

Application No. 13-7784

Mitigation Plan

Miller Family Real Estate LLC

The Applicant owns an on-stream reservoir located on Current Creek near Swan Lake, Idaho. Water right no. 11-7127 authorizes the diversion of Current Creek into the reservoir during the non-irrigation season to maintain a full reservoir. A condition of water right no. 11-7127 requires that from April 1 to October 31, the amount of water released from the reservoir must equal or exceed the amount of water entering the reservoir. Without additional inflow or the ability to reduce outflow, the reservoir surface area and volume gradually shrinks due to evaporation and seepage.

This application proposes to maintain a full reservoir throughout the entire year for a maximum size of 35 acres in surface area and 800 acre-feet of storage. An analysis was performed taking into account the past seasonal changing reservoir surface area to determine the net volume amount of new depletion and the appropriate mitigation required for a year-round, fully inundated reservoir.

Using 1992 USGS Digital Orthophotography, University of Idaho evapotranspiration data¹, and owner-provided rating curves for the reservoir, a daily changing reservoir surface area was calculated, using the methods described in a detailed narrative in Appendix A. The analysis indicates that maintaining the reservoir at full pool year-round increases the surface area exposed to evaporation by just a few acres in March and April, and as much as 22 acres in the fall when the reservoir has historically been at its lowest level. The calculated monthly average surface area was totaled from the daily surface area and inserted into the Calculations for Reservoir Evaporation and Mitigation spreadsheet in Appendix B as the monthly pond surface area. Evaporation and precipitation data from the Preston 3 NE (NWS-107346) climate station was used to determine the total annual pond loss of 19.5 AFA.

To mitigate for the new depletion, it is proposed to dry up 7.1 acres of irrigated *alfalfa-less frequent cuttings*² and 2.2 acres of *grass pasture-low maintenance*³ (for a total of 9.3 acres) currently irrigated from Cottonwood Creek with water rights 13-885A, 13-886A, 13-887A and 13-889C. Each acre of alfalfa has historically consumed 2.19 AFA, providing 15.6 AFA from 7.1 irrigated acres. Each acre of pasture has historically consumed 1.76 AFA, providing 3.9 AFA from 2.2 irrigated acres. The 9.3 acres to be dried

¹ Evapotranspiration data was obtained from Allen, Richard G. & Clarence W. Robison, 2009. *Evapotranspiration & Consumptive Irrigation Water Requirements for Idaho: Supplement updating the Time Series through December 2008*, Research Technical Completion Report, Kimberly Research & Extension Center, University of Idaho, Moscow, ID. Web address is : <http://www.kimberly.uidaho.edu/ETIdaho/>

² A type of managed land cover (or crop) that is typically used for beef cattle and only cut 3 times during a season. Described in the Allen and Robison report mentioned above.

³ A type of managed land cover (or crop) that is typically grown for longer grazing periods. Described in the Allen and Robison report mentioned above.

up are located in the SWSW and SESW of Section 13, Township 13S Range 38E, as depicted on a map in Appendix C.

Historically, Miller's water rights from Cottonwood Creek have been diverted from the stream, through the Treasureton Canal, down a ditch, and injected into Stockton Creek for delivery to the place of use downstream. It is proposed that the water rights continue to be diverted from Cottonwood Creek as historically practiced. However, the mitigation water appurtenant to the 9.3 dry acres will no longer be diverted at the existing diversion on Stockton Creek for water rights 13-885A, 13-886A, 13-887A, and 13-889C. Rather, the mitigation volume will be provided to the Miller Reservoir.

A measurement plan is outlined in the Settlement Agreement between Miller Family Real Estate, LLC, Merrill Ranch Partnership, LLC, Strongarm Reservoir Irrigation District, Brent Abbott, and Pacificorp Energy. A map showing the location of the proposed measurement devices is included in Appendix D.

In summary, the Applicant proposes to appropriate a new water right to maintain the water levels of the Miller Reservoir, increasing water consumption by 19.5 AFA. To mitigate for the new volume diverted from the three sources, 9.3 acres will be dried up from water rights 13-885A, 13-886A, 13-887A, and 13-889C to provide the required volume. Measurements will be taken according to the Settlement Agreement.

A digital copy of the Calculations_SA.xls spreadsheet in Appendix A is available upon request.

Appendix A

Narrative of Surface Area Calculations

Narrative Explanation of Surface Area Calculations

This document describes calculations of the approximate surface-area and evaporation from the existing water right and historical practices on the Miller Reservoir.

Data and Assumptions

The data available to us include:

1. An aerial image of the pond on August 26, 1992, showing 18 acres of surface area.
2. ET_{Idaho} data which provides net evaporation (evapotranspiration minus precipitation).
3. A stage/volume rating curve for the reservoir.
4. A stage/surface-area rating curve for the reservoir.

We assume:

1. Historically, the reservoir was filled uniformly from November 1 through March 31, the permitted season for filling. Hence, the pool volume and surface area increased through the winter season.
2. The reservoir has always been full on April 1.
3. Summertime management has been to pass all inflows through the reservoir. Hence, the pool volume and surface area have historically decreased throughout the irrigation season by evaporation and seepage.
4. Seepage rate is proportional to stage (driving head) in the reservoir. Implicit in this assumption are the following:
 - 4.1. Seepage is governed by Darcy's law:

$$Q = K A dh/dl \quad (1)$$

Where: Q = flow, acre feet/day
 A = cross sectional area of sediments through which
 seepage passes
 K = hydraulic conductivity, feet/day
 dh = driving head
 dl = thickness of sediments through which seepage
 passes

- 4.2. While the slope of the reservoir bottom causes the wetted surface to be larger than the reservoir surface area, the driving force (gravity) is normal to the reservoir surface. Applying Darcy's law to the horizontal reservoir surface area gives the same result as would calculating the slope area and the normal component of driving force. This means (A) in Equation (1) can be represented using reservoir surface area and dh/dl can be measured in the vertical direction.
- 4.3. Either the reservoir is perched above the aquifer or the seasonal aquifer fluctuations are negligible relative to the range of stage changes over the course of a year. In either case, this means that (dh) in Equation (1) can be calculated as (stage) - (fixed controlling elevation) and

(dl) can be represented as (reservoir bottom elevation) - (bottom of sediments). If the reservoir is perched the (fixed controlling elevation) is the (bottom of sediments) and if the reservoir is in contact with an aquifer it is the average head in the aquifer.

Calculation Approach

Summertime. In the summertime, we set up a spreadsheet to calculate the daily changes in depth and surface area, as a function of ET_{Idaho} net evaporation (evaporation minus precipitation) and seepage.

Seepage was approximated by Darcy's Law. Term (dh/dl) in Equation (1) was defined as:

$$(dh/dl) = (stage - controlling\ elevation)/dl \quad (2)$$

Substituting into Equation (1) and rearranging terms we obtained:

$$Q = (stage)(KA/dl) - (controlling\ elevation)(KA/dl) \quad (3)$$

Substituting lumped parameter (C) for (KA/dl), we obtain:

$$Q = (stage)(C) - (controlling\ elevation)(C) \quad (4)$$

We assumed a controlling elevation of 30 feet below the reservoir bottom, consistent with the assumption of river sediment thickness used in the Eastern Snake Plain Aquifer Model (ESPAM1.1). Assuming the reservoir was full on April 1 and using the aerial image for August, we estimated August surface area and then calibrated coefficient C to obtain a calculated surface area that matched GIS analysis of the image. The aerial image is shown as Figure 1.

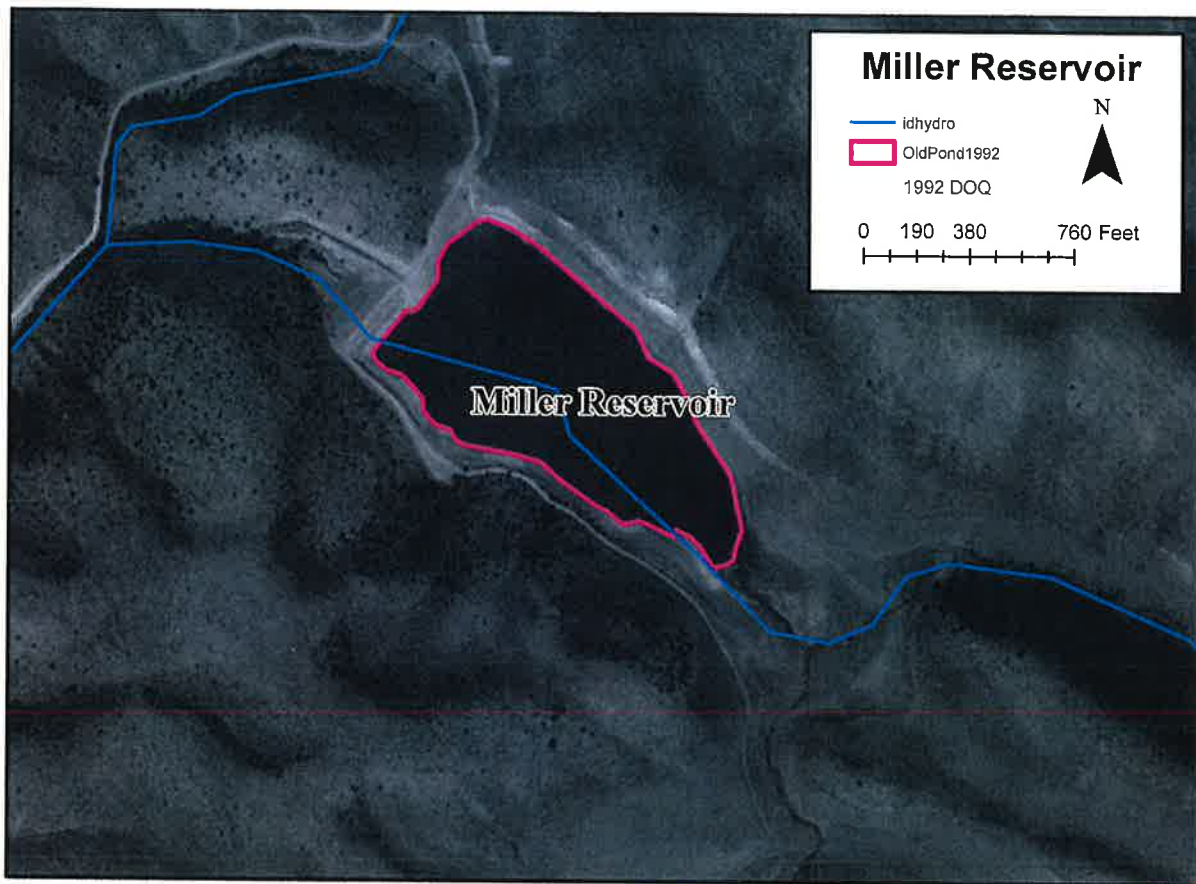


Figure 1. Map of reservoir.

Wintertime. Under the assumption of uniform fill, we calculated the daily fill of the reservoir at constant 4.89 acre feet/day. Using the stage/volume rating curve we derived the daily depth throughout the winter, and using the stage/area rating curve we derived the daily surface area.

After obtaining average monthly historical surface area for both summer and winter months, we subtracted these from full-pool acreage to estimate the increased area for evaporation under the new water right.

Details of Calculations

The details of the calculations are provided in spreadsheets *Calculations_SurfArea.xls* and *Calculations_Mitigation.xls*.

Calculations SurfArea.xls

Worksheet "SAIrrigSeas_RatingEq" contains our derivation of a rating equation from the paper rating chart available to us. Cells A1 through H10 contain data scaled by hand off the paper chart, and A14 through I36 contain the regression to develop the equation. The high adjusted R^2 value in cell B18 indicates that the equation is highly predictive of the data scaled off the paper chart, and the low F value in cell F25 indicates it is statistically significant at the $\alpha = 0.01$ level. High P-values in cells E30 through E36 indicate that individual coefficients are not statistically significant. This would ordinarily suggest that the equation was over-specified, but we accept the equation because it reasonably reproduces the slight deviations from a straight line that are apparent in the original rating chart. We attribute these deviations to the fact that the reservoir is on natural topography and not a structure of simple geometry. A copy of the paper rating chart titled Miller Reservoir Rating Chart is attached.

Worksheet "SAIrrigSeas" applies the calculation methods described above.

1. Column A contains dates.
2. Column B (hidden) contains monthly average ET_{Idaho} daily net evaporation depths in millimeters.
3. Column C contains the evaporation depths in feet.
4. Column D contains the calculation of seepage per Equation (4), using the calibrated coefficient in cell D3. Note that seepage is calculated using prior-day's stage. This is a slight temporal distortion but it avoids circular references in the spreadsheet.
5. Column E contains the calculated stage, subtracting the daily seepage and evaporation from the prior day's stage.
6. Column F contains the calculation of surface area using the derived rating equation in worksheet "SAIrrigSeas_RatingEq."
7. Cells K36 through L43 contain monthly average surface areas for pond calculations.

Worksheet "SANonIrrigSeas" contains a regression calculation to obtain a rating equation for the stage/volume relationship in the paper rating chart. Cells A1 through F10 contain the input data and Cells A14 through H34 contain the regression. Cell B19 indicates that the equation has strong predictive power, while Cell F25 indicates that the regression is statistically significant at $\alpha = 0.01$ and cells F30 through F34 indicate that all the coefficients are also significant at the $\alpha = 0.10$ level.

Worksheet "SANonIrrigSeas_RatingEq" applies the wintertime calculations described above. Column A contains the date and Column B contains the beginning-of-day volume. Column C contains the daily volume increment and Column D contains the end-of-day volume. Column E contains the end-of-day stage calculated from the regression in worksheet "SANonIrrigSeas" and Column F contains the end-of-day surface area calculated from the regression in worksheet "SAIrrigSeas_RatingEq." Cells M32 through N37 contain the average monthly surface area during winter months.

Calculations_Mitigation.xls

The average monthly surface areas derived from the calculations described above were subtracted from the full-pool surface area. The difference in acres is the maximum new surface area associated with the new permit application. These values were inserted into spreadsheet *Calculations_Mitigation.xls* (IDWR's standard spreadsheet) in Row 12, and the calculations proceeded per standard IDWR practice.

Result

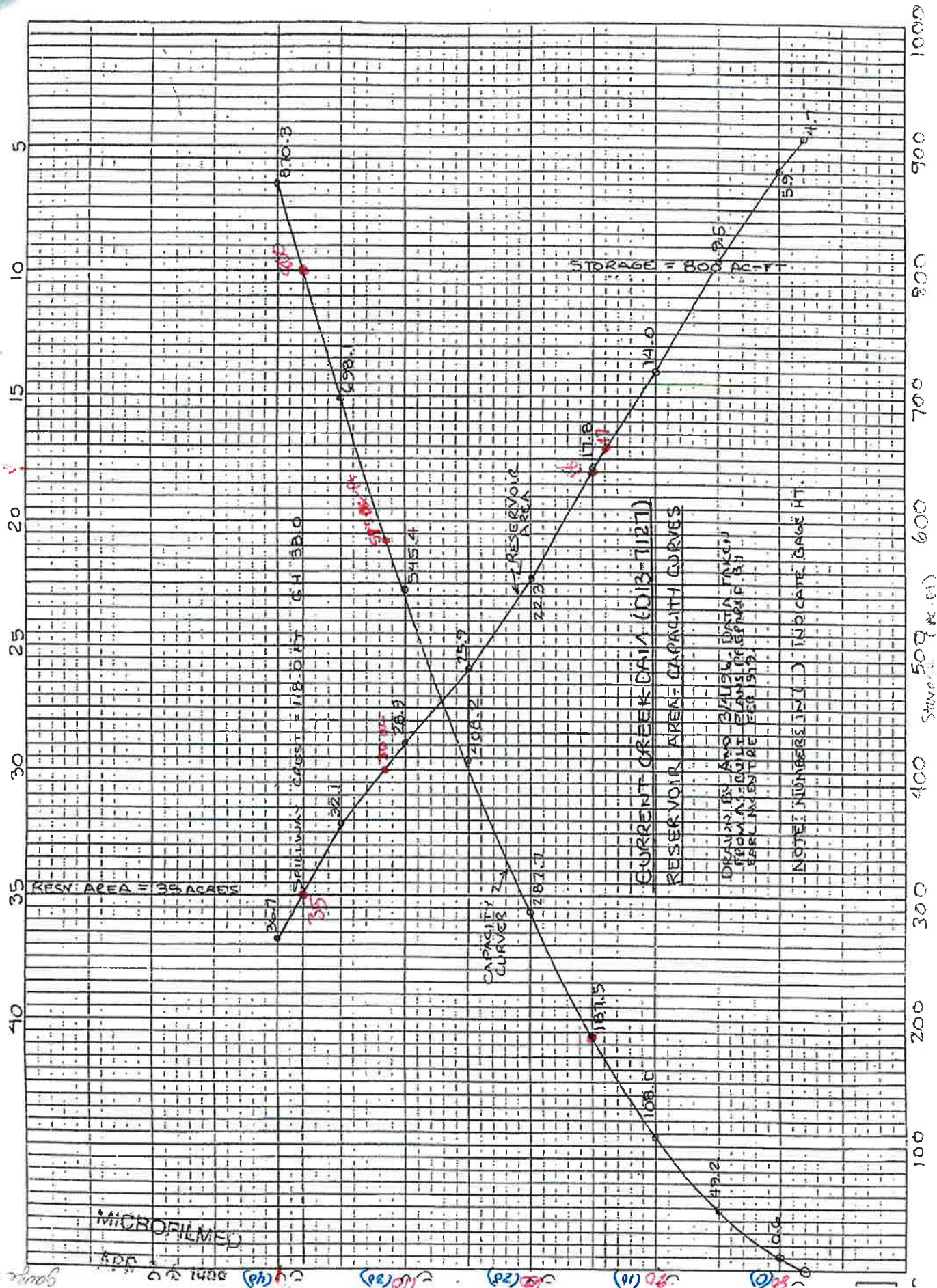
This analysis indicates that maintaining the reservoir at full pool for the irrigation season increases the surface area exposed to evaporation by just a few acres in March and April, and as much as 22 acres in the fall when the reservoir has historically been at its lowest level. Weighting the changes in surface area by monthly average net evaporation indicates that the new evaporation created by the proposed full reservoir is equivalent to irrigation of nine (9.0) acres of cropland.

Miller Reservoir Rating Chart

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RESERVOIR AREA (ACRES)



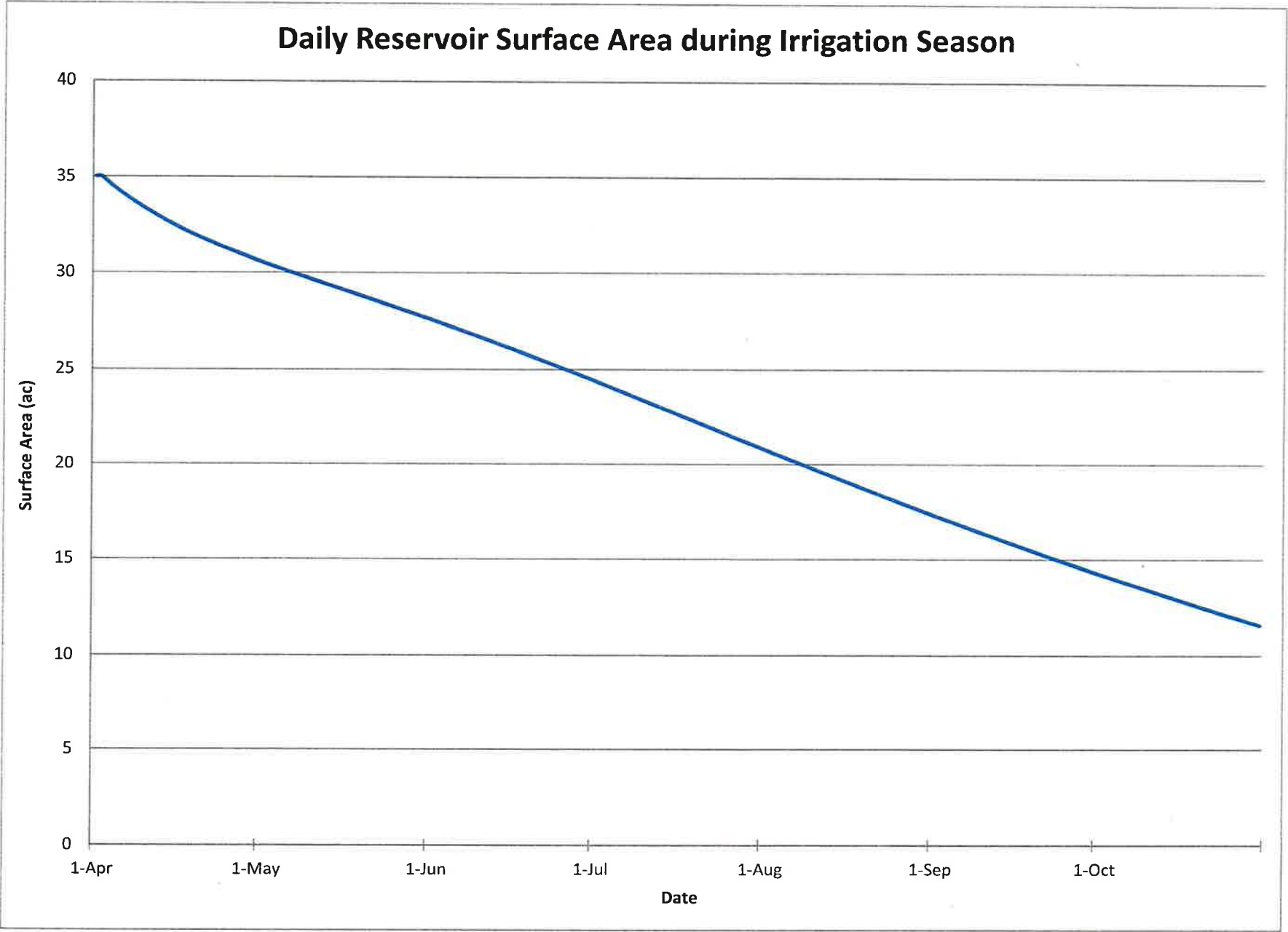
Daily Reservoir Surface Area during Irrigation Season

First Page of worksheet only.

Seepage Coefficient 0.00267605

Controlling Elevation -30

Date	ET Net Precip 1992 (ft)	Seepage (ft/day)	Stage (depth ft)	Surface Area (ac)	First day seepage is not calculated, to avoid circular reference in the formula.
1-Apr	0.0028	0	38.000	35.019525	
2-Apr	0.0028	0.1819716	37.997	35.015923	
3-Apr	0.0028	0.18196423	37.813	34.779094	
4-Apr	0.0028	0.18146989	37.628	34.551066	
5-Apr	0.0028	0.18097557	37.444	34.331999	
6-Apr	0.0028	0.18048257	37.260	34.12143	
7-Apr	0.0028	0.17999089	37.077	33.918918	
8-Apr	0.0028	0.17950054	36.894	33.724035	
9-Apr	0.0028	0.1790115	36.712	33.536375	
10-Apr	0.0028	0.17852377	36.530	33.355543	
11-Apr	0.0028	0.17803735	36.349	33.181166	
12-Apr	0.0028	0.17755224	36.168	33.012883	
13-Apr	0.0028	0.17706842	35.987	32.850348	
14-Apr	0.0028	0.17658591	35.808	32.693231	
15-Apr	0.0028	0.17610469	35.628	32.541216	
16-Apr	0.0028	0.17562476	35.449	32.394	
17-Apr	0.0028	0.17514612	35.271	32.251292	
18-Apr	0.0028	0.17466877	35.093	32.112816	
19-Apr	0.0028	0.17419269	34.916	31.978308	
20-Apr	0.0028	0.17371789	34.739	31.847513	
21-Apr	0.0028	0.17324437	34.562	31.72019	
22-Apr	0.0028	0.17277212	34.386	31.596108	
23-Apr	0.0028	0.17230113	34.211	31.475048	
24-Apr	0.0028	0.17183141	34.036	31.356799	
25-Apr	0.0028	0.17136295	33.861	31.241162	
26-Apr	0.0028	0.17089574	33.687	31.127946	
27-Apr	0.0028	0.17042979	33.513	31.01697	
28-Apr	0.0028	0.16996509	33.340	30.908061	
29-Apr	0.0028	0.16950163	33.167	30.801055	
30-Apr	0.0028	0.16903942	32.995	30.695797	
1-May	0.0037	0.16857845	32.823	30.592138	
2-May	0.0037	0.16811872	32.651	30.489375	
3-May	0.0037	0.16765767	32.479	30.387948	
4-May	0.0037	0.16719786	32.308	30.287733	
5-May	0.0037	0.16673928	32.137	30.188607	
6-May	0.0037	0.16628193	31.967	30.090457	
7-May	0.0037	0.1658258	31.797	29.993173	
8-May	0.0037	0.1653709	31.627	29.896655	
9-May	0.0037	0.16491722	31.458	29.800806	



Height (ft)	Height2	Height3	Height4	Height5	Height6	Surface Area (ac)	
38	1444	54872	2085136	79235168	3010936384	35	35.01952537
35	1225	42875	1500625	52521875	1838265625	32.1	32.04177225
30	900	27000	810000	24300000	729000000	28.9	28.9796152
25	625	15625	390625	9765625	244140625	25.9	25.88821679
20	400	8000	160000	3200000	64000000	22.3	22.15144431
15	225	3375	50625	759375	11390625	17.8	18.04362208
10	100	1000	10000	100000	1000000	14	13.81715829
5	25	125	625	3125	15625	9.5	9.569466172
0	0	0	0	0	0	5.9	5.889179531

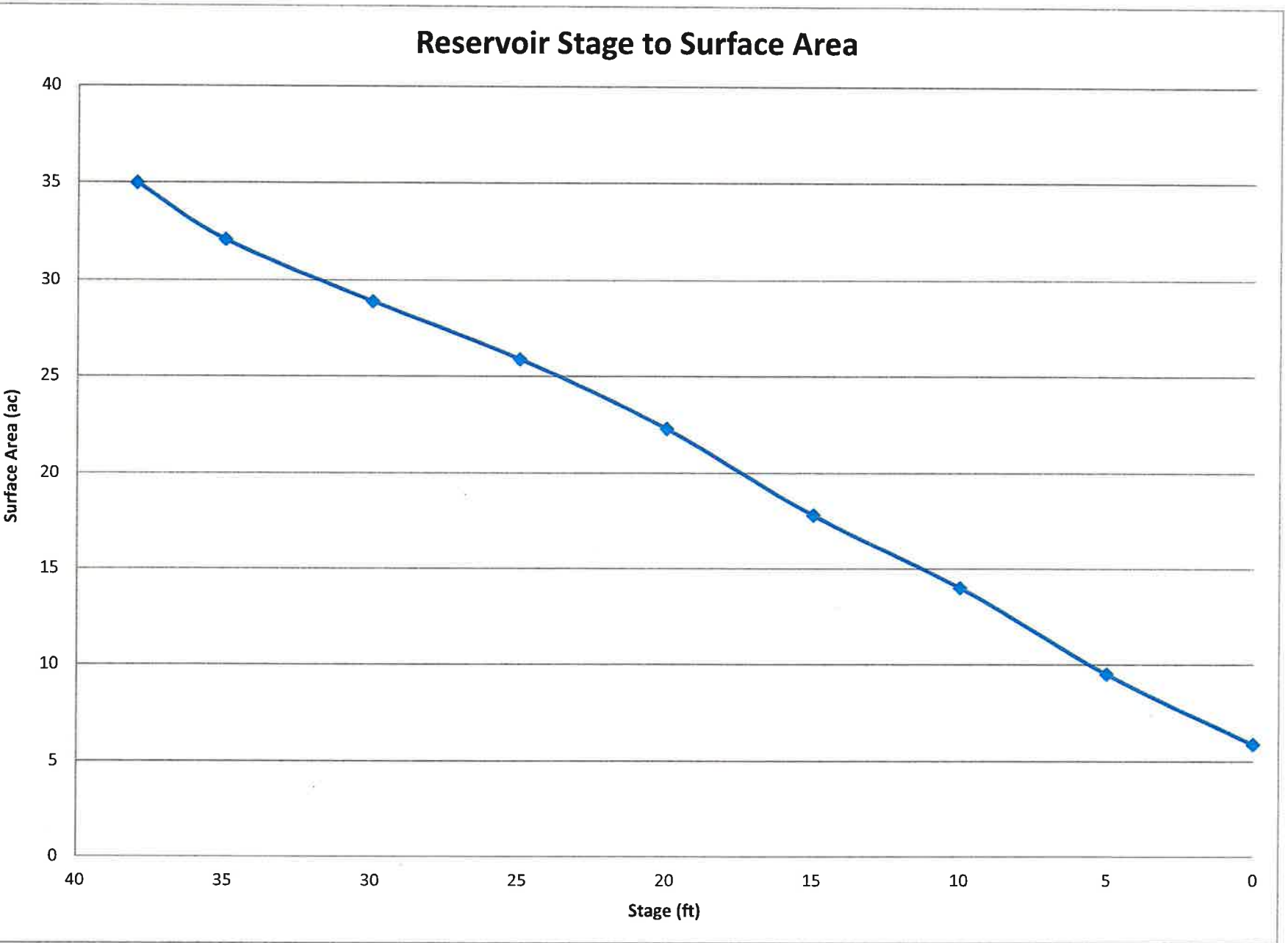
SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999921295
R Square	0.999842597
Adjusted R Square	0.999370387
Standard Error	0.254993498
Observations	9

ANOVA

	df	SS	MS	F	Significance F
Regression	6	826.0499566	137.6749928	2117.37046	0.000472135
Residual	2	0.130043368	0.065021684		
Total	8	826.18			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	5.889179531	0.254858189	23.1076724	0.001867539	4.79261325	6.985745812	4.79261325	6.985746
Height (ft)	0.563688396	0.293525945	1.920403992	0.194779806	-0.699251811	1.826628603	-0.699251811	1.826629
Height2	0.054759348	0.082115015	0.666861572	0.573496579	-0.298553044	0.40807174	-0.298553044	0.408072
Height3	-0.005223358	0.008643798	-0.60428977	0.607070698	-0.042414618	0.031967901	-0.042414618	0.031968
Height4	0.00026611	0.000420583	0.632717324	0.591610902	-0.001543513	0.002075733	-0.001543513	0.002076
Height5	-6.91854E-06	9.57363E-06	-0.722666131	0.544965892	-4.81105E-05	3.42735E-05	-4.81105E-05	3.43E-05
Height6	6.92706E-08	8.25177E-08	0.839463677	0.489562682	-2.85774E-07	4.24316E-07	-2.85774E-07	4.24E-07



Calculations_SA.xls

Worksheet "SAIrrigSeas_RatEq_Chart"

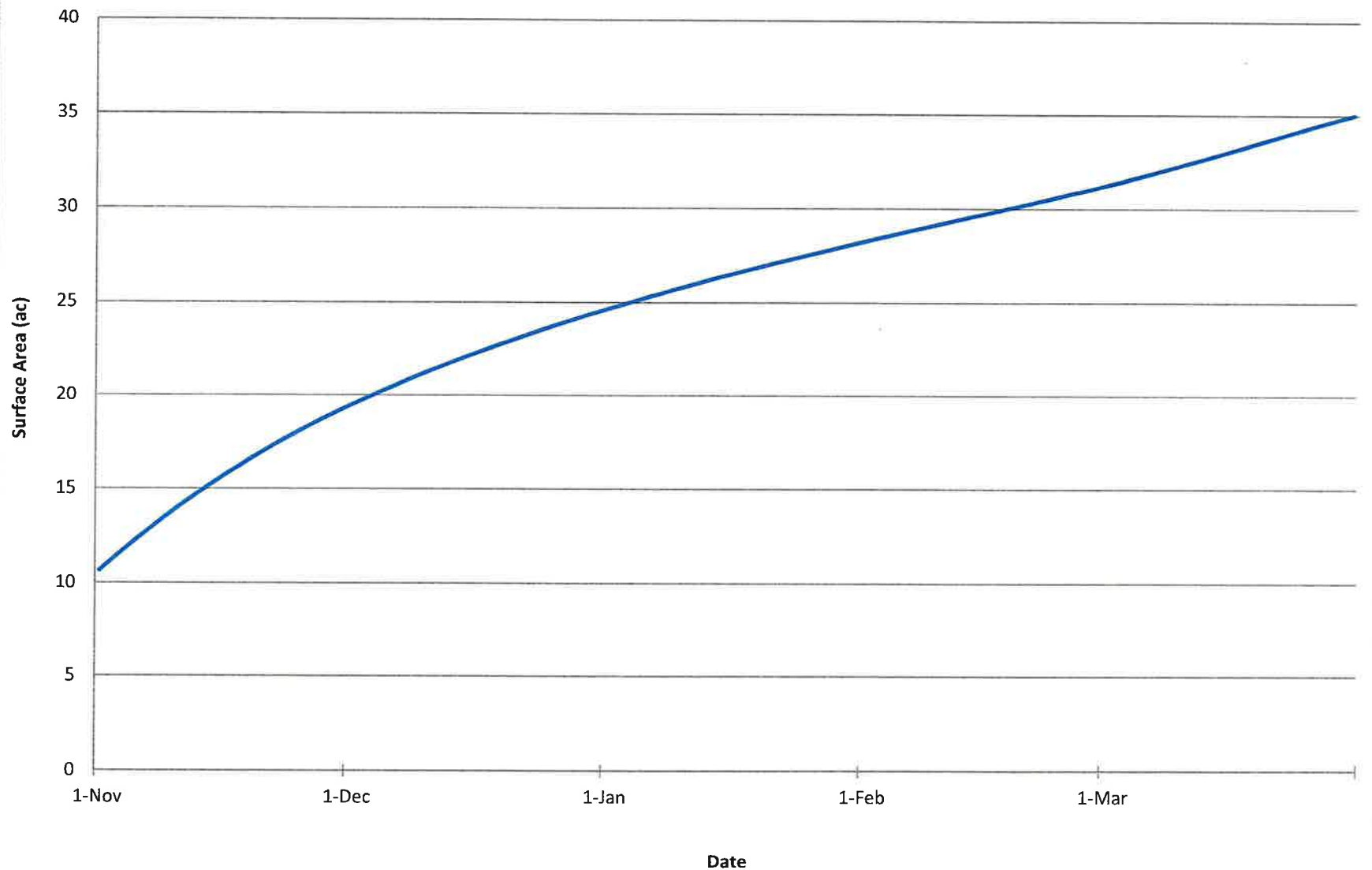


Daily Reservoir Surface Area during Non-Irrigation Season

First page of worksheet only.

Date	Volume (AF)	Volume Increase (AF)	End of Day volume (AF)	End of Day Stage (depth ft)	Surface Area (ac)
1-Nov	62.00	4.887417	66.887417	6.310013	10.67109
2-Nov	66.89	4.887417	71.774834	6.764987	11.0574
3-Nov	71.77	4.887417	76.662252	7.210563	11.43678
4-Nov	76.66	4.887417	81.549669	7.646952	11.80898
5-Nov	81.55	4.887417	86.437086	8.074366	12.17387
6-Nov	86.44	4.887417	91.324503	8.493012	12.53139
7-Nov	91.32	4.887417	96.211921	8.903096	12.88156
8-Nov	96.21	4.887417	101.099338	9.30482	13.22443
9-Nov	101.10	4.887417	105.986755	9.698386	13.56011
10-Nov	105.99	4.887417	110.874172	10.08399	13.88871
11-Nov	110.87	4.887417	115.761589	10.46183	14.21037
12-Nov	115.76	4.887417	120.649007	10.8321	14.52526
13-Nov	120.65	4.887417	125.536424	11.19499	14.83354
14-Nov	125.54	4.887417	130.423841	11.55068	15.13538
15-Nov	130.42	4.887417	135.311258	11.89937	15.43094
16-Nov	135.31	4.887417	140.198675	12.24124	15.72039
17-Nov	140.20	4.887417	145.086093	12.57646	16.00391
18-Nov	145.09	4.887417	149.973510	12.90523	16.28165
19-Nov	149.97	4.887417	154.860927	13.2277	16.55379
20-Nov	154.86	4.887417	159.748344	13.54407	16.82047
21-Nov	159.75	4.887417	164.635762	13.8545	17.08185
22-Nov	164.64	4.887417	169.523179	14.15915	17.33808
23-Nov	169.52	4.887417	174.410596	14.4582	17.58929
24-Nov	174.41	4.887417	179.298013	14.75182	17.83564
25-Nov	179.30	4.887417	184.185430	15.04015	18.07725
26-Nov	184.19	4.887417	189.072848	15.32337	18.31425
27-Nov	189.07	4.887417	193.960265	15.60162	18.54677
28-Nov	193.96	4.887417	198.847682	15.87507	18.77494
29-Nov	198.85	4.887417	203.735099	16.14387	18.99887
30-Nov	203.74	4.887417	208.622517	16.40816	19.21869
1-Dec	208.62	4.887417	213.509934	16.6681	19.43449
2-Dec	213.51	4.887417	218.397351	16.92382	19.64641
3-Dec	218.40	4.887417	223.284768	17.17548	19.85453
4-Dec	223.28	4.887417	228.172185	17.42321	20.05898
5-Dec	228.17	4.887417	233.059603	17.66715	20.25985
6-Dec	233.06	4.887417	237.947020	17.90744	20.45724
7-Dec	237.95	4.887417	242.834437	18.1442	20.65126
8-Dec	242.83	4.887417	247.721854	18.37757	20.842

Daily Reservoir Surface Area during Non-Irrigation Season



volume	volume2	volume3	volume4	height (ft)		
800	640000	5.12E+08	4.096E+11	38	37.91790928	
698.1	487343.61	3.4E+08	2.37504E+11	35	36.31358032	
545.4	297461.16	1.62E+08	88483141709	30	30.82082037	
408.2	166627.24	68017239	27764637110	25	25.8385484	
287.7	82771.29	23813300	6851086448	20	21.15305513	
187.5	35156.25	6591797	1235961914	15	16.21082217	
108	11664	1259712	136048896	10	10.83622857	
49.2	2420.64	119095.5	5859498.01	5	5.559583972	
10.6	112.36	1191.016	12624.7696	0	1.298922552	

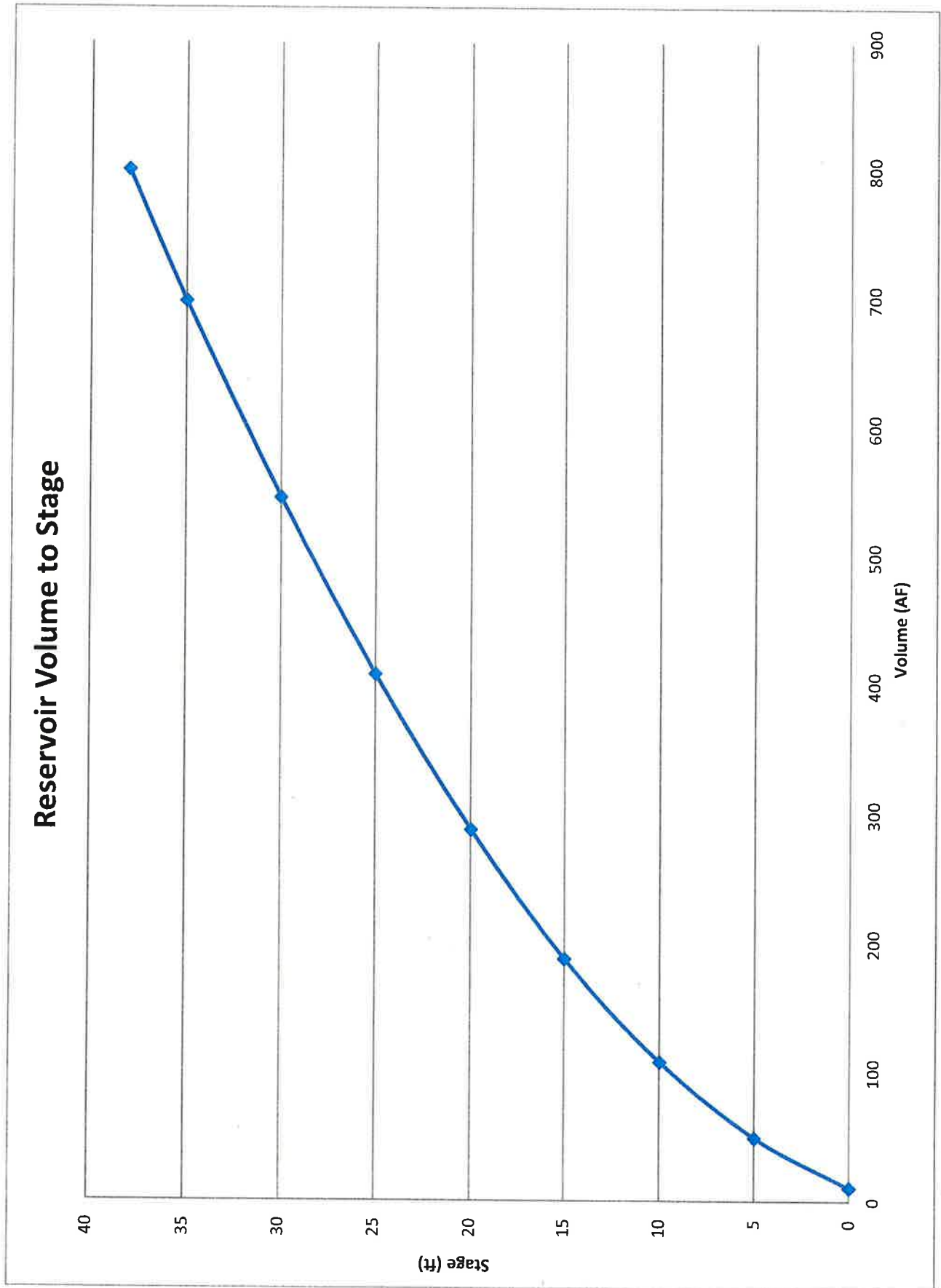
SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.9998321
R Square	0.9996642
Adjusted R S	0.9993284
Standard Err	0.3456923
Observation	9

ANOVA

	df	SS	MS	F	Significance F
Regression	4	1423.078	355.7693857	2977.070106	3.38185E-07
Residual	4	0.478013	0.119503194		
Total	8	1423.556			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-0.9780498	0.36052	-2.712885561	0.053377784	-1.979014129	0.022914	-1.97901	0.022914
volume	0.1253398	0.007589	16.51555365	7.87114E-05	0.104268784	0.146411	0.104269	0.146411
volume2	-0.0002679	4.16E-05	-6.445028487	0.002982478	-0.000383299	-0.00015	-0.00038	-0.00015
volume3	3.558E-07	8E-08	4.450101417	0.01124584	1.33809E-07	5.78E-07	1.34E-07	5.78E-07
volume4	-1.76E-10	4.95E-11	-3.55601542	0.023670456	-3.13402E-10	-3.9E-11	-3.1E-10	-3.9E-11



Appendix B

Pond Calculations

Calculations for Reservoir Evaporation and Mitigation

Climate Station: Preston 3 NE (NWS-107346)

Project Name: Miller Idaho Ranch

Reservoir Consumptive Use Calculations													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Annual FWW Evaporation (inches)	35	35	35	35	35	35	35	35	35	35	35	35	35
Monthly Distribution (%) #1	1	3	5	10	12	14	16	15	10	6	5	3	100
Monthly FWS Evaporation (in/mo)	0.35	1.05	1.75	3.5	4.2	4.9	5.6	5.25	3.5	2.1	1.75	1.05	35
Avg. Total Precipitation (in/mo) #2	1.41	1.24	1.33	1.63	1.95	1.48	0.78	0.98	1.35	1.66	1.29	1.63	16.74
Pond Loss [(Evap.) - (Precip.,in.)] #3	0	0	0.42	1.87	2.25	3.42	4.82	4.27	2.15	0.44	0.46	0	20.1
Pond Surface Area (acres)**	12.1	7.5	3.1	2.2	5.6	8.5	12	15.8	19.4	22.8	22.3	17.3	12.3833
Total Pond Loss (ac-in)	0.0	0.0	1.3	4.1	12.6	29.1	57.8	67.5	41.7	10.0	10.3	0.0	234.4
Total Pond Loss (ac-ft)	0.0	0.0	0.1	0.3	1.1	2.4	4.8	5.6	3.5	0.8	0.9	0.0	19.5 #7
Irrigation Consumption Crop		Alfalfa-less freq cuttings		Grass Pasture-low mainten.									
Precipitation Defecit (mm/season) =		667		537		# 4							
Mean Irr. Requirement (ac-in/ac/seas.) =		26.3		21.1		# 5							
Mean Irr. Requirement (ac-ft/ac/seas.) =		2.19		1.76		# 6							
Acres to dry up for pond use =		7.13 (15.6 AF)		2.2 (3.9 AF)									

Summary				
Original Surface Water Right 13-885A	Diversion Rate (cfs)	Place of Use (acres)	cfs per acre	AF per acre (#6)
	1	624	0.002	2.19
Original Surface Water Right 13-886A	Diversion Rate (cfs)	Place of Use (acres)	cfs per acre	AF per acre (#6)
	0.75	624	0.001	0.00
Original Surface Water Right 13-887A	Diversion Rate (cfs)	Place of Use (acres)	cfs per acre	AF per acre (#6)
	0.7	624	0.001	0.00
Original Surface Water Right 13-889C	Diversion Rate (cfs)	Place of Use (acres)	cfs per acre	AF per acre (#6)
	5	624	0.008	0.00
Amount of Water for Transfer	Pond Surface Area (acres)	Acres Equivalent to Evaporation Use (#8)	cfs required	AF (#7) Required
	35.0	9.3	0.111	19.5

**Pond Surface Area		
full pond = 35 acres		
Month	Avg Month	SA to Mitigate
November	15.4	19.6
December	22.2	12.8
January	26.5	8.5
February	29.7	5.3
March	33.1	1.9
April	32.6	2.4
May	29.1	5.9
June	26.1	8.9
July	22.7	12.3
August	19.1	15.9
September	15.9	19.1
October	12.9	22.1
Colored cells were pasted "values only" from file "Calculations_SA.xls"		

#1 - Molnau, Myron, Kpordze, Kojo C.S., and Craine, Katherine L., 1992. Monthly shallow pond evaporation in Idaho. ASAE paper PNW 92-111.

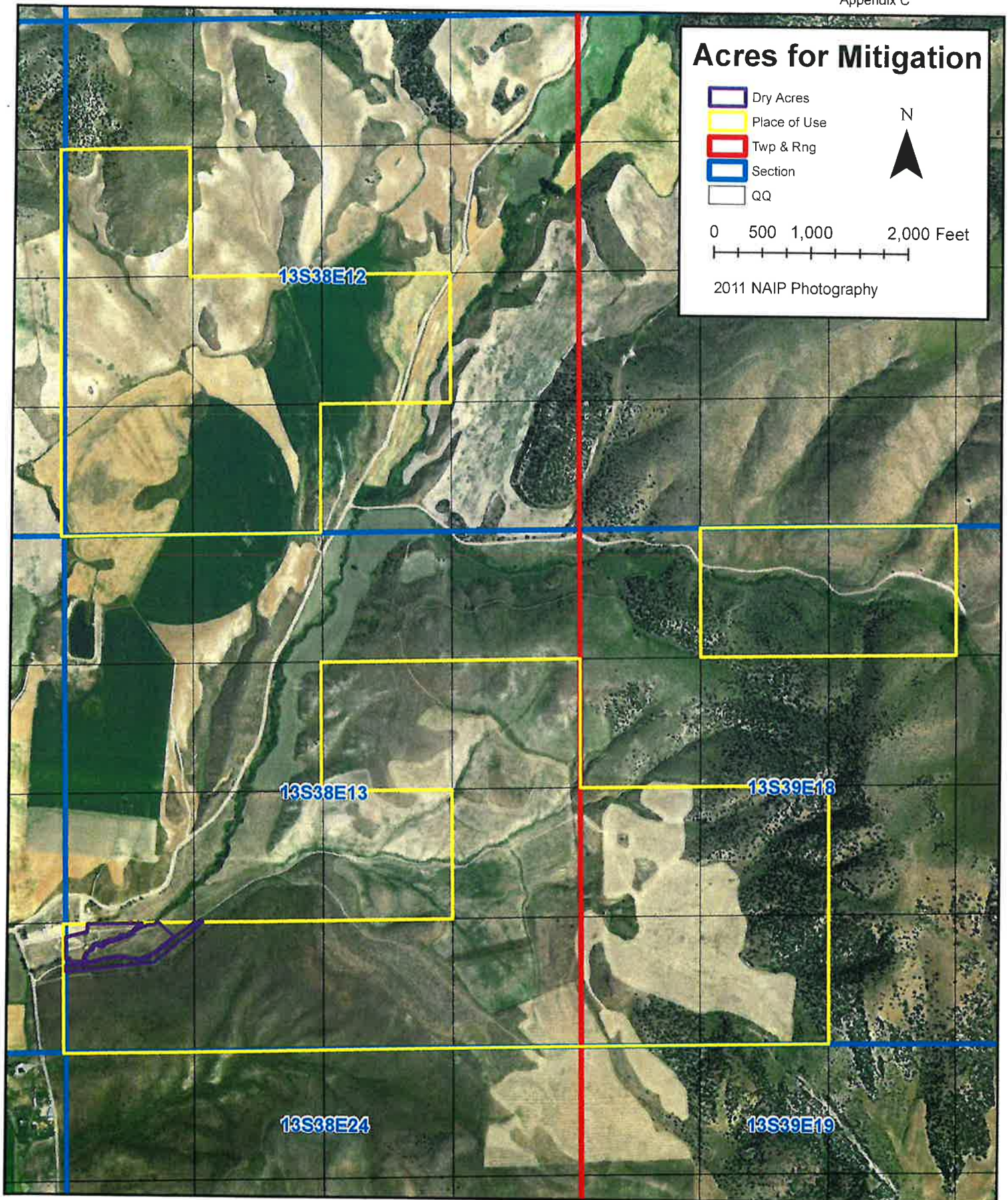
#2 - Data collected from the Western Regional Climate Summary, Monthly Climate Summary @ <http://www.wrcc.dri.edu/summary/Climsmsid.html> -See attached:

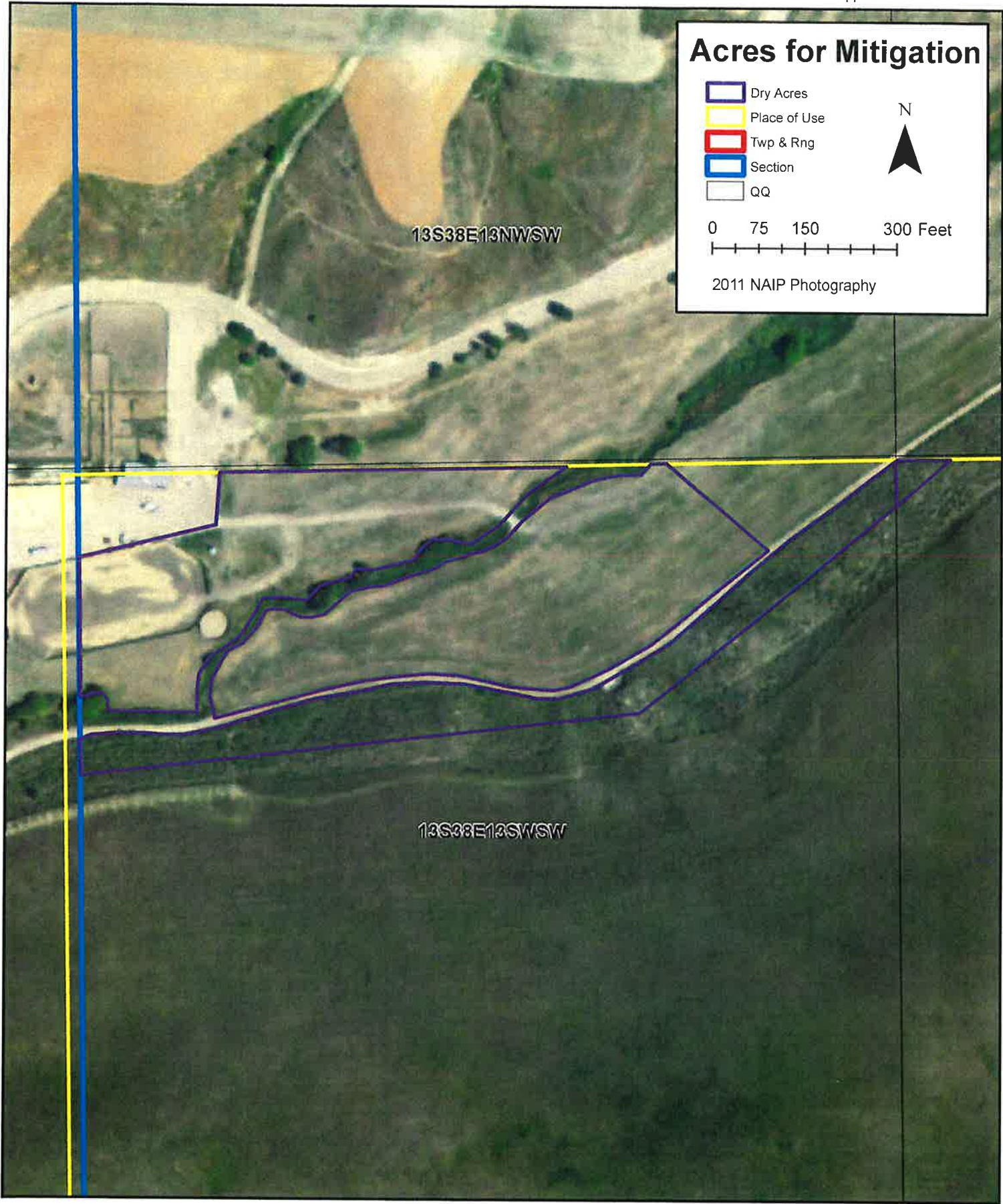
#3 - Note: for months where precipitation exceeds evaporation, the resultant pond loss is set to zero

#4, 5 & 6 - http://www.kimberly.uidaho.edu/ETIdaho/_Precipitation Deficit values used synonymously w/mean irrigation requirement. Values from Allen, Richard G. & Clarence W. Robison, 2006 (Revised 2007). Evapotranspiration & Consumptive Irrigation Water Requirements - Idaho, Research Technical Completion Report, Kimberly Research & Extension Center, University of Idaho, Moscow, ID.

Appendix C

Map of Acres for Mitigation





Appendix D
Map of Proposed Measuring Devices

