIREBCE2.NTL calculation has been reproduced in the Helix delta-Q program to verify methods employed.
Consumption flow rates have been set to flows used in the Netmate calculation.

Node Gauge Heads calculated

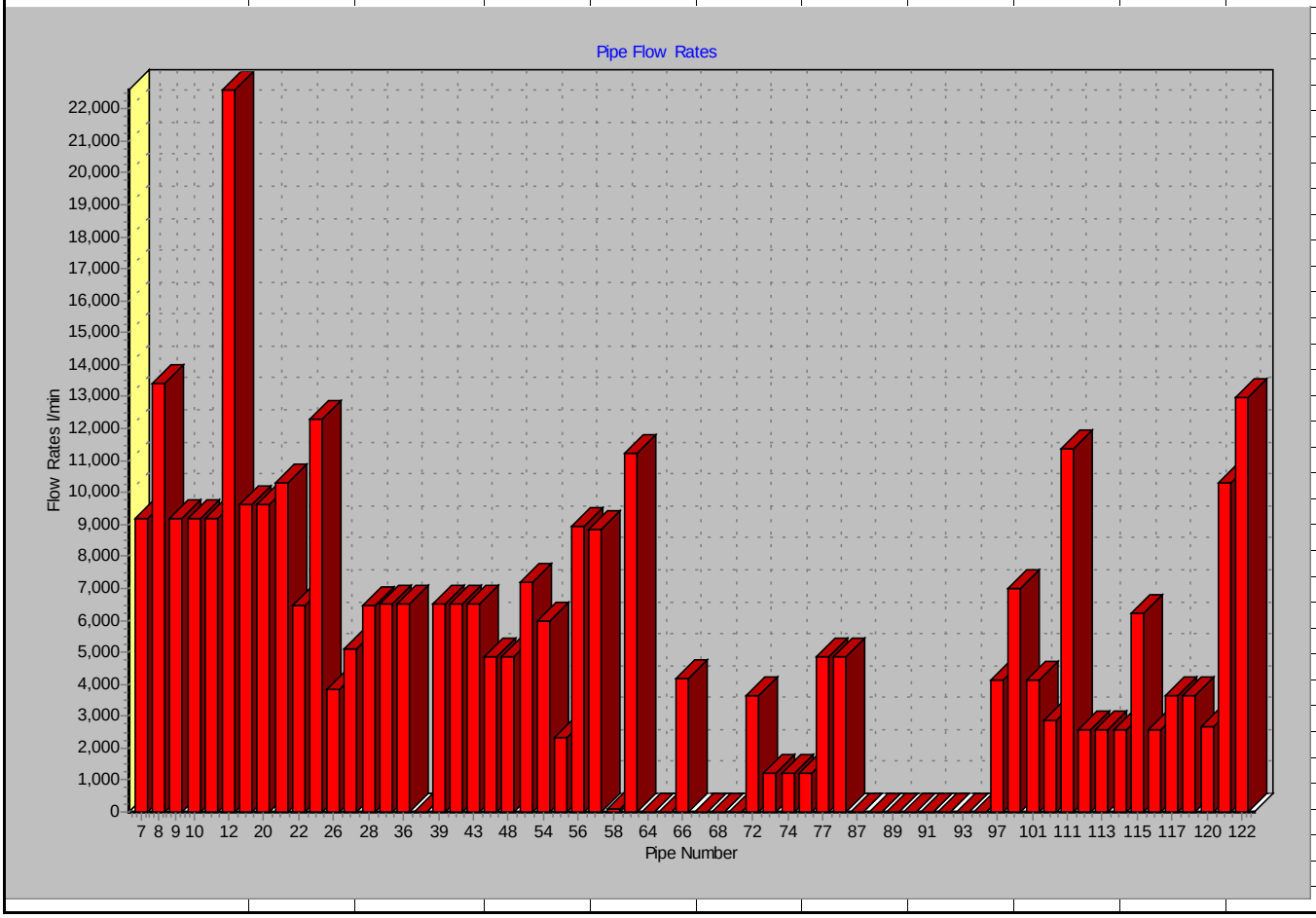
Helix Technologies	**Project No : PBK633**		Date	9-Mar-04					
Client	**Bulong Nickel Project**								
Prepared By	P.C Burrow				Rev P1				
Title	Fire Water Spray System Design Review - Scenario W1 with new pipe								
Pipe List	Liquids	Darcy							
Pipe Number		7	8	9	10	11	12	14	20
From Node To Node		0 - 5	1 - 6	5 - 2	2 - 3	6 - 3	6 - 4	4 - 13	13 - 15
Description	Units		Suct & Del pipe						
Liquid		WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Viscosity	cp	1	1.01	1	1.01	1.01	1.01	1.01	1.01
Temperature	C	20	20	20	20	20	20	20	20
Density	kg/m3	1,000	1000	1,000	1000	1000	1000	1000	1000
Vapour Pressure	kPa	2	1.6	2	1.6	1.6	1.6	1.6	1.6
Pipe Description		Polyethylene PE100 AS4130	Polyethylene PE100 AS4130	Steel B36.10	Steel B36.10	Steel B36.10	Steel B36.10	Polyethylene PE100 AS4130	Polyethylene PE100 AS4130
Pipe Class		PN20	PN20	Sch 040	Sch 040	Sch 040	Sch 040	PN20	PN20
Nominal Diameter	mm	355	355	250	250	250	200	355	355
Outside Diameter	mm	355	355	273	273	273	219.1	355	355
Inside Diameter	mm	273	273	254.5	254.5	254.5	202.7	273	273
Pipe Length	m	35	35	1	1	1	4	20	45
Pipe Roughness	mm	0.007	0.007	0.045	0.045	0.045	0.045	0.007	0.007
Allowable Pressure	kPa	2000	2000	1	1	1	1	2000	2000
Total Fittings K value		2.3	2.3	2	1.02	0	0.27	1.2	2.4
Total Fittings Kf value		0	0	0	0	0	0	0	0
Orifice Plate Dia	mm	0	0	0	0	0	0	0	0
Flow Rate	l/min	9200.9	13391.66	9200.9	9200.9	9200.9	22592.55	9638.67	9638.67
Velocity	m/s	2.62	3.81	3.01	3.01	3.01	11.67	2.74	2.74
Friction Loss	m	0.57	1.15	0.03	0.03	0.03	1.98	0.36	0.81
Fitting Losses	m	0.8	1.7	0.93	0.47	0	1.87	0.46	0.92
Orifice Losses	m	0	0	0	0	0	0	0	0
Fixed Head Loss	m	0	0	0	0	0	0	0	0
Total Head Loss	m	1.38	2.86	0.95	0.5	0.03	3.85	0.82	1.73
Total Pressure Drop	kPa	13.53	28.04	9.35	4.9	0.26	37.78	8.03	16.94
Entry Total Head	m	477.5	477.5	476.12	475.17	474.67	474.64	470.79	469.97
Exit Total Head	m	476.12	474.64	475.17	474.67	474.64	470.79	469.97	468.24
Reynolds Number		708117	1030645	759591	759591	759591	2341796	741809	741809
Friction Factor	(Darcy f)	0.0128	0.0121	0.0147	0.0147	0.0147	0.0144	0.0127	0.0127
Warnings		Pressure Exceeded	Pressure Exceeded	Pressure Exceeded	Pressure Exceeded	Pressure Exceeded	Pressure Exceeded	Pressure Exceeded	Pressure Exceeded
Comments									

Helix Technologies	**Project No :**									
Client	**Bulong Nicl**									
Prepared By	P.C Burrow									
Title	Fire Water S									
Pipe List	Liquids									
Pipe Number		21	22	24	26	27	28	35	36	37
From Node To Node		16 - 17	17 - 18	15 - 23	25 - 17	23 - 25	18 - 19	19 - 29	29 - 30	30 - 31
Description	Units									
Liquid		WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Viscosity	cp	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Temperature	C	20	20	20	20	20	20	20	20	20
Density	kg/m3	1000	1000	1000	1000	1000	1000	1000	1000	1000
Vapour Pressure	kPa	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Pipe Description		Polyethyle ne PE100 AS4130	Polyethyle ne PE100 AS4130	Polyethyle ne PE80 AS4130	Polyethyle ne PE100 AS4130	Polyethyle ne PE100 AS4130	Polyethyle ne PE100 AS4130	Polyethyle ne PE100 AS4130	Polyethyle ne PE100 AS4130	Polyethyle ne PE100 AS4130
Pipe Class		PN20	PN20	PN16	PN20	PN20	PN20	PN20	PN20	PN20
Nominal Diameter	mm	355	250	355	250	250	250	250	250	250
Outside Diameter	mm	355	250	355	250	250	250	250	250	250
Inside Diameter	mm	273	192	273	192	192	192	192	192	192
Pipe Length	m	140	115	140	70	140	115	73	75	33
Pipe Roughness	mm	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
Allowable Pressure	kPa	2000	2000	1600	2000	2000	2000	2000	2000	2000
Total Fittings K value		1.2	0.6	0.4	0	0	0	0	0	0
Total Fittings Kf value		0	0	0	0	0	0	0	0	0
Orifice Plate Dia	mm	0	0	0	0	0	0	0	0	0
Flow Rate	l/min	10283.58	6443.01	12308.98	3840.56	5098.32	6443.01	6524.22	6524.22	0.02
Velocity	m/s	2.93	3.71	3.5	2.21	2.93	3.71	3.76	3.76	0
Friction Loss	m	2.83	5.46	3.95	1.28	4.3	5.46	3.55	3.64	0
Fitting Losses	m	0.52	0.42	0.25	0	0	0	0	0	0
Orifice Losses	m	0	0	0	0	0	0	0	0	0
Fixed Head Loss	m	0	0	0	0	0	0	0	0	0
Total Head Loss	m	3.35	5.88	4.2	1.28	4.3	5.46	3.55	3.64	0
Total Pressure Drop	kPa	32.86	57.67	41.16	12.51	42.21	53.54	34.79	35.74	0
Entry Total Head	m	464.37	461.02	468.24	461.02	464.04	455.14	449.68	446.13	442.48
Exit Total Head	m	461.02	455.14	464.04	459.74	459.74	449.68	446.13	442.48	442.48
Reynolds Number		791442	705059	947320	420273	557909	705059	713946	713946	2
Friction Factor	(Darcy f)	0.0126	0.013	0.0123	0.014	0.0134	0.013	0.013	0.013	29.2424
Warnings		Pressure Exceeded	Pressure Exceeded	Pressure Exceeded	Pressure Exceeded	Pressure Exceeded	Pressure Exceeded	Pressure Exceeded	Pressure Exceeded	Pressure Exceeded
Comments										

Helix Technologies	**Project No : PBK633**		Date	9-Mar-04						
Client	**Bulong Nickel Project**									
Prepared By	P.C Burrow				Rev P1					
Title	Fire Water Spray System Design Review - Scenario W1 with new pipe									
Pipe List	Liquids	Darcy								
Pipe Number		7	8	9	10	11	12	14	20	21
From Node To Node		0 - 5	1-Jun	5-Feb	2-Mar	6-Mar	6-Apr	Apr-13	13 - 15	16 - 17
Description	Units		Suct & Del pipe							
Liquid		WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Viscosity	cp	1	1.01	1	1.01	1.01	1.01	1.01	1.01	1.01
Temperature	C	20	20	20	20	20	20	20	20	20
Density	kg/m3	1,000	1000	1,000	1000	1000	1000	1000	1000	1000
Vapour Pressure	kPa	2	1.6	2	1.6	1.6	1.6	1.6	1.6	1.6
Pipe Description		Polyethylene PE100 AS4130	Polyethylene PE100 AS4130	Steel B36.10	Steel B36.10	Steel B36.10	Steel B36.10	Polyethylene PE100 AS4130	Polyethylene PE100 AS4130	Polyethylene PE100 AS4130
Pipe Class		PN20	PN20	Sch 040	Sch 040	Sch 040	Sch 040	PN20	PN20	PN20
Nominal Diameter	mm	355	355	250	250	250	200	355	355	355
Outside Diameter	mm	355	355	273	273	273	219.1	355	355	355
Inside Diameter	mm	273	273	254.5	254.5	254.5	202.7	273	273	273
Pipe Length	m	35	35	1	1	1	4	20	45	140
Pipe Roughness	mm	0.007	0.007	0.045	0.045	0.045	0.045	0.007	0.007	0.007
Allowable Pressure	kPa	2000	2000	1	1	1	1	2000	2000	2000
Total Fittings K value		2.3	2.3	2	1.02	0	0.27	1.2	2.4	1.2
Total Fittings Kf value		0	0	0	0	0	0	0	0	0
Orifice Plate Dia	mm	0	0	0	0	0	0	0	0	0
Flow Rate	l/min	9200.9	13391.66	9200.9	9200.9	9200.9	22592.55	9638.67	9638.67	10283.58
Velocity	m/s	2.62	3.81	3.01	3.01	3.01	11.67	2.74	2.74	2.93
Friction Loss	m	0.57	1.15	0.03	0.03	0.03	1.98	0.36	0.81	2.83
Fitting Losses	m	0.8	1.7	0.93	0.47	0	1.87	0.46	0.92	0.52
Orifice Losses	m	0	0	0	0	0	0	0	0	0
Fixed Head Loss	m	0	0	0	0	0	0	0	0	0
Total Head Loss	m	1.38	2.86	0.95	0.5	0.03	3.85	0.82	1.73	3.35
Total Pressure Drop	kPa	13.53	28.04	9.35	4.9	0.26	37.78	8.03	16.94	32.86
Entry Total Head	m	477.5	477.5	476.12	475.17	474.67	474.64	470.79	469.97	464.37
Exit Total Head	m	476.12	474.64	475.17	474.67	474.64	470.79	469.97	468.24	461.02
Reynolds Number		708117	1030645	759591	759591	759591	2341796	741809	741809	791442
Friction Factor	(Darcy f)	0.0128	0.0121	0.0147	0.0147	0.0147	0.0144	0.0127	0.0127	0.0126
Warnings		Pressure Exceeded	Pressure Exceeded	Pressure Exceeded	Pressure Exceeded	Pressure Exceeded	Pressure Exceeded	Pressure Exceeded	Pressure Exceeded	Pressure Exceeded
Comments										

Helix Technologies	**Project No**									
Client	**Bulong Nic**									
Prepared By	P.C Burrow									
Title	Fire Water									
Pipe List	Liquids									
Pipe Number		22	24	26	27	28	35	36	37	39
From Node To Node		17 - 18	15 - 23	25 - 17	23 - 25	18 - 19	19 - 29	29 - 30	30 - 31	30 - 38
Description	Units									
Liquid		WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Viscosity	cp	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Temperature	C	20	20	20	20	20	20	20	20	20
Density	kg/m3	1000	1000	1000	1000	1000	1000	1000	1000	1000
Vapour Pressure	kPa	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Pipe Description		Polyethylene PE100 AS4130	Polyethylene PE80 AS4130	Polyethylene PE100 AS4130	Polyethylene PE100 AS4130	Polyethylene PE100 AS4130	Polyethylene PE100 AS4130	Polyethylene PE100 AS4130	Polyethylene PE100 AS4130	Polyethylene PE100 AS4130
Pipe Class		PN20	PN16	PN20	PN20	PN20	PN20	PN20	PN20	PN20
Nominal Diameter	mm	250	355	250	250	250	250	250	250	250
Outside Diameter	mm	250	355	250	250	250	250	250	250	250
Inside Diameter	mm	192	273	192	192	192	192	192	192	192
Pipe Length	m	115	140	70	140	115	73	75	33	36
Pipe Roughness	mm	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
Allowable Pressure	kPa	2000	1600	2000	2000	2000	2000	2000	2000	2000
Total Fittings K value		0.6	0.4	0	0	0	0	0	0	0
Total Fittings Kf value		0	0	0	0	0	0	0	0	0
Orifice Plate Dia	mm	0	0	0	0	0	0	0	0	0
Flow Rate	l/min	6443.01	12308.98	3840.56	5098.32	6443.01	6524.22	6524.22	0.02	6524.2
Velocity	m/s	3.71	3.5	2.21	2.93	3.71	3.76	3.76	0	3.76
Friction Loss	m	5.46	3.95	1.28	4.3	5.46	3.55	3.64	0	1.75
Fitting Losses	m	0.42	0.25	0	0	0	0	0	0	0
Orifice Losses	m	0	0	0	0	0	0	0	0	0
Fixed Head Loss	m	0	0	0	0	0	0	0	0	0
Total Head Loss	m	5.88	4.2	1.28	4.3	5.46	3.55	3.64	0	1.75
Total Pressure Drop	kPa	57.67	41.16	12.51	42.21	53.54	34.79	35.74	0	17.16
Entry Total Head	m	461.02	468.24	461.02	464.04	455.14	449.68	446.13	442.48	442.48
Exit Total Head	m	455.14	464.04	459.74	459.74	449.68	446.13	442.48	442.48	440.73
Reynolds Number		705059	947320	420273	557909	705059	713946	713946	2	713943
Friction Factor	(Darcy f)	0.013	0.0123	0.014	0.0134	0.013	0.013	0.013	29.2424	0.013
Warnings		Pressure Exceeded	Pressure Exceeded	Pressure Exceeded	Pressure Exceeded	Pressure Exceeded	Pressure Exceeded	Pressure Exceeded	Pressure Exceeded	Pressure Exceeded
Comments										

Helix Technologies	**Project No : PBK633**	Date	9-Mar-04	
Client	**Bulong Nickel Project**			
Prepared By	P.C Burrow		Rev P1	
Title	Fire Water Spray System Design Review - Scenario W1 with new pipe			



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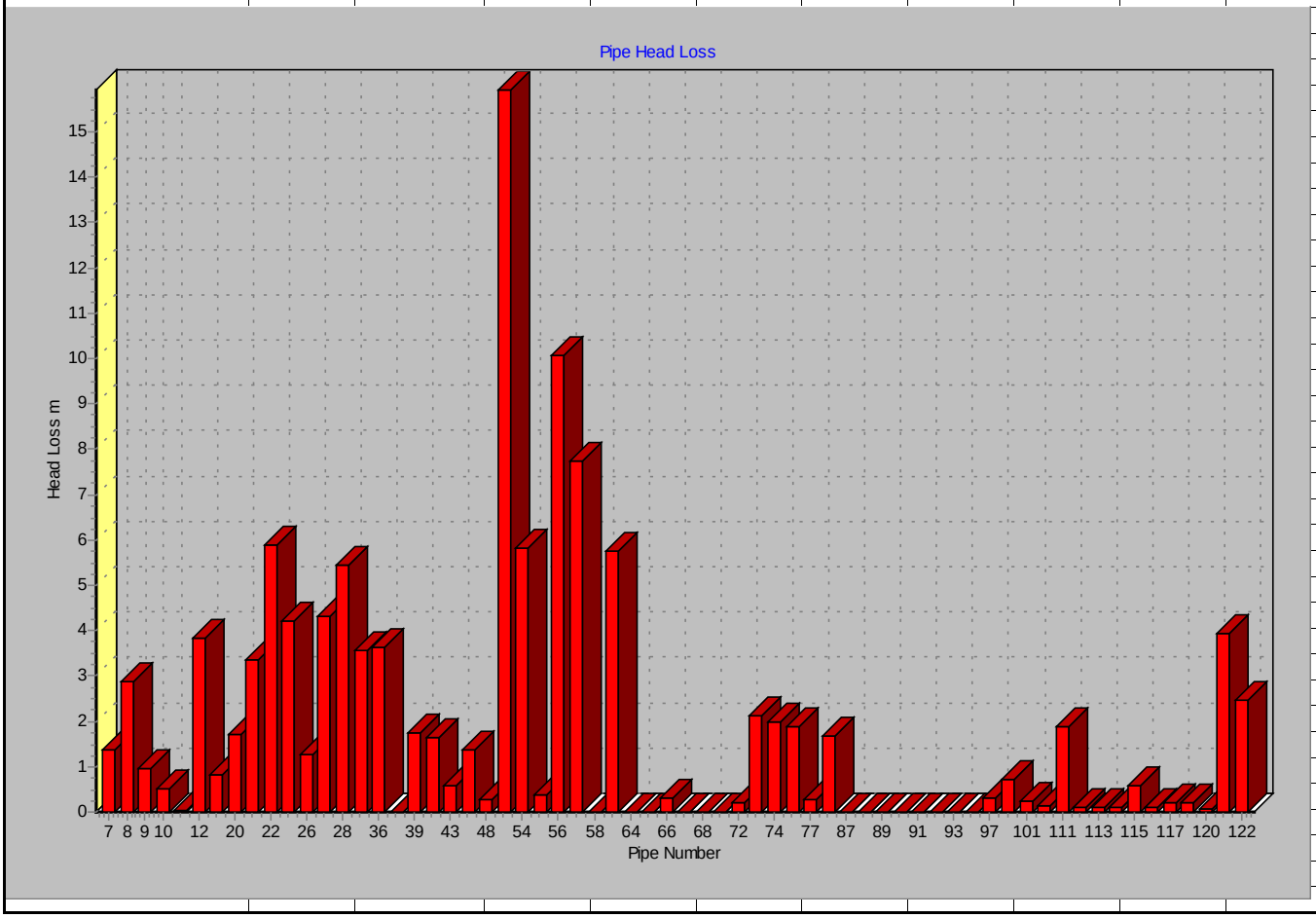
Title	Fire Water Spray System Design Review - Scenario W1 with new pipe			



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Client	**Bulong Nickel Project**			
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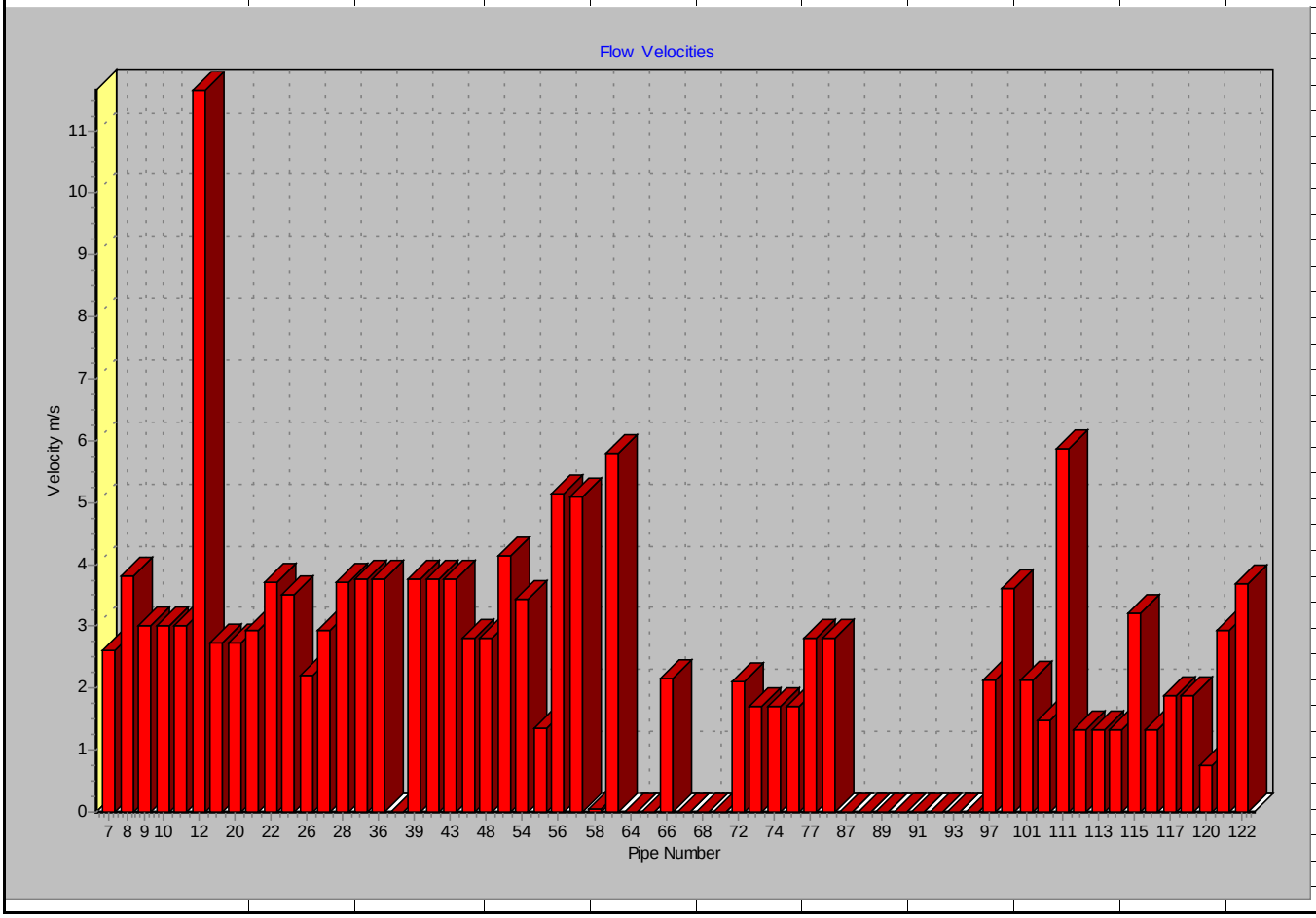
Title	Fire Water Spray System Design Review - Scenario W1 with new pipe			



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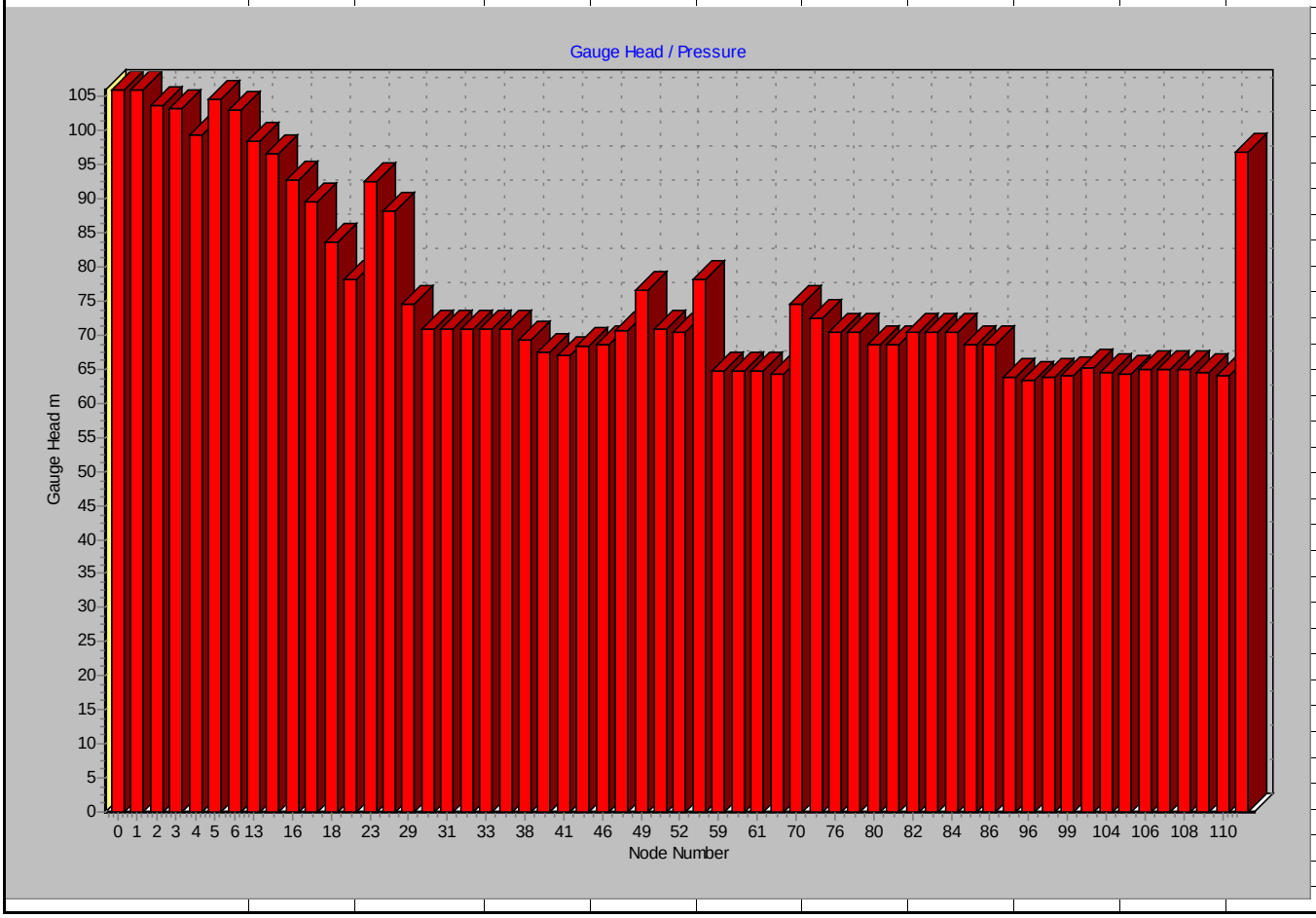
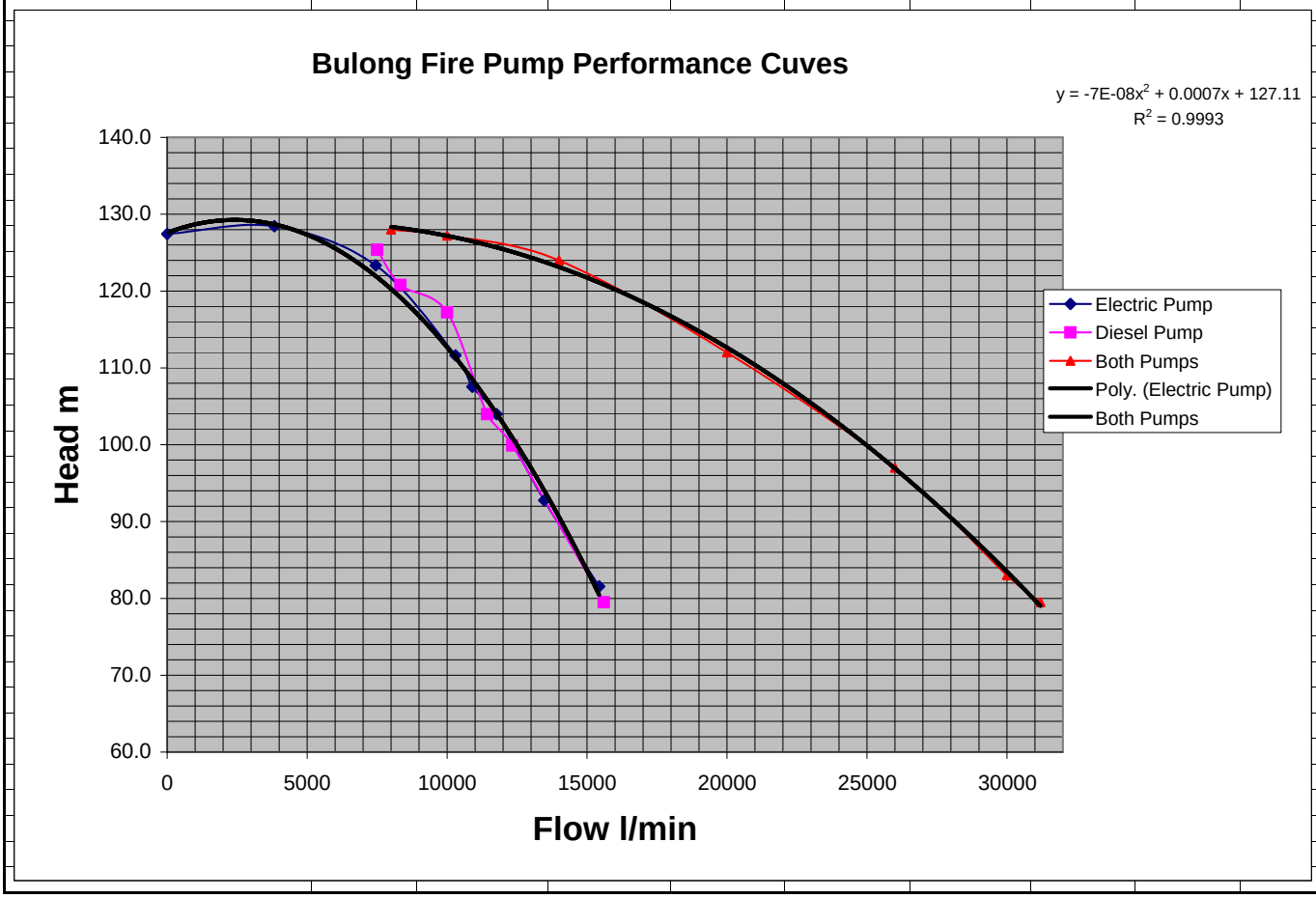
Client	**Bulong Nickel Project**			
Prepared By	P.C Burrow		Rev P1	
Title	Fire Water Spray System Design Review - Scenario W1 with new pipe			



Helix Technologies	**Project No : PBK633**		Date	9-Mar-04					
Client	**Bulong Nickel Project**								
Prepared By	P.C Burrow				Rev P1				
Title	Fire Water Spray System Design Review - Scenario W1 with new pipe								
	Electric pump			**Diesel Pump**					
Fire Pump Performance	**Flow**	**Discharge Pressure**	**Discharge Head**	**Flow**	**Discharge Pressure**	**Discharge Head**	**Two pumps I parallel**		
	l/min	**kPa**	**m**	**l/min**	**kPa**	**m**	**l/min**		
Data from Commissioning Tests	0	1250	127.4	7,500	1230	125.4	8000	128	
	3833	1260	128.4	8333	1185	120.8	10000	127.2	
	7450	1,210	123.3	10,000	1150	117.2	14000	124	
	10300	1,095	111.6	11,433	1020	104.0	20000	112	
	10900	1,055	107.5	12,333	980	99.9	26000	97	
	11767	1,020	104.0	15,600	780	79.5	30000	83	
	13467	910	92.8				31200	79.5	
	15433	800	81.5						



Helix Technologies	**Project No : PBK633**	Date	9-Mar-04
Client	**Bulong Nickel Project**		
Prepared By	P.C Burrow		Rev P1
Title	Fire Water Spray System Design Review - Scenario W1 with new pipe		

Design Flows and Pressures required for a fire in SX Settler tank 240-TK-405

Worst case scenario in SX area	**Design Flow required l/min**	**Design Pressure kPa**	**US units Calculated 'K' value**	**Remarks**
Foam Zone 1 V11	2727	710	71.0	Same as V4 ?
Foam Zone 2 V12	3519	580	101.4	From Test results 31/03/99
Water Valve V8	4022	584	115.4	
Water Valve V7	2779	587	79.6	
New Settlers (2 off)	4022	584	115.4	Same as V8
Foam Monitor FM2	2700	700	70.8	off take at Foam tank
Foam Monitor FM1	2700	700	70.8	off take at Foam tank
Total	**22469**			

Delta-Q can model "Nested" pipe networks within a Network. The sub-network is shown as a Nozzle and the consumption flow rate of the sub-network varies in proportion to the pressure.

The k value is a pseudo nozzle K value calculated from
$Q = k \times \mathrm{Sqrt}(P)$

where Q is in USGal / min
k is the nozzle discharge factor
P is the nozzle pressure in psi