Water Year 2018 Annual Monitoring Report
Saltese Flats Wetland Restoration Investigation

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1.0 Introduction

This report presents an annual summary of completed work and data collected for monitoring efforts at Saltese Flats (the Flats) in Spokane County, Washington. The current monitoring period is Water Year 2018 (WY2018) and extends from October 1, 2017 to September 20, 2018. Monitoring locations are shown on Figure 1.

Figure 1 Saltese Flats Monitoring Locations
1.1 Purpose and Scope

The purpose of the Flats monitoring program is to continue to collect baseline water level and flow data to better understand hydrologic conditions at the Flats prior to wetland restoration. A secondary goal is to use the data collected to continue to improve the monitoring efforts and develop a robust long-term monitoring network. This document presents data from WY2018 (10/1/2017-9/30/2018).

Monitoring data have been collected on the Flats since 2008 and documented in the Water Year 2017 annual report (Newfields, 2017). Information collected during the previous monitoring efforts is used to modify and improve the monitoring programs into the current effort described below.

Work completed during the current monitoring program includes the following:

- Completion of site visits by Spokane County, to record water levels, download data from dataloggers, and photograph site conditions when appropriate.
- Measurement of flow at surface water locations to quantify flow conditions at the time of the visit; and
- Completion of this annual report

2.0 Field Work Completed

This section presents a summary of the field work completed by the County during the 2018 Water Year. The work completed includes periodic site maintenance, monitoring visits, and retrieval of data loggers from the field locations on October 2, 2018. These field activities are discussed below and results from the monitoring visits and data collection are presented in Section 3.

2.1 Site Maintenance

Pressure transducers were first installed on the Flats several years ago and some units are nearing the end of their battery life. Replacing transducer batteries requires shipping them to the manufacturer for several weeks. A battery replacement program was started in 2013 to prevent data gaps from transducer batteries expiring during deployment. Five transducers at monitoring locations GP-1, SC-7, SC-6, SFW-10, and SFW-6 were replaced during WY2017.
2.2 Water Level and Flow Measurements

Water level data from pressure transducers, staff gages, and electronic water level tapes were collected from every site during periodic monitoring visits in 2018. All transducers except for Graham Pond and Shelley Lake were removed and downloaded on October 2, 2018. A full data set for each site was recorded for analysis in Water Year 2018.

A total of eight flow measurements were taken during the 2018 monitoring period, all of which were at site SC-6. The flow measurements recorded in WY2018 and total for all years for each site (in parentheses) are:

- UT-2: 0 (12)
- QC-2: 0 (14)
- SC-6: 8 (14)
- SC-7: 0 (12)
- SC-1: 0 (13)
- MP-1: 0 (10)

Flow measurements have been previously used to develop rating curves for the above locations. Rating curves are used to convert stage measurements from dataloggers to flow values. Currently, three sites, SC-1, UT-2 and SC-7, listed above do not have functional rating curves. In WY2018 a single rating curve was developed for site SC-6, figure A-1, is included in Appendix A.

In fall 2017 Spokane County conducted dredging in Saltese Creek upstream and downstream of SC-6. The dredging shifted the previously established rating curve at SC-6. The eight flow measurements collected during this water year were to re-establish a rating curve at SC-6.

3.0 Data and Results

This section presents data and analysis from the WY2018 monitoring effort.

3.1 Field Conditions and Climate

Precipitation patterns during the monitoring period are a key component of the site hydrology. Data from the Spokane Felts Field Airport (station 94176), Spokane International Airport and the Saltese Flats weather station are shown in Figure 2. This figure shows monthly cumulative totals for precipitation recorded in Water Year 2018. Cumulative precipitation by site in WY2018 was:

- Spokane Felts Field Airport: 16.70”
- Spokane International Airport: 16.75”
- Saltese Flats: 18.76”
Precipitation patterns in WY2018 were characterized by a wet fall, winter and spring, followed by a dry summer. Measured at the Saltese Flats weather station, December (3.17“), November (3.32“), and January (2.52“) were the wettest months and responsible for 48% of the annual precipitation. Alternatively, July and September were the driest months with 0.1 and 0.01 inches measured respectively. WY2018 was not as wet as WY2017, which saw 31.6 inches of precipitation, measured at Spokane International Airport.

Data reported here includes data collected from the Saltese Flats weather station located on site. The weather station was purchased by Spokane County and installed by students from the Spokane Community College. The station is located in the south-central area of the project.

3.2 Flow Data

Flow data in WY2018 was measured at SC-6, eight times over the course of the spring and early summer (Table 1). The highest measured flow was recorded on 4/20/2018 and was 30 cfs (Table 1). The highest calculated flow at SC-6 occurred on 2/18/2018 and was estimated to be 41.71 cfs (Table 2) based on rating curve information. Total flow volume was calculated using data from 11/16/2017-5/29/2018.

Channel dredging of SC-6 occurred in fall of 2017, rendering data collected after this date incomparable to past stage data because of the change in channel morphology. Water levels at SC-6 flats dropped below the level logger on 5/29/2018 for the remainder of the water year, these flows were undetectable by the level logger and thus no data is reported after that time period.
Flow data was not continuously measured at other sites in Saltese Flats during monitoring year 2018.

Table 1 Measured Flow and Stage readings at SC-6 in WY2018

<table>
<thead>
<tr>
<th>ID</th>
<th>Sample Date</th>
<th>Measured Flow</th>
<th>Stage (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC-6</td>
<td>2/14/2018</td>
<td>14.80</td>
<td>0.91</td>
</tr>
<tr>
<td></td>
<td>3/7/2018</td>
<td>7.28</td>
<td>0.86</td>
</tr>
<tr>
<td></td>
<td>3/14/2018</td>
<td>16.60</td>
<td>1.15</td>
</tr>
<tr>
<td></td>
<td>3/14/2018</td>
<td>16.70</td>
<td>1.20</td>
</tr>
<tr>
<td></td>
<td>4/20/2018</td>
<td>30.00</td>
<td>1.71</td>
</tr>
<tr>
<td></td>
<td>5/14/2018</td>
<td>7.60</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>5/29/2018</td>
<td>2.50</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td>6/28/2018</td>
<td>0.50</td>
<td>-0.48</td>
</tr>
</tbody>
</table>

Table 2 Calculated Flow at SC-6 in WY2018

<table>
<thead>
<tr>
<th>ID</th>
<th>Peak Flow (cfs)</th>
<th>Peak Flow Date</th>
<th>Base Flow (cfs)</th>
<th>Total Flow Volume (Acre-Feet) 1/1/2018-6/1/2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC-6</td>
<td>33.16</td>
<td>2/18/2018</td>
<td>0</td>
<td>4,255.2</td>
</tr>
</tbody>
</table>

3.3 Water Level Data

Table 3 includes elevation data for each gage site; the datum for this work is North American Vertical Datum 1998. A plot of the transducer data from two surface water sites, Graham Pond and Saltese Creek (GP-1 and SC-6) is shown on Figure B-1 in Appendix B.

On November 1, 2017 the pressure transducer in Graham Pond was replaced. Water level recordings from Shelley Lake (SL-1) for WY2018 were deemed to be inaccurate due to a failing logger. Shelley Lake data from WY2018 were not included in this report. The logger will be replaced to record readings in the future.

The water table elevation at Graham Pond (GP-1) reached a maximum on 4/13/2018 at 2040.96. The minimum water table elevation recorded was 2035.80 on 10/10/2017. These data are consistent with other measurements made on the flats in WY2018 (Figure B-6).
Groundwater monitoring at SFW-6 and SFW-10 showed an increase in water levels through May of 2018, with a steady decrease into the dry summer season. Max water table elevation at SFW-6 was 2044.4 on 4/16/2018 with a minimum water table elevation of 2039.48 on 9/24/2018 (Figure B-7).

Table 3 Gage Site Elevation (Table adopted from WY2017 report)

<table>
<thead>
<tr>
<th>Site</th>
<th>Type</th>
<th>0.0 Elevation (ft)</th>
<th>Survey Date</th>
<th>Rating Curve</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP-1</td>
<td>Surface</td>
<td>2034.99</td>
<td>5/9/2011</td>
<td>N/A</td>
<td>Gage replaced on 3/8/12</td>
</tr>
<tr>
<td>SC-1</td>
<td>Surface</td>
<td>2075</td>
<td>N/A</td>
<td>No</td>
<td>Not surveyed, elevation estimate from USGS topo map</td>
</tr>
<tr>
<td>SC-4</td>
<td>Surface</td>
<td>N/A</td>
<td>N/A</td>
<td>No</td>
<td>Gage replaced on 10/1/15, not surveyed</td>
</tr>
<tr>
<td>SC-6</td>
<td>Surface</td>
<td>2039.25</td>
<td>5/9/2011</td>
<td>Yes</td>
<td>Gage relocated on 3/7/12</td>
</tr>
<tr>
<td>UT-2</td>
<td>Surface</td>
<td>N/A</td>
<td>N/A</td>
<td>No</td>
<td>Not surveyed</td>
</tr>
<tr>
<td>QC-2</td>
<td>Surface</td>
<td>N/A</td>
<td>N/A</td>
<td>No</td>
<td>Not surveyed</td>
</tr>
<tr>
<td>MP-1</td>
<td>Surface</td>
<td>2060</td>
<td>N/A</td>
<td>No</td>
<td>Not surveyed, elevation estimate from USGS topo map</td>
</tr>
<tr>
<td>SFW-6</td>
<td>Groundwater</td>
<td>2043.72</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>SFW-10</td>
<td>Groundwater</td>
<td>2040.42</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>
4.0 Conclusions

This report presents data collected at the Flats for WY2018, the monitoring period was October 1, 2017 to September 30, 2018. Restoration construction began on the site in October 2018, as construction proceeds, data collection will be limited to Graham Pond, SC-6 and Shelley Lake for WY2019.

Flow data collection was limited to a single site in WY2018, SC-6. Water quality samples were not collected during WY2018.
Appendix A: Flow Rating Curve

Figure A-1 Rating Curve for SC-6 for WY2018

\[ y = 7.9144x^2 + 3.6522x + 0.7139 \]

\[ R^2 = 0.9864 \]
Appendix B: Data Plots for Individual Sites

Figure B-1 Transducer Levels for Graham Pond and SC-6 in WY2018
Figure B-2 Stream flow at SC-6 (Church Crossing) in cubic feet per second

Figure B-3 Transducer Level at QC-2 for WY2018
Figure B-4 Transducer Level for UT-2 during WY2018

Figure B-5 Transducer level at Morrison Pond (MP-1) during WY2018
Figure B-6 Water table Elevation at Graham Pond during WY2018
Figure B-7 Water Surface Elevation at groundwater sites SFW-6 and SFW-10 during WY2018