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April 5, 2013
Stantec File: 111440070
Conservation File: 5577.00

Attention: Peter Crocker, Environment Officer
Conservation and Water Stewardship
Environmental Compliance and Enforcement Branch
1129 Queens Avenue
Brandon, MB R7A 1L9

Dear Mr. Crocker,

Reference: Daly Irrigation Development Project – 2012 Monitoring Report – Licence No. 3010

Stantec Consulting Ltd. (Stantec) submits the following 2012 Monitoring Report for the Daly Irrigation Development Project, on behalf of the Daly Irrigation Development Group (DIDG). This letter provides a summary and status of monitoring data collected in 2012, as required by *Environment Act* Licence No. 3010 (the Licence), issued on July 5, 2012. A one-month extension for the submission of this monitoring report was granted by Manitoba Conservation and Water Stewardship, following a request by DIDG.

The following information is presented:

- Upstream and downstream flow levels, volumes and rates of water pumped, and durations of pumping as prescribed by Clause 21 of the Licence.
- Findings of the Dissolved Oxygen Monitoring Plan as prescribed by Clause 22 of the Licence.
- Photographs of the Little Saskatchewan River riffle bed exposure immediately downstream of the diversion point of the irrigation development as prescribed by Clause 23 of the Licence.

MEASUREMENT OF UPSTREAM AND DOWNSTREAM FLOW LEVELS

An upstream stream flow gauging station (05MF018), operated by Environment Canada, is in operation close to the crossing of Highway 25 over the Little Saskatchewan River, just downstream of the reservoir outlet. Data for the 2012 season from Environment Canada monitoring stations has not yet been released, as they are currently working through monitoring station calibration. It is anticipated that this data for 2012 will be available at some point during the 2013 irrigation season. Once the data is available, it can be reviewed retrospectively for 2012 and will be included as part of routine monitoring for 2013 and subsequent years.

A stream flow monitoring station was installed downstream of the pump intake in July 2012. This monitoring station consists of two flow loggers: one (ID: DIVER M4391) was installed at the bottom of the river to measure total water pressure and water temperature, and the other (ID: DIVER L6518) was installed at the surface, adjacent to the pumping station to measure atmospheric pressure and air temperature. Data from these loggers were retrieved for the period of July 20, 2012, to September 17, 2012, after which both loggers were redeployed on October 4, 2012, and have been in operation since then.

Three manual streamflow measurements were collected downstream of the intake pump in 2012, on July 20, October 4, and October 22, in order to calibrate the installed downstream monitoring station. These streamflow calibration measurement followed standard methods. However, due to a relatively small variation in water levels among these three dates, insufficient range in data was collected to produce an accurate rating curve for the 2012 season. Therefore, water pressure data collected using the Diver logger was not able to be converted into flow rates. Manual streamflow measurements will be resumed in Spring 2013 during high water flows in order to provide a sufficient range in flow rates to produce a reliable rating curve. This data will be used to retrospectively assess the 2012 streamflow at the downstream measurement station. The flow rates measured for the three calibration points are as follows:

- July 20 – 4.14 m^3/sec
- October 4 – 2.95 m^3/sec
- October 22 – 2.79 m^3/sec

To support meeting the monitoring and reporting requirements of the Licence, streamflow data is assessed herein based on pre-regulated flow, before the construction and operation of the 'Rivers Dam' (1944-1959); and post-regulated flow, after the construction and operation of the 'Rivers Dam (1963-1996), as measured at gauging station 05MF018.

Daily average streamflow data from pre- and post-regulation were analyzed to provide discernible patterns in historic streamflow on the reach of the Little Saskatchewan River where the pump station is located. Figure 1 presents daily average streamflow for pre- (red) and post-regulation (blue) periods.

The daily average streamflow varied from approximately 2.6 m^3/seconds (sec.) to more than 21 m^3/sec during the cropping/irrigation season. During the pre-regulated period, two obvious peaks were observed in May and July as shown in red; however, this variation changed post-regulation as daily streamflows ranged from 2.1 m^3/sec. to approximately 17 m^3/sec during the cropping/irrigation season.

Assuming that the distance from the guaging station (05MF018) to the pump station is relatively small and the area upstream of the pump station is relatively flat, additional flow from the local sub-catchment between the pump station and 05MF018 could be ignored. Therefore, the streamflow data recorded at the gauging station 05MF018 can be used to represent the stream discharge at the pump station site.

These flow rates are above the average values presented in Figure 1. Furthermore, they exceed the minimum instream flow rate (0.524 m^3/sec) and minimum instream flow rate plus the maximum allowable pumping rate (0.524 m^3/sec + 0.555 m^3/sec = 1.075 m^3/sec). These data demonstrate that the stream flow rate did not drop below the minimum instream flow rate during the cropping/irrigation season.

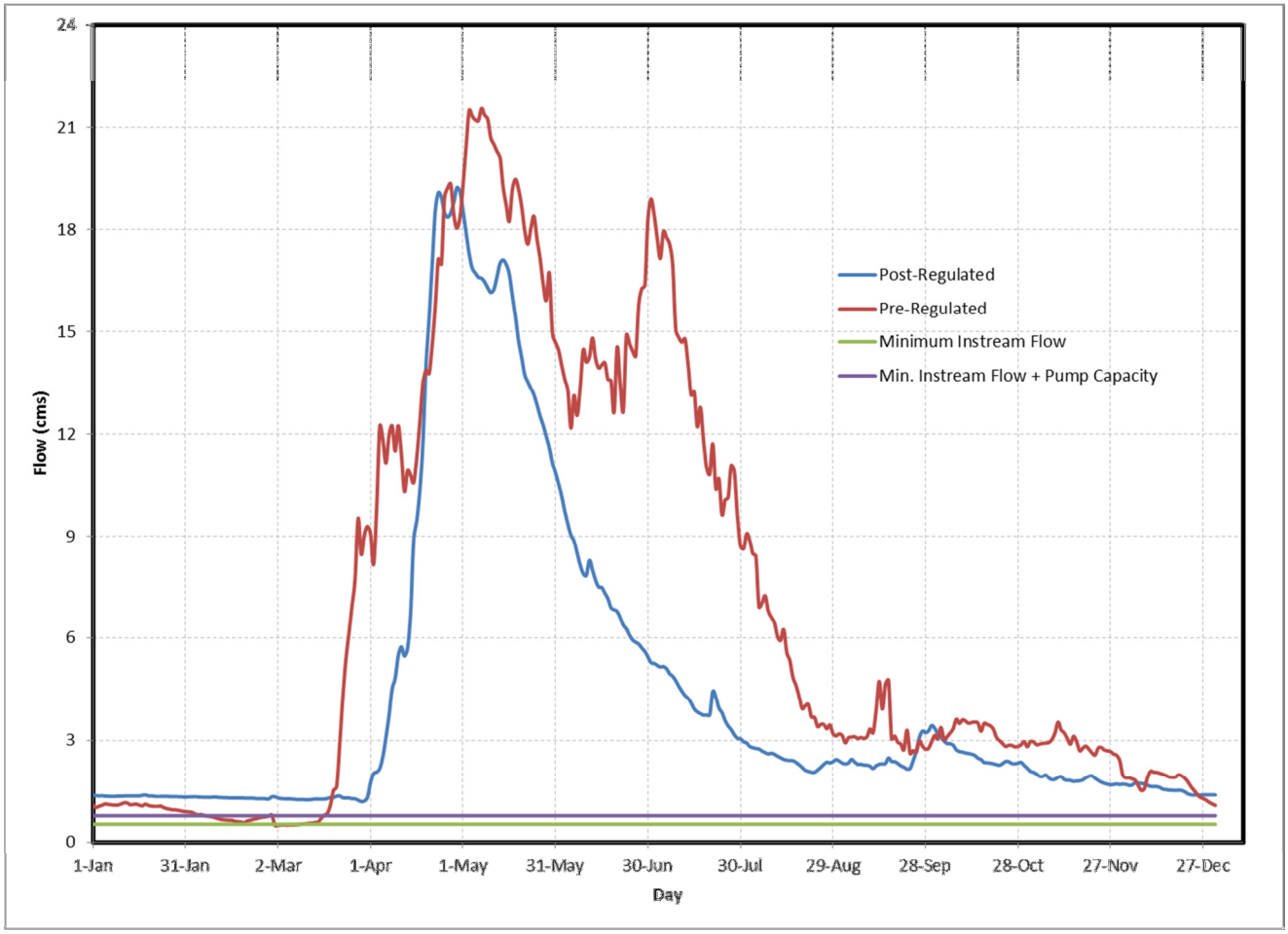

Figure 1: Daily Average Streamflow for Pre-regulated and Post-regulated Years and Minimum Instream Flow plus Pump Capacity Installed in Pump Station

VOLUMES AND RATES OF WATER PUMPED AND DURATION OF PUMPING

Water withdrawal for irrigation occurred during the period of July 25 to September 14, 2012. A total of approximately 910 acres of land were irrigated (780 acres of potatoes, 130 acres of wheat). Pump intake volumes, rates and dates are summarized in Table 1, as prescribed by Clause 21 of the licence.

By plotting the minimum instream flow (light green) and minimum instream flow plus pump capacity (purple; Figure 1), it can be concluded that historic, post-regulation streamflow at the pumping station is more than twice as much as the minimum instream flow required under the terms of the Licence even during the lower flows which occur later in the cropping/irrigation season.

It should be noted that the pump lines were flushed for cleaning purposes, however, this was of no consequence to pump intake volumes/rates.

Reference: Daly Irrigation Development Project – 2012 Monitoring Report – Licence No. 3010

Table 1: Daly Irrigation Development Project Licence No. 3010 Annual Water Use Report, 2012 Year

Date	Pump 1					Pump 2				
	Intake Location: NW10-12-21W					Intake Location: NW10-12-21W				
	Pump Capacity: 1600 US gpm (0.1001 m^3/s)					Pump Capacity: 2400 US gpm (0.1514 m^3/s)				
	Pumping Rate (Maximum Rate - gpm)	Volume Pumped (gallons)	Pumping Rate (Maximum Rate - m^3/s)	Volume Pumped (m^3)	Parcel(s) Irrigated	Pumping Rate (Maximum Rate - gpm)	Volume Pumped (gallons)	Pumping Rate (Maximum Rate - m^3/s)	Volume Pumped (m^3)	Parcel(s) Irrigated
7/25/2012	1376.2	1050901	0.08683	3978.1	SE 18-12-21 & NW 7-12-21	2383.78	1228176	0.15039	4649.2	NW 31-11-21 & NW 5-12-21 & NW 6-12-21
7/26/2012	1374.1	1942580	0.08669	7353.5	SE 18-12-21 & NW 7-12-21	2160.52	2752121	0.13631	10417.9	NW 31-11-21 & NW 5-12-21 & NW 6-12-21
7/27/2012	1364.3	1941075	0.08607	7347.8	SE 18-12-21 & NW 7-12-21	3077660	2205.85	194.17016	8.4	NW 31-11-21 & NW 5-12-21 & SE 6-12-21
7/28/2012	1367.1	1949465	0.08625	7379.5	SE 18-12-21 & NW 7-12-21	2191.22	3091688	0.13824	11703.3	NW 31-11-21 & NW 5-12-21 & SE 6-12-21

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	Pumping Rate (Maximum Rate - gpm)	Volume Pumped (gallons)	Pumping Rate (Maximum Rate - m^3/s)	Volume Pumped (m^3)	Parcel(s) Irrigated	Pumping Rate (Maximum Rate - gpm)	Volume Pumped (gallons)	Pumping Rate (Maximum Rate - m^3/s)	Volume Pumped (m^3)	Parcel(s) Irrigated
7/29/2012	1364.7	1938461	0.08610	7337.9	SE 18-12-21 & NW 7-12-21	2460.73	3101761	0.15525	11741.4	NW 31-11-21 & NW 5-12-21 & NW 6-12-21
7/30/2012	1829.5	1111127	0.11542	4206.1	SE 18-12-21 & NW 7-12-21	2211.08	2980051	0.13950	11280.7	NW 31-11-21 & NW 5-12-21 & NW 6-12-21
7/31/2012	1388.0	1362816	0.08757	5158.8	SE 18-12-21 & NW 7-12-21	1628.82	1569163	0.10276	5939.9	NW 31-11-21 & NW 5-12-21
8/3/2012	2240.8	1189037	0.14137	4501.0	SE 18-12-21 & NW 7-12-21	2212.78	1803579	0.13960	6827.3	NW 31-11-21 & NW 5-12-21 & SE 6-12-21

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	Pumping Rate (Maximum Rate - gpm)	Volume Pumped (gallons)	Pumping Rate (Maximum Rate - m^3/s)	Volume Pumped (m^3)	Parcel(s) Irrigated	Pumping Rate (Maximum Rate - gpm)	Volume Pumped (gallons)	Pumping Rate (Maximum Rate - m^3/s)	Volume Pumped (m^3)	Parcel(s) Irrigated
8/4/2012	1400.6	787230	0.08836	2980.0	SE 18-12-21 & NW 7-12-21	2213.69	1226872	0.13966	4644.2	NW 31-11-21 & NW 5-12-21 & SE 6-12-21
8/7/2012	1624.5	1295782	0.10249	4905.1	SE 18-12-21 & NW 7-12-21	2778.19	1123961	0.17528	4254.7	NW 31-11-21 & NW 5-12-21 & NW 6-12-21
8/8/2012	1409.9	2006719	0.08895	7596.3	SE 18-12-21 & NW 7-12-21	2218.53	3149848	0.13997	11923.5	NW 31-11-21 & NW 5-12-21 & NW 6-12-21
8/9/2012	1415.2	2010012	0.08928	7608.7	SE 18-12-21 & NW 7-12-21	2291.16	3057478	0.14455	11573.8	NW 31-11-21 & NW 5-12-21 & SE 6-12-21

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	Pumping Rate (Maximum Rate - gpm)	Volume Pumped (gallons)	Pumping Rate (Maximum Rate - m^3/s)	Volume Pumped (m^3)	Parcel(s) Irrigated	Pumping Rate (Maximum Rate - gpm)	Volume Pumped (gallons)	Pumping Rate (Maximum Rate - m^3/s)	Volume Pumped (m^3)	Parcel(s) Irrigated
8/10/2012	1407.1	2004104	0.08877	7586.4	SE 18-12-21 & NW 7-12-21	2084.75	2596907	0.13153	9830.4	NW 31-11-21 & NW 5-12-21 & SE 6-12-21
8/11/2012	1404.9	1570291	0.08863	5944.2	SE 18-12-21 & NW 7-12-21	1460.95	1599908	0.09217	6056.3	NW 31-11-21 & NW 5-12-21
8/16/2012	1684.2	1152650	0.10626	4363.3	SE 18-12-21 & NW 7-12-21	2349.69	1897478	0.14824	7182.7	NW 31-11-21 & NW 5-12-21 & NW 6-12-21
8/17/2012	1409.5	1999400	0.08893	7568.6	SE 18-12-21 & NW 7-12-21	2225.71	3147262	0.14042	11913.7	NW 31-11-21 & NW 5-12-21 & NW 6-12-21

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8/18/2012	1703.8	2022364	0.10749	7655.5	SE 18-12-21 & NW 7-12-21	2229.89	2701105	0.14068	10224.8	NW 31-11-21 & NW 5-12-21 & SE 6-12-21
8/19/2012	1430.9	2038971	0.09027	7718.3	SE 18-12-21 & NW 7-12-21	1589.36	2222958	0.10027	8414.8	NW 31-11-21 & NW 5-12-21
8/20/2012	1406.2	1288166	0.08872	4876.2	SE 18-12-21 & NW 7-12-21	1566.89	1409823	0.09886	5336.8	NW 31-11-21 & NW 5-12-21
8/21/2012	N/A	N/A	N/A	N/A	N/A	1354.47	25176.9	N/A	N/A	NW 31-11-21 & NW 5-12-21
8/22/2012	1405.4	1219856	0.08867	4617.7	SE 18-12-21 & NW 7-12-21	2727.5	2072853	0.17208	7846.6	NW 31-11-21 & NW 5-12-21 & SE 6-12-21

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8/23/2012	1330.9	1891081	0.08396	7158.5	SE 18-12-21 & NW 7-12-21	2189.52	3105615	0.13814	11756.0	NW 31-11-21 & NW 5-12-21 & NW 6-12-21
8/24/2012	1370.0	1798643	0.08644	6808.6	SE 18-12-21 & NW 7-12-21	2183.78	2443547	0.13778	9249.8	NW 31-11-21 & NW 5-12-21 & NW 6-12-21
8/28/2012	1749.7	628850	0.11039	2380.5	SE 18-12-21 & NW 7-12-21	2164.96	945868.9	0.13659	3580.5	NW 31-11-21 & NW 5-12-21 & SE 6-12-21
8/29/2012	1668.0	1951116	0.10523	7385.8	SE 18-12-21 & NW 7-12-21	2144.45	3044525	0.13529	11524.8	NW 31-11-21 & NW 5-12-21 & SE 6-12-21

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8/30/2012	1365.0	1937716	0.08612	7335.1	SE 18-12-21 & NW 7-12-21	2146.02	2928596	0.13539	11085.9	NW 31-11-21 & NW 5-12-21 & NW 6-12-21
8/31/2012	1607.9	1926422	0.10144	7292.3	SE 18-12-21 & NW 7-12-21	2107.22	2733241	0.13294	10346.4	NW 31-11-21 & NW 5-12-21 & NW 6-12-21
9/1/2012	1329.0	867026	0.08385	3282.1	SE 18-12-21 & NW 7-12-21	2068.81	1347656	0.13052	5101.4	NW 31-11-21 & NW 5-12-21 & SE 6-12-21
9/7/2012	1812.6	934828	0.11436	3538.7	SE 18-12-21 & NW 7-12-21	2509.72	1426254	0.15834	5399.0	NW 31-11-21 & NW 5-12-21 & SE 6-12-21

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	Pumping Rate (Maximum Rate - gpm)	Volume Pumped (gallons)	Pumping Rate (Maximum Rate - m^3/s)	Volume Pumped (m^3)	Parcel(s) Irrigated	Pumping Rate (Maximum Rate - gpm)	Volume Pumped (gallons)	Pumping Rate (Maximum Rate - m^3/s)	Volume Pumped (m^3)	Parcel(s) Irrigated
9/8/2012	1381.0	1514486	0.08713	5733.0	SE 18-12-21 & NW 7-12-21	2065.42	2921159	0.13031	11057.8	NW 31-11-21 & NW 5-12-21 & NW 6-12-21
9/9/2012	1419.0	1105486	0.08953	4184.7	SE 18-12-21 & NW 7-12-21	2151.51	2342961	0.13574	8869.1	NW 31-11-21 & NW 5-12-21 & NW 6-12-21
9/10/2012	1265.9	1192969	0.07987	4515.9	SE 18-12-21 & NW 7-12-21	N/A	N/A	N/A	N/A	N/A
9/11/2012	770.4	603113	0.04861	2283.0	SE 18-12-21 & NW 7-12-21	N/A	N/A	N/A	N/A	N/A
9/13/2012	1273.8	953274	0.08036	3608.5	SE 18-12-21 & NW 7-12-21	1858.61	1089183	0.11726	4123.0	NW 31-11-21 & NW 5-12-21

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	Intake Location: NW10-12-21W					Intake Location: NW10-12-21W				
	Pump Capacity: 1600 US gpm (0.1001 m^3/s)					Pump Capacity: 2400 US gpm (0.1514 m^3/s)				
	Pumping Rate (Maximum Rate - gpm)	Volume Pumped (gallons)	Pumping Rate (Maximum Rate - m^3/s)	Volume Pumped (m^3)	Parcel(s) Irrigated	Pumping Rate (Maximum Rate - gpm)	Volume Pumped (gallons)	Pumping Rate (Maximum Rate - m^3/s)	Volume Pumped (m^3)	Parcel(s) Irrigated
9/14/2012	1253.2	712006	0.07906	2695.2	SE 18-12-21 & NW 7-12-21	1503.27	1549678	0.09484	5866.2	NW 31-11-21 & NW 5-12-21
10/8/2012	0.1	1	0.00001	0.0	N/A	0.13	1.05	0.00001	0.0	N/A
Total (US gallons)	**49898022**					**68638659**				
Total (m3)	**48847122**					**259730**				
Total (ac-ft)	**153.1**					**210.6**				

DISSOLVED OXYGEN CONCENTRATION

The Dissolved Oxygen (DO) Monitoring Plan, developed in consultation with the Manitoba Fisheries Branch, and Riffle Monitoring Plan were submitted by Stantec on August 29 for approval on behalf of the Daly Irrigation Development Group in accordance with Clauses 22 and 23 of *Environment Act* Licence No. 3010.

The DO Monitoring Plan was developed to monitor DO in the Little Saskatchewan River immediately downstream of the Development diversion point while irrigation (i.e., pumping) is occurring. The purpose of the Plan is to 1) evaluate DO concentration in the Little Saskatchewan River to ascertain whether it approaches, or drops below, 8 mg/L, and 2) if DO supersaturation (>120% saturation) or undersaturation (<60% saturation) occurs during irrigation.

Approximately 5-8 mg/L is considered the optimal DO concentration, acknowledging that fish become distressed at DO concentrations of 2-4 mg/L, with fish kills typically occurring at DO concentrations <2 mg/L. Discrete measurements taken at 12:30 p.m. on July 20, 2012, indicated that the baseline DO concentration in the Little Saskatchewan River was approximately 12.40-13.61 mg/L.

The Fisheries Branch noted that supersaturation is not a biological concern for fish in the Little Saskatchewan as the shallow system does not provide sufficient depth for the condition to occur.

Continuous DO monitoring during pumping was not undertaken in 2012 because the HOBO® U26-001 DO Logger, which was released in June 2012, was not available until late August and, therefore, was not a practical solution for the 2012 monitoring year. However, the meter will be deployed in Spring 2013 to enable timely collection of ongoing DO concentration during the irrigation season. To compensate for the logger, a rental YSI unit was acquired in early July, but was not available for the entire period of withdrawal, and had to be returned prior to commencement of pumping. It was anticipated that this would be available until the HOBO was received. However, this was not the case as the YSI unit had to be returned.

RIFFLE MONITORING

Under Clause 21 of the Licence, the licensee is required to take photographs of the riffle of the Little Saskatchewan River immediately downstream of the diversion point of the Development. The following photographs are taken from a location downstream of the diversion point that illustrates the relative exposure of the bed of the riffle under varying conditions (pumping and non-pumping).

The photos show the riffle on days of active irrigation (July 30, August 2, and September 14) and days when no pumping occurred (August 1, August 25 and September 15). From the photographs there is no apparent visual disparity between active (pumping) and inactive (no pumping) days. The riffle bed does not appear more exposed on active pumping days.

Reference: Daly Irrigation Development Project – 2012 Monitoring Report – Licence No. 3010

Photo 1: August 1, 2012 – No Pumping

Photo 2: July 30, 2012 – Pumping

Reference: Daly Irrigation Development Project – 2012 Monitoring Report – Licence No. 3010

Photo 3: August 2, 2012 – Pumping

Photo 4: August 25, 2012 – No Pumping

Photo 5: September 14, 2012 –Pumping

Photo 6: September 15, 2012 – No Pumping

Reference: Daly Irrigation Development Project – 2012 Monitoring Report – Licence No. 3010

MONITORING ACTIVITIES PLANNED FOR 2013 (NEXT STEPS)

The HOBO® U26-001 DO Logger will be calibrated and deployed by May 15, 2013, to measure and record the instream DO concentration and water temperature, as outlined in the DO monitoring plan reference above.

Resumption of streamflow calibration measurements will take place in spring 2013. As mentioned above, calibration points collected during higher stream-flow rates will allow for the production of reliable streamflow curves. Further, the streamflow data from the upstream EC gauging station is anticipated to be available during the 2013 monitoring season. These data will be used to retrospectively develop streamflow monitoring results for 2012, which will be submitted as part of the monitoring reporting when it becomes available.

Regards,

STANTEC CONSULTING LTD.

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Managing Leader, Environmental Services
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Mick O'Dwyer, M.Sc., LLB, BA
Environmental Planner
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Attachment: DO Monitoring Plan, raw riffle bed exposure photos (on cd with hard copy letter only)

c. Bruce Webb, Manitoba Conservation and Water Stewardship; Ed Waldner, Daly Irrigation Development Group

Stantec Consulting Ltd.
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Winnipeg MB R3C 3R6
Tel: (204) 942-2505
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August 29, 2012
Stantec File: 111440070
Conservation File: 5577.00

Attention: Ms. Tracey Braun
Conservation and Water Stewardship
Environmental Approvals
160-123 Main Street
Winnipeg, MB R3C 1A5

Reference: Daly Irrigation Project – Dissolved Oxygen Monitoring Plan – Licence No. 3010

Dear Ms. Braun,

The following Dissolved Oxygen (DO) Monitoring Plan, developed in consultation with the Manitoba Fisheries Branch, and Riffle Monitoring Plan are submitted by Stantec Consulting Ltd. for approval on behalf of the Daly Irrigation Development Group[1] in accordance with Clauses 22 and 23 of Environment Act Licence No. 3010 (Attachment A).

DISSOLVED OXYGEN MONITORING PLAN

PURPOSE

The DO Monitoring Plan has been developed to monitor DO in the Little Saskatchewan River immediately downstream of the Development diversion point while irrigation (i.e., pumping) is occurring. The purpose of the Plan will be to evaluate if the DO concentration in the Little Saskatchewan River approaches or drops below 8 mg/L or if DO supersaturation (>120% saturation) or undersaturation (<60% saturation) occurs while irrigation is occurring.

Approximately 5-8 mg/L is considered the optimal DO concentration, acknowledging that fish become distressed at DO concentrations of 2-4 mg/L, with fish kills typically occurring at DO concentrations <2mg/L. Discreet measurements taken at 12:30 p.m. on July 20, 2012 indicated that the baseline DO concentration in the Little Saskatchewan River was approximately 12.40-13.61 mg/L.

EQUIPMENT

A HOBO® U26-001 DO Logger will be used to measure and record the surface water DO concentration and water temperature. The specifications for this optical sensor logger are enclosed as Attachment B. Note: this device, which was released in June 2012, is not available until late August, and, therefore, not a practical solution for this monitoring year. A YSI® 600OMS Sonde (see specifications in Attachment B) will be used for the balance of the 2012 monitoring season once this monitoring plan is approved and until the HOBO® U26 is

[1] Sundance Farms, Ed Waldner, Don Loewen, Ray Redfern and Keywest Farms

available for the 2013 monitoring season. A barometer and data logger installed in close proximity to the DO monitoring site will be used to measure barometric pressure readings to support DO saturation calculations.

LOCATION

The logger will be installed 15 m downstream from the diversion point[2], as illustrated in Figure 1-1. The logger will be deployed in a free flowing section of the Little Saskatchewan River at the depicted monitoring point, avoiding areas impounded water. The logger will be weighted to the stream bottom and the unit will be positioned approximately 30 cm off of the bottom. The barometer will be located approximately 30 m upstream, as illustrated in Figure 1-1.

FREQUENCY

Dissolved oxygen concentration data will be logged at 1 hour intervals continually for a 24 hour period, 7 days per week during the irrigation season. This data logging interval will allow for continuous diurnal data collection to evaluate fluctuations in DO concentration during the 24 hour cycle. For the balance of the 2012 monitoring year, data will be downloaded by the Licensee, or their designate, on a weekly basis. For the 2013 and all subsequent monitoring years, data will be downloaded by the Licensee on a monthly basis.

DURATION

Loggers will be deployed annually by May 15th and recovered by September 30th each year.

REPORTING

An annual report summarizing the findings of the DO Monitoring Plan will be prepared by the Licensee, or their designate, and submitted to the Environment Officer responsible for the administration of Licence No. 3010 and the Environmental Approvals Branch by March 1 of the following year.

In the first two years of the program (i.e., 2012 and 2013), interim data reporting will be provided approximately on a weekly and monthly basis, respectively.

The following data will be reported:

- Daily high, daily low and 24 hour average DO concentration for dates when irrigation occurred (tabular);
- Daily high, daily low and 24 hour average DO concentration for dates when irrigation did not occur (tabular);
- Diurnal cycle of surface water temperature (°C), DO concentration (mg/L) and DO saturation (% saturation) for each week (graphical).

[2] Under the monitoring plan, a single logger placed at a single monitoring location is proposed. It may be determined in time and in consultation with Manitoba Fisheries Branch that monitoring multiple locations across the stream channel cross-section (i.e., multiple placements of single data logger within a monitoring season) is favourable. If this occurs then the monitoring plan as presented will be modified accordingly.

The actual dates of calibration, deployment and recovery will also be included in the report.

QA/QC

Monitors will be calibrated within 24 hours prior to deployment in accordance with manufacturer's specifications. The DO sensor cap which expires after 7 months will be replaced at the outset of each year. The battery will be replaced at least every 3 years.

RIFFLE MONITORING PLAN

PURPOSE

The Riffle Monitoring Plan has been developed to document with photographs the exposure of the bed of the riffle located downstream of the Development's diversion point and the degree to which it changes while irrigation is occurring.

LOCATION

A trail camera has been established approximately 30 m upstream of the riffle location, facing south-southwest towards the riffle, as illustrated in Figure 1-1. This fixed location will allow for photographs to be consistently taken from the same vantage point.

FREQUENCY

The camera has been set-up to take photos daily at every hour between 8:00 a.m. to 8:00 p.m. The photos will be downloaded by the Licensee on a weekly basis for the balance of 2012. For the 2013 and all subsequent monitoring years, the photos will be downloaded by the Licensee on a monthly basis.

DURATION

The camera will be deployed annually by May 15th and recovered by September 30th each year.

REPORTING

An annual letter report summarizing the findings of the Riffle Monitoring Plan will be prepared by the Licensee, or their designate, and submitted to the Environment Officer responsible for the administration of Licence No. 3010 and the Environmental Approvals Branch by March 1 of the following year. This reporting will be completed in conjunction with the annual flow and pumping reporting completed in accordance with Clause 21 of the licence.

The letter report will include an example of the greatest, typical, and least amount of bed exposure encountered while irrigation was occurring during the reporting period, and, if feasible, a comparison of riffle conditions during periods of water diversion for irrigation and periods when diversion was not occurring. A data disk of all the raw photographs taken for the reporting time period will be provided with a stamped date in chronological order.

Reference: Daly Irrigation Project – Dissolved Oxygen Monitoring Plan – Licence No. 3010

QA/QC

The camera will be routinely checked by the Licensee during the deployment period to evaluate if it is in good working order. Batteries will be replaced as needed.

CLOSING

We trust the foregoing is sufficient to monitor dissolved oxygen concentration and riffle bed exposure in the Little Saskatchewan River immediately downstream of the Development's diversion point. This Plan is submitted for approval, in order to satisfy the requirements of Clause 22 of the Licence.

Regards,

STANTEC CONSULTING LTD.

David Whetter
Senior Associate, Environmental Management
Tel: (204) 488-5706
Fax: (204) 942-2548
david.whetter@stantec.com

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Environmental Planner
Tel: (204) 928-8809
Fax: (204) 942-2548
carmen.anseeuw@stantec.com

Attachment: Attachment A – Environment Act Licence No. 3010
Attachment B – Data Logger Specifications
Figure 1-1 – Location Plan

c. Long, Jeff (Manitoba Fisheries Branch);
Webb, Bruce (Manitoba Conservation);
Daly Irrigation Development Group

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Attachment A
Environment Act Licence No. 3010

Manitoba

Conservation and Water Stewardship

Climate Change and Environmental Protection Division
Environmental Approvals Branch
123 Main Street, Suite 160, Winnipeg, Manitoba R3C 1A5
T 204 945-8321 F 204 945-5229
www.gov.mb.ca/conservation/eal

CLIENT FILE NO.: 5577.00

July 5, 2012

Ed Waldner
Daly Irrigation Development Group
1908 Currie Blvd.
Brandon MB R7B 4E7

Dear Mr. Waldner:

Enclosed is **Environment Act Licence No. 3010** dated July 5, 2012 issued to the **Daly Irrigation Development Group** for the construction and operation of the Development being an irrigation system in the Rural Municipality of Daly (Daly Irrigation Development Project), with four water intakes at one location on the Little Saskatchewan River in NW 10-12-21W, in accordance with the Proposal filed under *The Environment Act* dated March 15, 2012

In addition to the enclosed Licence requirements, please be informed that all other applicable federal, provincial and municipal regulations and by-laws must be complied with. A Notice of Alteration must be filed with the Director for approval prior to any alteration to the Development as licensed.

For further information on the administration and application of the Licence, please feel free to contact Peter Crocker, Environment Officer at 204-726-6565.

Pursuant to Section 27 of *The Environment Act*, this licensing decision may be appealed by any person who is affected by the issuance of this Licence to the Minister of Conservation within 30 days of the date of the Licence.

Yours truly,

Tracey Braun

Tracey Braun, M.Sc.
Director
Environment Act

c: Don Labossiere, Director, Environmental Compliance and Enforcement
Peter Crocker, Environment Officer
Public Registries
Ruth Pryzner (via email)

NOTE: Confirmation of Receipt of this Licence No. 3010 *(by the Licencee only)* is required by the Director of Environmental Assessment and Licensing. Please acknowledge receipt by signing in the space provided below and faxing a copy (letter only) to the Department by July 19, 2012.

On behalf of Daly Irrigation Development Group **Date**

****A COPY OF THE LICENCE MUST BE KEPT ON SITE AT THE DEVELOPMENT AT ALL TIMES****

THE ENVIRONMENT ACT
LOI SUR L'ENVIRONNEMENT

LICENCE

Manitoba

Licence No. / Licence n° 3010

Issue Date / Date de délivrance July 5, 2012

In accordance with The Environment Act (C.C.S.M. c. E125) /
Conformément à la Loi sur l'environnement (C.P.L.M. c. E125)

Pursuant to Section 11(1) / Conformément au Paragraphe 11(1)

THIS LICENCE IS ISSUED TO: / CETTE LICENCE EST DONNÉE À:

DALY IRRIGATION DEVELOPMENT GROUP (SUNDANCE FARMS, ED WALDNER, DON LOEWEN, RAY REDFERN AND KEYWEST FARMS); "the Licencee"

for the construction and operation of the Development being an irrigation system in the Rural Municipality of Daly (Daly Irrigation Development Project), with four water intakes at one location on the Little Saskatchewan River in NW 10-12-21W, in accordance with the Proposal filed under *The Environment Act* dated March 15, 2012, and subject to the following specifications, limits, terms and conditions:

GENERAL TERMS AND CONDITIONS

This Section of the Licence contains requirements intended to provide guidance to the Licencee in implementing practices to ensure that the environment is maintained in such a manner as to sustain a high quality of life, including social and economic development, recreation and leisure for present and future Manitobans.

1. The Licencee shall collect and dispose of all used oil products and other regulated hazardous wastes generated by the machinery used in the construction and operation of the Development in accordance with applicable Manitoba Conservation and Water Stewardship and legislation requirements.

2. The Licencee shall submit all information required to be provided to the Director under this Licence, in writing, in such form (including number of copies) and of such content as may be required by the Director, and each submission shall be clearly labeled with the Licence Number and Client File Number associated with this Licence.

3. The Licencee shall revegetate areas disturbed by the construction of the Development with a mixture of native or introduced grasses or legumes. These areas shall be revegetated as quickly as possible following construction to prevent soil erosion and the establishment of noxious weeds. Native species shall be used to revegetate areas where native species existed prior to construction.

SPECIFICATIONS, LIMITS, TERMS AND CONDITIONS

Project Scope

4. The Licencee shall, unless otherwise approved by the Director in writing, construct the water diversion and management works and irrigate the lands as described on Figure 1, attached to this Licence. Proposed amendments to this project must be submitted to the Director for approval with an accompanying discussion of the nature and purpose of the amendments.

Construction

5. The Licencee shall, not less than two weeks prior to beginning construction of the Development, provide notification to the Environment Officer responsible for the administration of this Licence of the intended starting date of construction and the name of the contractor responsible for the construction.

6. The Licencee shall establish any fuel storage areas required for the construction and operation of the Development:
   a) a minimum distance of 100 metres from any waterbody unless double containment is provided; and
   b) in compliance with the requirements of ***Manitoba Regulation 188/2001*** respecting ***Storage and Handling of Petroleum Products and Allied Products*** or any future amendment thereof.

7. The Licencee shall, in the event of a release, spill, leak, or discharge of a pollutant or contaminant in an amount or concentration, or at a level or rate of release, that exceeds the limit that is expressly provided under this Act, another Act of the Legislature, or an Act of Parliament, or in a regulation, licence, permit, order, instruction, directive or other approval or authorization issued or made under one of those Acts, immediately report the release, spill, leak, or discharge by calling 204-944-4888. The report shall indicate the nature of the release, leak, or discharge, the time and estimated duration of the event and the reason for the release, spill, leak, or discharge.

8. The Licencee shall not remove, destroy or disturb species listed as rare, endangered, or of special concern, or their habitats. These species are listed in ***Manitoba***

Regulation 25/98 respecting ***Threatened, Endangered and Extirpated Species*** or any future amendment thereof, and in the federal Species at Risk Act.

9. The Licencee shall, during construction of the Development, take all appropriate measures to prevent erosion and the deposition of sediment into the Little Saskatchewan River.

10. The Licencee shall not undertake instream construction activities in connection with the Development between April 1 and June 30 of any year.

11. The Licencee shall not undertake instream construction activities in connection with the Development during periods of high streamflow.

12. The Licencee shall, during construction of water intake works in connection with the Development, minimize the extent of clearing of riparian vegetation adjacent to the Little Saskatchewan River.

13. The Licencee shall install buried pipelines on cultivated land or land in its natural state in accordance with the methodology illustrated in Figures 2 to 4, attached to this Licence. These procedures do not apply when a plough, continuous trencher or directional drill is used to install a pipeline.

Operation – Matters Respecting Water Management and Water Quality Protection

14. The Licencee shall install and maintain instream water diversion works associated with the Development in accordance with the requirements of the Department of Fisheries and Oceans.

15. The Licencee shall screen the pump intakes associated with the Development in accordance with the Department of Fisheries and Oceans publication "Freshwater Intake End-of-Pipe Fish Screen Guideline" (March, 1995). Final screen designs shall be approved by the Department of Fisheries and Oceans prior to the operation of the Development.

16. The Licencee shall alter the screens on the pump intakes associated with the Development if future research indicates that different design criteria are appropriate with respect to water withdrawals prior to July 1 of any year.

17. The Licencee shall, during times when irrigation of the Development is occurring, monitor flows in the Little Saskatchewan River upstream and downstream of the diversion point of the Development in NW 10-12-21W.

18. The Licencee shall immediately cease diverting water from the Little Saskatchewan River or reduce the diversion rate if the minimum instream flow provided for in Clause 19 of this Licence is not equalled or exceeded immediately below the diversion point of the Development in NW 10-12-21W.

19. The Licencee shall not cause flow immediately below the diversion point of the Development to fall below a minimum instream flow of 0.524 cubic metres per second (18.5 cubic feet per second) or as determined by Manitoba Conservation and Water Stewardship and in accordance with the provisions of a Water Rights Licence issued for the Development.

20. The Licencee shall limit the maximum pumping rate at the diversion point of the Development on the Little Saskatchewan River in NW 10-12-21W to 0.555 cubic metres per second (19.6 cubic feet per second) or as specified in a Water Rights Licence issued for the Development by Manitoba Conservation and Water Stewardship.

21. The Licencee shall, on a daily basis while irrigation of the Development is occurring, record flows upstream and downstream of the diversion point of the Development, volumes and rates of water pumped, and durations of pumping. A report on this information shall be provided, by March 1 of the following year, to the Environment Officer responsible for the administration of this Licence and the Environmental Approvals Branch. The report shall be provided in the format shown in Table 1, attached to this Licence, or as otherwise approved by the Environment Officer.

22. The Licencee shall, while irrigation of the Development is occurring, monitor dissolved oxygen in the riffle of the Little Saskatchewan River immediately downstream of the diversion point of the Development. A dissolved oxygen monitoring plan shall be developed in consultation with the Fisheries Branch and submitted for the approval of the Director within one month of the date of this Licence. The monitoring plan shall address the location(s), frequency and duration of monitoring, and reporting.

23. The Licencee shall, on a daily basis while irrigation of the Development is occurring, take photographs of the riffle of the Little Saskatchewan River immediately downstream of the diversion point of the Development. The photographs shall be taken from a location that consistently illustrates the degree of exposure of the bed of the riffle under varying flow conditions, and shall be provided to the Environment Officer in conjunction with the report required by Clause 21 of this Licence, or in conjunction with reporting required by Clause 22 of this Licence.

24. The Licencee shall install backflow prevention devices and maintain them in operational condition at all times if fertilizer or crop protection products are applied through the irrigation systems of the Development.

25. The Licencee shall, if fertilizer or crop protection products are applied through the irrigation systems of the Development, not allow irrigation water containing these materials to be applied to or drain to surface water bodies.

26. The Licencee shall have any farmstead wells made redundant by the project sealed by a qualified professional well driller.

27. The Licencee shall comply with the requirements of ***Manitoba Regulation 62/2008***, or any future amendment thereof, respecting ***Nutrient Management***.

28. The Licencee shall not apply nutrients within three metres of Nutrient Buffer Zones, including roadside ditches and drains.

Operation – Matters Respecting Land Management and Soil Quality Protection

29. The Licencee shall provide a detailed land assessment and management recommendations and receive the approval of the Director prior to irrigating the nine land parcels identified in the Proposal as requiring a Phase II investigation. These parcels include E1//2 8-12-21W, NW 13-12-22W, SE 20-12-21W, N1/2 21-12-21W, SE 21-12-21W, SW 21-12-21W, NW 22-12-21W, SW 22-12-21W, and SW 36-11-22W.

30. The Licencee shall manage phosphorus as well as nitrogen in all nutrient management plans developed pursuant to Clause 31 of this Licence.

31. The Licencee shall implement agronomic practices described in the following documents:
    a) Section 7 of the report "Environmental Impact Assessment for the Daly Irrigation Development Project" prepared by Stantec Consulting Ltd., March, 2012;
    b) The report "Land Assessment Reports and Producer Surveys for the Daly Irrigation Development Project" prepared by Stantec Consulting Ltd., March, 2012;
    c) "Draft Best Management Practices Manual 1999" by the Central Manitoba Irrigators Association and Central Manitoba Resource Management Ltd., concerning general agronomic practices, or future versions thereof; and
    d) other practices approved by the Director and determined to be appropriate and providing equal or improved agronomic management of land and soil quality.

Monitoring

32. The Licencee shall, upon the request of the Director:
    a) sample, monitor, analyze or investigate specific areas of concern regarding groundwater, surface water and soil for such duration and at such frequencies as may be specified;
    b) determine the environmental impact associated with the specific areas of concern; and
    c) provide the Director, within such time as may be specified, with such reports, drawings, specifications, analytical data, descriptions of sampling and analytical procedures being used, and such other information as may from time to time be requested.

33. The Licencee shall, prior to the commencement of operation of the Development, meet with the Environment Officer responsible for the administration of this Licence and the contact person for the Environmental Approvals Branch of Manitoba Conservation and Water Stewardship to review the monitoring and reporting requirements of this Licence.

REVIEW AND REVOCATION

A. If, in the opinion of the Director, the Licencee has exceeded or is exceeding or has or is failing to meet the specifications, limits, terms, or conditions set out in this Licence, the Director may, temporarily or permanently, revoke this Licence.

B. If construction of the development has not commenced within three years of the date of this Licence, the Licence is revoked.

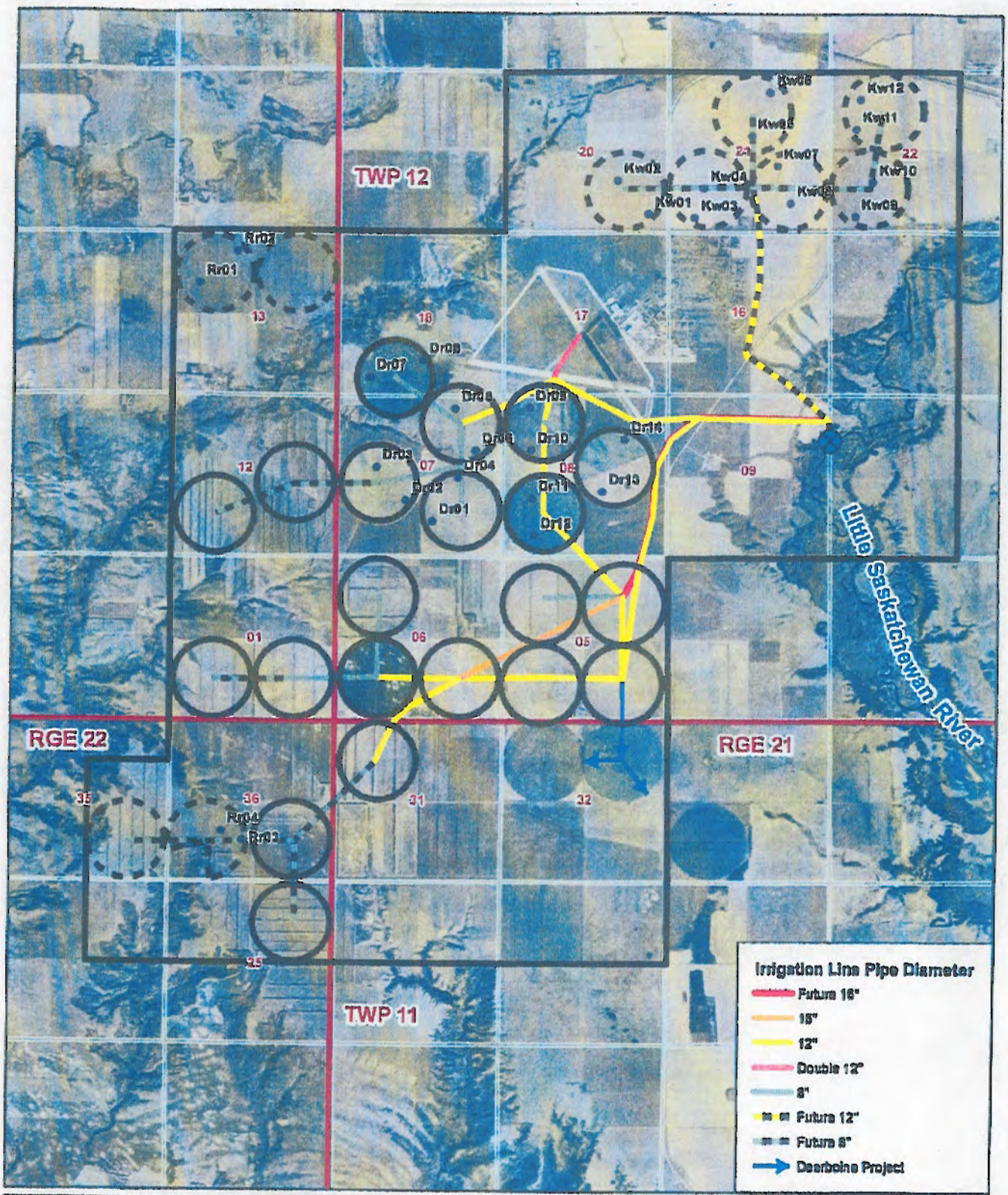
C. If, in the opinion of the Director, new evidence warrants a change in the specifications, limits, terms or conditions of this Licence, the Director may require the filing of a new proposal pursuant to Section 11 of The Environment Act.

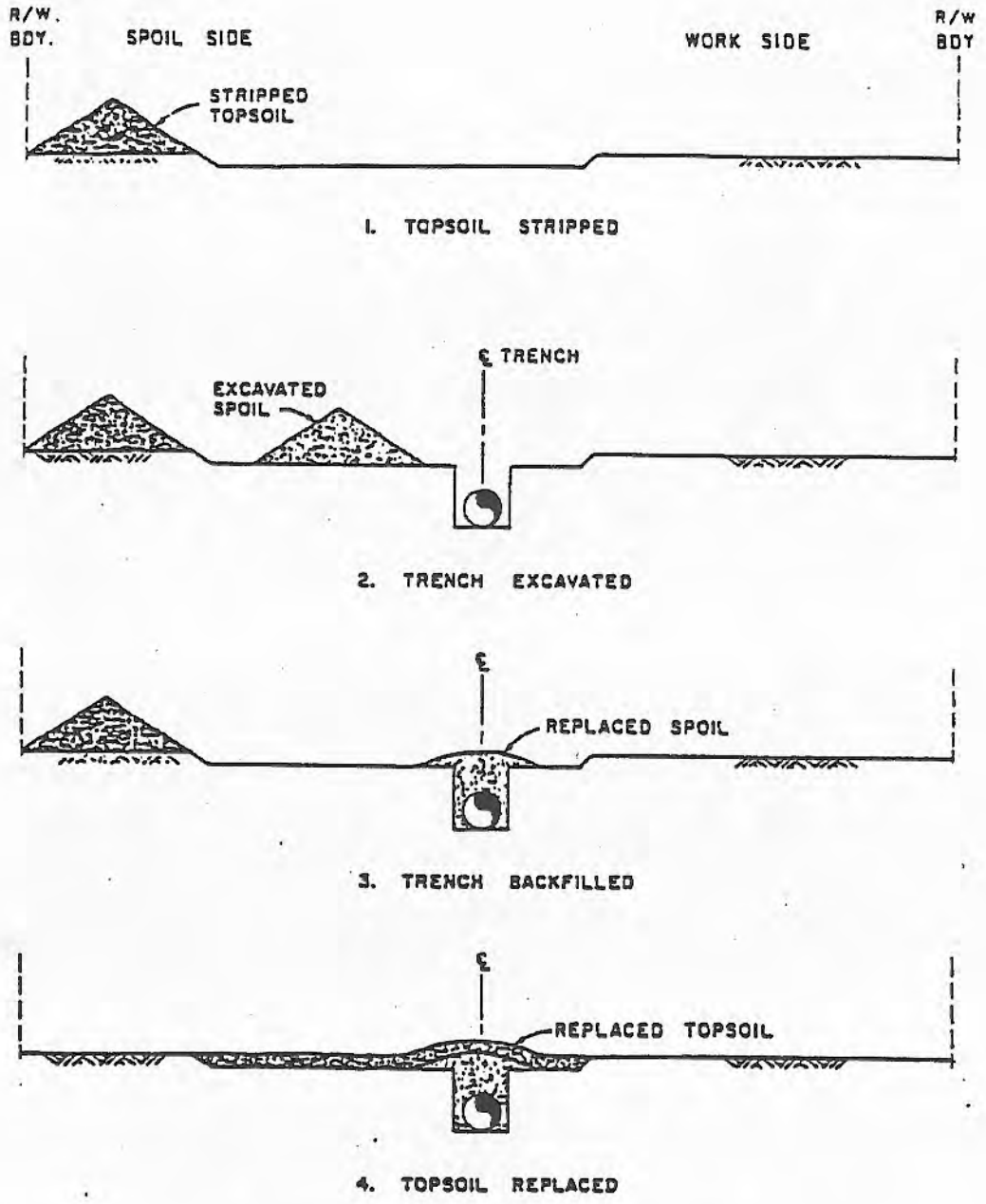
Tracey Braun

Tracey Braun, M.Sc.
Director
Environment Act

Client File: 5577.00

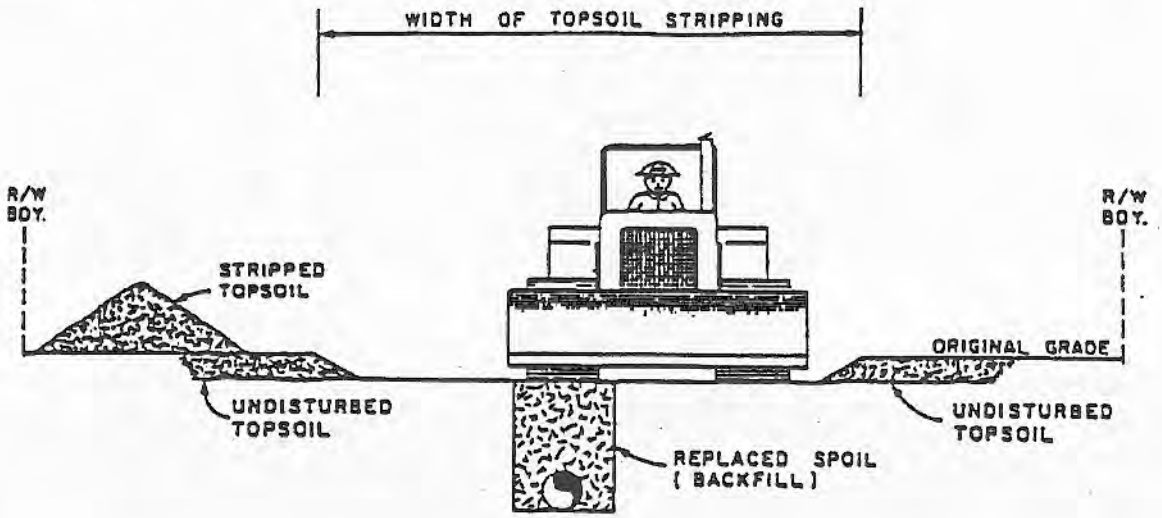
Environment Act Licence No. 3010 Figure 1





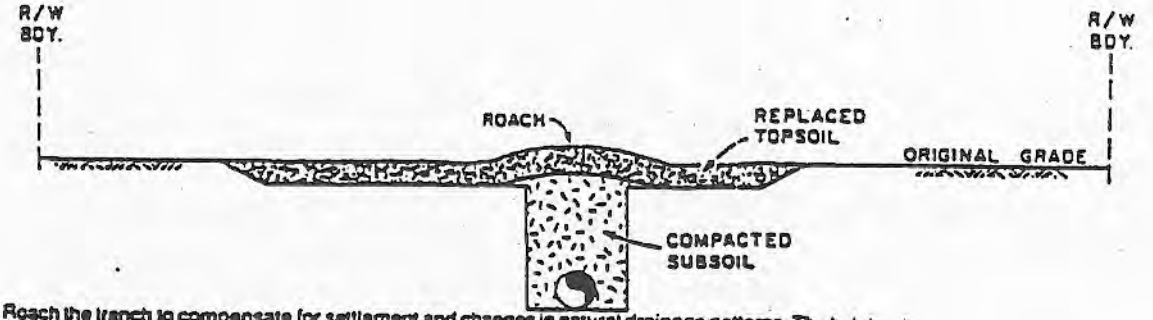
SEQUENCE OF TOPSOIL HANDLING

Figure 2



COMPACTION OF BACKFILL

Figure 3



Roach the trench to compensate for settlement and changes in natural drainage patterns. The height of the roach depends upon land use, the degree of compaction achieved.

ROACHING THE TRENCH

Figure 4

Table 1
Daly Irrigation Development Project Licence No. 3010

Annual Water Use Report Year: _____

Intake Location: NW 10-12-21W

Pump Capacity: _____ m3/s or cfs
Minimum Instream Flow: _____ m3/s or cfs Measured at: _____

Conversions: 1 acre (ac.) = 0.405 hectares (ha.) 1 ha. = 2.471 ac.
1 acre-foot (ac.-ft.) = 1.233 cubic decametres (dam3) 1 dam3 = 0.811 ac.-ft.
1 cubic foot per second (cfs) = 0.0283 cubic metres per second (m3/s)
1 m3/s = 35.31 cfs
1 imperial gallon per minute (IGPM) = 0.000076 m3/s
1 US gallon per minute (USGPM) = 0.000063 m3/s

Date	Pumping Rate	Duration hours	Vol. Pumped dam3	Parcel(s) Irrigated
TOTAL		sum	sum	

Attachment B
Data Logger Specifications

HOBO® Dissolved Oxygen Logger (U26-001) Manual

HOBO Dissolved Oxygen Logger with Included Calibration Boot and Sponge (Shown Wet in Photo)

The HOBO Dissolved Oxygen logger is a standalone logger that uses RDO® Basic Technology to measure dissolved oxygen (DO). The logger has an optical sensor that provides 0.2 mg/L accuracy. The logger also features an easily replaceable sensor cap and an integrated temperature sensor. Using HOBOware® software for logger setup and a HOBO Waterproof Shuttle for quick data offload, this logger is easy to deploy in both freshwater and saltwater environments making it an ideal tool for environmental impact studies as well as ecological and oceanographic research.

Using the data offloaded from the logger, the HOBOware Dissolved Oxygen Assistant can calculate percent saturation and salinity-adjusted DO concentration as well as correct for measurement drift from fouling.

HOBO Dissolved Oxygen Logger

U26-001

Included Items:

- Dissolved Oxygen Sensor Cap
- Protective Guard
- Calibration Boot and Sponge

Required Items:

- Coupler (COUPLER-2-C) with USB Optic Base Station (BASE-U-4) *or* HOBO Waterproof Shuttle (U-DTW-1)
- HOBOware Pro 3.3.1 or later

Accessories:

- Replacement Dissolved Oxygen Sensor Cap (U26-RDOB-1)
- Anti-Fouling Guard (U26-GUARD-2)
- Sodium Sulfite (U26-CAL-SOL)

You May Also Need:

- For saltwater, salinity or conductivity measurements are required; HOBO Conductivity/Salinity Logger (U24-002) recommended
- For percent saturation, barometric pressure is required; HOBO Water Level Logger (U20-001-0x) recommended

Specifications

Dissolved Oxygen

Sensor Type	Optical (dynamic luminescence quenching)
Measurement Range	0 to 30 mg/L
Calibrated Range	0 to 20 mg/L; 0 to 35°C (32 to 95°F)
Accuracy	0.2 mg/L up to 8 mg/L; 0.5 mg/L from 8 to 20 mg/L
Resolution	0.02 mg/L
Response Time	To 90% in less than 2 minutes
DO Sensor Cap Life	6 months (cap expires 7 months after initialization)

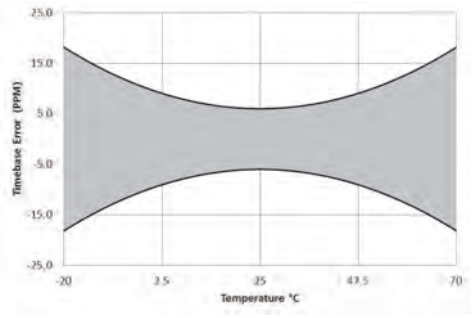
Temperature

Temperature Measurement/ Operating Range	-5 to 40°C (23 to 104°F), non-freezing
Temperature Accuracy	0.2°C (0.36°F)
Temperature Resolution	0.02°C (0.04°F)
Response Time	To 90% in less than 30 minutes

Logger

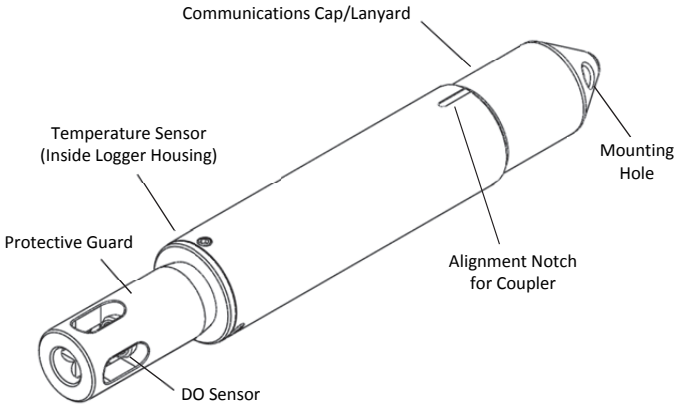
Memory	21,700 sets of DO and temperature measurements (64 KB total memory); logging stops when memory fills
Logging Rate	1 minute to 18 hours
Time Accuracy	±1 minute per month at 0 to 50°C (32 to 122°F) (see Plot A on next page)
Battery	3.6 V lithium battery; factory replaceable
Battery Life	3 years (at 5 minute logging)
Download Type	Optical
Depth Rating	100 m (328 ft)
Wetted Materials	Black Delrin®, PVC, EPDM o-rings, silicon bronze screws; rated for saltwater use
Size	39.6 mm diameter x 266.7 mm length (1.56 x 10.5 inches)
Weight	464 g (16.37 oz)
CE	The CE Marking identifies this product as complying with all relevant directives in the European Union (EU).

Specifications (continued)



Plot A: Time Accuracy

Logger Components and Operation



Communications Cap/Lanyard. This removable cap protects the optical communications window. An LED in the communications window of the logger confirms logger operation. When the logger is logging, the LED blinks once every four seconds. The LED also blinks when the logger is recording a sample. When the logger is awaiting a start because it is configured to start "At Interval," "On Date/Time," or "Using Coupler," the LED blinks once every eight seconds until logging begins. See *Connecting the Logger to a Computer or Waterproof Shuttle* for details on using the communications window.

Mounting Hole. Use the hole on the communications cap to mount the logger. See *Deploying the Logger* for more information.

Alignment Notch for Coupler. Use this notch to align the coupler when communicating with the logger. See *Connecting the Logger to a Computer or Waterproof Shuttle* for more information.

DO Sensor. This optical sensor measures dissolved oxygen using RDO® Basic Technology. It is shipped with a red dust cap that must be replaced with a green sensor cap that lasts for six months plus a one-month grace period. See *Installing the Sensor Cap* for more details.

Protective Guard. This removable guard protects the DO sensor. Unscrew it to install or replace the sensor cap as needed. See *Installing the Sensor Cap* for more details.

Temperature Sensor. This built-in sensor (not visible in diagram) measures temperature.

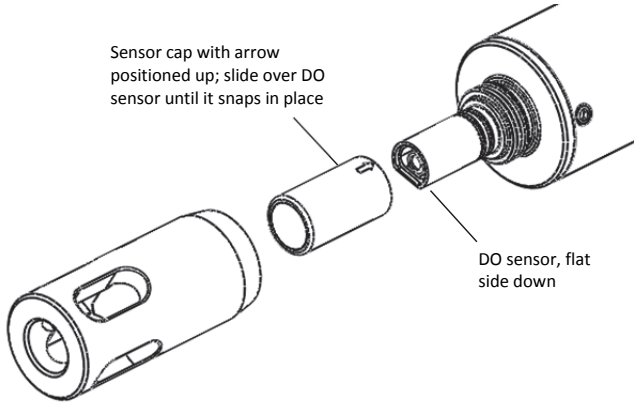
WARNING: This logger can be damaged by mechanical shock. Always handle the logger with care. The logger may be damaged if it is dropped. Use proper packaging when transporting or shipping the logger.

Do not attempt to open the logger case or sensor housing. Disassembling of the logger case or sensor housing will cause serious damage to the sensor and logger electronics. There are no user-serviceable parts inside the case. Contact Onset Technical Support at 1-800-LOGGERS (1-800-564-4377) or an authorized Onset dealer if your logger requires servicing.

Installing the Sensor Cap

The logger ships with a replaceable sensor cap that provides six months of continuous use. Once the cap is initialized, an internal clock within the logger will count down until the sensor cap expiration date. When the sensor cap expires, you will need to replace it with a new cap (U26-RDOB-1). The sensor cap is intended for six months of actual deployment, but the expiration date is seven months from the date the cap was initialized. This allows for any time needed between launching the logger and physically deploying as well as extra time in case you are not able to get the logger after exactly six months of deployment. To install the sensor cap:

1. Unscrew the protective guard covering the DO sensor (see diagram at left).
2. Remove the red dust cap that protects the sensor during shipping.
3. Take the green sensor cap out of the canister.
4. With the flat part of the DO sensor pointing down and the the green sensor cap oriented with the arrow up, slide the sensor cap over the sensor until it snaps in place. The cap should be snug against the logger housing without any gaps.



5. Screw the external protective guard back on until tight.

Important: The sensor cap expires 7 months (to the day) after it has been initialized. The logger will record a value of -888 mg/L at each logging interval after the cap has expired. Initialization occurs automatically when the cap is installed while the logger is logging. You can also initialize it from the Status window in HOBOware or when using the Lab Calibration tool. To see when the sensor cap expires after being initialized, check the Status in HOBOware for the expiration date. The cap also has a shelf life; check the "Install By" date printed on the canister.

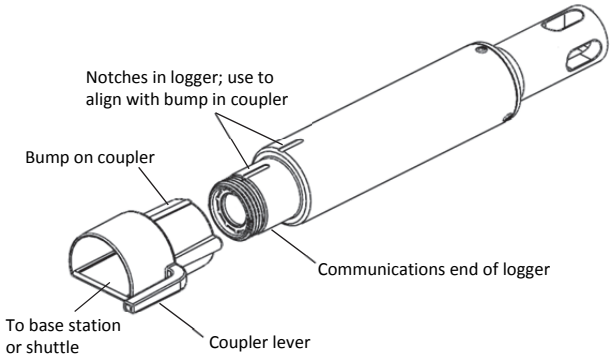
Connecting the Logger to a Computer or Waterproof Shuttle

To connect the logger to a computer, use either the Optic USB Base Station (BASE-U-4) or HOBO Waterproof Shuttle (U-DTW-1) with a coupler (COUPLER2-C). To launch and read out the logger in the field, use one of these three methods:

- Laptop computer with Optic USB Base Station (BASE-U-4) and coupler (COUPLER2-C)
- HOBO Waterproof Shuttle (U-DTW-1, Firmware Version 3.2.0 or later) and coupler (COUPLER2-C)
- HOBO U-Shuttle (U-DT-1, Firmware Version 1.16 or later) with Optic USB Base Station and coupler (COUPLER2-C)

IMPORTANT: USB 2.0 specifications do not guarantee operation outside the range of 0°C (32°F) to 50°C (122°F).

1. Follow the instructions that came with your base station or Waterproof Shuttle to attach it to a USB port on the computer.
2. Unscrew the pointed cap on the communications end of the logger.
3. Attach the coupler to the base station or shuttle.
4. Insert the logger into the coupler, aligning the bump/arrow on the coupler with the notches on the logger. Be sure that it is properly seated in the coupler. If the logger has never been connected to the computer before, it may take a few seconds for the new hardware to be detected by the computer. **Note**: If you are using the HOBO Waterproof Shuttle as a base station with a computer, briefly press the coupler lever to put the shuttle into base station mode. A green LED on the shuttle or base station indicates good communication.



5. After logger communications are complete, remove the logger from the coupler. Make sure the o-ring is still in the groove inside the cap and then reinstall the communications cap.

IMPORTANT: When connected to a coupler, the logger is "awake" and consumes significantly more power than when it is disconnected and considered "asleep." The logger will automatically "go to sleep" after being left in the coupler for 30 minutes. It will no longer appear as a USB device connected to the computer. If this occurs, remove it from the coupler and start the instructions to connect the logger to a computer or waterproof shuttle over again.

Calibrating the Logger with the Lab Calibration Tool

Use the Lab Calibration tool in HOBOware when you need to calibrate the logger before deploying it or after replacing an expired sensor cap. The tool sets the gain and offset adjustment values for the logger by:

- Restoring logger calibration values to the factory defaults,
- Using your own gain and offset adjustment values, or
- Calculating the values with a three-step calibration procedure.

In the three-step procedure, the logger is first calibrated to 100% saturation by placing it in water-saturated air. Then, you can calibrate the logger to 0% saturation by placing it in sodium sulfite or another 0% oxygen environment (recommended if the logger will be deployed in water with DO levels of 4 mg/L or less).

IMPORTANT: Lab calibration only affects future launches; any data saved in the logger will be based on the previous calibration values. If the sensor cap is installed and it has not yet been initialized, you will be prompted to do so. Follow the instructions on the screen.

To complete these steps, you will need fresh water, the calibration boot and sponge supplied with the logger, and a source for current barometric pressure at your current location. You will also need sodium sulfite solution and a 7.6 cm (3 inch) beaker if you will be calibrating to 0% saturation.

The fresh water, logger, and sodium sulfite (if applicable) should be left out in the lab where the calibration is being done long enough so that they are at room temperature. If the logger was deployed previously, make sure the sensor is clean and dry (see *Maintenance* for more details). To use the Lab Calibration tool:

1. Connect the logger to the computer as described in the previous section. Stop the logger if it is currently logging or awaiting a coupler or delayed start.
2. From the Device menu, click Lab Calibration.
3. The current gain and offset adjustments are displayed in the top pane of the Lab Calibration window along with the date and time the last lab calibration was completed (if applicable). Completing Steps 1 through 3 in the Lab Calibration tool will result in new gain and offset adjustment values based on the current logger conditions. Continue to the next section for details on how to complete these steps.

   If you already know what the gain and offset values should be (for example, the values from a previous calibration that you want to use again) or want to return to the default factory values, click the "I know my values, skip to Finish" button. This will automatically move you to "Step 3: Finish" in the Lab Calibration window. Either click the "Reset to Factory Defaults" button or type in the desired gain adjustment and offset adjustment values and click the "Send Calibration to the Logger" button. **Note:** If you decide you do not need to change the calibration, click Close to cancel the calibration and revert back to the last saved logger values.

Step 1: 100% Saturation

1. In "Step 1: 100% Saturation" in the Lab Calibration window, enter the barometric pressure for your current location. If the barometric pressure reading has been adjusted for sea level (such as a reading taken from the National Weather Service weather station), select the "If using sea level barometric pressure, enter elevation" checkbox and enter your elevation in either meters or feet.
2. Make sure the logger either has the protective guard or the anti-fouling guard installed (whichever guard you plan to use in the deployment) so that the sensor is covered.
3. Wet the small sponge with fresh water. Squeeze out any excess water.
4. Place the sponge in the end of the calibration boot.
5. Insert the logger in the calibration boot so that there is approximately a 1 cm (0.5 inch) overlap between the end of the boot and the body of the logger. This will ensure there is enough space between the end of the logger and the sponge (the logger should not be pressed up tightly against the sponge).
6. Wait for approximately 15 minutes until the logger reaches temperature equilibrium (and less than 30 minutes so the logger does not go to sleep).
7. Click the "Get DO value from the logger" button to display the 100% saturation results. You can click this button as often as needed. The results are updated each time you click the button. To check for equilibrium, click the "Get DO value from the logger" button several times in a row to check the current "DO Conc from logger at 100% Saturation" value. If the value remains the same or varies very little with each button click, then temperature equilibrium has likely been reached.
8. When you are satisfied with the results displaying in the "Step 1: 100% Saturation" tab, click the Next button to proceed to "Step 2: 0% Saturation."

Step 2: 0% Saturation (optional)

If the logger will be deployed in water with DO levels greater than 4 mg/L, click the "Skip this Step" button. Otherwise, continue with the following procedure.

1. Make sure the logger either has the protective guard or the anti-fouling guard installed (whichever guard you plan to use in the deployment) so that the sensor is covered.
2. Pour the sodium sulfite into the beaker so that it is about two-thirds full.
3. Place the sensor end of the logger into the solution so that the entire protective guard or anti-fouling guard and at least 2.5 cm (1 inch) of the logger body are submerged in the beaker. Allow it to rest on the bottom of the beaker.
4. Wait for approximately 15 minutes until the logger reaches temperature equilibrium (and less than 30 minutes so the logger does not go to sleep).
5. Click the "Get DO value from the logger" button to display the 0% saturation results. As with the 100% calibration, you can click this button as often as needed. The results are automatically updated each time you click the button. If the value remains the same or varies very little with each button click, then temperature equilibrium has likely been reached.
6. When you are satisfied with the results displaying in the "Step 2: 0% Saturation" tab, click the Next button to proceed to "Step 3: Finish."

Step 3: Finish

The results from the first two steps are displayed as well as the overall calibration results and the new gain and offset adjustment values. If you are satisfied with the results, click the "Send Calibration to Logger" button. The logger will then be calibrated based on the new values. These values will not take effect until the logger is launched. If you do not want to save these values, click Close to cancel the calibration and revert back to the last saved logger values. Or, click "Reset to Factory Defaults" to return to the original values. If you performed Step 2, then remove the logger from the solution and thoroughly rinse it with fresh water to remove any excess sodium sulfite. See *Maintenance* for additional details on cleaning the logger.

Launching the Logger

After calibrating the logger, it needs to be launched to configure it before taking it to the field for deployment. Once launched, the logger will record two types of data: samples and events. Samples are the sensor measurements recorded at each logging interval. Events are independent occurrences triggered by a logger activity, such as Bad Battery or Host Connected. Events help you determine what was happening while the logger was logging. To launch the logger:

1. With the logger connected to the computer, open HOBOware. From the Device menu, select Launch.
2. Select both the DO and Temperature channels to log. **Note:** HOBOware provides the option of recording the current battery voltage at each logging interval, which is disabled by default. Recording battery life at each logging interval takes up memory and therefore reduces logging duration. It is recommended that you only record battery voltage for diagnostic purposes. Even with the channel disabled, a bad battery event will still be recorded.
3. Select a logging interval.
4. Choose when to start logging and click the Start button.
5. Remove the logger from the coupler and screw the communications cap back on the logger.

IMPORTANT: If this is the first launch with a new sensor cap, the sensor cap will expire six months (plus a one-month grace period) from the time of the first sensor reading. Two caps per year are required for year-round deployment.

Deploying the Logger

The logger is designed to be easy to deploy in many environments. Follow these guidelines when deploying it:

- Remove the calibration boot before deploying the logger.
- Make sure the logger is located where it will receive an unrestricted flow of the water being monitored to the sensor.

- Make sure the logger is fully submerged and not in direct sunlight to minimize temperature changes that are unrelated to water temperature.
- When deploying the logger in rivers, streams, and ponds, insert the logger in a PVC or ABS pipe for protection from debris (if possible). The pipe should have enough holes to ensure good circulation of water to the sensor.
- If possible, position the logger so the sensor face is oriented vertically. After deploying in the water, move the logger around slightly to eliminate any bubbles that may have formed.
- Do not deploy the logger in freezing water with moving ice where the logger could be crushed.
- Use the optional anti-fouling guard to protect against fouling. Unscrew the protective guard and replace it with the anti-fouling guard.
- If fouling is expected during deployment, use field calibration readings from both the beginning and end of the deployment as described in the next section. These readings can then be entered into the HOBOware Dissolved Oxygen Assistant to compensate for any measurement drift due to fouling. Scrub fouling off the logger with a plastic bristle brush.
- When deploying the logger in saltwater, you will need a conductivity value to enter in the Dissolved Oxygen Assistant that adjusts the data from the logger for salinity. If the salinity is constant through the deployment, you will need a single salinity reading from either a conductivity meter or salinometer. However, if the conductivity changes, then you will need a data file with salinity or specific conductivity readings for the entire deployment. Consider deploying a HOBO Conductivity logger (U24-002) next to this DO logger to use the resulting data file for salinity data.
- To generate a percent saturation series, you will need to deploy a barometric pressure logger (such as a HOBO Water Level Logger, U20-001-0x) or have access to a nearby weather station to gather barometric pressure data. This data is necessary for the Dissolved Oxygen Assistant to calculate percent saturation.

Taking Field Calibration Readings

If fouling is expected during the deployment, you can take calibration readings at the beginning and end of the deployment to enter in the Dissolved Oxygen Assistant. This will adjust the data from the logger to compensate for any measurement drift due to fouling. There are two methods for taking field calibration readings: the first method involves taking readings using a dissolved oxygen meter or titration while the second method involves calibrating the logger in 100% water-saturated air. The first method is recommended because it is quicker to get the necessary calibration readings; the second method can take 40 minutes or more to achieve equilibrium with temperature extremes.

To Take Calibration Readings Using a DO Meter or Titration:

1. The logger must be logging. Take a DO measurement of the water where the logger is being deployed using either a DO meter or by titration. If using a meter, make sure it is calibrated and allow time for the meter probe to stabilize (this will occur when three meter measurements taken in a row are within your accuracy tolerance).

   If the logger is being deployed in saltwater, adjust the meter measurements for salinity using a meter with both conductivity and DO probes. If the saltwater has a constant salinity, you can use a DO meter where you can enter that salinity value to adjust the readings. If the salinity and/or DO are changing rapidly, then you will need to get a sample of the water in a container large enough for both the logger and meter probe to be completely submerged. Place both devices in the water long enough for them to stabilize and then for the DO logger to log at least two values, and take a concurrent meter reading.
2. Record the reading, date, and time of the measurement in a field notebook.
3. At the end of the deployment, repeat steps 1 and 2.

To Take Calibration Readings Using 100% Water-Saturated Air:

1. The logger must be logging. You will need fresh water, the included calibration boot and sponge, and the current barometric pressure from a HOBO U20 Water Level logger, a barometer, or a nearby weather station.
2. If the logger has been in salt water, clean the logger body and sensor cap as described in the *Maintenance* section. Make sure the sensor cap is dry before continuing.
3. Make sure the protective guard or anti-fouling guard is installed on the logger.
4. Wet the small sponge with fresh water. Squeeze out any excess water.
5. Place the sponge in the end of the calibration boot.
6. Insert the logger in the calibration boot so that there is approximately a 1 cm (0.5 inch) overlap between the end of the boot and the body of the logger. This will ensure there is enough space between the end of the logger and the sponge (the logger should not be pressed up tightly against the sponge).
7. Allow at least 40 minutes for the logger to reach temperature equilibrium, and then write down the date and time in a field notebook.
8. Write down the barometric pressure at that time (note the elevation if the barometric reading has been adjusted for sea level).
9. Repeat these steps at the end of the deployment.

Reading Out the Logger and Redeploying

Your readout and maintenance schedule will be determined by the amount of fouling at the site. To read out the logger in the field:

1. Take a field calibration reading as described in the *Taking Field Calibration Readings* section.
2. If the logger was in saltwater and you did not deploy a HOBO Conductivity Logger, then use a conductivity meter or salinometer to take a conductivity reading. Write down the reading and the date and time.

3. Remove the logger from the water and read out the data from the logger using a shuttle or computer with a base station.
4. If you are deploying it again, clean the sensor (see *Maintenance* for details).
5. Check the expiration date for your cap and make sure it will not expire before the end of your deployment. Replace it if needed.
6. Relaunch the logger if it is not already logging.
7. Take another field calibration reading after the logger is cleaned.
8. Redeploy the logger.

Using the HOBOware Dissolved Oxygen Assistant

Use the Dissolved Oxygen Assistant to obtain accurate Dissolved Oxygen readings if the logger was deployed in a saltwater environment or if percent saturation is required. Also use this assistant if you took field calibration readings. The Dissolved Oxygen Assistant is only available in HOBOware from the Plot Setup window when you open a file from this logger. To use the assistant:

1. Offload the most recent data files from the shuttle or logger to your computer.
2. Open a data file in HOBOware.
3. In the Plot Setup window, select the Dissolved Oxygen Assistant and click Process.
4. In the Dissolved Oxygen Assistant window, enter the salinity, barometric pressure, and field calibration information as needed. Click the Help button in the Dissolved Oxygen Assistant for more details and to learn about the ranges of input data allowed.
5. Plot the data and save it as a project file.

Maintenance

To clean the sensor cap:

1. Remove the protective guard or anti-fouling guard, but leave the sensor cap on the sensor.
2. Rinse the logger with clean water from a squirt bottle or spray bottle.
3. Gently wipe the cap with a soft-bristled brush (such as a toothbrush) or soft cloth if biofouling is present. Use Alconox® to remove grease.
4. If extensive debris or mineral build-up is present, soak the cap end in vinegar for 15 minutes, then soak it in deionized (DI) water for another 15 minutes.
5. If the logger is being immediately redeployed with the same sensor cap, a field calibration is adequate. If a new sensor cap is being installed, a lab calibration with HOBOware is recommended. When storing the logger between deployments, keep it in the calibration boot (wet the small sponge with fresh water, place the sponge in the end of the calibration boot, and then insert the logger in the boot.)

WARNING: Do not use organic solvents; they will damage the sensor. Do not remove the sensor cap from the sensor prior to cleaning with a brush. Only clean the sensor when you replace the sensor cap. See the full instructions that ship with the replacement sensor cap. Do not wet the sensor optical lens area with water or any solution. Remove the cap and gently wipe the window with a soft cloth.

To clean the logger body:

1. Make sure the sensor cap is installed on the logger.
2. Gently scrub the logger body with a plastic bristle brush or nylon dish scrubber.
3. Use Alconox® to remove grease.
4. Soak in vinegar to remove mineral deposits.
5. Rinse the logger with deionized (DI) water.

Battery Guidelines

The battery life of the logger should be three years or more. Actual battery life is a function of the number of deployments, logging interval, and operation/storage temperature of the logger. Frequent deployments with fast logging intervals, continuous storage/operation at temperatures above 35°C (95°), and keeping the logger connected to the coupler will result in significantly lower battery life. For example, the battery may last less than a year with a 1-minute logging interval. To obtain a three-year battery life, a logging interval of five minutes or greater should be used and the logger should be operated and stored at temperatures between 0° and 25°C (32° and 77°F).

The logger can report and log its battery voltage. If the battery falls below 3.2 V, the logger will record a “bad battery” event in the datafile. The logger will record a second “bad battery” event and stop logging when the battery falls below 3.1 V. If the datafile contains “bad battery” events, the logger should be returned to Onset for battery replacement. Note the logger does not have to be recording the battery channel for it to detect bad battery events. The logger will record these events regardless of what channels are logged. To have your logger’s battery replaced, contact Onset or your place of purchase for return arrangements. Do not attempt to replace the battery yourself. Severe damage to the logger will result if the case is opened without special tools, and the warranty will be voided.

WARNING: Do not cut open, incinerate, heat above 100°C (212°F), or recharge the lithium battery. The battery may explode if the logger is exposed to extreme heat or conditions that could damage or destroy the battery case. Do not dispose of the logger or battery in fire. Do not expose the contents of the battery to water. Dispose of the battery according to local regulations for lithium batteries.

600OMS V2 Optical Monitoring System

Dissolved Oxygen, Turbidity, Chlorophyll, Blue-Green Algae, or Rhodamine in a Low-Cost Package

Measure any one of the parameters above in combination with temperature, conductivity, and depth or vented level in fresh, sea, or polluted water.

The YSI 600OMS V2 and optical sensors

The 600OMS V2 can take advantage of the newest optical sensors from YSI: ROX Reliable Oxygen (YSI 6150) and two new blue-green algae sensors (YSI 6131 phycocyanin and YSI 6132 phycoerythrin). Utilize the field-proven YSI 6136 turbidity sensor, the YSI 6025 chlorophyll sensor, as well as the revolutionary YSI 6130 rhodamine WT sensor. The OMS V2 also incorporates innovations in sensor configuration such as a conductivity and temperature module that fits into the sonde body.

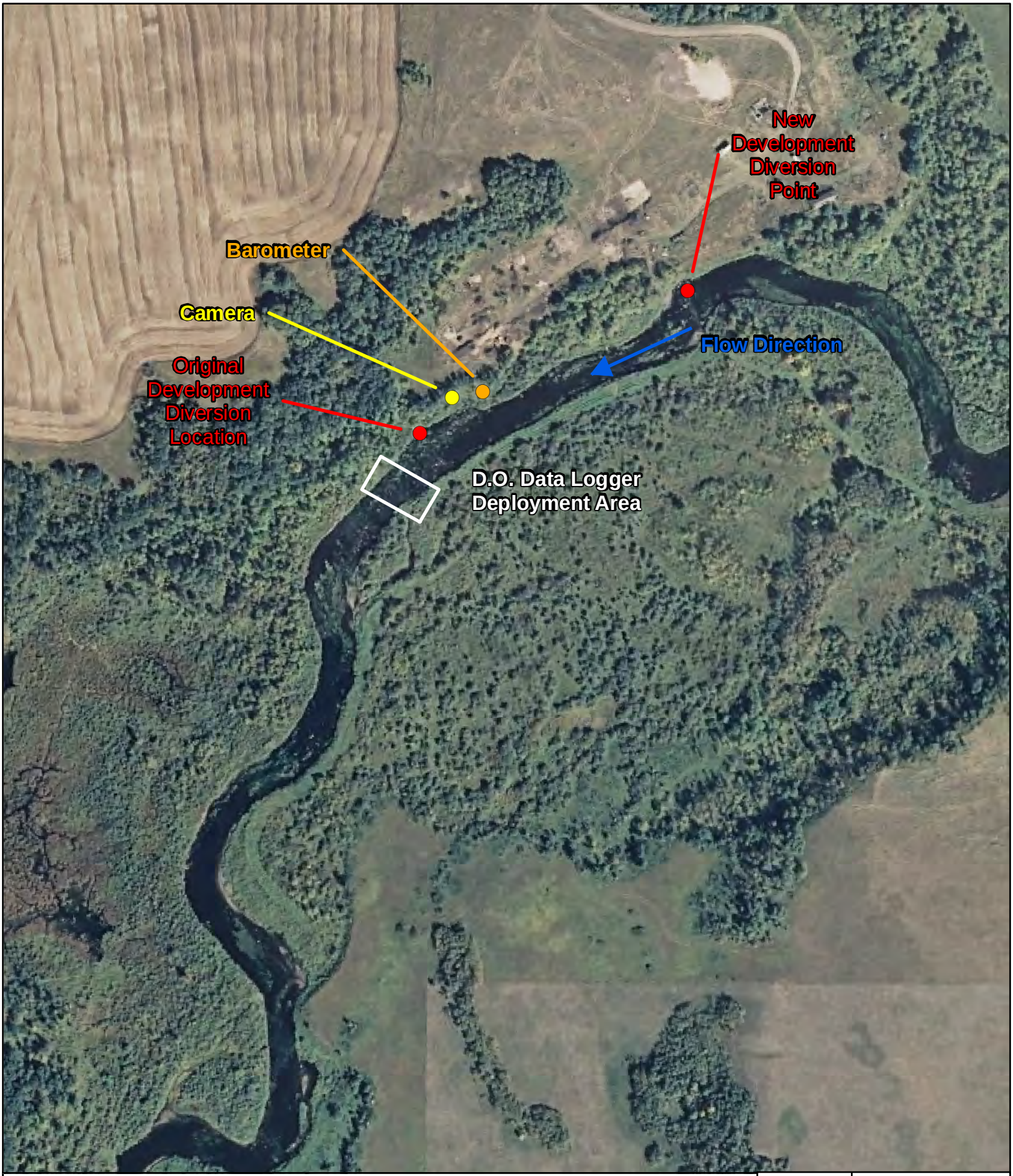
- **Wiped optics for maximum anti-fouling protection**
- **Ideal for long-term deployments**
- **Low power requirements**
- **Field-replaceable optical sensors**
- **150,000 reading memory**
- **Integrate with DCPs**
- **Compatible with EcoWatch® for Windows® data analysis software**
- **Compatible with YSI 650MDS display and datalogger**

Pure Data for a Healthy Planet.®

Low-cost, single parameter optical monitoring system

Sensor performance verified*

The 600OMS V2 sonde uses sensor technology that was verified through the US EPA's Environmental Technology Verification Program (ETV). For information on which sensors were performance-verified, turn this sheet over and look for the ETV logo.



Location Plan

Figure 1-1

NORTH

0 40 80

Metres

Acknowledgements: Orthophoto Imagery and Soil Resource Information provided by Manitoba Land Initiative, Province of Manitoba.

DATE	July 2012
DRAWN	AC
MAP SCALE	1: 3,250
PROJECT	111440070

PRODUCED BY

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