

Variable Costs of Production:

Attachment DLW-1

	Jan.	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	12 month average
WTP finished water production per month in millions of gallons -	281.05	252.30	278.19	280.53	395.39	460.98	513.43	491.17	432.69	326.06	271.14	277.10	
Projected 2022 Electric Costs per million gallons -	\$ 204	\$ 214	\$ 192	\$ 210	\$ 185	\$ 187	\$ 194	\$ 195	\$ 181	\$ 190	\$ 192	\$ 194	
Projected 2022 Chemical Costs (including residuals disposal) per million gallons -	\$ 331	\$ 330	\$ 331	\$ 331	\$ 330	\$ 330	\$ 355	\$ 355	\$ 355	\$ 330	\$ 330	\$ 331	
Total Variable Costs (not including Merrimack River station electricity) per MG -	\$ 535	\$ 545	\$ 523	\$ 541	\$ 515	\$ 518	\$ 549	\$ 550	\$ 536	\$ 520	\$ 522	\$ 525	\$ 532
Merrimack River Electric cost/mg of finished water -	\$ 120	\$ 141	\$ 132	\$ 136	\$ 109	\$ 160	\$ 123	\$ 131	\$ 84	\$ 112	\$ 153	\$ 114	\$ 126
Total Variable Costs w/ Merrimack River per MG before GAC consideration -	\$ 655	\$ 685	\$ 655	\$ 677	\$ 624	\$ 678	\$ 672	\$ 680	\$ 620	\$ 632	\$ 676	\$ 638	\$ 658
Variable Cost/100 CCF w/ Merrimack River before GAC consideration -	\$ 0.49	\$ 0.51	\$ 0.49	\$ 0.51	\$ 0.47	\$ 0.51	\$ 0.50	\$ 0.51	\$ 0.46	\$ 0.47	\$ 0.51	\$ 0.48	\$ 0.49

GAC Analysis

	2016	2017	2018	2019	2020	Total in five years	Average/year
Millions of gallons processed through WTP/year -	4,870	4,308	4,256	3,997	4,423	21,854	4,371
Millions of gallons through an individual filter -	406	359	355	333	369	1,821	364
qty. of media in each filter in Cubic feet -	2,460						
qty of media in all 12 filters -	29,520						
Life span of filter media in months -	18						
Average flow through an individual filter per year in million gallons -	364						
Average flow through an individual filter per month in million gallons -	30.4						
Replacement cost per pound of virgin GAC -	\$ 1.77						
average unit weight of dry GAC in pounds/cubic foot -	30.5						
Cost per cu/ft virgin GAC -	\$ 53.99						
Cost/filter bed with virgin GAC -	\$ 132,803						
Cost for 12 filters virgin GAC -	\$ 1,593,637						
Cost per million gallons of water processed during media lifespan, Virgin GAC -	\$ 243.08						
Cost per 100 CCF, Virgin GAC -	\$ 0.18						

Projected 2022 Plant Variable Costs w/ Virgin GAC	
per MG	\$ 900.77
per 100 CCF	\$ 0.67

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Gallons Pumped in millions of gallons -			281.05	252.30	278.19	280.53	395.39	460.98	513.43	491.17	432.69	326.06	271.14	277.10	4,260
KWH consumed per month @ WTP -			333,747	300,348	303,316	335,021	390,804	463,419	549,011	539,181	434,684	342,736	292,094	303,991	4,588,352
KW Demand (peak value per month)-			486	558	506	558	900	1057	1126	993	852	658	518	519	
Customer Charge per month			\$ 190.14	\$ 190.14	\$ 190.14	\$ 190.14	\$ 190.14	\$ 190.14	\$ 190.14	\$ 190.14	\$ 190.14	\$ 190.14	\$ 190.14	\$ 190.14	
Distribution Demand Charge															
	Jan. - June	July - Dec													
First 100 KW	\$ 6.070000	\$ 6.070000	\$ 607.00	\$ 607.00	\$ 607.00	\$ 607.00	\$ 607.00	\$ 607.00	\$ 607.00	\$ 607.00	\$ 607.00	\$ 607.00	\$ 607.00	\$ 607.00	\$ 607.00
following KW	\$ 5.810000	\$ 5.810000	\$ 2,242.66	\$ 2,660.98	\$ 2,360.80	\$ 2,658.08	\$ 4,648.97	\$ 5,559.20	\$ 5,963.00	\$ 5,190.27	\$ 4,368.15	\$ 3,243.43	\$ 2,427.13	\$ 2,435.84	\$ 2,435.84
Transmission Demand Charge per KWH	\$ 10.400000	\$ 10.400000	\$ 5,054.40	\$ 5,803.20	\$ 5,265.87	\$ 5,798.00	\$ 9,361.73	\$ 10,991.07	\$ 11,713.87	\$ 10,330.67	\$ 8,859.07	\$ 6,845.80	\$ 5,384.60	\$ 5,400.20	\$ 5,400.20
Stranded Cost Recovery Demand Charge per KWH	\$ 0.650000	\$ 0.650000	\$ 315.90	\$ 362.70	\$ 329.12	\$ 362.38	\$ 585.11	\$ 686.94	\$ 732.12	\$ 645.67	\$ 553.69	\$ 427.86	\$ 336.54	\$ 337.51	\$ 337.51
KWH Distribution Charge	\$ 0.006500	\$ 0.006500	\$ 1,300.00	\$ 1,300.00	\$ 1,300.00	\$ 1,300.00	\$ 1,300.00	\$ 1,300.00	\$ 1,300.00	\$ 1,300.00	\$ 1,300.00	\$ 1,300.00	\$ 1,300.00	\$ 1,300.00	\$ 1,300.00
Following KWH	\$ 0.005540	\$ 0.005540	\$ 740.96	\$ 555.93	\$ 572.37	\$ 748.02	\$ 1,057.06	\$ 1,459.34	\$ 1,933.52	\$ 1,879.06	\$ 1,300.15	\$ 790.76	\$ 510.20	\$ 576.11	\$ 576.11
KWH Stranded Cost Recovery Charge (credit)	\$ 0.006430	\$ 0.006430	\$ 2,146.00	\$ 1,931.24	\$ 1,950.32	\$ 2,154.19	\$ 2,512.87	\$ 2,979.79	\$ 3,530.14	\$ 3,466.93	\$ 2,795.02	\$ 2,203.79	\$ 1,878.16	\$ 1,954.66	\$ 1,954.66
System Benefits Charge per KWH	\$ 0.007430	\$ 0.007430	\$ 2,479.74	\$ 2,231.59	\$ 2,253.64	\$ 2,489.21	\$ 2,903.68	\$ 3,443.20	\$ 4,079.15	\$ 4,006.11	\$ 3,229.70	\$ 2,546.53	\$ 2,170.26	\$ 2,258.66	\$ 2,258.66
Apparatus Rental Charge per month			\$ 698.64	\$ 698.64	\$ 698.64	\$ 698.64	\$ 698.64	\$ 698.64	\$ 698.64	\$ 698.64	\$ 698.64	\$ 698.64	\$ 698.64	\$ 698.64	\$ 698.64
Energy Supply charge per KWH	12/1/19 - 11/30/21	\$ 0.069500	\$ 23,195.44	\$ 20,874.19	\$ 21,080.48	\$ 23,283.97	\$ 27,160.91	\$ 32,207.63	\$ 38,156.24	\$ 37,473.06	\$ 30,210.54	\$ 23,820.13	\$ 20,300.51	\$ 21,127.39	\$ 21,127.39
Total Electric cost/month WTP based on 2021 electric rate of -			\$ 38,970.88	\$ 37,215.61	\$ 36,608.38	\$ 40,289.61	\$ 51,026.11	\$ 60,122.95	\$ 68,903.81	\$ 65,787.54	\$ 54,112.10	\$ 42,674.07	\$ 35,803.17	\$ 36,886.16	\$ 568,400.39
2021 WTP Electric Cost/MG/Month -			\$ 138.66	\$ 147.50	\$ 131.60	\$ 143.62	\$ 129.05	\$ 130.43	\$ 134.20	\$ 133.94	\$ 125.06	\$ 130.88	\$ 132.04	\$ 133.11	\$ 134.17
Projected 2022 Electric Supply charge per KWH	\$ 0.120		\$ 40,049.68	\$ 36,041.77	\$ 36,397.96	\$ 40,202.54	\$ 46,896.54	\$ 55,610.30	\$ 65,881.28	\$ 64,701.68	\$ 52,162.09	\$ 41,128.28	\$ 35,051.23	\$ 36,478.95	\$ 36,478.95
Projected 2022 increase in Transmission Demand charge	10.00%		\$ 17,352.98	\$ 17,975.55	\$ 17,080.69	\$ 18,706.20	\$ 26,251.72	\$ 30,706.85	\$ 33,822.32	\$ 31,145.93	\$ 26,291.72	\$ 20,739.34	\$ 17,052.93	\$ 17,334.64	\$ 17,334.64
Total Electric cost/month WTP based on 2021 electric rate of -			\$ 57,402.67	\$ 54,017.32	\$ 53,478.64	\$ 58,908.74	\$ 73,148.25	\$ 86,317.15	\$ 99,703.61	\$ 95,847.61	\$ 78,453.81	\$ 61,867.62	\$ 52,104.16	\$ 53,813.59	\$ 825,063.18
2021 WTP Electric Cost/MG/Month -			\$ 204.24	\$ 214.10	\$ 192.24	\$ 209.99	\$ 185.00	\$ 187.25	\$ 194.19	\$ 195.14	\$ 181.32	\$ 189.74	\$ 192.16	\$ 194.20	\$ 194.96
															Rate per KWH - \$ 0.1798
															Projected increase in Electrical Costs - 45.2%
Merrimack River Pumps station:			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Estimated total monthly cost @ 2021 Rates -	\$		22,874.99	24,442.62	25,222.19	26,145.22	30,070.71	51,355.63	43,795.08	44,000.00	25,000.00	25,087.72	28,511.19	21,571.04	
Estimated total monthly cost @ 2022 Rates -	\$		33,694.01	35,477.72	36,845.35	38,227.77	43,107.73	73,730.11	63,371.35	64,104.77	36,245.96	36,371.44	41,492.18	31,470.21	
Estimated Merrimack River 2022 Electric cost/mg -	\$		119.89	140.62	132.45	136.27	109.03	159.94	123.43	130.51	83.77	111.55	153.03	113.57	

2021 profomed WTP Pumpage in millions of gallons	Chemical Quantities (lbs)												Annual Total in lbs				
	January	February	March	April	May	June	July	August	September	October	November	December					
	281.1	252.3	278.2	280.5	395.4	461.0	513.4	491.2	432.7	326.1	271.1	277.1	4260				
Chemical Dose (PPM)	qtr. 1	qtr. 2	qtr. 3	qtr. 4													
Sodium Permanganate	0	0	0	0	0	0	0	0	0	0	0	0	0				
50% Caustic Soda coag. pH adjust	10	10	15	10	23439.7368	21041.9868	23200.8792	23396.3688	32975.526	38445.3984	64230.093	61445.1168	54129.519	27193.2372	22613.4096	23110.4736	415300
Carbon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ferric Chloride	35	35	40	35	82039.0788	73646.9538	81203.0772	81887.2908	115414.341	134558.894	171280.248	163853.645	144345.384	95176.3302	79146.9336	80886.6576	1303500
Polymer	0.3	0.3	0.3	0.3	703.192104	631.259604	696.026376	701.891064	989.26578	1153.36195	1284.60186	1228.90234	1082.59038	815.797116	678.402288	693.314208	10700
Sodium Hypochlorite	2.5	2.5	2.5	2.5	5859.9342	5260.4967	5800.2198	5849.0922	8243.8815	9611.3496	10705.0155	10240.8528	9021.5865	6798.3093	5653.3524	5777.6184	88900
Zinc Ortho-phosphate	2.5	2.5	2.5	2.5	5859.9342	5260.4967	5800.2198	5849.0922	8243.8815	9611.3496	10705.0155	10240.8528	9021.5865	6798.3093	5653.3524	5777.6184	88900
Tetra potassium pyrophosphate	0.65	0.65	0.65	0.65	1523.682892	1367.72914	1508.05715	1520.78397	2143.40919	2498.9509	2783.30403	2862.62173	2345.61249	1767.56042	1469.87162	1502.18078	23100
50% Caustic Soda final pH adjust	20	20	20	20	46879.4736	42083.9736	46401.7584	46792.7376	65951.052	76890.7968	85640.124	81926.8224	72172.692	45368.4744	45226.8192	46220.9472	710600
25% Caustic Soda (sludge adjust)	70	70	70	70	1314.414024	1179.04248	1301.31355	1314.41402	1847.16655	2157.21106	2401.7532	2296.94942	2021.83951	1524.02158	1266.37896	1296.94673	20000

Chemical Cost	Unit Cost per quarter				Unit	January	February	March	April	May	June	July	August	September	October	November	December
	qtr. 1	qtr. 2	qtr. 3	qtr. 4													
Sodium Permanganate	\$ 0.2135	\$ 0.2135	\$ 0.2135	\$ 0.2135	lbs.	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
50% Caustic Soda coag. pH adjust	\$ 5.010	\$ 4.500	\$ 4.960	\$ 5.000	lbs.	\$ 5,010	\$ 4,500	\$ 4,960	\$ 5,000	\$ 7,050	\$ 8,210	\$ 13,720	\$ 13,120	\$ 11,560	\$ 5,810	\$ 4,830	\$ 4,940
Carbon Dioxide	\$ -	\$ -	\$ -	\$ -	lbs.	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Ferric Chloride	\$ 0.2950	\$ 0.2950	\$ 0.2950	\$ 0.2950	lbs.	\$ 24,210	\$ 21,730	\$ 23,960	\$ 24,160	\$ 34,050	\$ 39,700	\$ 50,530	\$ 48,340	\$ 42,590	\$ 28,080	\$ 23,350	\$ 23,870
Polymer	\$ 1.82	\$ 1.82	\$ 1.82	\$ 1.82	lbs.	\$ 1,280	\$ 1,150	\$ 1,270	\$ 1,280	\$ 1,810	\$ 2,100	\$ 2,340	\$ 2,240	\$ 1,980	\$ 1,490	\$ 1,240	\$ 1,270
Sodium Hypochlorite	\$ 0.6400	\$ 0.6400	\$ 0.6400	\$ 0.6400	lbs.	\$ 3,760	\$ 3,370	\$ 3,720	\$ 3,750	\$ 5,280	\$ 6,160	\$ 6,860	\$ 6,560	\$ 5,780	\$ 4,360	\$ 3,620	\$ 3,700
Zinc Ortho-phosphate	\$ 0.590	\$ 0.590	\$ 0.590	\$ 0.590	lbs.	\$ 3,460	\$ 3,110	\$ 3,430	\$ 3,460	\$ 4,870	\$ 5,680	\$ 6,320	\$ 6,050	\$ 5,330	\$ 4,020	\$ 3,340	\$ 3,410
TKPP	\$ 1.20	\$ 1.20	\$ 1.20	\$ 1.20	lbs.	\$ 1,830	\$ 1,650	\$ 1,810	\$ 1,830	\$ 2,580	\$ 3,000	\$ 3,340	\$ 3,200	\$ 2,820	\$ 2,130	\$ 1,770	\$ 1,810
50% Caustic Soda final pH adjust	\$ 0.2840	\$ 0.2840	\$ 0.2840	\$ 0.2840	lbs.	\$ 13,320	\$ 11,960	\$ 13,180	\$ 13,290	\$ 18,740	\$ 21,840	\$ 24,330	\$ 23,270	\$ 20,500	\$ 15,450	\$ 12,850	\$ 13,130
25% Caustic Soda	\$ 0.4490	\$ 0.4490	\$ 0.4490	\$ 0.4490	lbs.	\$ 600	\$ 530	\$ 590	\$ 600	\$ 830	\$ 970	\$ 1,080	\$ 1,040	\$ 910	\$ 690	\$ 570	\$ 590
	\$ 53,470	\$ 48,000	\$ 52,920	\$ 53,370		\$ 53,370	\$ 75,210	\$ 87,660	\$ 108,520	\$ 103,820	\$ 91,470	\$ 62,030	\$ 51,570	\$ 52,720	\$ 840,760		

WTP Sludge disposal	Sludge produced gallons/MG				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	qtr.1	qtr.2	qtr.3	qtr.4													
Sludge gallons/mg of raw water flow	8000	8000	8000	8000	3010	2700	2980	3010	4230	4940	5500	5260	4630	3490	2900		
Unit cost/100 cuft	0	9.07	9.07	9.07	100 ccf	\$ 27,310	\$ 24,490	\$ 27,030	\$ 27,310	\$ 38,370	\$ 44,810	\$ 49,890	\$ 47,710	\$ 42,000	\$ 31,660		
Million lbs/month					\$ 18,7773432	\$ 16,843464	\$ 18,5901936	\$ 18,7773432	\$ 26,3880936	\$ 30,8173008	\$ 34,31076	\$ 32,8135632	\$ 28,8834216	\$ 21,7717368	\$ 18,091128		
																\$ -	
																	\$ 293
																	\$ 337

Specific Gravity of Liquid Chemicals	Liquid Chemical Conversion Lbs to Gallons																
	solution Strength	Specific Gravity	wet Lbs/gallon	2021 Dry lbs/gallon	\$/gallon	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
Sodium Permanganate	40%	1.375	11.4675	4.587		0	0	0	0	0	0	0	0	0	0	0	0
50% Caustic Soda	50%	1.55	12.927	6.72	\$ 1.43	10470	9400	10360	10450	14730	17170	22310	21340	18900	12150	10100	10320
Ferric Chloride	39%	1.4	11.676	4.55364	\$ 1.34	18020	16180	17840	17990	25350	29550	37620	35990	31700	20910	17390	17770
Sodium Hypochlorite	13%	1.2	10.008	1.251	\$ 0.80	4690	4210	4640	4680	6590	7690	8560	8190	7220	5440	4520	4620
Zinc Orthophosphate	100%	1.55	12.927	12.927	\$ 7.63	460	410	450	460	640	750	830	800	700	530	440	450
25% Caustic	25%	1.27	10.5918	2.752474	\$ 1.24	480	430	480	480	680	790	880	840	740	560	470	480

1. 2022 Chemicals Expenses expected to increase by 15.0%