



**Southwestern Illinois
Flood Prevention District Council**
104 United Drive, Collinsville, Illinois

September 2018

WOOD RIVER DRAINAGE & LEVEE DISTRICT
FEMA LEVEL IMPROVEMENTS – LIFE CYCLE COSTS



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1.0 Introduction

In December of 2017, the Southwestern Illinois Flood Prevention District Council (FPD Council) officially turned over the assets constructed as part of the “100-Year” or “FEMA-Level” projects to the Wood River Drainage and Levee District (the “District”). The improvements to the Upper Wood River Levee System and the Lower Wood River Levee System were constructed as part of the following construction projects:

- Southwestern Illinois Levee Certification Design, Bid Package 2B
- Southwestern Illinois Levee Certification Design, Bid Package 3
- Southwestern Illinois Levee Certification Design, Bid Package 7A
- Southwestern Illinois Levee Certification Design, Bid Package 7B

Assets transferred to the District as part of these projects include: sluice gates, relief wells, piezometers, blanket drains, clay caps, cutoff walls, seepage berms, random fill areas, ditch and stream bank protection, relief well conveyance systems, weirs, and pump stations. The following paragraphs outline a brief description of maintenance requirements, an estimated cost associated with maintaining the new asset, and an estimated replacement cost.

The costs represented are estimates that were calculated using single payment compound amount factors based on initial installation costs; compound adjustment factors (CAFs) for 3-percent interest rates are shown in each table. The useful life of each feature has been estimated based on manufacturers’ literature and recommendations from the U.S. Army Corps of Engineers (USACE). Maintenance costs are estimated only up to the useful life of the improvement. The useful life is highly dependent upon diligent maintenance by the District as outlined in the System Wide Operation and Maintenance Manual.

2.0 Sluice Gates

2.1 Maintenance

Sluice gates are to be examined, greased, and trial-operated through a complete open/close cycle at least once every 90 days. (See the system wide O&M for further information).

The scope of this project included installing three (3) new sluice gates in new catch basins and replacing one (1) existing sluice gate in an existing structure. All four (4) gates will be added to the District’s operation and maintenance budget. Maintenance costs have been estimated as shown in the table below.

Table 2-1 – Sluice Gates – Maintenance Costs					
Year No.	Year	CAF (3%)	Sluice Gate		Cost per Year
			Price	QTY	
0	2017	1.000	\$ 50	0	\$ -
1	2018	1.030	\$ 52	4	\$ 206
2	2019	1.061	\$ 53	4	\$ 212
3	2020	1.093	\$ 55	4	\$ 219
4	2021	1.126	\$ 56	4	\$ 225
5	2022	1.159	\$ 58	4	\$ 232
6	2023	1.194	\$ 60	4	\$ 239
7	2024	1.230	\$ 62	4	\$ 246
8	2025	1.267	\$ 63	4	\$ 253
9	2026	1.305	\$ 65	4	\$ 261
10	2027	1.344	\$ 67	4	\$ 269
11	2028	1.384	\$ 69	4	\$ 277
12	2029	1.426	\$ 71	4	\$ 285
13	2030	1.469	\$ 73	4	\$ 294
14	2031	1.513	\$ 76	4	\$ 303
15	2032	1.558	\$ 78	4	\$ 312
16	2033	1.605	\$ 80	4	\$ 321
17	2034	1.653	\$ 83	4	\$ 331
18	2035	1.702	\$ 85	4	\$ 340
19	2036	1.754	\$ 88	4	\$ 351
20	2037	1.806	\$ 90	4	\$ 361
21	2038	1.860	\$ 93	4	\$ 372
22	2039	1.916	\$ 96	4	\$ 383
23	2040	1.974	\$ 99	4	\$ 395
24	2041	2.033	\$ 102	4	\$ 407
25	2042	2.094	\$ 105	4	\$ 419
26	2043	2.157	\$ 108	4	\$ 431
27	2044	2.221	\$ 111	4	\$ 444
28	2045	2.288	\$ 114	4	\$ 458
29	2046	2.357	\$ 118	4	\$ 471
Total:					\$ 9,316

2.2 Replacement

One (1) 24”, two (2) 30”, and one (1) 42” sluice gates were installed. The manufacturer of these sluice gates estimates a 30-year useful life. Replacement costs have been estimated as shown in the table below.

Table 2-2 – Sluice Gates – Replacement Costs

Gate Size	Station	Gate Well No.	Initial Cost	Installation	Useful Life	Planned Replacement	CAF (3%)	Replacement Cost
30"	308+50	CB-2	\$ 15,000	2016	30	2046	2.427	\$ 36,405
24"	308+50	Hawthorne	\$ 10,000	2017	30	2047	2.427	\$ 24,270
42"	310+50	CB-3	\$ 30,000	2016	30	2046	2.427	\$ 72,810
30"	580+50	CB-10	\$ 15,000	2016	30	2046	2.427	\$ 36,405
Total:			\$ 70,000					\$ 169,890

3.0 Relief Wells

3.1 Maintenance

Relief wells should be kept free of sand, silt, organic matter, or any other material that will retard flow. Wells should be inspected once per year, preferably prior to normal high-water season. Particular attention should be directed to inspecting the condition of the neoprene gaskets on the underside of the check valves. Each well should be sounded annually, and after each major high-water event, to see if the well is free of debris or any other obstruction. All wells that require removal of sediment should be pump-tested after cleanout to see if there has been any appreciable loss of efficiency as a result of foreign material entering the well. In addition, all wells should be pump-tested periodically in accordance with a program that will result in at least 10 percent of all the wells being pumped each year. This annual pumping should be rotated so that in a period of ten years, all wells will have been pump tested.

3.1.1 Existing Relief Wells

Seven (7) existing Type “D” relief wells were converted to Type “T” and tied into new relief well collector systems.

Nine (9) existing Type “T” relief wells were converted to tie into a relief well collector system.

All sixteen (16) relief wells were existing and consequently already in the District’s maintenance program. Therefore, these assets do not add additional maintenance to the District’s budget.

3.1.2 New Relief Wells

Ninety-Two (92) new stainless-steel relief wells (49 Type “D”, 43 Type “T”) were installed and thirty-six (36) existing relief wells were abandoned as part of these improvements. In theory, there is only a net increase of fifty-six (56) relief wells to the District’s program. However, the costs for adding all ninety-two (92) wells are shown below.

3.1.3 Relief Well Maintenance

Regardless of the construction material (wood-stave or stainless-steel) or discharge type (Type “D” or Type “T”), the annual inspection and periodic pump testing requirements are the same, with the only exception being that wood stave wells require cleaning/filtering of the standing water within the column of the well prior to pump testing. Relief well rehabilitation, if needed, may include mechanical or chemical treatment of the screen; rehabilitation is estimated to occur at the mid-life of the relief well. Maintenance costs have been estimated as shown in the table below.

Table 3-1 – Relief Wells – Maintenance Costs									
Year No.	Year	CAF (3%)	Annual Sounding		10-Year Pump Testing		Mid-Life Rehabilitation		Cost per Year
			Price	No. of RWs	Price	No. of RWs	Price	No. of RWs	
0	2018	1.000	\$ 200	92	\$ 1,500	9	\$ 2,500.00	0	\$ 31,900
1	2019	1.030	\$ 206	92	\$ 1,545	9	\$ 2,575.00	0	\$ 32,857
2	2020	1.061	\$ 212	92	\$ 1,592	9	\$ 2,652.50	0	\$ 33,846
3	2021	1.093	\$ 219	92	\$ 1,640	9	\$ 2,732.50	0	\$ 34,867
4	2022	1.126	\$ 225	92	\$ 1,689	9	\$ 2,815.00	0	\$ 35,919
5	2023	1.159	\$ 232	92	\$ 1,739	9	\$ 2,897.50	0	\$ 36,972
6	2024	1.194	\$ 239	92	\$ 1,791	9	\$ 2,985.00	0	\$ 38,089
7	2025	1.230	\$ 246	92	\$ 1,845	9	\$ 3,075.00	0	\$ 39,237
8	2026	1.267	\$ 253	92	\$ 1,901	10	\$ 3,167.50	0	\$ 42,318
9	2027	1.305	\$ 261	92	\$ 1,958	10	\$ 3,262.50	0	\$ 43,587
10	2028	1.344	\$ 269	92	\$ 2,016	9	\$ 3,360.00	0	\$ 42,874
11	2029	1.384	\$ 277	92	\$ 2,076	9	\$ 3,460.00	0	\$ 44,150
12	2030	1.426	\$ 285	92	\$ 2,139	9	\$ 3,565.00	0	\$ 45,489
13	2031	1.469	\$ 294	92	\$ 2,204	9	\$ 3,672.50	0	\$ 46,861
14	2032	1.513	\$ 303	92	\$ 2,270	9	\$ 3,782.50	0	\$ 48,265
15	2033	1.558	\$ 312	92	\$ 2,337	9	\$ 3,895.00	0	\$ 49,700
16	2034	1.605	\$ 321	92	\$ 2,408	9	\$ 4,012.50	0	\$ 51,200
17	2035	1.653	\$ 331	92	\$ 2,480	9	\$ 4,132.50	0	\$ 52,731
18	2036	1.702	\$ 340	92	\$ 2,553	10	\$ 4,255.00	0	\$ 56,847
19	2037	1.754	\$ 351	92	\$ 2,631	10	\$ 4,385.00	0	\$ 58,584
20	2038	1.806	\$ 361	92	\$ 2,709	9	\$ 4,515.00	0	\$ 57,611
21	2039	1.860	\$ 372	92	\$ 2,790	9	\$ 4,650.00	0	\$ 59,334
22	2040	1.916	\$ 383	92	\$ 2,874	9	\$ 4,790.00	0	\$ 61,120
23	2041	1.974	\$ 395	92	\$ 2,961	9	\$ 4,935.00	0	\$ 62,971
24	2042	2.033	\$ 407	92	\$ 3,050	9	\$ 5,082.50	0	\$ 64,853
25	2043	2.094	\$ 419	92	\$ 3,141	9	\$ 5,235.00	92	\$ 548,419

Table 3-1 – Relief Wells – Maintenance Costs									
Year No.	Year	CAF (3%)	Annual Sounding		10-Year Pump Testing		Mid-Life Rehabilitation		Cost per Year
			Price	No. of RWs	Price	No. of RWs	Price	No. of RWs	
26	2044	2.157	\$ 431	92	\$ 3,236	9	\$ 5,392.50	0	\$ 68,808
27	2045	2.221	\$ 444	92	\$ 3,332	9	\$ 5,552.50	0	\$ 70,850
28	2046	2.288	\$ 458	92	\$ 3,432	10	\$ 5,720.00	0	\$ 76,419
29	2047	2.357	\$ 471	92	\$ 3,536	10	\$ 5,892.50	0	\$ 78,724
30	2048	2.427	\$ 485	92	\$ 3,641	9	\$ 6,067.50	0	\$ 77,421
31	2049	2.500	\$ 500	92	\$ 3,750	9	\$ 6,250.00	0	\$ 79,750
32	2050	2.575	\$ 515	92	\$ 3,863	9	\$ 6,437.50	0	\$ 82,143
33	2051	2.652	\$ 530	92	\$ 3,978	9	\$ 6,630.00	0	\$ 84,599
34	2052	2.732	\$ 546	92	\$ 4,098	9	\$ 6,830.00	0	\$ 87,151
35	2053	2.814	\$ 563	92	\$ 4,221	9	\$ 7,035.00	0	\$ 89,767
36	2054	2.898	\$ 580	92	\$ 4,347	9	\$ 7,245.70	0	\$ 92,455
37	2055	2.985	\$ 597	92	\$ 4,478	9	\$ 7,463.07	0	\$ 95,229
38	2056	3.075	\$ 615	92	\$ 4,612	10	\$ 7,686.96	0	\$ 102,698
39	2057	3.167	\$ 633	92	\$ 4,751	10	\$ 7,917.57	0	\$ 105,779
40	2058	3.262	\$ 652	92	\$ 4,893	9	\$ 8,155.09	0	\$ 104,059
41	2059	3.360	\$ 672	92	\$ 5,040	9	\$ 8,399.75	0	\$ 107,181
42	2060	3.461	\$ 692	92	\$ 5,191	9	\$ 8,651.74	0	\$ 110,396
43	2061	3.565	\$ 713	92	\$ 5,347	9	\$ 8,911.29	0	\$ 113,708
44	2062	3.671	\$ 734	92	\$ 5,507	9	\$ 9,178.63	0	\$ 117,119
45	2063	3.782	\$ 756	92	\$ 5,672	9	\$ 9,453.99	0	\$ 120,633
46	2064	3.895	\$ 779	92	\$ 5,843	9	\$ 9,737.61	0	\$ 124,252
47	2065	4.012	\$ 802	92	\$ 6,018	9	\$ 10,029.74	0	\$ 127,979
48	2066	4.132	\$ 826	92	\$ 6,198	10	\$ 10,330.63	0	\$ 138,017
49	2067	4.256	\$ 851	92	\$ 6,384	10	\$ 10,640.55	0	\$ 142,158
Totals:									\$ 4,117,892

3.2 Replacement

USACE recommends relief well replacement after 50 years; therefore, a 50-year useful life was assumed. Replacement costs have been estimated as shown in the table below.

Table 3-2 – Relief Wells – Replacement Costs

Relief Well No.	Relief Well Type	Levee System	Station	Initial Cost	Installation	Useful Life	Planned Replacement	CAF (3%)	Replacement Cost
RW-1000	Type "T"	UWR	38+28	\$ 42,000	2016	50	2066	4.384	\$ 184,128
RW-1001	Type "T"	UWR	38+59	\$ 57,000	2016	50	2066	4.384	\$ 249,888
RW-1002	Type "T"	UWR	39+00	\$ 52,000	2016	50	2066	4.384	\$ 227,968
RW-1003	Type "T"	UWR	39+65	\$ 55,000	2016	50	2066	4.384	\$ 241,120
RW-1004	Type "T"	UWR	40+56	\$ 62,000	2016	50	2066	4.384	\$ 271,808
RW-1005	Type "T"	UWR	41+43	\$ 50,000	2016	50	2066	4.384	\$ 219,200
RW-1006	Type "T"	UWR	42+31	\$ 56,000	2016	50	2066	4.384	\$ 245,504
RW-1007	Type "T"	UWR	43+28	\$ 54,000	2016	50	2066	4.384	\$ 236,736
RW-1008	Type "T"	UWR	44+84	\$ 45,000	2016	50	2066	4.384	\$ 197,280
RW-1009	Type "T"	UWR	45+57	\$ 48,000	2016	50	2066	4.384	\$ 210,432
RW-1010	Type "T"	UWR	56+21	\$ 38,000	2016	50	2066	4.384	\$ 166,592
RW-1011	Type "T"	UWR	47+06	\$ 45,000	2016	50	2066	4.384	\$ 197,280
RW-1012	Type "T"	UWR	47+78	\$ 45,000	2016	50	2066	4.384	\$ 197,280
RW-1013	Type "T"	UWR	48+48	\$ 42,000	2016	50	2066	4.384	\$ 184,128
RW-1014	Type "T"	UWR	48+83	\$ 41,000	2016	50	2066	4.384	\$ 179,744
RW-1015	Type "T"	UWR	49+66	\$ 50,000	2016	50	2066	4.384	\$ 219,200
RW-1016	Type "T"	UWR	51+12	\$ 60,000	2016	50	2066	4.384	\$ 263,040
RW-90U	Type "T"	UWR	220+88	\$ 48,000	2016	50	2066	4.384	\$ 210,432
RW-1017	Type "T"	LWR	11+94	\$ 24,000	2016	50	2066	4.384	\$ 105,216
RW-1018	Type "T"	LWR	12+80	\$ 26,000	2016	50	2066	4.384	\$ 113,984
RW-1019	Type "T"	LWR	13+62	\$ 25,500	2016	50	2066	4.384	\$ 111,792
RW-1020	Type "T"	LWR	14+16	\$ 25,500	2016	50	2066	4.384	\$ 111,792
RW-1021	Type "D"	LWR	136+04	\$ 65,000	2016	50	2066	4.384	\$ 284,960
RW-1022	Type "D"	LWR	136+72	\$ 55,000	2016	50	2066	4.384	\$ 241,120
RW-1023	Type "D"	LWR	137+47	\$ 65,000	2016	50	2066	4.384	\$ 284,960
RW-1024	Type "D"	LWR	138+12	\$ 65,000	2016	50	2066	4.384	\$ 284,960
RW-1025	Type "D"	LWR	139+17	\$ 66,000	2016	50	2066	4.384	\$ 289,344
RW-1026	Type "D"	LWR	139+43	\$ 80,000	2016	50	2066	4.384	\$ 350,720
RW-1027	Type "D"	LWR	140+03	\$ 40,000	2016	50	2066	4.384	\$ 175,360
RW-1028	Type "D"	LWR	140+46	\$ 45,000	2016	50	2066	4.384	\$ 197,280
RW-1029	Type "D"	LWR	141+35	\$ 71,000	2016	50	2066	4.384	\$ 311,264
RW-1030	Type "D"	LWR	142+53	\$ 71,000	2016	50	2066	4.384	\$ 311,264
RW-1031	Type "D"	LWR	143+80	\$ 43,000	2016	50	2066	4.384	\$ 188,512
RW-1032	Type "D"	LWR	144+98	\$ 49,000	2016	50	2066	4.384	\$ 214,816
RW-1033	Type "D"	LWR	145+92	\$ 58,000	2016	50	2066	4.384	\$ 254,272
RW-1034	Type "D"	LWR	147+06	\$ 38,000	2016	50	2066	4.384	\$ 166,592
RW-1035	Type "D"	LWR	148+16	\$ 54,000	2016	50	2066	4.384	\$ 236,736

Table 3-2 – Relief Wells – Replacement Costs

Relief Well No.	Relief Well Type	Levee System	Station	Initial Cost	Installation	Useful Life	Planned Replacement	CAF (3%)	Replacement Cost
RW-1036	Type "D"	LWR	149+30	\$ 52,000	2016	50	2066	4.384	\$ 227,968
RW-1037	Type "D"	LWR	150+33	\$ 52,000	2016	50	2066	4.384	\$ 227,968
RW-1038	Type "T"	LWR	151+15	\$ 80,000	2016	50	2066	4.384	\$ 350,720
RW-1038A	Type "D"	LWR	153+93	\$ 115,000	2017	50	2067	4.384	\$ 504,160
RW-1038B	Type "D"	LWR	156+29	\$ 105,000	2017	50	2067	4.384	\$ 460,320
RW-1038C	Type "D"	LWR	160+24	\$ 112,000	2017	50	2067	4.384	\$ 491,008
RW-1038D	Type "D"	LWR	160+57	\$ 92,000	2017	50	2067	4.384	\$ 403,328
RW-1038E	Type "D"	LWR	161+07	\$ 90,000	2017	50	2067	4.384	\$ 394,560
RW-1038F	Type "D"	LWR	165+66	\$ 90,000	2017	50	2067	4.384	\$ 394,560
RW-1038G	Type "D"	LWR	168+38	\$ 108,000	2017	50	2067	4.384	\$ 473,472
RW-1039	Type "D"	LWR	170+30	\$ 49,000	2016	50	2066	4.384	\$ 214,816
RW-1040	Type "D"	LWR	171+00	\$ 55,000	2016	50	2066	4.384	\$ 241,120
RW-1041X	Type "D"	LWR	171+74	\$ 90,000	2016	50	2066	4.384	\$ 394,560
RW-1042	Type "D"	LWR	172+34	\$ 45,000	2016	50	2066	4.384	\$ 197,280
RW-1043	Type "D"	LWR	172+87	\$ 38,000	2016	50	2066	4.384	\$ 166,592
RW-1044	Type "D"	LWR	173+91	\$ 65,000	2016	50	2066	4.384	\$ 284,960
RW-1045	Type "D"	LWR	175+05	\$ 51,000	2016	50	2066	4.384	\$ 223,584
RW-1046	Type "D"	LWR	175+79	\$ 59,000	2016	50	2066	4.384	\$ 258,656
RW-1047	Type "D"	LWR	176+29	\$ 43,500	2016	50	2066	4.384	\$ 190,704
RW-1048	Type "D"	LWR	177+09	\$ 50,500	2016	50	2066	4.384	\$ 221,392
RW-1049	Type "D"	LWR	177+61	\$ 49,500	2016	50	2066	4.384	\$ 217,008
RW-1050	Type "D"	LWR	178+32	\$ 51,000	2016	50	2066	4.384	\$ 223,584
RW-1051	Type "D"	LWR	178+84	\$ 54,000	2016	50	2066	4.384	\$ 236,736
RW-1052	Type "D"	LWR	179+44	\$ 45,000	2016	50	2066	4.384	\$ 197,280
RW-1053	Type "D"	LWR	179+87	\$ 46,000	2016	50	2066	4.384	\$ 201,664
RW-1054	Type "D"	LWR	180+25	\$ 49,000	2016	50	2066	4.384	\$ 214,816
RW-1055	Type "D"	LWR	180+75	\$ 49,000	2016	50	2066	4.384	\$ 214,816
RW-1056	Type "D"	LWR	181+22	\$ 42,000	2016	50	2066	4.384	\$ 184,128
RW-1057	Type "D"	LWR	181+72	\$ 41,000	2016	50	2066	4.384	\$ 179,744
RW-1058	Type "D"	LWR	182+30	\$ 46,000	2016	50	2066	4.384	\$ 201,664
RW-1059	Type "D"	LWR	182+82	\$ 47,000	2016	50	2066	4.384	\$ 206,048
RW-1060	Type "D"	LWR	183+77	\$ 54,000	2016	50	2066	4.384	\$ 236,736
RW-1061	Type "D"	LWR	184+34	\$ 48,000	2016	50	2066	4.384	\$ 210,432
RW-1062	Type "D"	LWR	184+85	\$ 45,000	2016	50	2066	4.384	\$ 197,280
RW-1063	Type "D"	LWR	185+46	\$ 45,000	2016	50	2066	4.384	\$ 197,280
RW-1064	Type "T"	LWR	186+40	\$ 66,000	2016	50	2066	4.384	\$ 289,344
RW-1065	Type "T"	LWR	187+60	\$ 73,500	2016	50	2066	4.384	\$ 322,224

Table 3-2 – Relief Wells – Replacement Costs

Relief Well No.	Relief Well Type	Levee System	Station	Initial Cost	Installation	Useful Life	Planned Replacement	CAF (3%)	Replacement Cost
RW-1066	Type "T"	LWR	297+66	\$ 115,000	2016	50	2066	4.384	\$ 504,160
RW-1067	Type "T"	LWR	298+81	\$ 105,000	2016	50	2066	4.384	\$ 460,320
RW-1068	Type "T"	LWR	299+78	\$ 100,000	2016	50	2066	4.384	\$ 438,400
RW-1069	Type "T"	LWR	300+56	\$ 103,000	2016	50	2066	4.384	\$ 451,552
RW-1070	Type "T"	LWR	301+60	\$ 125,000	2016	50	2066	4.384	\$ 548,000
RW-1071	Type "T"	LWR	302+71	\$ 110,000	2016	50	2066	4.384	\$ 482,240
RW-1072	Type "T"	LWR	304+29	\$ 95,000	2016	50	2066	4.384	\$ 416,480
RW-1073	Type "T"	LWR	305+94	\$ 125,000	2016	50	2066	4.384	\$ 548,000
RW-1074	Type "T"	LWR	307+75	\$ 115,000	2016	50	2066	4.384	\$ 504,160
RW-1075	Type "T"	LWR	308+49	\$ 110,000	2016	50	2066	4.384	\$ 482,240
RW-1076	Type "T"	LWR	310+49	\$ 100,000	2016	50	2066	4.384	\$ 438,400
RW-1077	Type "T"	LWR	311+56	\$ 120,000	2016	50	2066	4.384	\$ 526,080
RW-1078	Type "T"	LWR	313+29	\$ 98,000	2016	50	2066	4.384	\$ 429,632
RW-1079	Type "T"	LWR	314+85	\$ 105,000	2016	50	2066	4.384	\$ 460,320
RW-1080	Type "T"	LWR	316+18	\$ 105,000	2016	50	2066	4.384	\$ 460,320
RW-1081	Type "T"	LWR	323+66	\$ 102,000	2016	50	2066	4.384	\$ 447,168
RW-1082	Type "T"	LWR	324+71	\$ 132,000	2016	50	2066	4.384	\$ 578,688
RW-1083	Type "T"	LWR	326+17	\$ 118,000	2016	50	2066	4.384	\$ 517,312
Total:				\$ 6,132,000					\$ 26,882,688

4.0 Piezometers

4.1 Maintenance

The site of piezometers should be kept clear of weeds and brush and cared for in the same manner as described for relief wells. The District should report any damaged or destroyed piezometers to the Geotechnical Branch, St. Louis District, USACE. General maintenance of piezometers is the responsibility of USACE personnel. Therefore, these assets do not add additional maintenance to the District's budget.

4.2 Replacement

Seventy-Two (72) new piezometers were installed and retro-fitted with transducers. Each piezometer itself (stainless steel screen and riser and filter pack) is estimated to have a useful life of 50 years. Replacement costs have been estimated as shown in the table below.

Table 4-1 – Piezometers – Replacement Costs

PZ No.	PZ Type	Levee System	Station	Initial Cost	Installation	Useful Life	Planned Replacement	CAF (3%)	Replacement Cost
UWR-PZ-1	Above Grade	UWR	25+00	\$15,000.00	2015	50	2065	4.384	\$ 65,760
UWR-PZ-2	Above Grade	UWR	25+00	\$15,000.00	2015	50	2065	4.384	\$ 65,760
UWR-PZ-3	Above Grade	UWR	25+00	\$15,000.00	2015	50	2065	4.384	\$ 65,760
UWR-PZ-4	Above Grade	UWR	25+00	\$15,000.00	2015	50	2065	4.384	\$ 65,760
UWR-PZ-5	Above Grade	UWR	35+00	\$15,000.00	2015	50	2065	4.384	\$ 65,760
UWR-PZ-6	Above Grade	UWR	35+00	\$15,000.00	2015	50	2065	4.384	\$ 65,760
UWR-PZ-7	Above Grade	UWR	35+00	\$15,000.00	2015	50	2065	4.384	\$ 65,760
UWR-PZ-8	Above Grade	UWR	35+00	\$15,000.00	2015	50	2065	4.384	\$ 65,760
PZ-P06	At Grade	UWR	40+54	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P05	Above Grade	UWR	40+62	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P04	Above Grade	UWR	40+73	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P07	Above Grade	UWR	46+33	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P08	Above Grade	UWR	49+62	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P09	Above Grade	UWR	52+93	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P12	At Grade	UWR	120+94	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P11	Above Grade	UWR	121+14	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P10	Above Grade	UWR	121+55	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P13	Above Grade	UWR	128+33	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P14	Above Grade	UWR	128+52	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P15	At Grade	UWR	128+54	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P16	Above Grade	UWR	141+64	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P17	At Grade	UWR	141+45	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P19	At Grade	UWR	145+93	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P18	Above Grade	UWR	146+20	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P20	Above Grade	UWR	218+66	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P21	At Grade	UWR	218+66	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P22	Above Grade	LWR	13+55	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P23	At Grade	LWR	13+60	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P24	Above Grade	LWR	139+07	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P25	Above Grade	LWR	139+11	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P26	At Grade	LWR	139+32	\$11,000.00	2016	50	2066	4.384	\$ 48,224
LWR-PZ-1	Above Grade	LWR	152+00	\$15,000.00	2016	50	2066	4.384	\$ 65,760
LWR-PZ-2	Above Grade	LWR	152+00	\$15,000.00	2016	50	2066	4.384	\$ 65,760
LWR-PZ-3	Above Grade	LWR	152+00	\$15,000.00	2016	50	2066	4.384	\$ 65,760
PZ-P27	Above Grade	LWR	154+98	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P28	At Grade	LWR	154+98	\$11,000.00	2016	50	2066	4.384	\$ 48,224
LWR-PZ-4	Above Grade	LWR	160+00	\$15,000.00	2016	50	2066	4.384	\$ 65,760
LWR-PZ-5	Above Grade	LWR	160+00	\$15,000.00	2016	50	2066	4.384	\$ 65,760

Table 4-1 – Piezometers – Replacement Costs

PZ No.	PZ Type	Levee System	Station	Initial Cost	Installation	Useful Life	Planned Replacement	CAF (3%)	Replacement Cost
LWR-PZ-6	Above Grade	LWR	160+00	\$15,000.00	2016	50	2066	4.384	\$ 65,760
LWR-PZ-7	Above Grade	LWR	160+00	\$15,000.00	2016	50	2066	4.384	\$ 65,760
PZ-P30	Above Grade	LWR	165+04	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P31	At Grade	LWR	165+04	\$11,000.00	2016	50	2066	4.384	\$ 48,224
LWR-PZ-8	Above Grade	LWR	167+00	\$15,000.00	2016	50	2066	4.384	\$ 65,760
LWR-PZ-9	Above Grade	LWR	167+00	\$15,000.00	2016	50	2066	4.384	\$ 65,760
LWR-PZ-10	Above Grade	LWR	167+00	\$15,000.00	2016	50	2066	4.384	\$ 65,760
LWR-PZ-11	Above Grade	LWR	170+00	\$15,000.00	2016	50	2066	4.384	\$ 65,760
LWR-PZ-12	Above Grade	LWR	170+00	\$15,000.00	2016	50	2066	4.384	\$ 65,760
LWR-PZ-13	Above Grade	LWR	170+00	\$15,000.00	2016	50	2066	4.384	\$ 65,760
PZ-P33	Above Grade	LWR	174+74	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P34	At Grade	LWR	175+04	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P35	Above Grade	LWR	185+04	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P36	At Grade	LWR	185+04	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P37	At Grade	LWR	187+33	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P38	At Grade	LWR	187+64	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P39	At Grade	LWR	208+84	\$36,000.00	2016	50	2066	4.384	\$ 157,824
PZ-P40	Above Grade	LWR	208+84	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P41	At Grade	LWR	208+84	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P42	Above Grade	LWR	229+31	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P43	Above Grade	LWR	232+12	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P44	Above Grade	LWR	289+88	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P45	At Grade	LWR	289+88	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P46	At Grade	LWR	324+47	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P47	At Grade	LWR	324+47	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P48	Above Grade	LWR	331+08	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P49	Above Grade	LWR	548+80	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P50	At Grade	LWR	548+81	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P51	Above Grade	LWR	571+13	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P52	At Grade	LWR	571+13	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P53	Above Grade	LWR	582+20	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P54	At Grade	LWR	582+02	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P55	Above Grade	LWR	593+53	\$11,000.00	2016	50	2066	4.384	\$ 48,224
PZ-P56	At Grade	LWR	593+14	\$11,000.00	2016	50	2066	4.384	\$ 48,224
Total:				\$901,000.00					\$ 3,949,984

4.2.1 Transducer Replacement

Each new piezometer was equipped with a transducer. The manufacturer estimates a useful life of 10 years. Replacement costs for the transducers throughout the life of the Piezometer have been estimated as shown in the table below.

Year No.	Year	CAF (3%)	Price	No. of PZs	Cost per Year
0	2016	1.000	\$ 1,000	0	\$ -
10	2026	1.344	\$ 1,344	72	\$ 96,768
20	2036	1.806	\$ 1,806	72	\$ 130,032
30	2046	2.427	\$ 2,427	72	\$ 174,744
40	2056	3.262	\$ 3,262	72	\$ 234,867
50	2066	Cost included in new Piezometer			
Total:					\$ 636,411

5.0 Clay Caps

Clay Caps shall be maintained in accordance with the system wide operation and maintenance manual. Clay Caps have a relatively indefinite life and do not require replacement. Two (2) clay cap areas were added on the riverside slope of the levee. These caps maintained a similar cross section to the existing slope and have added a negligible area where general maintenance is required. Therefore, these assets do not add additional maintenance to the District’s budget.

6.0 Cutoff Walls

One cutoff wall was constructed in Upper Wood River and another was constructed in Lower Wood River. Although these assets represent a large upfront cost, they do not require any maintenance, have a relatively indefinite life, and do not require replacement. Therefore, these assets do not add additional maintenance to the District’s budget.

7.0 Blanket Drains

Blanket drains shall be maintained in accordance with the system wide operation and maintenance manual. Seepage berms have a relatively indefinite life and do not require replacement. However, they do require periodic maintenance such as herbicide application to ensure the aggregate within the filter does not become compromised. Seven (7) blanket drains covering approximately eleven (11) acres were constructed. Maintenance costs have been estimated as shown in the table below.

Table 7-1 – Blanket Drains – Maintenance Costs

Year No.	Year	CAF (3%)	Herbicide Treatment			Cost per Year
			Price	Area (Ac)	Frequency/Year	
0	2018	1.000	\$ 100	11	1	\$ 1,100
1	2019	1.030	\$ 103	11	1	\$ 1,133
2	2020	1.061	\$ 106	11	1	\$ 1,167
3	2021	1.093	\$ 109	11	1	\$ 1,202
4	2022	1.126	\$ 113	11	1	\$ 1,239
5	2023	1.159	\$ 116	11	1	\$ 1,275
6	2024	1.194	\$ 119	11	1	\$ 1,313
7	2025	1.230	\$ 123	11	1	\$ 1,353
8	2026	1.267	\$ 127	11	1	\$ 1,394
9	2027	1.305	\$ 131	11	1	\$ 1,436
10	2028	1.344	\$ 134	11	1	\$ 1,478
11	2029	1.384	\$ 138	11	1	\$ 1,522
12	2030	1.426	\$ 143	11	1	\$ 1,569
13	2031	1.469	\$ 147	11	1	\$ 1,616
14	2032	1.513	\$ 151	11	1	\$ 1,664
15	2033	1.558	\$ 156	11	1	\$ 1,714
16	2034	1.605	\$ 161	11	1	\$ 1,766
17	2035	1.653	\$ 165	11	1	\$ 1,818
18	2036	1.702	\$ 170	11	1	\$ 1,872
19	2037	1.754	\$ 175	11	1	\$ 1,929
20	2038	1.806	\$ 181	11	1	\$ 1,987
21	2039	1.860	\$ 186	11	1	\$ 2,046
22	2040	1.916	\$ 192	11	1	\$ 2,108
23	2041	1.974	\$ 197	11	1	\$ 2,171
24	2042	2.033	\$ 203	11	1	\$ 2,236
25	2043	2.094	\$ 209	11	1	\$ 2,303
26	2044	2.157	\$ 216	11	1	\$ 2,373
27	2045	2.221	\$ 222	11	1	\$ 2,443
28	2046	2.288	\$ 229	11	1	\$ 2,517
29	2047	2.357	\$ 236	11	1	\$ 2,593
30	2048	2.427	\$ 243	11	1	\$ 2,670
31	2049	2.500	\$ 250	11	1	\$ 2,750
32	2050	2.575	\$ 258	11	1	\$ 2,833
33	2051	2.652	\$ 265	11	1	\$ 2,917

Table 7-1 – Blanket Drains – Maintenance Costs

Year No.	Year	CAF (3%)	Herbicide Treatment			Cost per Year
			Price	Area (Ac)	Frequency/Year	
34	2052	2.732	\$ 273	11	1	\$ 3,005
35	2053	2.814	\$ 281	11	1	\$ 3,095
36	2054	2.898	\$ 290	11	1	\$ 3,188
37	2055	2.985	\$ 299	11	1	\$ 3,284
38	2056	3.075	\$ 307	11	1	\$ 3,382
39	2057	3.167	\$ 317	11	1	\$ 3,484
40	2058	3.262	\$ 326	11	1	\$ 3,588
41	2059	3.360	\$ 336	11	1	\$ 3,696
42	2060	3.461	\$ 346	11	1	\$ 3,807
43	2061	3.565	\$ 356	11	1	\$ 3,921
44	2062	3.671	\$ 367	11	1	\$ 4,039
45	2063	3.782	\$ 378	11	1	\$ 4,160
46	2064	3.895	\$ 390	11	1	\$ 4,285
47	2065	4.012	\$ 401	11	1	\$ 4,413
48	2066	4.132	\$ 413	11	1	\$ 4,545
49	2067	4.256	\$ 426	11	1	\$ 4,682
50	2068	4.384	\$ 438	11	1	\$ 4,822
51	2069	4.516	\$ 452	11	1	\$ 4,967
52	2070	4.651	\$ 465	11	1	\$ 5,116
53	2071	4.791	\$ 479	11	1	\$ 5,270
54	2072	4.934	\$ 493	11	1	\$ 5,428
55	2073	5.082	\$ 508	11	1	\$ 5,590
56	2074	5.235	\$ 523	11	1	\$ 5,758
57	2075	5.392	\$ 539	11	1	\$ 5,931
58	2076	5.554	\$ 555	11	1	\$ 6,109
59	2077	5.720	\$ 572	11	1	\$ 6,292
60	2078	5.892	\$ 589	11	1	\$ 6,481
61	2079	6.068	\$ 607	11	1	\$ 6,675
62	2080	6.251	\$ 625	11	1	\$ 6,876
63	2081	6.438	\$ 644	11	1	\$ 7,082
64	2082	6.631	\$ 663	11	1	\$ 7,294
65	2083	6.830	\$ 683	11	1	\$ 7,513
66	2084	7.035	\$ 704	11	1	\$ 7,739
67	2085	7.246	\$ 725	11	1	\$ 7,971
68	2086	7.463	\$ 746	11	1	\$ 8,210
69	2087	7.687	\$ 769	11	1	\$ 8,456

Table 7-1 – Blanket Drains – Maintenance Costs

Year No.	Year	CAF (3%)	Herbicide Treatment			Cost per Year
			Price	Area (Ac)	Frequency/Year	
70	2088	7.918	\$ 792	11	1	\$ 8,710
71	2089	8.156	\$ 816	11	1	\$ 8,971
72	2090	8.400	\$ 840	11	1	\$ 9,240
73	2091	8.652	\$ 865	11	1	\$ 9,517
74	2092	8.912	\$ 891	11	1	\$ 9,803
75	2093	9.179	\$ 918	11	1	\$ 10,097
76	2094	9.454	\$ 945	11	1	\$ 10,400
77	2095	9.738	\$ 974	11	1	\$ 10,712
78	2096	10.030	\$ 1,003	11	1	\$ 11,033
79	2097	10.331	\$ 1,033	11	1	\$ 11,364
80	2098	10.641	\$ 1,064	11	1	\$ 11,705
81	2099	10.960	\$ 1,096	11	1	\$ 12,056
82	2100	11.289	\$ 1,129	11	1	\$ 12,418
83	2101	11.628	\$ 1,163	11	1	\$ 12,791
84	2102	11.977	\$ 1,198	11	1	\$ 13,174
85	2103	12.336	\$ 1,234	11	1	\$ 13,570
86	2104	12.706	\$ 1,271	11	1	\$ 13,977
87	2105	13.087	\$ 1,309	11	1	\$ 14,396
88	2106	13.480	\$ 1,348	11	1	\$ 14,828
89	2107	13.884	\$ 1,388	11	1	\$ 15,273
90	2108	14.301	\$ 1,430	11	1	\$ 15,731
91	2109	14.730	\$ 1,473	11	1	\$ 16,203
92	2110	15.172	\$ 1,517	11	1	\$ 16,689
93	2111	15.627	\$ 1,563	11	1	\$ 17,190
94	2112	16.096	\$ 1,610	11	1	\$ 17,705
95	2113	16.579	\$ 1,658	11	1	\$ 18,236
96	2114	17.076	\$ 1,708	11	1	\$ 18,783
97	2115	17.588	\$ 1,759	11	1	\$ 19,347
98	2116	18.116	\$ 1,812	11	1	\$ 19,927
99	2117	18.659	\$ 1,866	11	1	\$ 20,525
100	2118	19.219	\$ 1,922	11	1	\$ 21,141
Total:						\$ 689,172

8.0 Seepage Berms, Random Fills, and Drainage Ditches

Seepage berms, random fills, and ditches shall be maintained in accordance with the system wide operation and maintenance manual. These features have a relatively indefinite life and do not require replacement. However, they do require periodic maintenance, such as mowing, herbicide application, and rodent abatement. Four (4) seepage berms, two (2) random fill areas, and one (1) drainage ditch covering approximately sixteen (16) acres were constructed. Maintenance costs have been estimated as shown in the table below.

Table 8-1 – Seepage Berms, Random Fills, & Drainage Ditches – Maintenance Costs									
Year No.	Year	CAF (3%)	Rodent/Herbicide			Mowing			Cost per Year
			Price	Area (Ac)	Frequency/Year	Price	Area (Ac)	Frequency/Year	
0	2018	1.000	\$ 20	16	1	\$ 60.00	16	4	\$4,160
1	2019	1.030	\$ 21	16	1	\$ 61.80	16	4	\$4,285
2	2020	1.061	\$ 21	16	1	\$ 63.66	16	4	\$4,414
3	2021	1.093	\$ 22	16	1	\$ 65.58	16	4	\$4,547
4	2022	1.126	\$ 23	16	1	\$ 67.56	16	4	\$4,684
5	2023	1.159	\$ 23	16	1	\$ 69.54	16	4	\$4,821
6	2024	1.194	\$ 24	16	1	\$ 71.64	16	4	\$4,967
7	2025	1.230	\$ 25	16	1	\$ 73.80	16	4	\$5,117
8	2026	1.267	\$ 25	16	1	\$ 76.02	16	4	\$5,271
9	2027	1.305	\$ 26	16	1	\$ 78.30	16	4	\$5,429
10	2028	1.344	\$ 27	16	1	\$ 80.64	16	4	\$5,591
11	2029	1.384	\$ 28	16	1	\$ 83.04	16	4	\$5,757
12	2030	1.426	\$ 29	16	1	\$ 85.56	16	4	\$5,932
13	2031	1.469	\$ 29	16	1	\$ 88.14	16	4	\$6,111
14	2032	1.513	\$ 30	16	1	\$ 90.78	16	4	\$6,294
15	2033	1.558	\$ 31	16	1	\$ 93.48	16	4	\$6,481
16	2034	1.605	\$ 32	16	1	\$ 96.30	16	4	\$6,677
17	2035	1.653	\$ 33	16	1	\$ 99.18	16	4	\$6,876
18	2036	1.702	\$ 34	16	1	\$ 102.12	16	4	\$7,080
19	2037	1.754	\$ 35	16	1	\$ 105.24	16	4	\$7,297
20	2038	1.806	\$ 36	16	1	\$ 108.36	16	4	\$7,513
21	2039	1.860	\$ 37	16	1	\$ 111.60	16	4	\$7,738
22	2040	1.916	\$ 38	16	1	\$ 114.96	16	4	\$7,971
23	2041	1.974	\$ 39	16	1	\$ 118.44	16	4	\$8,212
24	2042	2.033	\$ 41	16	1	\$ 121.98	16	4	\$8,457
25	2043	2.094	\$ 42	16	1	\$ 125.64	16	4	\$8,711
26	2044	2.157	\$ 43	16	1	\$ 129.42	16	4	\$8,973

Table 8-1 – Seepage Berms, Random Fills, & Drainage Ditches – Maintenance Costs

Year No.	Year	CAF (3%)	Rodent/Herbicide			Mowing			Cost per Year
			Price	Area (Ac)	Frequency/Year	Price	Area (Ac)	Frequency/Year	
27	2045	2.221	\$ 44	16	1	\$ 133.26	16	4	\$9,239
28	2046	2.288	\$ 46	16	1	\$ 137.28	16	4	\$9,518
29	2047	2.357	\$ 47	16	1	\$ 141.42	16	4	\$9,805
30	2048	2.427	\$ 49	16	1	\$ 145.62	16	4	\$10,096
31	2049	2.500	\$ 50	16	1	\$ 150.00	16	4	\$10,400
32	2050	2.575	\$ 52	16	1	\$ 154.50	16	4	\$10,712
33	2051	2.652	\$ 53	16	1	\$ 159.12	16	4	\$11,032
34	2052	2.732	\$ 55	16	1	\$ 163.92	16	4	\$11,365
35	2053	2.814	\$ 56	16	1	\$ 168.84	16	4	\$11,706
36	2054	2.898	\$ 58	16	1	\$ 173.90	16	4	\$12,057
37	2055	2.985	\$ 60	16	1	\$ 179.11	16	4	\$12,419
38	2056	3.075	\$ 61	16	1	\$ 184.49	16	4	\$12,791
39	2057	3.167	\$ 63	16	1	\$ 190.02	16	4	\$13,175
40	2058	3.262	\$ 65	16	1	\$ 195.72	16	4	\$13,570
41	2059	3.360	\$ 67	16	1	\$ 201.59	16	4	\$13,977
42	2060	3.461	\$ 69	16	1	\$ 207.64	16	4	\$14,396
43	2061	3.565	\$ 71	16	1	\$ 213.87	16	4	\$14,828
44	2062	3.671	\$ 73	16	1	\$ 220.29	16	4	\$15,273
45	2063	3.782	\$ 76	16	1	\$ 226.90	16	4	\$15,731
46	2064	3.895	\$ 78	16	1	\$ 233.70	16	4	\$16,203
47	2065	4.012	\$ 80	16	1	\$ 240.71	16	4	\$16,689
48	2066	4.132	\$ 83	16	1	\$ 247.94	16	4	\$17,190
49	2067	4.256	\$ 85	16	1	\$ 255.37	16	4	\$17,706
50	2068	4.384	\$ 88	16	1	\$ 263.04	16	4	\$18,237
51	2069	4.516	\$ 90	16	1	\$ 270.93	16	4	\$18,785
52	2070	4.651	\$ 93	16	1	\$ 279.06	16	4	\$19,348
53	2071	4.791	\$ 96	16	1	\$ 287.43	16	4	\$19,929
54	2072	4.934	\$ 99	16	1	\$ 296.05	16	4	\$20,526
55	2073	5.082	\$102	16	1	\$ 304.94	16	4	\$21,142
56	2074	5.235	\$105	16	1	\$ 314.08	16	4	\$21,776
57	2075	5.392	\$108	16	1	\$ 323.51	16	4	\$22,430
58	2076	5.554	\$111	16	1	\$ 333.21	16	4	\$23,103
59	2077	5.720	\$114	16	1	\$ 343.21	16	4	\$23,796
60	2078	5.892	\$118	16	1	\$ 353.50	16	4	\$24,510
61	2079	6.068	\$121	16	1	\$ 364.11	16	4	\$25,245
62	2080	6.251	\$125	16	1	\$ 375.03	16	4	\$26,002

Table 8-1 – Seepage Berms, Random Fills, & Drainage Ditches – Maintenance Costs

Year No.	Year	CAF (3%)	Rodent/Herbicide			Mowing			Cost per Year
			Price	Area (Ac)	Frequency/Year	Price	Area (Ac)	Frequency/Year	
63	2081	6.438	\$129	16	1	\$ 386.28	16	4	\$26,782
64	2082	6.631	\$133	16	1	\$ 397.87	16	4	\$27,586
65	2083	6.830	\$137	16	1	\$ 409.81	16	4	\$28,413
66	2084	7.035	\$141	16	1	\$ 422.10	16	4	\$29,266
67	2085	7.246	\$145	16	1	\$ 434.77	16	4	\$30,144
68	2086	7.463	\$149	16	1	\$ 447.81	16	4	\$31,048
69	2087	7.687	\$154	16	1	\$ 461.24	16	4	\$31,979
70	2088	7.918	\$158	16	1	\$ 475.08	16	4	\$32,939
71	2089	8.156	\$163	16	1	\$ 489.33	16	4	\$33,927
72	2090	8.400	\$168	16	1	\$ 504.01	16	4	\$34,945
73	2091	8.652	\$173	16	1	\$ 519.13	16	4	\$35,993
74	2092	8.912	\$178	16	1	\$ 534.71	16	4	\$37,073
75	2093	9.179	\$184	16	1	\$ 550.75	16	4	\$38,185
76	2094	9.454	\$189	16	1	\$ 567.27	16	4	\$39,331
77	2095	9.738	\$195	16	1	\$ 584.29	16	4	\$40,511
78	2096	10.030	\$201	16	1	\$ 601.82	16	4	\$41,726
79	2097	10.331	\$207	16	1	\$ 619.87	16	4	\$42,978
80	2098	10.641	\$213	16	1	\$ 638.47	16	4	\$44,267
81	2099	10.960	\$219	16	1	\$ 657.62	16	4	\$45,595
82	2100	11.289	\$226	16	1	\$ 677.35	16	4	\$46,963
83	2101	11.628	\$233	16	1	\$ 697.67	16	4	\$48,372
84	2102	11.977	\$240	16	1	\$ 718.60	16	4	\$49,823
85	2103	12.336	\$247	16	1	\$ 740.16	16	4	\$51,318
86	2104	12.706	\$254	16	1	\$ 762.36	16	4	\$52,857
87	2105	13.087	\$262	16	1	\$ 785.23	16	4	\$54,443
88	2106	13.480	\$270	16	1	\$ 808.79	16	4	\$56,076
89	2107	13.884	\$278	16	1	\$ 833.05	16	4	\$57,758
90	2108	14.301	\$286	16	1	\$ 858.05	16	4	\$59,491
91	2109	14.730	\$295	16	1	\$ 883.79	16	4	\$61,276
92	2110	15.172	\$303	16	1	\$ 910.30	16	4	\$63,114
93	2111	15.627	\$313	16	1	\$ 937.61	16	4	\$65,008
94	2112	16.096	\$322	16	1	\$ 965.74	16	4	\$66,958
95	2113	16.579	\$332	16	1	\$ 994.71	16	4	\$68,967
96	2114	17.076	\$342	16	1	\$1,024.55	16	4	\$71,036
97	2115	17.588	\$352	16	1	\$1,055.29	16	4	\$73,167
98	2116	18.116	\$362	16	1	\$1,086.95	16	4	\$75,362

Year No.	Year	CAF (3%)	Rodent/Herbicide			Mowing			Cost per Year
			Price	Area (Ac)	Frequency/Year	Price	Area (Ac)	Frequency/Year	
99	2117	18.659	\$373	16	1	\$1,119.56	16	4	\$77,623
100	2118	19.219	\$384	16	1	\$1,153.14	16	4	\$79,951
Total:									\$2,606,325

9.0 Indian Creek Rip Rap (Bank Stabilization)

Indian Creek was experiencing extreme erosion that was nearing the toe of the flank levee. Rip rap was added to stabilize the bank. This feature has a relatively indefinite life and will not require replacement. However, it will require periodic maintenance such as herbicide application. Maintenance costs have been estimated as shown in the table below.

Year No.	Year	CAF (3%)	Herbicide Treatment			Cost per Year
			Price	Area (Ac)	Frequency/Year	
0	2018	1.000	\$ 100	1	1	\$ 100
1	2019	1.030	\$ 103	1	1	\$ 103
2	2020	1.061	\$ 106	1	1	\$ 106
3	2021	1.093	\$ 109	1	1	\$ 109
4	2022	1.126	\$ 113	1	1	\$ 113
5	2023	1.159	\$ 116	1	1	\$ 116
6	2024	1.194	\$ 119	1	1	\$ 119
7	2025	1.230	\$ 123	1	1	\$ 123
8	2026	1.267	\$ 127	1	1	\$ 127
9	2027	1.305	\$ 131	1	1	\$ 131
10	2028	1.344	\$ 134	1	1	\$ 134
11	2029	1.384	\$ 138	1	1	\$ 138
12	2030	1.426	\$ 143	1	1	\$ 143
13	2031	1.469	\$ 147	1	1	\$ 147
14	2032	1.513	\$ 151	1	1	\$ 151
15	2033	1.558	\$ 156	1	1	\$ 156
16	2034	1.605	\$ 161	1	1	\$ 161
17	2035	1.653	\$ 165	1	1	\$ 165
18	2036	1.702	\$ 170	1	1	\$ 170
19	2037	1.754	\$ 175	1	1	\$ 175
20	2038	1.806	\$ 181	1	1	\$ 181

Table 9-1 – Indian Creek Rip Rap – Maintenance Costs						
Year No.	Year	CAF (3%)	Herbicide Treatment			Cost per Year
			Price	Area (Ac)	Frequency/Year	
21	2039	1.860	\$ 186	1	1	\$ 186
22	2040	1.916	\$ 192	1	1	\$ 192
23	2041	1.974	\$ 197	1	1	\$ 197
24	2042	2.033	\$ 203	1	1	\$ 203
25	2043	2.094	\$ 209	1	1	\$ 209
26	2044	2.157	\$ 216	1	1	\$ 216
27	2045	2.221	\$ 222	1	1	\$ 222
28	2046	2.288	\$ 229	1	1	\$ 229
29	2047	2.357	\$ 236	1	1	\$ 236
30	2048	2.427	\$ 243	1	1	\$ 243
31	2049	2.500	\$ 250	1	1	\$ 250
32	2050	2.575	\$ 258	1	1	\$ 258
33	2051	2.652	\$ 265	1	1	\$ 265
34	2052	2.732	\$ 273	1	1	\$ 273
35	2053	2.814	\$ 281	1	1	\$ 281
36	2054	2.898	\$ 290	1	1	\$ 290
37	2055	2.985	\$ 299	1	1	\$ 299
38	2056	3.075	\$ 307	1	1	\$ 307
39	2057	3.167	\$ 317	1	1	\$ 317
40	2058	3.262	\$ 326	1	1	\$ 326
41	2059	3.360	\$ 336	1	1	\$ 336
42	2060	3.461	\$ 346	1	1	\$ 346
43	2061	3.565	\$ 356	1	1	\$ 356
44	2062	3.671	\$ 367	1	1	\$ 367
45	2063	3.782	\$ 378	1	1	\$ 378
46	2064	3.895	\$ 390	1	1	\$ 390
47	2065	4.012	\$ 401	1	1	\$ 401
48	2066	4.132	\$ 413	1	1	\$ 413
49	2067	4.256	\$ 426	1	1	\$ 426
50	2068	4.384	\$ 438	1	1	\$ 438
51	2069	4.516	\$ 452	1	1	\$ 452
52	2070	4.651	\$ 465	1	1	\$ 465
53	2071	4.791	\$ 479	1	1	\$ 479
54	2072	4.934	\$ 493	1	1	\$ 493
55	2073	5.082	\$ 508	1	1	\$ 508
56	2074	5.235	\$ 523	1	1	\$ 523

Table 9-1 – Indian Creek Rip Rap – Maintenance Costs						
Year No.	Year	CAF (3%)	Herbicide Treatment			Cost per Year
			Price	Area (Ac)	Frequency/Year	
57	2075	5.392	\$ 539	1	1	\$ 539
58	2076	5.554	\$ 555	1	1	\$ 555
59	2077	5.720	\$ 572	1	1	\$ 572
60	2078	5.892	\$ 589	1	1	\$ 589
61	2079	6.068	\$ 607	1	1	\$ 607
62	2080	6.251	\$ 625	1	1	\$ 625
63	2081	6.438	\$ 644	1	1	\$ 644
64	2082	6.631	\$ 663	1	1	\$ 663
65	2083	6.830	\$ 683	1	1	\$ 683
66	2084	7.035	\$ 704	1	1	\$ 704
67	2085	7.246	\$ 725	1	1	\$ 725
68	2086	7.463	\$ 746	1	1	\$ 746
69	2087	7.687	\$ 769	1	1	\$ 769
70	2088	7.918	\$ 792	1	1	\$ 792
71	2089	8.156	\$ 816	1	1	\$ 816
72	2090	8.400	\$ 840	1	1	\$ 840
73	2091	8.652	\$ 865	1	1	\$ 865
74	2092	8.912	\$ 891	1	1	\$ 891
75	2093	9.179	\$ 918	1	1	\$ 918
76	2094	9.454	\$ 945	1	1	\$ 945
77	2095	9.738	\$ 974	1	1	\$ 974
78	2096	10.030	\$ 1,003	1	1	\$ 1,003
79	2097	10.331	\$ 1,033	1	1	\$ 1,033
80	2098	10.641	\$ 1,064	1	1	\$ 1,064
81	2099	10.960	\$ 1,096	1	1	\$ 1,096
82	2100	11.289	\$ 1,129	1	1	\$ 1,129
83	2101	11.628	\$ 1,163	1	1	\$ 1,163
84	2102	11.977	\$ 1,198	1	1	\$ 1,198
85	2103	12.336	\$ 1,234	1	1	\$ 1,234
86	2104	12.706	\$ 1,271	1	1	\$ 1,271
87	2105	13.087	\$ 1,309	1	1	\$ 1,309
88	2106	13.480	\$ 1,348	1	1	\$ 1,348
89	2107	13.884	\$ 1,388	1	1	\$ 1,388
90	2108	14.301	\$ 1,430	1	1	\$ 1,430
91	2109	14.730	\$ 1,473	1	1	\$ 1,473
92	2110	15.172	\$ 1,517	1	1	\$ 1,517

Table 9-1 – Indian Creek Rip Rap – Maintenance Costs						
Year No.	Year	CAF (3%)	Herbicide Treatment			Cost per Year
			Price	Area (Ac)	Frequency/Year	
93	2111	15.627	\$ 1,563	1	1	\$ 1,563
94	2112	16.096	\$ 1,610	1	1	\$ 1,610
95	2113	16.579	\$ 1,658	1	1	\$ 1,658
96	2114	17.076	\$ 1,708	1	1	\$ 1,708
97	2115	17.588	\$ 1,759	1	1	\$ 1,759
98	2116	18.116	\$ 1,812	1	1	\$ 1,812
99	2117	18.659	\$ 1,866	1	1	\$ 1,866
100	2118	19.219	\$ 1,922	1	1	\$ 1,922
Total:						\$ 62,652

10.0 Relief Well Conveyance System Piping, Structures, and Check Valves

10.1 Maintenance

Relief well conveyance systems are to be inspected periodically to ensure that the pipes, structures, and check valves are in good condition and that there is not an accumulation of silt, trash, and debris in the conveyance pipes, manholes, or at the outfall structures. At a minimum, conveyance systems shall be televised via CCTV every 5 years to ensure that there are no obstructions, rips, tears, or deformations in the pipe and that the structural integrity of the pipe has not been compromised in any way. It is estimated that half way through the useful life, the pipe may require some sort of pipe rehab such as a cured in place liner. Maintenance costs have been estimated as shown in the table below.

Table 10-1 – Pipe Systems – Maintenance Costs							
Year No.	Year	CAF (3%)	Cleaning/CCTV		Pipe Rehab		Cost per Year
			Price	LF of Pipe	Price	LF of Pipe	
0	2016	1.000	\$ 10	0	\$ 99	0	\$ -
5	2021	1.159	\$ 12	5100	\$ 115	0	\$ 59,109
10	2026	1.344	\$ 13	5100	\$ 133	0	\$ 68,544
15	2031	1.558	\$ 16	5100	\$ 154	0	\$ 79,458
20	2036	1.806	\$ 18	5100	\$ 179	0	\$ 92,106
25	2041	2.094	\$ 21	5100	\$ 207	0	\$ 106,794
30	2046	2.427	\$ 24	5100	\$ 240	0	\$ 123,777
35	2051	2.814	\$ 28	5100	\$ 279	0	\$ 143,514
40	2056	3.262	\$ 33	5100	\$ 323	0	\$ 166,362
45	2061	3.782	\$ 38	5100	\$ 374	0	\$ 192,882
50	2066	4.384	\$ 44	5100	\$ 434	5100	\$ 2,437,066
55	2071	5.082	\$ 51	5100	\$ 503	0	\$ 259,182
60	2076	5.892	\$ 59	5100	\$ 583	0	\$ 300,492
65	2081	6.830	\$ 68	5100	\$ 676	0	\$ 348,330
70	2086	7.918	\$ 79	5100	\$ 784	0	\$ 403,818
75	2091	9.179	\$ 92	5100	\$ 909	0	\$ 468,129
80	2096	10.641	\$ 106	5100	\$1,053	0	\$ 542,691
85	2101	12.336	\$ 123	5100	\$1,221	0	\$ 629,136
90	2106	14.300	\$ 143	5100	\$1,416	0	\$ 729,300
95	2111	16.578	\$ 166	5100	\$1,641	0	\$ 845,478
Total:							\$ 7,996,168

10.2 Replacement

These projects added nearly 5,100 linear feet of polyvinyl chloride (PVC), high-density polyethylene (HDPE), reinforced (RCP), and ductile iron pipe (DIP) pipe of varying sizes. These systems are located at Russell Commons Park, Blanket Drain #2, Blanket Drain #3, RW 1064/65 Collector System, Blanket Drain #4, Misc. Relief Well Laterals, Hartford Weir System, Old St. Louis Road Collector System, Seepage Berm #1, and Random Fill. The manufacturers of the pipe publish a useful life of 100 years. The manufacturer of the reinforced concrete structures publishes a useful life of 75 to 100 years. The manufacturers of the check valves publish a useful life of 35-50 years. Replacement costs have been estimated as shown in the table below.

Table 10-2 – Pipe Systems – Replacement Costs (Pipe)

System	Start Station	End Station	Initial Cost	Installation	Useful Life	Planned Replacement	CAF (3%)	Replacement Cost
Russell Commons Park	38+00	51+00	\$ 52,038	2016	100	2116	19.219	\$ 1,000,109
Blanket Drain #2	143+00	154+00	\$ 102,163	2016	100	2116	19.219	\$ 1,963,476
Blanket Drain #3	216+00	220+00	\$ 52,459	2016	100	2116	19.219	\$ 1,008,217
1064/65 Collector System	185+50	187+6w0	\$ 15,200	2016	100	2116	19.219	\$ 292,121
Blanket Drain #4	194+00	199+00	\$ 207,174	2016	100	2116	19.219	\$ 3,981,682
Misc. Relief Well Laterals	Misc.	Misc.	\$ 27,999	2016	100	2116	19.219	\$ 538,116
Hartford Weirs	308+50	310+00	\$ 5,954	2016	100	2116	19.219	\$ 114,421
Old STL Collector System	320+00	326+00	\$ 37,606	2016	100	2116	19.219	\$ 722,751
Seepage Berm	576+00	852+00	\$ 36,539	2016	100	2116	19.219	\$ 702,252
Random Fill	651+34	652+02	\$ 6,784	2016	100	2116	19.219	\$ 130,382
Total:			\$ 543,916					\$ 10,453,527

Table 10-3 – Pipe Systems – Replacement Costs (Structures)

System	Structure Type	Quantity	Initial Cost	Installation	Useful Life	Planned Replacement	CAF (3%)	Replacement Cost
Russell Commons Park	HEADWALL	17	\$ 64,600	2016	75	2091	9.179	\$ 592,963
	48" MH	0	\$ -	2016	75	2091	9.179	\$ -
	72" MH	0	\$ -	2016	75	2091	9.179	\$ -
	48"X48" CB	0	\$ -	2016	75	2091	9.179	\$ -
	60"X60" CB	0	\$ -	2016	75	2091	9.179	\$ -
	36" FES	0	\$ -	2016	75	2091	9.179	\$ -
	42" FES	0	\$ -	2016	75	2091	9.179	\$ -
Blanket Drain #2	HEADWALL	0	\$ -	2016	75	2091	9.179	\$ -
	48" MH	2	\$ 12,658	2016	75	2091	9.179	\$ 116,186
	72" MH	4	\$ 34,020	2016	75	2091	9.179	\$ 312,270
	48"x48" CB	3	\$ 16,748	2016	75	2091	9.179	\$ 153,734
	60"X60" CB	0	\$ -	2016	75	2091	9.179	\$ -
	36" FES	1	\$ 6,000	2016	75	2091	9.179	\$ 55,074
	42" FES	0	\$ -	2016	75	2091	9.179	\$ -
Blanket Drain #3	Headwalls	4	\$ 15,200	2016	75	2091	9.179	\$ 139,521
	48" MH	2	\$ 12,658	2016	75	2091	9.179	\$ 116,186
	72" MH	0	\$ -	2016	75	2091	9.179	\$ -
	48"X48" CB	0	\$ -	2016	75	2091	9.179	\$ -
	60"X60" CB	0	\$ -	2016	75	2091	9.179	\$ -
	36" FES	0	\$ -	2016	75	2091	9.179	\$ -
	42" FES	0	\$ -	2016	75	2091	9.179	\$ -
1064/65 Collector System	Headwalls	1	\$ 3,800	2016	75	2091	9.179	\$ 34,880
	48" MH	1	\$ 6,329	2016	75	2091	9.179	\$ 58,093
	72" MH	0	\$ -	2016	75	2091	9.179	\$ -
	48"X48" CB	0	\$ -	2016	75	2091	9.179	\$ -
	60"X60" CB	0	\$ -	2016	75	2091	9.179	\$ -
	36" FES	0	\$ -	2016	75	2091	9.179	\$ -
	42" FES	0	\$ -	2016	75	2091	9.179	\$ -
Blanket Drain #4	Headwalls	0	\$ -	2016	75	2091	9.179	\$ -
	48" MH	8	\$ 50,631	2016	75	2091	9.179	\$ 464,746
	72" MH	0	\$ -	2016	75	2091	9.179	\$ -
	48"X48" CB	0	\$ -	2016	75	2091	9.179	\$ -
	60"X60" CB	2	\$ 13,802	2016	75	2091	9.179	\$ 126,689
	36" FES	0	\$ -	2016	75	2091	9.179	\$ -
	42" FES	1	\$ 8,000	2016	75	2091	9.179	\$ 73,432

Table 10-3 – Pipe Systems – Replacement Costs (Structures)

System	Structure Type	Quantity	Initial Cost	Installation	Useful Life	Planned Replacement	CAF (3%)	Replacement Cost
Misc. Relief Well Laterals	Headwalls	19	\$ 72,200	2016	75	2091	9.179	\$ 662,724
	48" MH	0	\$ -	2016	75	2091	9.179	\$ -
	72" MH	0	\$ -	2016	75	2091	9.179	\$ -
	48"X48" CB	0	\$ -	2016	75	2091	9.179	\$ -
	60"X60" CB	0	\$ -	2016	75	2091	9.179	\$ -
	36" FES	0	\$ -	2016	75	2091	9.179	\$ -
	42" FES	0	\$ -	2016	75	2091	9.179	\$ -
Hartford Weirs	Headwalls	0	\$ -	2016	75	2091	9.179	\$ -
	48" MH	0	\$ -	2016	75	2091	9.179	\$ -
	72" MH	0	\$ -	2016	75	2091	9.179	\$ -
	48"X48" CB	4	\$ 22,331	2016	75	2091	9.179	\$ 204,978
	60"X60" CB	0	\$ -	2016	75	2091	9.179	\$ -
	36" FES	0	\$ -	2016	75	2091	9.179	\$ -
	42" FES	0	\$ -	2016	75	2091	9.179	\$ -
Old STL Collector System	Headwalls	1	\$ 3,800	2016	75	2091	9.179	\$ 34,880
	48" MH	4	\$ 25,316	2016	75	2091	9.179	\$ 232,373
	72" MH	0	\$ -	2016	75	2091	9.179	\$ -
	48"X48" CB	0	\$ -	2016	75	2091	9.179	\$ -
	60"X60" CB	0	\$ -	2016	75	2091	9.179	\$ -
	36" FES	0	\$ -	2016	75	2091	9.179	\$ -
	42" FES	0	\$ -	2016	75	2091	9.179	\$ -
Seepage Berm	Headwalls	2	\$ 7,600	2016	75	2091	9.179	\$ 69,760
	48" MH	0	\$ -	2016	75	2091	9.179	\$ -
	72" MH	0	\$ -	2016	75	2091	9.179	\$ -
	48"X48" CB	2	\$ 11,166	2016	75	2091	9.179	\$ 102,489
	60"X60" CB	0	\$ -	2016	75	2091	9.179	\$ -
	36" FES	0	\$ -	2016	75	2091	9.179	\$ -
	42" FES	0	\$ -	2016	75	2091	9.179	\$ -
Random Fill	Headwalls	2	\$ 7,600	2016	75	2091	9.179	\$ 69,760
	48" MH	0	\$ -	2016	75	2091	9.179	\$ -
	72" MH	0	\$ -	2016	75	2091	9.179	\$ -
	48"X48" CB	0	\$ -	2016	75	2091	9.179	\$ -
	60"X60" CB	0	\$ -	2016	75	2091	9.179	\$ -
	36" FES	0	\$ -	2016	75	2091	9.179	\$ -
	42" FES	0	\$ -	2016	75	2091	9.179	\$ -
Total:			\$ 394,459					\$ 3,620,740

Table 10-4 – Pipe Systems – Replacement Costs (Check Valves)

System	Type	Quantity	Initial Cost	Installation	Useful Life	Planned Replacement	CAF (3%)	Replacement Cost
Russell Commons Park	Duckbill	17	\$ 17,000	2016	35	2051	2.814	\$ 47,838
Blanket Drain #2	N/A	0	\$ -	2016	35	2051	2.814	\$ -
Blanket Drain #3	Duckbill	4	\$ 4,000	2016	35	2051	2.814	\$ 11,256
1064/65 Collector System	Duckbill	1	\$ 1,000	2016	35	2051	2.814	\$ 2,814
Blanket Drain #4	N/A	0	\$ -	2016	35	2051	2.814	\$ -
Misc. Relief Well Laterals	Duckbill	5	\$ 5,000	2016	35	2051	2.814	\$ 14,070
	Flap	14	\$ 14,000	2016	35	2051	2.814	\$ 39,396
Hartford Weirs	N/A	0	\$ -	2016	35	2051	2.814	\$ -
Old STL Collector System	Flap	1	\$ 1,000	2016	35	2051	2.814	\$ 2,814
Seepage Berm	N/A	0	\$ -	2016	35	2051	2.814	\$ -
Random Fill	N/A	0	\$ -	2016	35	2051	2.814	\$ -
Total:			\$ 42,000					\$ 118,188

11.0 Weirs (4 Locations)

11.1 Maintenance

Periodic inspections of the weirs shall be made to ensure that concrete and miscellaneous metals are in good condition. Metal parts are to be adequately covered with paint and kept free from rust. Machine-finished surfaces shall be protected from rusting by applying a coating of lubricant. Care shall be exercised to prevent the accumulation of silt, trash, and debris near or within the structure. Maintenance costs have been estimated as shown in the table below.

Table 11-1 – Weirs – Maintenance Costs					
Year No.	Year	CAF (3%)	Annual Cleaning		Cost per Year
			Price	QTY	
0	2016	1.000	\$ 1,500	0	\$ -
1	2017	1.030	\$ 1,545	0	\$ -
2	2018	1.061	\$ 1,592	4	\$ 6,366
3	2019	1.093	\$ 1,640	4	\$ 6,558
4	2020	1.126	\$ 1,689	4	\$ 6,756
5	2021	1.159	\$ 1,739	4	\$ 6,954
6	2022	1.194	\$ 1,791	4	\$ 7,164
7	2023	1.230	\$ 1,845	4	\$ 7,380
8	2024	1.267	\$ 1,901	4	\$ 7,602
9	2025	1.305	\$ 1,958	4	\$ 7,830
10	2026	1.344	\$ 2,016	4	\$ 8,064
11	2027	1.384	\$ 2,076	4	\$ 8,304
12	2028	1.426	\$ 2,139	4	\$ 8,556
13	2029	1.469	\$ 2,204	4	\$ 8,814
14	2030	1.513	\$ 2,270	4	\$ 9,078
15	2031	1.558	\$ 2,337	4	\$ 9,348
16	2032	1.605	\$ 2,408	4	\$ 9,630
17	2033	1.653	\$ 2,480	4	\$ 9,918
18	2034	1.702	\$ 2,553	4	\$ 10,212
19	2035	1.754	\$ 2,631	4	\$ 10,524
20	2036	1.806	\$ 2,709	4	\$ 10,836
21	2037	1.860	\$ 2,790	4	\$ 11,160
22	2038	1.916	\$ 2,874	4	\$ 11,496
23	2039	1.974	\$ 2,961	4	\$ 11,844
24	2040	2.033	\$ 3,050	4	\$ 12,198
25	2041	2.094	\$ 3,141	4	\$ 12,564
26	2042	2.157	\$ 3,236	4	\$ 12,942
27	2043	2.221	\$ 3,332	4	\$ 13,326
28	2044	2.288	\$ 3,432	4	\$ 13,728
29	2045	2.357	\$ 3,536	4	\$ 14,142
30	2046	2.427	\$ 3,641	4	\$ 14,562
31	2047	2.500	\$ 3,750	4	\$ 15,000
32	2048	2.575	\$ 3,863	4	\$ 15,450
33	2049	2.652	\$ 3,978	4	\$ 15,912
34	2050	2.732	\$ 4,098	4	\$ 16,392
35	2051	2.814	\$ 4,221	4	\$ 16,884
36	2052	2.898	\$ 4,347	4	\$ 17,390

Year No.	Year	CAF (3%)	Annual Cleaning		Cost per Year
			Price	QTY	
37	2053	2.985	\$ 4,478	4	\$ 17,911
38	2054	3.075	\$ 4,612	4	\$ 18,449
39	2055	3.167	\$ 4,751	4	\$ 19,002
40	2056	3.262	\$ 4,893	4	\$ 19,572
41	2057	3.360	\$ 5,040	4	\$ 20,159
42	2058	3.461	\$ 5,191	4	\$ 20,764
43	2059	3.565	\$ 5,347	4	\$ 21,387
44	2060	3.671	\$ 5,507	4	\$ 22,029
45	2061	3.782	\$ 5,672	4	\$ 22,690
46	2062	3.895	\$ 5,843	4	\$ 23,370
47	2063	4.012	\$ 6,018	4	\$ 24,071
48	2064	4.132	\$ 6,198	4	\$ 24,794
49	2065	4.256	\$ 6,384	4	\$ 25,537
Total:					\$ 664,620

11.2 Replacement

The estimated life of each weir is approximately 50 years. Performing periodic and annual maintenance as described in the Operation and Maintenance Manual may prolong the useful life. However, full replacement will undoubtedly be necessary at some point. Replacement costs have been estimated as shown in the table below.

Weir	Station	Initial Cost	Installation	Useful Life	Planned Replacement	CAF (3%)	Replacement Cost
Weir 1	218+00	\$ 40,000	2016	50	2066	4.384	\$ 175,360
Weir 2	308+50	\$ 76,000	2016	50	2066	4.384	\$ 333,184
Weir 3	310+00	\$ 76,000	2016	50	2066	4.384	\$ 333,184
Weir 4	594+50	\$ 350,000	2016	50	2066	4.384	\$ 1,534,400
Total:		\$ 542,000					\$ 2,376,128

12.0 Relief Well Pump Stations (1 Station)

12.1 Maintenance

Periodic inspections of the pump station shall be made to ensure that concrete, miscellaneous metals, riprap, pipes, gates and operating mechanisms are in good condition. Metal parts are to be adequately covered with paint and kept free from rust. Machine-finished surfaces shall be protected from rusting by applying a coating of lubricant. Care is being exercised to prevent the accumulation of silt, trash, and debris near or within the structure. Sluice gates within the wet well are to be maintained as described in the System Wide Operation and Maintenance Manual. Pumps, controls, and other instrumentation are to be maintained per the Operation and Maintenance Manual for each pump station. Over the long term, the pump station may need to be rehabilitated. For example, several mechanical components may be worn or broken, and electronic components may become obsolete. If a major rehabilitation is needed, the sponsor should coordinate with USACE to discuss the technical plans and the timing of the work. If parts of the pump station or gravity drain structures have been damaged or worn to the point where they should be replaced rather than repaired, the replacement parts should be the same as those shown on the as-built drawings. Maintenance costs have been estimated as shown in the table below.

Table 12-1 – Pump Stations – Maintenance Costs											
Year No.	Year	CAF (3%)	Sluice Gate		Sluice Gate Rehab		Pumps/Controls		Pumps/Controls Rehab		Cost per Year
			Price	QTY	Price	QTY	Price	QTY	Price	QTY	
0	2017	1.000	\$ 50	0	\$ 30,000	0	\$ 500	0	\$ 50,000	0	\$ -
1	2018	1.030	\$ 52	1	\$ 30,900	0	\$ 515	0	\$ 51,500	0	\$ 52
2	2019	1.061	\$ 53	1	\$ 31,830	0	\$ 531	0	\$ 53,050	0	\$ 53
3	2020	1.093	\$ 55	1	\$ 32,790	0	\$ 547	0	\$ 54,650	0	\$ 55
4	2021	1.126	\$ 56	1	\$ 33,780	0	\$ 563	0	\$ 56,300	0	\$ 56
5	2022	1.159	\$ 58	1	\$ 34,770	0	\$ 580	2	\$ 57,950	0	\$ 1,217
6	2023	1.194	\$ 60	1	\$ 35,820	0	\$ 597	0	\$ 59,700	0	\$ 60
7	2024	1.230	\$ 62	1	\$ 36,900	0	\$ 615	0	\$ 61,500	0	\$ 62
8	2025	1.267	\$ 63	1	\$ 38,010	0	\$ 634	0	\$ 63,350	0	\$ 63
9	2026	1.305	\$ 65	1	\$ 39,150	0	\$ 653	0	\$ 65,250	0	\$ 65
10	2027	1.344	\$ 67	1	\$ 40,320	0	\$ 672	2	\$ 67,200	0	\$ 1,411
11	2028	1.384	\$ 69	1	\$ 41,520	0	\$ 692	0	\$ 69,200	0	\$ 69
12	2029	1.426	\$ 71	1	\$ 42,780	0	\$ 713	0	\$ 71,300	0	\$ 71
13	2030	1.469	\$ 73	1	\$ 44,070	0	\$ 735	0	\$ 73,450	0	\$ 73
14	2031	1.513	\$ 76	1	\$ 45,390	0	\$ 757	0	\$ 75,650	0	\$ 76
15	2032	1.558	\$ 78	1	\$ 46,740	0	\$ 779	2	\$ 77,900	0	\$ 1,636
16	2033	1.605	\$ 80	1	\$ 48,150	0	\$ 803	0	\$ 80,250	0	\$ 80
17	2034	1.653	\$ 83	1	\$ 49,590	0	\$ 827	0	\$ 82,650	0	\$ 83

Table 12-1 – Pump Stations – Maintenance Costs

Year No.	Year	CAF (3%)	Sluice Gate		Sluice Gate Rehab		Pumps/Controls		Pumps/Controls Rehab		Cost per Year
			Price	QTY	Price	QTY	Price	QTY	Price	QTY	
18	2035	1.702	\$ 85	1	\$ 51,060	0	\$ 851	0	\$ 85,100	0	\$ 85
19	2036	1.754	\$ 88	1	\$ 52,620	0	\$ 877	0	\$ 87,700	0	\$ 88
20	2037	1.806	\$ 90	1	\$ 54,180	0	\$ 903	2	\$ 90,300	0	\$ 1,896
21	2038	1.860	\$ 93	1	\$ 55,800	0	\$ 930	0	\$ 93,000	0	\$ 93
22	2039	1.916	\$ 96	1	\$ 57,480	0	\$ 958	0	\$ 95,800	0	\$ 96
23	2040	1.974	\$ 99	1	\$ 59,220	0	\$ 987	0	\$ 98,700	0	\$ 99
24	2041	2.033	\$102	1	\$ 60,990	0	\$1,017	0	\$101,650	0	\$ 102
25	2042	2.094	\$105	1	\$ 62,820	1	\$1,047	2	\$104,700	2	\$ 274,419
26	2043	2.157	\$108	1	\$ 64,710	0	\$1,079	0	\$107,850	0	\$ 108
27	2044	2.221	\$111	1	\$ 66,630	0	\$1,111	0	\$111,050	0	\$ 111
28	2045	2.288	\$114	1	\$ 68,640	0	\$1,144	0	\$114,400	0	\$ 114
29	2046	2.357	\$118	1	\$ 70,710	0	\$1,179	0	\$117,850	0	\$ 118
30	2047	2.427	\$121	1	\$ 72,810	0	\$1,214	2	\$121,350	0	\$ 2,548
31	2048	2.500	\$125	1	\$ 75,000	0	\$1,250	0	\$125,000	0	\$ 125
32	2049	2.575	\$129	1	\$ 77,250	0	\$1,288	0	\$128,750	0	\$ 129
33	2050	2.652	\$133	1	\$ 79,560	0	\$1,326	0	\$132,600	0	\$ 133
34	2051	2.732	\$137	1	\$ 81,960	0	\$1,366	0	\$136,600	0	\$ 137
35	2052	2.814	\$141	1	\$ 84,420	0	\$1,407	2	\$140,700	0	\$ 2,955
36	2053	2.898	\$145	1	\$ 86,948	0	\$1,449	0	\$144,914	0	\$ 145
37	2054	2.985	\$149	1	\$ 89,557	0	\$1,493	0	\$149,261	0	\$ 149
38	2055	3.075	\$154	1	\$ 92,244	0	\$1,537	0	\$153,739	0	\$ 154
39	2056	3.167	\$158	1	\$ 95,011	0	\$1,584	0	\$158,351	0	\$ 158
40	2057	3.262	\$163	1	\$ 97,861	0	\$1,631	2	\$163,102	0	\$ 3,425
41	2058	3.360	\$168	1	\$100,797	0	\$1,680	0	\$167,995	0	\$ 168
42	2059	3.461	\$173	1	\$103,821	0	\$1,730	0	\$173,035	0	\$ 173
43	2060	3.565	\$178	1	\$106,936	0	\$1,782	0	\$178,226	0	\$ 178
44	2061	3.671	\$184	1	\$110,144	0	\$1,836	0	\$183,573	0	\$ 184
45	2062	3.782	\$189	1	\$113,448	0	\$1,891	2	\$189,080	0	\$ 3,971
46	2063	3.895	\$195	1	\$116,851	0	\$1,948	0	\$194,752	0	\$ 195
47	2064	4.012	\$201	1	\$120,357	0	\$2,006	0	\$200,595	0	\$ 201
48	2065	4.132	\$207	1	\$123,968	0	\$2,066	0	\$206,613	0	\$ 207
49	2066	4.256	\$213	1	\$127,687	0	\$2,128	0	\$212,811	0	\$ 213
Total:											\$ 298,056

12.2 Replacement

The estimated life of this pump station is approximately 50 years. Performing periodic and annual maintenance as described in the Operation and Maintenance Manual may prolong the useful life, especially if the sluice gates and pumps are rehabilitated after 25 years as shown above. However, full replacement will undoubtedly be necessary at some point. Replacement costs have been estimated as shown in the table below.

System	Station	Initial Cost	Installation	Useful Life	Planned Replacement	CAF (3%)	Replacement Cost
Site 15	308+50	\$360,000	2017	50	2067	4.384	\$1,578,240
Total:		\$360,000					\$1,578,240

12.3 Operation

Operation costs have been estimated on a yearly basis. Using available data for the Mississippi River Gage at St. Louis, the number and duration of “activating” events were evaluated to deduce a reasonable pumping duration. It was determined that there is no correlation between an event’s magnitude and its duration (i.e. 2-yr flood events can and tend to last nearly as long as 50-yr and 100-yr flood events, etc.). An operating duration of 120 days was chosen to capture both the average days in operation per year (120) and the maximum duration that can represent 75% of the events (98). The last recorded event that exceeded a 100-yr event was the Flood of 1993, which was an approximately 300-yr event. According to operational levels of the constructed pump station, the Flood of 1993 would have activated the station for 200 consecutive days. While not expected each year, the increased operating costs for flood events of such magnitude should be anticipated.

Costs included in Table 12-3 assume that during an operating event, the duty pump will run simultaneously, and continuously for the event duration. Additionally, the table below includes the cost for 200-day duration. It is recommended that this amount be held on reserve in the event of a high-magnitude flood event or duration. Electrical costs, per kilowatt hour, were obtained from Site 16 invoices in Cahokia, IL between May 2015 and May 2018. The operating costs are listed annually for the useful life of the stations in Table 12-4.

Pump Station Site	Starting River Level (ft)	Ending River Level (ft)	No. of Duty Pumps	Rated Horsepower (per Pump)	Total Kilowatts	Average Days in Operation	Total Kilowatt Hours / Year	Energy Cost Per Kilowatt Hour	Cost Per Year	200-Day Reserve
Site 15	21	15	1	60	45	120	128857	\$ 0.034360	\$ 4,428	\$ 7,379
Total:									\$ 4,428	\$ 7,379

Table 12-4 – Pump Stations – Total Annual Operation Costs					
Year No.	Year	CAF (3%)	Installation	Useful Life	Total (All Stations) Operation Cost
0	2018	1.000	2017	50	\$ 4,428
1	2019	1.030	2017	50	\$ 4,561
2	2020	1.061	2017	50	\$ 4,698
3	2021	1.093	2017	50	\$ 4,839
4	2022	1.126	2017	50	\$ 4,984
5	2023	1.159	2017	50	\$ 5,133
6	2024	1.194	2017	50	\$ 5,287
7	2025	1.230	2017	50	\$ 5,446
8	2026	1.267	2017	50	\$ 5,609
9	2027	1.305	2017	50	\$ 5,778
10	2028	1.344	2017	50	\$ 5,951
11	2029	1.384	2017	50	\$ 6,129
12	2030	1.426	2017	50	\$ 6,313
13	2031	1.469	2017	50	\$ 6,503
14	2032	1.513	2017	50	\$ 6,698
15	2033	1.558	2017	50	\$ 6,899
16	2034	1.605	2017	50	\$ 7,106
17	2035	1.653	2017	50	\$ 7,319
18	2036	1.702	2017	50	\$ 7,538
19	2037	1.754	2017	50	\$ 7,765
20	2038	1.806	2017	50	\$ 7,997
21	2039	1.860	2017	50	\$ 8,237
22	2040	1.916	2017	50	\$ 8,485
23	2041	1.974	2017	50	\$ 8,739
24	2042	2.033	2017	50	\$ 9,001
25	2043	2.094	2017	50	\$ 9,271
26	2044	2.157	2017	50	\$ 9,549
27	2045	2.221	2017	50	\$ 9,836
28	2046	2.288	2017	50	\$ 10,131
29	2047	2.357	2017	50	\$ 10,435
30	2048	2.427	2017	50	\$ 10,748
31	2049	2.500	2017	50	\$ 11,070
32	2050	2.575	2017	50	\$ 11,402
33	2051	2.652	2017	50	\$ 11,745
34	2052	2.732	2017	50	\$ 12,097

Table 12-4 – Pump Stations – Total Annual Operation Costs					
Year No.	Year	CAF (3%)	Installation	Useful Life	Total (All Stations) Operation Cost
35	2053	2.814	2017	50	\$ 12,460
36	2054	2.898	2017	50	\$ 12,834
37	2055	2.985	2017	50	\$ 13,219
38	2056	3.075	2017	50	\$ 13,615
39	2057	3.167	2017	50	\$ 14,024
40	2058	3.262	2017	50	\$ 14,444
41	2059	3.360	2017	50	\$ 14,878
42	2060	3.461	2017	50	\$ 15,324
43	2061	3.565	2017	50	\$ 15,784
44	2062	3.671	2017	50	\$ 16,257
45	2063	3.782	2017	50	\$ 16,745
46	2064	3.895	2017	50	\$ 17,247
47	2065	4.012	2017	50	\$ 17,765
48	2066	4.132	2017	50	\$ 18,298
49	2067	4.256	2017	50	\$ 18,847
Total:					\$ 499,465

13.0 Summary

The costs represented above are the best estimate of the engineer at the time of this study. An interest rate of 3-percent was chosen and applied at a constant rate, though it should be expected that this value will fluctuate over the useful life of the improvements. Costs detailed in this study constitute major routine (predictable) costs; any incidental or unpredictable costs shall be considered by the District based on past experience. These estimates do not provide a guarantee of cost values that will be incurred, but shall be used to anticipate the necessity for inevitable and periodic maintenance and replacement. The total cost estimated per year is only inclusive of newly installed features that are still within their useful life (e.g. maintenance costs for piezometers and relief wells, which have estimated useful lives of 50 years, are not included in the year costs behind 2066). The useful life of the improvements is highly dependent upon the diligent maintenance by the District, as outlined in the System Wide Operation and Maintenance Manual. The District is encouraged to engage their financial advisor in any budgetary modifications to ensure that funds are available to maintain the system.

Table 13-1 – Annual Costs

Year	Sluice Gate Maintenance	Sluice Gates Replacement	Relief Well Maintenance	Relief Wells Replacement	PZ Replacement	PZ Transducer Replacement	Blanket Drain Maintenance	Seepage Berm, Random Fill, Ditches Maintenance	Indian Creek Rip Rap Maintenance	Pipe Systems Maintenance	Pipe Systems Replacement	Weir Maintenance	Weir Replacement	Pump Station Maintenance	Pump Station Replacement	Pump Station Operation	Total
2018	\$206		\$31,900				\$1,100	\$4,160	\$100			\$6,366		\$52		\$4,428	\$48,312
2019	\$212		\$32,857				\$1,133	\$4,285	\$103			\$6,558		\$53		\$4,561	\$49,762
2020	\$219		\$33,846				\$1,167	\$4,414	\$106			\$6,756		\$55		\$4,698	\$51,260
2021	\$225		\$34,867				\$1,202	\$4,547	\$109	\$59,109		\$6,954		\$56		\$4,839	\$111,908
2022	\$232		\$35,919				\$1,239	\$4,684	\$113			\$7,164		\$1,217		\$4,984	\$55,551
2023	\$239		\$36,972				\$1,275	\$4,821	\$116			\$7,380		\$60		\$5,133	\$55,996
2024	\$246		\$38,089				\$1,313	\$4,967	\$119			\$7,602		\$62		\$5,287	\$57,685
2025	\$253		\$39,237				\$1,353	\$5,117	\$123			\$7,830		\$63		\$5,446	\$59,422
2026	\$261		\$42,318			\$96,768	\$1,394	\$5,271	\$127	\$68,544		\$8,064		\$65		\$5,609	\$228,420
2027	\$269		\$43,587				\$1,436	\$5,429	\$131			\$8,304		\$1,411		\$5,778	\$66,343
2028	\$277		\$42,874				\$1,478	\$5,591	\$134			\$8,556		\$69		\$5,951	\$64,930
2029	\$285		\$44,150				\$1,522	\$5,757	\$138			\$8,814		\$71		\$6,129	\$66,868
2030	\$294		\$45,489				\$1,569	\$5,932	\$143			\$9,078		\$73		\$6,313	\$68,891
2031	\$303		\$46,861				\$1,616	\$6,111	\$147	\$79,458		\$9,348		\$76		\$6,503	\$150,422
2032	\$312		\$48,265				\$1,664	\$6,294	\$151			\$9,630		\$1,636		\$6,698	\$74,650
2033	\$321		\$49,700				\$1,714	\$6,481	\$156			\$9,918		\$80		\$6,899	\$75,269
2034	\$331		\$51,200				\$1,766	\$6,677	\$161			\$10,212		\$83		\$7,106	\$77,533
2035	\$340		\$52,731				\$1,818	\$6,876	\$165			\$10,524		\$85		\$7,319	\$79,859
2036	\$351		\$56,847			\$130,032	\$1,872	\$7,080	\$170	\$92,106		\$10,836		\$88		\$7,538	\$306,920
2037	\$361		\$58,584				\$1,929	\$7,297	\$175			\$11,160		\$1,896		\$7,765	\$89,167
2038	\$372		\$57,611				\$1,987	\$7,513	\$181			\$11,496		\$93		\$7,997	\$87,250
2039	\$383		\$59,334				\$2,046	\$7,738	\$186			\$11,844		\$96		\$8,237	\$89,864
2040	\$395		\$61,120				\$2,108	\$7,971	\$192			\$12,198		\$99		\$8,485	\$92,566
2041	\$407		\$62,971				\$2,171	\$8,212	\$197	\$106,794		\$12,564		\$102		\$8,739	\$202,157
2042	\$419		\$64,853				\$2,236	\$8,457	\$203			\$12,942		\$274,419		\$9,001	\$372,530
2043	\$431		\$548,419				\$2,303	\$8,711	\$209			\$13,326		\$108		\$9,271	\$582,779
2044	\$444		\$68,808				\$2,373	\$8,973	\$216			\$13,728		\$111		\$9,549	\$104,202
2045	\$458		\$70,850				\$2,443	\$9,239	\$222			\$14,142		\$114		\$9,836	\$107,304
2046	\$471	\$145,620	\$76,419			\$174,744	\$2,517	\$9,518	\$229	\$123,777		\$14,562		\$118		\$10,131	\$558,106
2047		\$24,270	\$78,724				\$2,593	\$9,805	\$236			\$15,000		\$2,548		\$10,435	\$143,611
2048			\$77,421				\$2,670	\$10,096	\$243			\$15,450		\$125		\$10,748	\$116,753
2049			\$79,750				\$2,750	\$10,400	\$250			\$15,912		\$129		\$11,070	\$120,261
2050			\$82,143				\$2,833	\$10,712	\$258			\$16,392		\$133		\$11,402	\$123,872
2051			\$84,599				\$2,917	\$11,032	\$265	\$143,514	\$118,188	\$16,884		\$137		\$11,745	\$389,281
2052			\$87,151				\$3,005	\$11,365	\$273			\$17,390		\$2,955		\$12,097	\$134,236

Table 13-1 – Annual Costs

Year	Sluice Gate Maintenance	Sluice Gates Replacement	Relief Well Maintenance	Relief Wells Replacement	PZ Replacement	PZ Transducer Replacement	Blanket Drain Maintenance	Seepage Berm, Random Fill, Ditches Maintenance	Indian Creek Rip Rap Maintenance	Pipe Systems Maintenance	Pipe Systems Replacement	Weir Maintenance	Weir Replacement	Pump Station Maintenance	Pump Station Replacement	Pump Station Operation	Total
2053			\$89,767				\$3,095	\$11,706	\$281			\$17,911		\$145		\$12,460	\$135,366
2054			\$92,455				\$3,188	\$12,057	\$290			\$18,449		\$149		\$12,834	\$139,421
2055			\$95,229				\$3,284	\$12,419	\$299			\$19,002		\$154		\$13,219	\$143,604
2056			\$102,698			\$234,867	\$3,382	\$12,791	\$307	\$166,362		\$19,572		\$158		\$13,615	\$553,753
2057			\$105,779				\$3,484	\$13,175	\$317			\$20,159		\$3,425		\$14,024	\$160,362
2058			\$104,059				\$3,588	\$13,570	\$326			\$20,764		\$168		\$14,444	\$156,920
2059			\$107,181				\$3,696	\$13,977	\$336			\$21,387		\$173		\$14,878	\$161,628
2060			\$110,396				\$3,807	\$14,396	\$346			\$22,029		\$178		\$15,324	\$166,476
2061			\$113,708				\$3,921	\$14,828	\$356	\$192,882		\$22,690		\$184		\$15,784	\$364,353
2062			\$117,119				\$4,039	\$15,273	\$367			\$23,370		\$3,971		\$16,257	\$180,396
2063			\$120,633				\$4,160	\$15,731	\$378			\$24,071		\$195		\$16,745	\$181,913
2064			\$124,252				\$4,285	\$16,203	\$390			\$24,794		\$201		\$17,247	\$187,371
2065			\$127,979		\$526,080		\$4,413	\$16,689	\$401			\$25,537		\$207		\$17,765	\$719,072
2066			\$138,017	\$23,761,280	\$3,423,904		\$4,545	\$17,190	\$413	\$2,437,066			\$2,376,128	\$213		\$18,298	\$32,177,054
2067			\$142,158	\$3,121,408			\$4,682	\$17,706	\$426						\$1,578,240	\$18,847	\$4,883,466
2068							\$4,822	\$18,237	\$438							\$499,465	\$522,963
2069							\$4,967	\$18,785	\$452								\$24,203
2070							\$5,116	\$19,348	\$465								\$24,929
2071							\$5,270	\$19,929	\$479	\$259,182							\$284,859
2072							\$5,428	\$20,526	\$493								\$26,447
2073							\$5,590	\$21,142	\$508								\$27,241
2074							\$5,758	\$21,776	\$523								\$28,058
2075							\$5,931	\$22,430	\$539								\$28,900
2076							\$6,109	\$23,103	\$555	\$300,492							\$330,259
2077							\$6,292	\$23,796	\$572								\$30,660
2078							\$6,481	\$24,510	\$589								\$31,580
2079							\$6,675	\$25,245	\$607								\$32,527
2080							\$6,876	\$26,002	\$625								\$33,503
2081							\$7,082	\$26,782	\$644	\$348,330							\$382,838
2082							\$7,294	\$27,586	\$663								\$35,543
2083							\$7,513	\$28,413	\$683								\$36,609
2084							\$7,739	\$29,266	\$704								\$37,708
2085							\$7,971	\$30,144	\$725								\$38,839
2086							\$8,210	\$31,048	\$746	\$403,818							\$443,822
2087							\$8,456	\$31,979	\$769								\$41,204

Table 13-1 – Annual Costs

Year	Sluice Gate Maintenance	Sluice Gates Replacement	Relief Well Maintenance	Relief Wells Replacement	PZ Replacement	PZ Transducer Replacement	Blanket Drain Maintenance	Seepage Berm, Random Fill, Ditches Maintenance	Indian Creek Rip Rap Maintenance	Pipe Systems Maintenance	Pipe Systems Replacement	Weir Maintenance	Weir Replacement	Pump Station Maintenance	Pump Station Replacement	Pump Station Operation	Total
2088							\$8,710	\$32,939	\$792								\$42,440
2089							\$8,971	\$33,927	\$816								\$43,714
2090							\$9,240	\$34,945	\$840								\$45,025
2091							\$9,517	\$35,993	\$865	\$468,129	\$3,620,740						\$4,135,245
2092							\$9,803	\$37,073	\$891								\$47,767
2093							\$10,097	\$38,185	\$918								\$49,200
2094							\$10,400	\$39,331	\$945								\$50,676
2095							\$10,712	\$40,511	\$974								\$52,196
2096							\$11,033	\$41,726	\$1,003	\$542,691							\$596,453
2097							\$11,364	\$42,978	\$1,033								\$55,375
2098							\$11,705	\$44,267	\$1,064								\$57,036
2099							\$12,056	\$45,595	\$1,096								\$58,747
2100							\$12,418	\$46,963	\$1,129								\$60,510
2101							\$12,791	\$48,372	\$1,163	\$629,136							\$691,461
2102							\$13,174	\$49,823	\$1,198								\$64,195
2103							\$13,570	\$51,318	\$1,234								\$66,121
2104							\$13,977	\$52,857	\$1,271								\$68,104
2105							\$14,396	\$54,443	\$1,309								\$70,148
2106							\$14,828	\$56,076	\$1,348	\$729,300							\$801,552
2107							\$15,273	\$57,758	\$1,388								\$74,420
2108							\$15,731	\$59,491	\$1,430								\$76,652
2109							\$16,203	\$61,276	\$1,473								\$78,952
2110							\$16,689	\$63,114	\$1,517								\$81,320
2111							\$17,190	\$65,008	\$1,563	\$845,478							\$929,238
2112							\$17,705	\$66,958	\$1,610								\$86,273
2113							\$18,236	\$68,967	\$1,658								\$88,861
2114							\$18,783	\$71,036	\$1,708								\$91,527
2115							\$19,347	\$73,167	\$1,759								\$94,272
2116							\$19,927	\$75,362	\$1,812		\$10,453,527						\$10,550,627
2117							\$20,525	\$77,623	\$1,866								\$100,014
2118							\$21,141	\$79,951									\$101,092