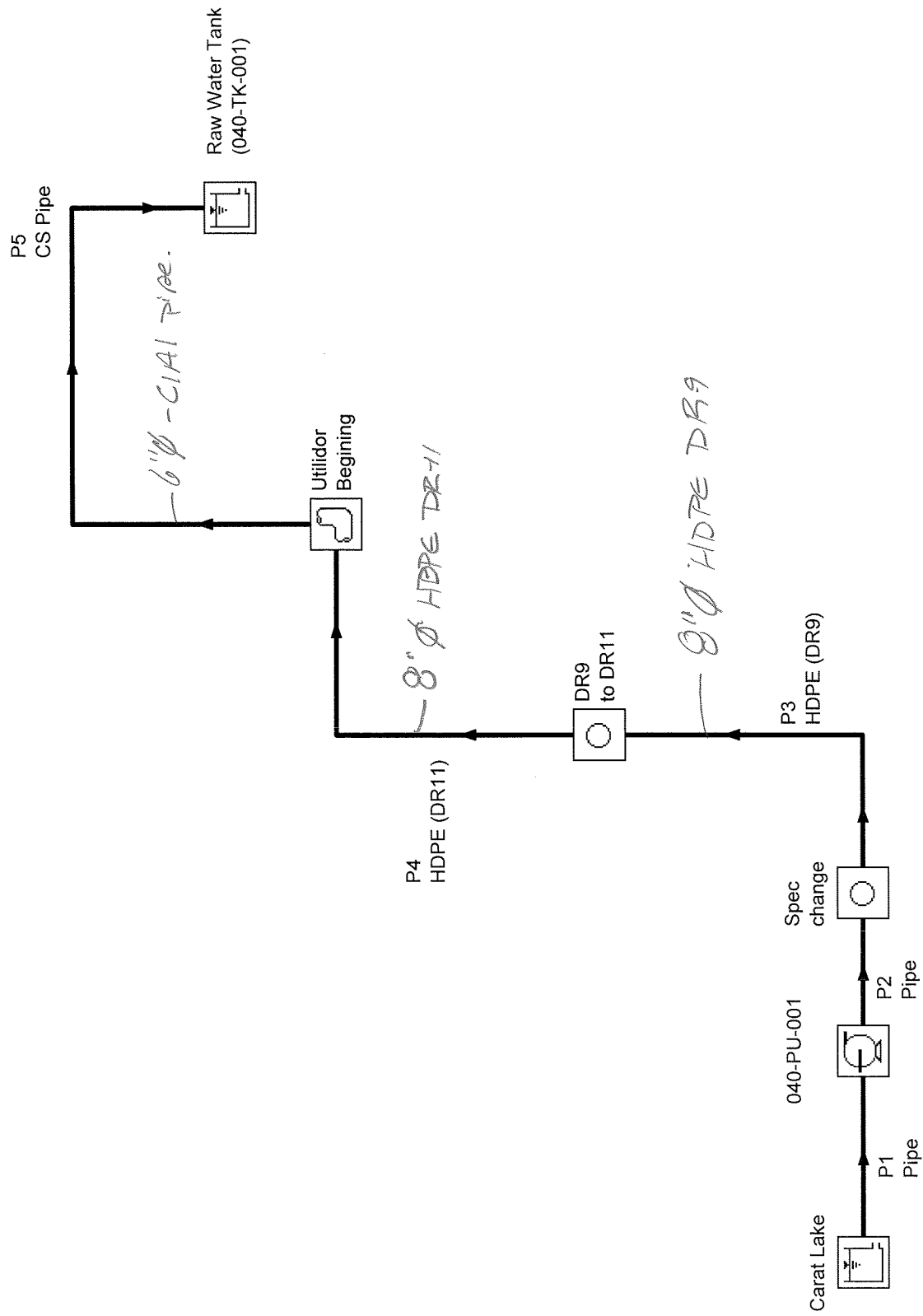




Title: RAC discharge pumps to classifier P/3931 et P/3932
Input File: P:\ahera\316996\DES\PSizing\Pumps\040-PU-001.fth

Number Of Pipes= 5
Number Of Junctions= 6

Pressure/Head Tolerance= 0.0001 relative change
Flow Rate Tolerance= 0.0001 relative change
Temperature Tolerance= 0.0001 relative change
Flow Relaxation= (Automatic)
Pressure Relaxation= (Automatic)

Constant Fluid Property Model
Fluid Database: AFT Standard
Fluid: Water at 1 atm
Max Fluid Temperature Data= 212 deg. F
Min Fluid Temperature Data= 32 deg. F
Temperature= 20 deg. C
Density= 998.3167 kg/m3
Viscosity= 1.003451 centipoise
Vapor Pressure= 0.3365602 psia
Viscosity Model= Newtonian

Atmospheric Pressure= 1 atm
Gravitational Acceleration= 1 g
Turbulent Flow Above Reynolds Number= 4000
Laminar Flow Below Reynolds Number= 2300

Design factor for losses 15%

*100 meter 8" Ø DR-9 pipe
1400 meter 8" Ø DR-11 pipe*

Pipe Input Table

Pipe	Name	Pipe Defined	Length	Length Units	Hydraulic Diameter	Hydraulic Diam. Units	Friction Data Set	Roughness	Roughness Units	Losses (K)	Initial Flow	Initial Flow Units	Junctions (Up, Down)
1	Pipe	Yes	0.1	meters	17.25	inches	Standard	0.0018	inches	0			1, 2
2	Pipe	Yes	10.5	meters	6.065	inches	Standard	0.0018	inches	2.050547			2, 5
3	HDPE (DR9)	Yes	100	meters	6.593333	inches	Standard	0.00006	inches	0.4116933			5, 6
4	HDPE (DR11)	Yes	1400	meters	6.962727	inches	Standard	0.00006	inches	1.219566			6, 4
5	CS Pipe	Yes	165	meters	6.065	inches	Standard	0.0018	inches	1.824702			4, 3

Pipe	Geometry	Material	Size	Type	Special Condition
1	Cylindrical Pipe	Steel	18 inch	STD	None
2	Cylindrical Pipe	Steel	6 inch	STD (schedule 40)	None
3	Cylindrical Pipe	HDPE	8 inch	SDR 9	None
4	Cylindrical Pipe	HDPE	8 inch	SDR 11	None
5	Cylindrical Pipe	Steel	6 inch	STD (schedule 40)	None

Pipe Loss Table

Pipe Losses	Pipe K Total	Standard Bends	Mitre Bends	Smooth Bends	Angle Valves	Ball Valves	Butterfly Valves	Cylinder Valves	Gate Valves	Globe Valves	Plug Valves	Poppet Valves	Three-way Valves	Swing Check Valves	Lift Check Valves
2	2.05			3 (0.63)			1 (0.67)							1 (0.75)	
3	0.41			2 (0.41)											
4	1.22			6 (1.22)											
5	1.82			9 (1.82)											

Pipe Losses	Tilting Disc Check Valves	Stop Check Valves	Sharp-edged Orifice	Long Orifice	Contractions	Expansions	Entrances	Exits	Differential Flowmeter	Honeycomb	Screen	Tee	Add'l Loss
2													
3													
4													
5													

Bend Table

Bend	Name	Object Defined	Inlet Elevation	Elevation Units	Initial Pressure	Initial Pressure Units	Database Source	Type	Angle (Degrees)	R/D	Loss Factor
4	Utilidor Beginning	Yes	521000	mm				Smooth Bend	90.	1.5	0.2033

Branch Table

Branch	Name	Object Defined	Inlet Elevation	Elevation Units	Initial Pressure	Initial Pressure Units	Database Source	Special Condition	Boundary Flow (+ = in/- = out)	Boundary Flow Units	(Pipe #1) K In, K Out	(Pipe #2) K In, K Out
5	Spec change	Yes	469200	mm				None			(P2) 0, 0	(P3) 0, 0
6	DR9 to DR11	Yes	485500	mm				None			(P3) 0, 0	(P4) 0, 0

Branch	(Pipe #3) K In, K Out	(Pipe #4) K In, K Out	(Pipe #5) K In, K Out	(Pipe #6) K In, K Out	(Pipe #7) K In, K Out	(Pipe #8) K In, K Out	(Pipe #9) K In, K Out	(Pipe #10) K In, K Out	(Pipe #11) K In, K Out	(Pipe #12) K In, K Out	(Pipe #13) K In, K Out	(Pipe #14) K In, K Out
5												
6												

Branch	(Pipe #15) K In, K Out	(Pipe #16) K In, K Out	(Pipe #17) K In, K Out	(Pipe #18) K In, K Out	(Pipe #19) K In, K Out	(Pipe #20) K In, K Out	(Pipe #21) K In, K Out	(Pipe #22) K In, K Out	(Pipe #23) K In, K Out	(Pipe #24) K In, K Out	(Pipe #25) K In, K Out
5											
6											

Pump Table

ADD 5 METERS HEAD FOR NEW PROCESS PLANT LOCATED ON
(5-M HIGHER, NOW @ 575M INSTEAD OF 520)

RAC discharge pumps to classifier P/3931 et P/3932

Pipe	Vol. Flow (m3/hr)	Velocity (feet/sec)	Elevation Inlet (mm)	Elevation Outlet (mm)	dP Static Total (m H2O std.)	dP Gravity (m H2O std.)	dH (meters)	P Static In (m H2O std. (g))	P Static Out (kPa (g))	Equiv. Length (meters)
1	100.0	0.6044	462,500	462,500	0.000008717	0.00	0.000008731	2.493	24.45	0.1000
2	100.0	4.8895	469,200	469,200	0.421070755	0.00	0.421769176	79.558	776.05	28.6213
3	100.0	4.1373	469,200	485,500	17.171970367	16.27	0.900424403	79.169	607.97	103.8498
4	100.0	3.7099	485,500	521,000	44.842437744	35.44	9.416842437	62.013	168.38	1,411.9213
5	100.0	4.8895	521,000	535,500	17.109718323	14.48	2.638109266	17.110	0.00	179.0221

All Junction Table

Jct	Name	Elevation Inlet (mm)	Elevation Outlet (mm)	P Static In (kPa (g))	P Static Out (kPa (g))	Vol. Flow Into System (m3/hr)	Loss Factor (K)	Pipes (+ = In, - = Out)
1	Carat Lake	465,000	465,000	0.00	24.48	100.0	0.5000	-1
2	040-PU-001	462,500	469,200	24.45	780.18	0.0	0.0000	1-2
3	Raw Water Tank (040-TK-001)	529,000	529,000	0.00	0.00	-100.0	1.0000	5
4	Utilidor Beginning	521,000	521,000	168.38	167.78	0.0	0.2033	4-5
5	Spec change	469,200	469,200	776.05	776.37	0.0	0.0000	2-3
6	DR9 to DR11	485,500	485,500	607.97	608.13	0.0	0.0000	3-4

HATCH	FEUILLE DE CALCUL CALCULATION SHEET			FEUILLE NO. SHEET NO.
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DESCRIPTION <i>max pressure inside HDPE pipe</i>	PROJ. NO. <i>316996</i>	FAIT PAR: MADE BY: <i>Stefan</i>	VERIF PAR: CHKD. BY: <i>JKP</i>	DATE <i>28.9.2009</i>
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20% Safety margin

DR-9 ⇒ 200 psi ⇒ 140,9 mH₂O ⇒ 117,3 mH₂O

DR-11 ⇒ 160 psi ⇒ 112,7 mH₂O ⇒ 93,9 mH₂O

HATCH	FEUILLE DE CALCUL CALCULATION SHEET	FEUILLE NO. SHEET NO. <u>1/2</u>
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DESCRIPTION	PROJ. NO.	FAIT PAR: MADE BY:	VERIF. PAR: CHKD. BY:	DATE
040-PV-007 → Fathom Back check	31646	JFB	JFB	26-09-2009

Using Hazen-Williams

Pump inlet elevation 462,500(m)

highest elevation 535.5 m

head elevation above pump suction: 2.5 m.

Static $\Delta h_s = 535.5 \text{ m} - (462.5 + 2.5) = 70.5 \text{ meter.}$

$Q = 100 \text{ m}^3/\text{h} = 440 \text{ gpm}$

$$h_f = 0.002083 L_{eq} \left(\frac{100}{C} \right)^{1.85} \times \frac{\text{gpm}^{1.85}}{C^{4.8655}}$$

$C = \frac{100 \text{ GPE}}{150 \text{ HDPE.}}$

inside pump house → 6" sch 40 id = 6.065 inches

3 elbow 90° 1.5" → $L_{eq} = 3 \times 10 \text{ ft} = 30 \text{ ft} (9.14 \text{ m})$

1 butterfly valve → $L_{eq} = 23 \text{ ft} (7 \text{ m})$

1 check valve → $L_{eq} = 65 \text{ ft} (19.82 \text{ m})$

pipe length → $L = 10.5 \text{ m.}$

$L_{eq} = 46.5 \text{ m}$

2.3583 ft.

HDPE 8"φ-DR9 → id = 6.5933 in.

$L = 100 \text{ m}$

2 x Elbow 90° 1.5" → $L_{eq} = 2 \times 14 \text{ ft} = 28 \text{ ft} (8.54 \text{ m})$

$L_{eq} = 108.55 \text{ m}$

2.8149 ft.

HATCH

FEUILLE DE CALCUL CALCULATION SHEET

FEUILLE NO.
SHEET NO.

2/2

DESCRIPTION

04070-001

PROJ. NO.

316996

FAIT PAR:
MADE BY:

SFR

VERIF PAR:
CHKD. BY:

JPP

DATE

28-09-2007

HDPE - Pipe 8"Ø - SDR 11

id = 6.9627 in

 $L \Rightarrow 1400 \text{ m}$ 6x Elbow 90d, 1.5m $\Rightarrow L_{eg} = 6 \times 14 \text{ ft} = 84 \text{ ft} (25.61 \text{ m})$ $L_{eg} = 1425.61 \text{ m}$ $h_f = 28.36 \text{ ft}$

inside plant pipe 6"Ø sch. 40 - id = 6.065 in.

 $L_{\text{pipe}} = 165 \text{ m}$ 8x 90d elbow 1.5m $\Rightarrow L_{eg} = 8 \times 14 \text{ ft} = 80 \text{ ft} (24.4 \text{ m})$ 1x 40d elbow 1.5m $\Rightarrow L_{eg} = 10 \text{ ft} (3.1 \text{ m})$ 1 exit $\Rightarrow L_{eg} = 36 \text{ ft} (10.98 \text{ m})$ $L_{eg} = 203.5 \text{ m}$

10,324.

 $h_f = 43.8572 \text{ ft} (13.37 \text{ m H}_2\text{O})$
 $\times 1.15\%$ $= 50.44 \text{ ft H}_2\text{O} (15.4 \text{ m H}_2\text{O})$

$$\begin{aligned} \text{TDL} &= \Delta h_s + h_{f, 1.15\%} = 70.5 \text{ m} + 15.4 \text{ m H}_2\text{O} \\ &= 85.9 \text{ m TDL} \end{aligned}$$

 $\Rightarrow$ Fathom 84 m. OK