SPF WATER ENGINEERING

February 16, 2017

Tim Luke
Idaho Department of Water Resources
PO Box 83720
Boise, ID 83720-0098

Subject: Sandy Pond Recharge 2016 Annual Report

Dear Tim,

Enclosed are summary data and calculations for recharge at Sandy Ponds. Measured daily inflow data was not available until April 29, so inflow was estimated prior to that. Per SPF's observations, the ponds were dry on April 13 and full on April 20. SPF observed a flow of 17.5 cfs on April 22, we assume flow of 25 cfs from April 23 through 28 per another observation by SPF. Data provided by North Side Canal Company is used for April 29 through July 13 with SCADA data obtained by SPF used for most of the remainder of the year. See the W-26 Daily Record spreadsheet, attached.

Outflows from the ponds include 1) Morris's pond pump measured with a magnetic flowmeter, 2) Morris's pond overflow weir, 3) flow into the Sandy Pipe Vault measured with an ultrasonic meter, and 4) evaporation estimated based on average ETIdaho information.

Morris's pond pump was fitted with a new meter on May 14 as the prior meter had failed. At the end of the season, this meter indicated a total volume of 232.34 acre-feet. Prior to May 14, SPF estimates the pump ran for an equivalent of 24days at 1.3 cfs for an additional 61.89 acre-feet, giving a total for this pump of 294.23 acre-feet.

Total volume passing the Morris Pond Weir is 0.08acre-feet.

The installed ultrasonic flowmeter installed on the Sandy Pipe Vault entrance indicated a total volume of 1623 acre-feet. However, upon reviewing year-end data, it became obvious that there was a significant data error. For example, from approximately September 9 through November 7, the SCADA reported data indicates a daily average constant 2.9 cfs flow. However, SCADA indicated that none of the vault pumps operated during this period, indicating that all 2.9 cfs would have spilled to Curren Ditch. Mr. Morris confirmed that during this period, none of the vault pumps were operated and no flow was diverted from the ponds

300 E. Mallard Drive, Suite 350, Boise, Idaho 83706 Tel: 208-383-4140 Fax: 208-383-4156

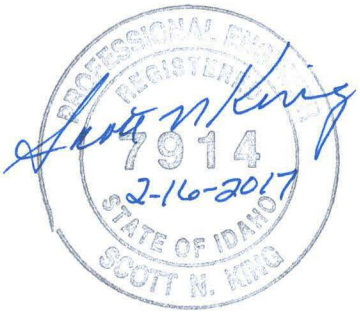
to the Sandy pipeline. This was also confirmed by SPF on a couple of fall site visits. Much of the data for earlier in the year tends to show a high spill rate from the vault to Curren Ditch, which is inconsistent with Mr. Morris who explained that he operated this "very tight" with minimal spill. Therefore, flow into the vault is based on flow pumped out (Morris, Musser and Candy pumps), an estimate of flow out to Curren Ditch, minus inflow from the Farmer's Box. Pumped flows per 2016 annual reports are: Morris Pump = 155.04 acre-feet, Musser Pump = 564.89 acre-feet, and Candy Pump = 88.40 acre-feet. The Candy Pump meter display had some issues early in the season so this volume includes 40 acre-feet based on estimated flow of 0.5 cfs/day from April 22 to May 30. Inflow from the Farmer's Box was 7.52 acre-feet. The District 36A Watermaster estimated spill out from the box to Curren Ditch was approximately the same volume as flow in from Farmer's Box. SPF increased this volume to 10% of total volume pumped or 80.83 acre-feet.

Evaporation from the ponds is calculated based on ETIdaho's Hagerman station for 231 days (April 14 through November 30) for the full 44-acre surface area and totals 117.54 acre-feet. Total computed recharge is as follows:

W-26 inflow	6759.50
Morris Pond Pump	- 294.23
Morris Pond Weir	- 0.08
Morris Vault Pump	- 155.04
Musser Vault Pump	- 564.89
Candy Vault Pump	- 88.40
Farmers Box Inflow	+ 7.52
Curren Ditch Outflow	- 80.83
Evaporation	- 117.54
Total Recharge	5466.41 acre-feet

Please let me know if you have any questions.

Sincerely,



Scott N. King, P.E.
Supervising Engineer

cc: T.J. Budge

File: 535.0240

Sandy Ponds Recharge
2016

Date	Inflow - NSCC W-26 Weir (acre-feet)[1]	Outflow 1 - Sandy Pipeline (acre feet)[2]	Outflow 2 - Morris Pond Pump (acre-feet)[3]	Outflow 3 - Morris Pond Weir (acre-feet)[4]	Evaporation rate (mm/year)[5]	Pond Surface Area (Acres)[6]	Annual Evaporation (acre-feet)[7]	Cumulative Recharge (Ac-Ft)	Note
2016	6759.90	881.64	294.23	0.08	814.25	44.00	117.54	5466.41	

[1] Sandy Pond Inflow measured at North Side Canal Company W-26 Lateral Broad Crested Weir (found in SPF Files S:\PROJECTS\I thru L Projects\I Projects\IGWA_535\0110_Sandy Pond Measurement\PROJECT\Data\Dataloggers\CR6-CP02_W26_DailyData - Column D - W26_CFS_Avg). Value is daily average of 15-minute readings.

[2] Sandy Ponds Outflow 1 measured at the Sandy Pipe immediately upstream of the Sandy Vault had erroneous measurements during 2016. Inflow is calculated as outflows from Morris, Musser and Candy pumps (155.04 + 564.89 + 88.40 af) minus inflow from Farmer's Box (7.52 af) and outflow to Curren Ditch (estimated at 15% of Sandy Pipe inflow af).

[3] Sandy Ponds Outflow 2 measured at the Butch Morris' pump out of the Morris Pond. A new flowmeter installed on May 19 showed 232.34 AF at end of season. Include an additional 61.89 AF based on 1.3 cfs for 24 days prior to May 19 new meter installation.

[4] Sandy Ponds Outflow 3 measured at the Morris Pond outlet weir (found in SPF Files S:\PROJECTS\I thru L Projects\I Projects\IGWA_535\0110_Sandy Pond Measurement\PROJECT\Data\Dataloggers\CR6_CP01_MorrisPond_DailyData - Column E - MorrisWeir_AcreFt). Value is from daily average readings.

[5] Evaporation is based on the average monthly Precipitation Deficit for the Hagerman 2 SW (NWS 103932) Station for Open Water - Shallow Systems (ponds, streams). The monthly average has been assumed for each day of the month beginning April 14 (when flow began entering ponds) through November.

[6] No gauges are present for calculation of pond area. When water is present, pond area has been assumed to be 44 acres as described in 3rd Mitigation Plan report prepared by SPF. When water is not present, pond area is assumed as 0 acres.

[7] Evaporation is calculated as (mm/year evaporation x 0.00328084 ft/mm x Pond Surface Area acres)

[8] Recharge is calculated as Inflow - Outflow 1 - Outflow 2 - Outflow 3 - Evaporation

W-26 Daily Record

2016 Daily Average cfs

Day	January	February	March	April	May	June	July	August	September	October	November	December	Total
1				0.0	25.9	7.8	6.9	13.6	12.1	13.5			
2				0.0	27.2	7.9	7.0	11.7	18.7	12.5			
3				0.0	31.3	14.9	7.0	11.9	20.6	12.4			
4				0.0	22.6	13.8	9.1	11.6	23.4	15.0			
5				0.0	31.0	8.9	13.1	10.8	30.2	12.7			
6				0.0	25.5	14.1	18.8	13.7	30.9	13.6			
7				0.0	27.1	12.3	19.8	6.2	25.5	17.8			
8				0.0	33.0	12.0	13.6	7.7	18.1	17.5			
9				0.0	36.7	11.7	16.9	12.6	20.5	14.3			
10				0.0	40.5	12.7	19.9	11.8	23.3	14.3			
11				0.0	42.7	12.0	21.9	9.1	28.0	17.2			
12				0.0	39.1	18.8	18.8	4.7	27.1	17.6			
13				0.0	35.7	18.9	16.2	6.6	26.9	19.9			
14				17.5	29.9	22.7	14.13	6.7	31.7	20.9			
15				17.5	31.7	23.9	14.13	10.9	32.5	22.8			
16				17.5	36.1	24.6	14.28	6.1	26.8	23.3			
17				17.5	32.5	30.2	14.78	7.8	25.0	21.9			
18				17.5	29.4	27.5	13.9	7.5	19.8	6.1			
19				17.5	29.4	20.3	13.7	10.4	20.4	3.1			
20				17.5	35.3	17.6	13.2	9.0	12.8	0.3			
21				17.5	42.8	9.1	11.7	9.7	13.8				
22				17.5	45.2	9.3	12.1	15.5	20.5				
23				25.0	43.7	8.0	8.5	10.3	27.2				
24				25.0	42.9	7.6	8.8	7.5	25.8				
25				25.0	35.9	5.9	9.7	6.4	24.3				
26				25.0	19.6	6.6	4.1	8.0	25.4				
27				25.0	12.8	9.3	4.8	11.7	25.1				
28				25.0	18.4	6.3	9.4	17.3	19.8				
29				24.2	19.1	4.6	7.4	19.6	18.3				
30		----		23.6	20.4	6.2	4.0	13.5	13.3				
31		----		----	17.6	----	12.4	11.9	----		----		
Total 24-hr CFS	**0.0**	**0.0**	**0.0**	**355.2**	**961.2**	**405.3**	**380.1**	**321.8**	**687.9**	**296.5**	**0.0**	**0.0**	**3408.0**
Total Ac-Ft	**0.0**	**0.0**	**0.0**	**704.6**	**1906.6**	**803.9**	**753.8**	**638.4**	**1364.4**	**588.2**	**0.0**	**0.0**	**6759.9**

Record based on daily average cfs data collected through telemetry:
S:\PROJECTS\I thru L Projects\I Projects\IGWA_535\0110_Sandy Pond Measurement\PROJECT\Data\Dataloggers\CR6_CP02_W26_Daily Data
Column D => W26_CFS_Avg

- Data Estimated
- Data Missing from Daily Download but provided by NSCC
- Average based on available 15MinData (no Daily reading-dying battery)
- Data Missing from Daily Download AND NSCC data. Flows interpolated.
- Data Missing from NCSS and collected with faulty data logger
- Average based on NSCC data (NSCC provided 15 minute data, complete until July 13)

Hagerman

Open water - shallow systems (ponds, streams)

Precipitation Deficit (Click here for a graph)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Growing Season[a]	Non Growing Season[b]	Annual
Mean	mm/day												mm		
Monthly	-0.17	0.27	1.54	2.74	3.71	4.74	5.42	4.75	3.93	2.29	0.21	-0.94	871	0	871
Days	0	0	0	17	31	30	31	31	30	31	30	0			231
Monthly Total	0	0	0	46.6	115.0	142.2	168.0	147.3	117.9	71.0	6.3	0			814.25

MEMO

State of Idaho
Department of Water Resources
322 E Front Street, P.O. Box 83720, Boise, Idaho 83720-0098
Phone: (208) 287-4800 Fax: (208) 287-6700

Date: February 13, 2017
To: Jennifer Sukow, Allan Wylie
From: Tim Luke, Water Compliance Bureau TJL
Subject: Sandy Ponds 2016 Recharge

The Department received a report from Scott King, SPF Water Engineering ("SPF"), dated January 31, 2017, summarizing data and calculations for recharge at Sandy Ponds (see attached copy of report).

Both the WD36-A watermaster, Frank Erwin, and I have reviewed the report. The method of calculation for recharge to the Sandy Ponds during 2016 is consistent with the methodology outlined in previous memorandums between the Department and SPF. See specifically *Technical Memorandum to Randy Budge from Bob Hardgrove, P.E., SPF Water Engineering, July 28, 2014, Regarding IGWA's 3rd Mitigation Plan: Flow Measurements at Sandy Ponds and Aquifer Recharge Measurement, 60% Submittal;* and the Department's *Staff Memorandum/Comments to Gary Spackman, Director, from Tim Luke, IDWR, February 17, 2015, Regarding IGWA's 3rd Mitigation Plan: SPF Water Engineering's Proposed Flow Measurements at Sandy Ponds and Aquifer Recharge Measurement (60% Submittal)*

The SPF report documents that total recharge to the Sandy Ponds in 2016 was 5, 466.4 acre-feet ("AF"). The report documents some data gaps during the season due to one or more failed measuring devices during a portion of the irrigation season or erroneous measurement data collected over a portion of the season. SPF's correction or estimate of missing flow data during these brief periods appears reasonable. Frank Erwin concurred with the data summarized in the report and the total estimate of 2016 recharge to Sandy Ponds. Frank had no additional comments or concerns. I also find that the data and methodology are acceptable.

There appears to be one typographical error in the table on page 2 of the narrative report whereby the W-26 inflow is listed as 6,799.5 AF. The appendices show that the total inflow from the W-26 Canal is 6,759.9 AF. If the W-26 inflow value in the table on page 2 is changed to 6,795.9 AF, then the arithmetic in the table is correct. The total recharge as shown in the table, 5,466.4 AF, is the correct value.

I recommend that the Department accept SPF's report and estimate of recharge to the Sandy Ponds during 2016. I understand that you will include the Sandy Ponds recharge data in a 2016 post-audit analysis of IGWA mitigation activities in the ESPA and WD130.