

Appendix HYDRO-1

Flow Statistics Tables

Under the Proposed Action, IID will reduce diversions up to 300,000 acre feet (AF)/year from the Colorado River for a period of three years resulting in a maximum 900,000 AF of conserved water. The effect of the Proposed Action on the flow of water in the LCR and within the IID service area was evaluated as an average flow reduction, evenly applied both spatially and temporally. Monthly variability in discharge to the Salton Sea in the IID drain network under existing conditions was analyzed and compared to the Proposed Action for each drain.

IID's diversions from the Lower Colorado River have been decreasing since the implementation of the QSA in 2002 as shown in Table H1-1. An annual diversion of 2.535 MAF is assumed in this analysis as the existing average flow volume through the IID system. This volume is the same assumption used for DWR's SSAM and the Long Range Plan (DWR, 2022). The annual proportional reduction in diversions to IID using the Proposed annual reduction of 300 TAF divided by 2.535 MAF is 11.9 percent. To characterize the magnitude of monthly diversions to IID, the mean monthly and annual diversion volumes were calculated for the years 2000 through 2020 and re-scaled by the ratio of the 22-year annual average of 2.753 MAF and 2.535 MAF (**Table H1-1** and **Figure H1-1**). The mean monthly diversion volumes were then converted to mean daily diversion rates in cfs for existing conditions. The estimated mean daily diversion rate under the Proposed Action for each month was calculated by subtracting 414 cfs from the existing conditions mean daily mean diversion rate (**Table H1-2**). As a check, the diversion rate-weighted mean was calculated and was found to be 11.9 percent, which is in accord with the proportion of the Proposed annual reduction. The results are summarized in Table H1-2.

Estimates of the reduction in monthly drain flow to the Salton Sea were made by applying the monthly proportional reduction in Table H1-2 of the Proposed diversion reductions to mean monthly drain flow for the 2017 to 2023 period (Table H1-3). The standard deviation of monthly drain flow in AF was calculated for existing conditions and under the Proposed Action. In this way, the relative magnitude of drain discharge variability under existing conditions was compared to the magnitude of the effect of flow reduction under the Proposed Action. The effect of the Proposed Action would reduce flows by approximately 11.9 percent on annual basis. However, since a proportional reduction in discharge was applied to each monthly drain discharge, the relative effect of the Proposed Action is highest in those months with the least flow. For instance, the effect of flow reduction in the IID drainage network is lower in months with high runoff (April through September) and highest in months with lower runoff (October through March).

This average monthly flow reduction would be well within the standard deviation of historic (last five years) drainage flows for every drain. That is to say, impacts of the flow reduction would not significantly alter the pattern of flow variability for every drain. During any month of the year under existing conditions, drain flows vary significantly more than the 11.9 percent increment estimated to be the effect of the Proposed Action.

TABLE H1-1

U.S. BUREAU OF RECLAMATION COLORADO RIVER MONTHLY DIVERSIONS (AF) TO IMPERIAL IRRIGATION DISTRICT FOR YEARS 2000 TO 2022

Colorado River Monthly Diversions (AF) to Imperial Irrigation District													
Year	January	February	March	April	May	June	July	August	September	October	November	December	Total
2000	159,534	179,174	283,818	352,066	362,321	332,461	352,379	305,213	179,293	145,911	179,311	145,975	2,977,456
2001	125,766	167,868	221,562	342,406	371,484	339,109	370,894	340,093	293,193	265,665	198,881	154,005	3,190,927
2002	153,082	192,273	277,049	332,514	360,734	333,917	377,089	341,232	272,637	257,724	187,775	143,876	3,230,252
2003	162,274	126,025	278,351	336,869	339,641	319,043	341,347	293,460	265,472	270,714	178,927	154,238	3,066,361
2004	141,009	142,098	266,314	296,357	331,689	321,012	325,220	299,970	254,353	200,251	142,698	101,823	2,822,794
2005	107,626	92,107	264,840	319,404	340,457	318,711	339,173	264,213	265,738	216,677	187,354	144,226	2,860,526
2006	155,181	177,064	236,042	299,375	342,111	316,698	326,189	302,081	265,331	244,800	176,117	153,336	2,994,325
2007	157,668	174,743	287,839	317,642	333,477	310,384	339,390	290,303	249,979	230,433	149,390	11,278	2,952,526
2008	121,090	179,039	302,559	354,756	326,038	294,192	324,639	288,199	234,857	221,274	164,539	107,926	2,919,108
2009	149,728	138,256	291,539	318,877	284,424	254,593	271,045	249,091	215,700	228,542	159,637	119,923	2,679,356
2010	87,028	103,002	245,534	291,276	321,872	282,699	311,096	274,205	245,160	186,780	169,938	122,179	2,640,769
2011	148,868	131,536	271,913	317,419	317,743	305,923	333,956	303,172	243,663	240,458	159,160	125,542	2,899,353
2012	146,018	175,122	282,788	332,230	334,585	316,965	303,373	244,271	240,452	243,470	166,409	111,919	2,897,602
2013	128,295	138,943	246,298	291,516	294,139	276,919	265,914	222,207	184,563	224,741	142,898	119,019	2,535,452
2014	112,654	147,221	240,771	267,407	300,923	283,010	291,138	215,476	199,711	192,825	153,596	91,696	2,496,428
2015	114,944	149,559	225,000	273,215	218,767	256,347	248,279	241,971	205,432	217,581	174,857	129,697	2,455,649
2016	84,186	168,966	241,342	242,006	275,253	280,128	254,111	235,997	198,192	203,110	156,965	121,306	2,461,562
2017	58,392	127,709	245,589	268,744	283,328	279,141	261,534	228,921	215,151	229,926	156,229	133,951	2,488,615
2018	123,031	165,030	222,166	281,155	298,009	279,935	258,328	242,009	205,137	210,785	150,338	79,292	2,515,215
2019	89,225	120,375	225,344	273,787	312,564	289,701	293,201	275,510	227,562	220,660	123,027	78,841	2,529,797
2020	110,253	133,835	147,400	236,304	327,819	288,291	277,937	244,294	216,451	220,493	158,613	125,686	2,487,376
2021	92,643	144,715	253,897	290,313	301,824	287,866	283,947	255,113	215,127	212,376	150,661	129,428	2,617,910
2022	125,484	173,712	268,163	302,782	326,101	290,967	258,839	211,687	169,125	190,311	163,413	132,451	2,613,035
Average:	124,086	149,929	253,309	301,670	317,622	298,174	304,740	268,204	228,795	220,674	163,075	119,027	2,753,582

Source: Colorado River Accounting and Water Use Report: Arizona, California, and Nevada for years 2000 through 2022. Available at <https://www.usbr.gov/lc/region/g4000/wtracct.html>

TABLE H1-2**ESTIMATED EXISTING CONDITIONS AND PROPOSED ACTION COLORADO RIVER MONTHLY USBR DIVERSION RATES (cfs) TO IID**

Month	Existing Diversion (cfs)	Proposed Diversion (cfs)	Proposed Monthly Reduction (cfs)	Percent Reduction
January	1,857.9	1,443.5	414.4	22.3%
February	2,485.3	2,070.9	414.4	16.7%
March	3,792.7	3,378.3	414.4	10.9%
April	4,667.3	4,252.9	414.4	8.9%
May	4,755.6	4,341.2	414.4	8.7%
June	4,613.2	4,198.8	414.4	9.0%
July	4,562.7	4,148.3	414.4	9.1%
August	4,015.7	3,601.3	414.4	10.3%
September	3,539.8	3,125.4	414.4	11.7%
October	3,304.0	2,889.6	414.4	12.5%
November	2,523.0	2,108.6	414.4	16.4%
December	1,782.1	1,367.7	414.4	23.3%
<i>Weighted Mean: 11.9%</i>				

Source: ESA analysis of Colorado River Accounting and Water Use Report: Arizona, California, and Nevada for years 2000 through 2022. Available at
<https://www.usbr.gov/lc/region/g4000/wtracct.html>

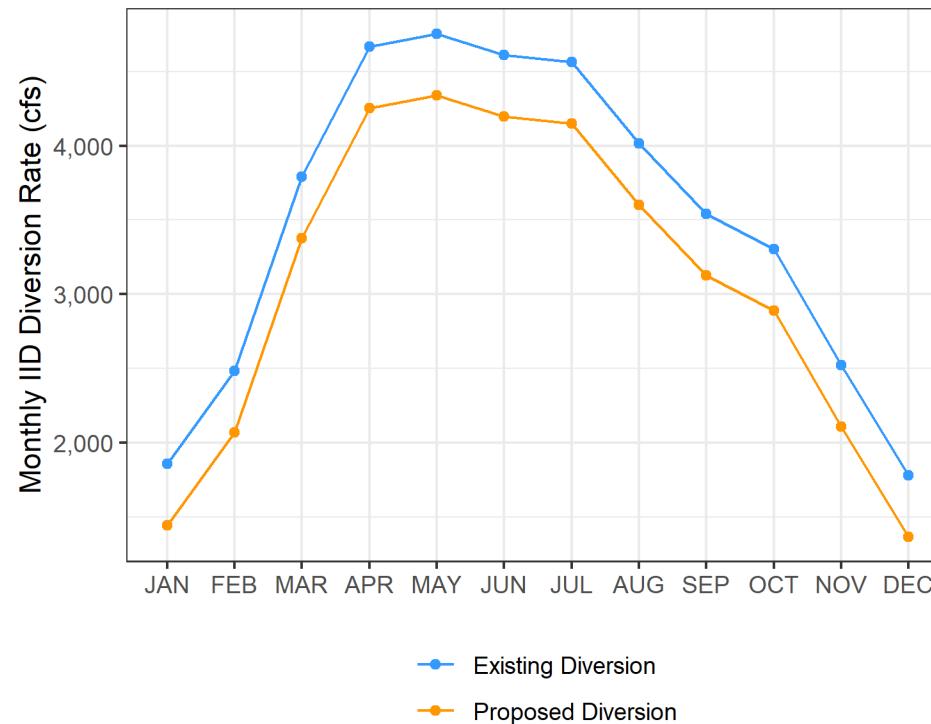
FIGURE H1-1. ESTIMATED EXISTING CONDITIONS AND PROPOSED ACTION COLORADO RIVER MONTHLY USBR DIVERSION RATES (CFS) TO IID

TABLE H1-3

SUMMARY OF MONTHLY MEAN IID DRAIN DISCHARGE (AF) FOR EXISTING CONDITIONS AND DRAIN DISCHARGE REDUCTION (AF) UNDER THE PROPOSED ACTION. THE STANDARD DEVIATION (SD) OF THE MEAN MONTHLY IID DRAIN DISCHARGE THE PROPOSED ACTION MONTHLY FLOW REDUCTION ARE ALSO PRESENTED

Drain	Month	Existing Mean Monthly AF	Proposed Mean Monthly AF	Existing Mean Monthly SD	Proposed Mean Reduction AF
Niland Drain 1	1	29.3	24.9	17.8	4.4
Niland Drain 1	2	20.9	16.9	15.2	4.0
Niland Drain 1	3	61.3	56.9	61.3	4.4
Niland Drain 1	4	38.0	33.7	21.0	4.3
Niland Drain 1	5	29.2	24.8	21.9	4.4
Niland Drain 1	6	46.6	42.3	39.0	4.3
Niland Drain 1	7	53.2	48.8	46.4	4.4
Niland Drain 1	8	32.8	28.4	16.6	4.4
Niland Drain 1	9	40.5	36.3	20.6	4.3
Niland Drain 1	10	34.6	30.2	29.2	4.4
Niland Drain 1	11	21.6	17.3	11.2	4.3
Niland Drain 1	12	29.7	25.2	8.1	4.4
Niland Drain 2	1	35.8	24.2	15.2	11.7
Niland Drain 2	2	42.8	32.3	17.7	10.5
Niland Drain 2	3	65.0	53.4	50.3	11.7
Niland Drain 2	4	91.7	80.4	56.1	11.3
Niland Drain 2	5	121.8	110.2	85.1	11.7
Niland Drain 2	6	165.9	154.6	69.3	11.3
Niland Drain 2	7	168.0	156.4	39.9	11.7
Niland Drain 2	8	144.0	132.3	52.0	11.7
Niland Drain 2	9	121.4	110.1	36.3	11.3
Niland Drain 2	10	103.3	91.6	60.4	11.7
Niland Drain 2	11	63.1	51.8	24.6	11.3
Niland Drain 2	12	35.8	24.2	10.6	11.7
Niland Drain 3	1	13.8	10.1	16.4	3.7
Niland Drain 3	2	30.6	27.3	13.0	3.4
Niland Drain 3	3	29.7	26.0	17.6	3.7
Niland Drain 3	4	35.3	31.7	34.8	3.6
Niland Drain 3	5	30.0	26.2	24.7	3.7
Niland Drain 3	6	37.6	34.0	27.1	3.6
Niland Drain 3	7	48.9	45.2	49.8	3.7
Niland Drain 3	8	44.4	40.7	31.7	3.7
Niland Drain 3	9	41.1	37.5	36.7	3.6
Niland Drain 3	10	30.4	26.6	27.9	3.7
Niland Drain 3	11	19.4	15.8	16.7	3.6
Niland Drain 3	12	9.5	5.7	7.2	3.7

Drain	Month	Existing Mean Monthly AF	Proposed Mean Monthly AF	Existing Mean Monthly SD	Proposed Mean Reduction AF
Niland Drain 4	1	18.6	15.2	21.2	3.4
Niland Drain 4	2	20.1	17.0	10.9	3.1
Niland Drain 4	3	26.7	23.2	15.4	3.4
Niland Drain 4	4	28.9	25.5	19.7	3.3
Niland Drain 4	5	18.8	15.4	28.7	3.4
Niland Drain 4	6	20.9	17.6	17.3	3.3
Niland Drain 4	7	33.4	30.0	35.9	3.4
Niland Drain 4	8	35.5	32.1	46.4	3.4
Niland Drain 4	9	54.7	51.4	71.6	3.3
Niland Drain 4	10	46.0	42.6	45.4	3.4
Niland Drain 4	11	18.5	15.1	7.2	3.3
Niland Drain 4	12	19.5	16.0	22.3	3.4
O Drain	1	444.0	376.7	153.0	67.4
O Drain	2	403.7	342.9	119.6	60.8
O Drain	3	641.6	574.2	152.0	67.4
O Drain	4	633.4	568.2	210.8	65.2
O Drain	5	624.3	557.0	126.1	67.4
O Drain	6	625.3	560.1	210.5	65.2
O Drain	7	663.1	595.8	345.0	67.4
O Drain	8	715.9	648.5	359.8	67.4
O Drain	9	597.2	532.0	259.0	65.2
O Drain	10	429.0	361.6	221.8	67.4
O Drain	11	431.3	366.1	138.1	65.2
O Drain	12	474.1	406.7	165.3	67.4
P Drain	1	176.6	134.8	100.6	41.8
P Drain	2	278.8	241.1	71.2	37.8
P Drain	3	368.1	326.3	82.7	41.8
P Drain	4	447.9	407.5	174.0	40.4
P Drain	5	474.6	432.8	82.3	41.8
P Drain	6	534.4	494.0	83.2	40.4
P Drain	7	502.1	460.3	85.4	41.8
P Drain	8	399.2	357.4	96.1	41.8
P Drain	9	303.7	263.3	92.5	40.4
P Drain	10	202.9	161.1	161.1	41.8
P Drain	11	260.0	219.6	160.6	40.4
P Drain	12	198.9	157.1	73.3	41.8
Pumice Drain	1	497.8	424.1	630.4	73.7
Pumice Drain	2	440.4	373.9	596.2	66.6
Pumice Drain	3	671.4	597.7	900.7	73.7

Drain	Month	Existing Mean Monthly AF	Proposed Mean Monthly AF	Existing Mean Monthly SD	Proposed Mean Reduction AF
Pumice Drain	4	622.8	551.4	1057.1	71.3
Pumice Drain	5	547.6	473.9	855.4	73.7
Pumice Drain	6	632.0	560.7	791.9	71.3
Pumice Drain	7	647.7	574.0	826.4	73.7
Pumice Drain	8	489.0	415.3	628.4	73.7
Pumice Drain	9	540.8	469.5	715.8	71.3
Pumice Drain	10	790.4	716.7	1075.0	73.7
Pumice Drain	11	806.9	735.5	972.1	71.3
Pumice Drain	12	626.2	552.5	744.0	73.7
Q Drain	1	134.2	109.4	82.9	24.8
Q Drain	2	122.5	100.2	82.1	22.4
Q Drain	3	182.2	157.4	71.5	24.8
Q Drain	4	230.4	206.4	61.0	24.0
Q Drain	5	299.9	275.1	154.6	24.8
Q Drain	6	281.0	257.0	112.6	24.0
Q Drain	7	311.1	286.3	123.0	24.8
Q Drain	8	244.5	219.7	88.3	24.8
Q Drain	9	226.9	202.9	105.6	24.0
Q Drain	10	153.0	128.2	134.3	24.8
Q Drain	11	142.6	118.6	59.5	24.0
Q Drain	12	130.9	106.1	46.5	24.8
R Drain	1	114.1	82.7	26.0	31.4
R Drain	2	134.8	106.5	49.4	28.4
R Drain	3	255.8	224.4	106.8	31.4
R Drain	4	264.9	234.5	120.4	30.4
R Drain	5	413.9	382.5	121.3	31.4
R Drain	6	331.5	301.2	67.6	30.4
R Drain	7	301.5	270.1	111.0	31.4
R Drain	8	391.1	359.7	175.0	31.4
R Drain	9	399.1	368.7	253.3	30.4
R Drain	10	254.4	223.0	174.8	31.4
R Drain	11	125.0	94.6	74.1	30.4
R Drain	12	129.1	97.7	32.3	31.4
S Drain	1	134.3	116.6	99.2	17.6
S Drain	2	122.7	106.8	88.2	15.9
S Drain	3	157.5	139.9	47.8	17.6
S Drain	4	133.4	116.3	43.3	17.1
S Drain	5	211.8	194.2	81.7	17.6
S Drain	6	185.6	168.6	56.9	17.1

Drain	Month	Existing Mean Monthly AF	Proposed Mean Monthly AF	Existing Mean Monthly SD	Proposed Mean Reduction AF
S Drain	7	179.0	161.4	58.1	17.6
S Drain	8	193.9	176.2	38.1	17.6
S Drain	9	143.7	126.7	54.3	17.1
S Drain	10	97.9	80.2	58.3	17.6
S Drain	11	86.1	69.0	60.4	17.1
S Drain	12	102.8	85.2	87.5	17.6
San Felipe Wash	1	167.9	154.1	113.6	13.7
San Felipe Wash	2	107.8	95.4	64.6	12.4
San Felipe Wash	3	106.8	93.1	60.7	13.7
San Felipe Wash	4	58.0	44.7	22.5	13.3
San Felipe Wash	5	37.7	24.0	25.4	13.7
San Felipe Wash	6	54.1	40.8	45.2	13.3
San Felipe Wash	7	90.3	76.5	52.5	13.7
San Felipe Wash	8	113.7	99.9	69.4	13.7
San Felipe Wash	9	119.6	106.3	79.8	13.3
San Felipe Wash	10	123.1	109.4	96.2	13.7
San Felipe Wash	11	175.6	162.3	107.2	13.3
San Felipe Wash	12	208.7	194.9	169.7	13.7
T Drain	1	318.6	293.9	101.6	24.6
T Drain	2	296.1	273.9	96.4	22.2
T Drain	3	224.6	200.0	125.5	24.6
T Drain	4	194.0	170.2	46.9	23.8
T Drain	5	236.0	211.3	92.6	24.6
T Drain	6	194.1	170.3	86.4	23.8
T Drain	7	172.1	147.5	52.7	24.6
T Drain	8	143.0	118.4	97.7	24.6
T Drain	9	96.6	72.8	53.8	23.8
T Drain	10	99.1	74.5	93.6	24.6
T Drain	11	237.5	213.7	155.5	23.8
T Drain	12	230.1	205.5	83.4	24.6
Trifolium 1 Drain	1	1560.4	1417.7	1567.1	142.7
Trifolium 1 Drain	2	1141.2	1012.3	1112.0	128.9
Trifolium 1 Drain	3	1313.9	1171.1	1180.1	142.7
Trifolium 1 Drain	4	1184.7	1046.5	837.5	138.1
Trifolium 1 Drain	5	847.0	704.2	867.2	142.7
Trifolium 1 Drain	6	866.7	728.6	772.0	138.1
Trifolium 1 Drain	7	858.1	715.3	751.7	142.7
Trifolium 1 Drain	8	913.0	770.2	794.0	142.7
Trifolium 1 Drain	9	801.6	663.4	918.6	138.1

Drain	Month	Existing Mean Monthly AF	Proposed Mean Monthly AF	Existing Mean Monthly SD	Proposed Mean Reduction AF
Trifolium 1 Drain	10	1269.3	1126.6	1372.0	142.7
Trifolium 1 Drain	11	1810.1	1671.9	1790.5	138.1
Trifolium 1 Drain	12	1596.9	1454.2	1679.4	142.7
Trifolium 12 Drain	1	214.0	159.2	104.7	54.8
Trifolium 12 Drain	2	375.2	325.7	104.8	49.5
Trifolium 12 Drain	3	605.4	550.7	244.5	54.8
Trifolium 12 Drain	4	598.4	545.4	164.5	53.0
Trifolium 12 Drain	5	523.7	468.9	93.7	54.8
Trifolium 12 Drain	6	425.3	372.3	79.4	53.0
Trifolium 12 Drain	7	502.0	447.2	63.0	54.8
Trifolium 12 Drain	8	465.3	410.5	79.9	54.8
Trifolium 12 Drain	9	454.9	401.9	84.4	53.0
Trifolium 12 Drain	10	663.3	608.5	746.5	54.8
Trifolium 12 Drain	11	334.4	281.4	119.4	53.0
Trifolium 12 Drain	12	273.0	218.2	106.2	54.8
Trifolium 20A Drain	1	43.1	38.1	44.1	5.0
Trifolium 20A Drain	2	29.0	24.5	25.4	4.5
Trifolium 20A Drain	3	39.8	34.8	24.9	5.0
Trifolium 20A Drain	4	45.8	41.0	24.1	4.9
Trifolium 20A Drain	5	42.9	37.9	13.6	5.0
Trifolium 20A Drain	6	51.7	46.8	24.9	4.9
Trifolium 20A Drain	7	64.8	59.8	42.6	5.0
Trifolium 20A Drain	8	59.9	54.8	32.8	5.0
Trifolium 20A Drain	9	49.5	44.7	27.7	4.9
Trifolium 20A Drain	10	28.8	23.7	26.2	5.0
Trifolium 20A Drain	11	21.6	16.7	25.6	4.9
Trifolium 20A Drain	12	20.8	15.8	29.1	5.0
Trifolium 22 Drain	1	239.9	205.4	85.3	34.5
Trifolium 22 Drain	2	264.2	233.1	57.2	31.2
Trifolium 22 Drain	3	651.6	617.1	306.6	34.5
Trifolium 22 Drain	4	506.5	473.1	81.3	33.4
Trifolium 22 Drain	5	206.0	171.5	70.1	34.5
Trifolium 22 Drain	6	162.0	128.6	85.1	33.4
Trifolium 22 Drain	7	226.6	192.1	84.0	34.5
Trifolium 22 Drain	8	248.4	213.9	81.1	34.5
Trifolium 22 Drain	9	179.0	145.6	63.8	33.4
Trifolium 22 Drain	10	219.4	184.9	114.4	34.5
Trifolium 22 Drain	11	258.0	224.6	58.4	33.4
Trifolium 22 Drain	12	260.6	226.1	70.5	34.5

Drain	Month	Existing Mean Monthly AF	Proposed Mean Monthly AF	Existing Mean Monthly SD	Proposed Mean Reduction AF
Trifolium 23 Drain	1	228.3	194.1	97.8	34.2
Trifolium 23 Drain	2	245.9	215.0	80.1	30.9
Trifolium 23 Drain	3	339.9	305.7	97.3	34.2
Trifolium 23 Drain	4	314.2	281.1	90.4	33.1
Trifolium 23 Drain	5	247.5	213.3	60.5	34.2
Trifolium 23 Drain	6	239.9	206.8	121.1	33.1
Trifolium 23 Drain	7	347.3	313.1	215.2	34.2
Trifolium 23 Drain	8	257.1	222.9	117.2	34.2
Trifolium 23 Drain	9	308.8	275.7	106.9	33.1
Trifolium 23 Drain	10	312.1	277.9	171.3	34.2
Trifolium 23 Drain	11	302.4	269.3	165.6	33.1
Trifolium 23 Drain	12	250.4	216.2	127.8	34.2
U Drain	1	231.5	216.7	168.6	14.8
U Drain	2	189.0	175.6	102.4	13.4
U Drain	3	127.2	112.4	78.7	14.8
U Drain	4	98.0	83.7	39.4	14.3
U Drain	5	72.4	57.6	36.2	14.8
U Drain	6	55.5	41.2	19.8	14.3
U Drain	7	56.3	41.5	19.3	14.8
U Drain	8	79.2	64.4	29.2	14.8
U Drain	9	98.1	83.7	59.1	14.3
U Drain	10	83.8	69.0	90.3	14.8
U Drain	11	162.1	147.8	147.2	14.3
U Drain	12	215.3	200.5	140.6	14.8
W+Y Drain	1	38.2	16.7	48.6	21.5
W+Y Drain	2	67.0	47.6	78.8	19.4
W+Y Drain	3	140.6	119.1	126.7	21.5
W+Y Drain	4	179.7	158.9	156.2	20.8
W+Y Drain	5	241.5	220.0	171.7	21.5
W+Y Drain	6	353.3	332.5	225.0	20.8
W+Y Drain	7	328.0	306.5	214.1	21.5
W+Y Drain	8	224.1	202.6	205.3	21.5
W+Y Drain	9	219.0	198.2	233.1	20.8
W+Y Drain	10	177.3	155.8	155.0	21.5
W+Y Drain	11	100.5	79.7	94.3	20.8
W+Y Drain	12	64.7	43.1	51.2	21.5
Z Drain	1	216.7	175.0	230.7	41.7
Z Drain	2	220.5	182.8	202.0	37.6
Z Drain	3	249.9	208.3	130.1	41.7

Drain	Month	Existing Mean Monthly AF	Proposed Mean Monthly AF	Existing Mean Monthly SD	Proposed Mean Reduction AF
Z Drain	4	279.3	239.0	49.6	40.3
Z Drain	5	341.7	300.0	94.9	41.7
Z Drain	6	446.2	405.9	88.9	40.3
Z Drain	7	499.2	457.5	98.9	41.7
Z Drain	8	404.4	362.7	120.0	41.7
Z Drain	9	382.4	342.0	64.2	40.3
Z Drain	10	272.5	230.8	165.3	41.7
Z Drain	11	516.4	476.1	706.5	40.3
Z Drain	12	304.9	263.2	333.0	41.7