Response to reviewers for "Ephemeral stream sensor design using state loggers" by R. Bhamjee and J.B. Lindsay

First, I would like to begin by thanking both referees. Your insights were helpful in revising this paper. I will start with comments found in both reviews (mainly figures and results) and then address individual comments seperately (except in cases where appropriate).

Beginning with the figures, I have made changes with regard to the comments made and have included the new version of the figures/captions below.

Figure 1

I have rearranged the figure labelling in a way which hopefully makes it easier to read, as well as adding in the missing value of the height of the electrodes and the direction of flow. I will add a colour photo of the sensor set up in a channel as supplimental information with the paper (below).

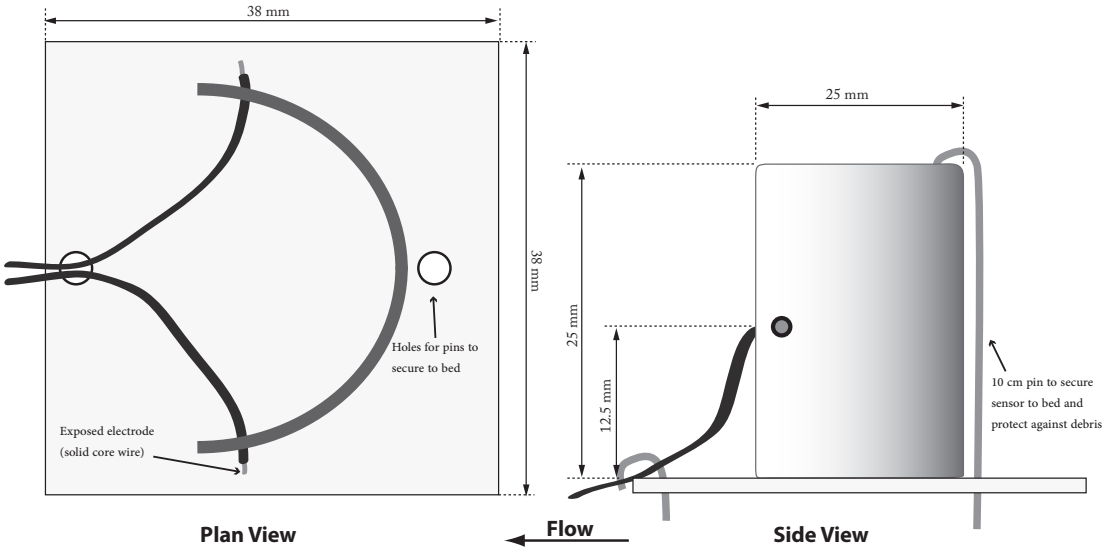

Figure 1: *Electronic resistance (ER) sensor schematic.*

Figure 2

This figure was intended to act as a schematic of the typical erosion/deposition patterns found during the lab testing under direct flow conditions (i.e. not when the sensor was on an angle). I have changed the caption to better reflect that.

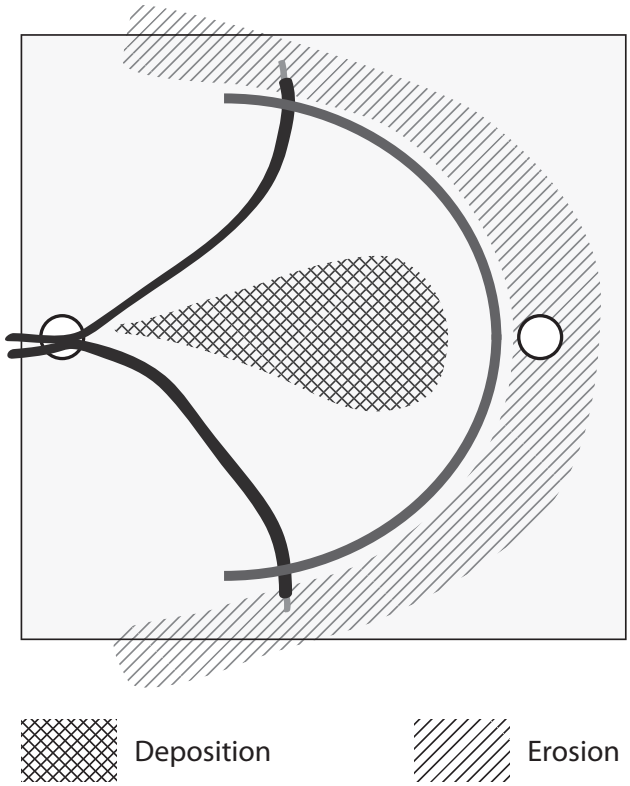

Figure 2: *Schematic of typical erosional and depositional areas around the sensor head under lab conditions.*

Figures 3 and 4

These figures were presented in order to give the reader an idea of the surrounding area of the reaches and where the sensors were set up. I will also include the lat/long coordinates to these to make it easier for the reader to locate them. Arrows have also been added to show downslope direction as per the comment by Reviewer #1.

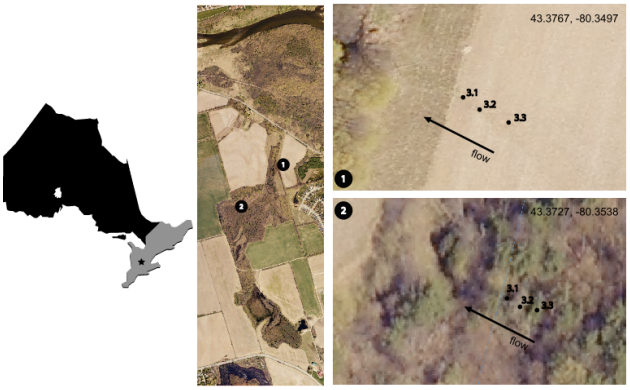

Figure 3: *RARE study sites.*

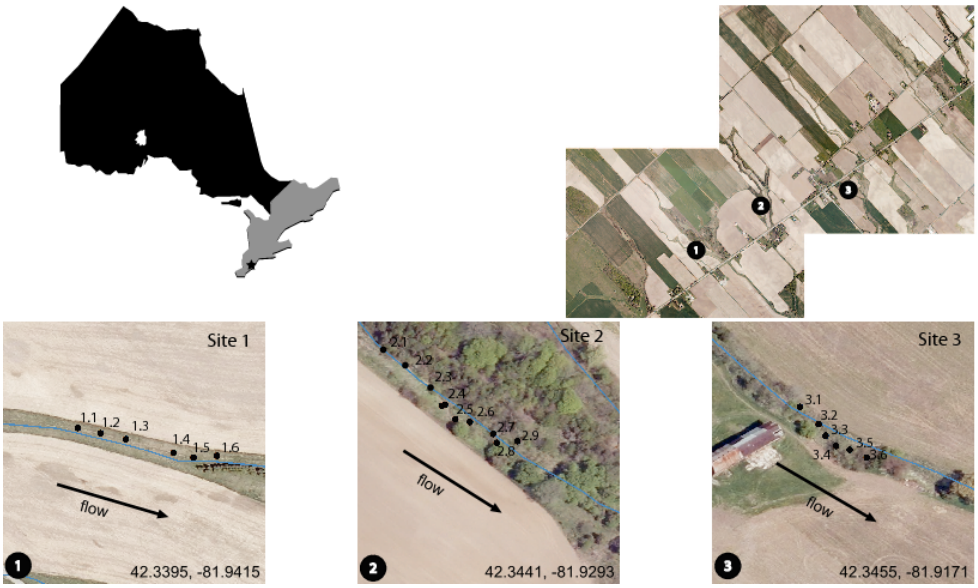

Figure 4: *Rondeau Bay study sites.*

Figure 5

I have altered the figure slightly to clarify what the boxes are showing (i.e. a magnification of the data). I have also labeled the x-axis as time. As an additional note, while the data used in the figure is from the dataset, the figure was being used more as a schematic on the typical noise patterns during onset and cessation of events.

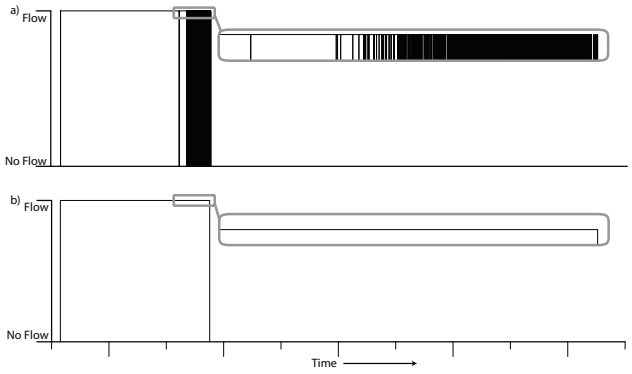

Figure 5: *Raw data* ***(a)*** *and post-processed data* ***(b)*** *with the noise removed for one sensor head.*

Figure 6

In response to referee #1's comment on providing a figure of both pre-processed and post-processed data for the study site, I have chosen not to do this as the size of the figure limits how much can be seen. Even at the current scale, individual noise events are not clearly visible due to the high temporal resolution (it is evident why when looking at Figure 5). The caption was also altered for clarity.

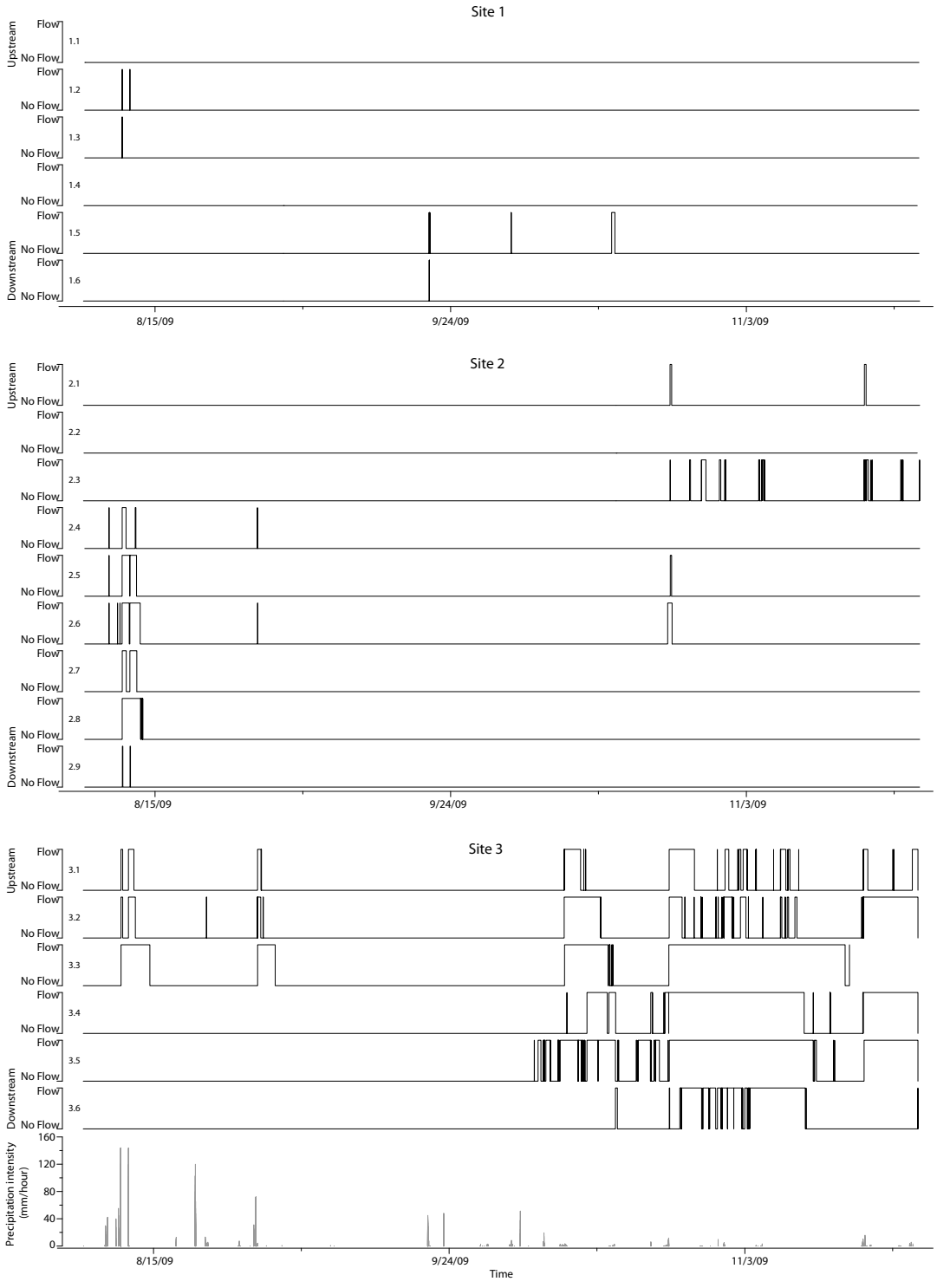

Figure 6: Final flow data from Rondeau Bay study site with noise removed and precipitation intensity.

Results section

In response to the lack of a results section, one has been added which describes three models of stream network expansion as well as two models of stream network contraction which were observed in the dataset (the addition of two figures which show schematics of these models has also been included). The occurrence of these models (as a percent of all events) in the dataset is also described and presented and two tables have been added which show this information (Tables 1 & 2).

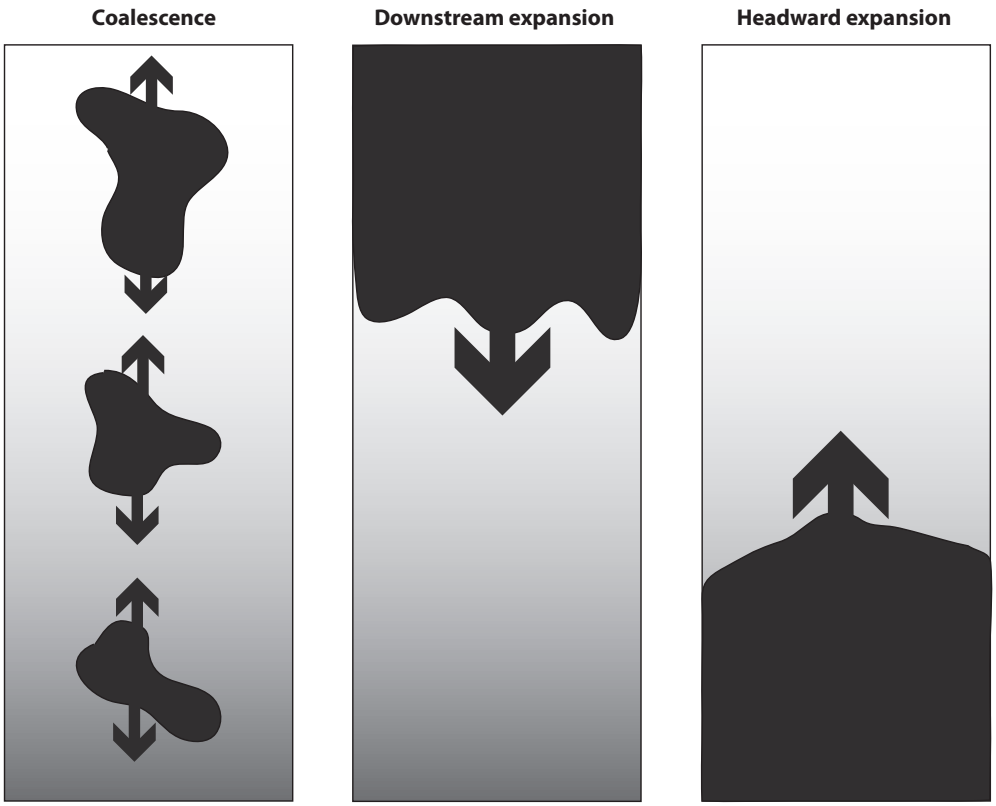

Figure 7: *Models of stream network expansion. Coalescence: the formation of individual pools which join to create a flowing network; Downstream expansion: movement of water from upstream to downstream; Headward expansion: movement of the channel head upstream.*

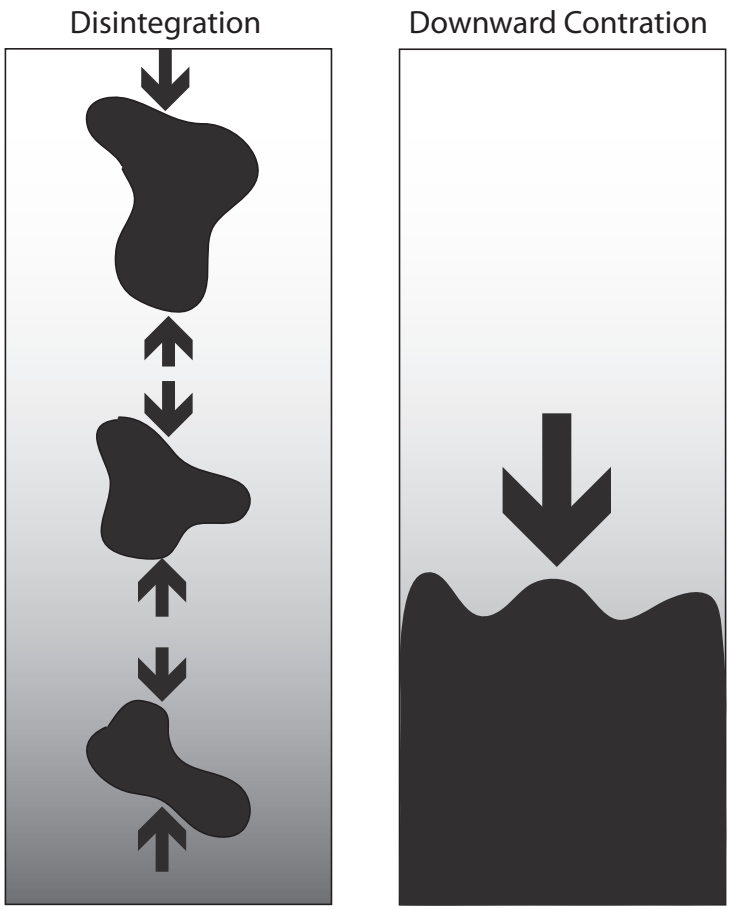

Figure 8: Models of stream network contraction. Disintegration: the breaking up of a flowing reach into drying pools. Downward contraction: movement of the channel head downstream.

Table 1: Occurrence of each model of expansion as a percent of all events.

Stream network expansion				
			Coalescence	
Site	Downstream expansion	Upward expansion	Complete	Incomplete
1	10	15	35	40
2	5.88	5.88	23.53	64.71
3	0	0	40	60
All sites	7.14	9.52	30.95	52.38

Table 2: Occurrence of each model of contraction as a percent of all events.

Stream network contraction			
		Disintegration	
Site	Downstream contraction	Complete	Incomplete
1	20	40	40
2	0	35.41	64.71
3	0	40	60
All sites	9.52	38.09	52.38

Responses to Reviewer #1

First, the major concern you had was the lack of a proper results section in the paper. This has been added as noted on the previous page.

There was no comparison of data with a gauged stream due to the fact that the majority of the channels are running into steep gullies which are not gauged (there were no gauges downstream of my sites in Rondeau). This only reenforces the idea that there is little attention paid to ephemeral streams especially in this region where those gullies drain water directly into a closed bay with eutrophication issues.

With regard to false-positives, there were none noted on days when data from the loggers was downloaded. There were a few occasions where site visits were right after the conclusion of rain events (flow present at least on some sensors). In these cases, the data being logged was true to what was observed in the channel.

You point out the potential of films building up on the sensor electrodes which may cause a false-positive or noise. There was no visible build up of any biofilms on the sensor electrodes both during the field season and when the sensors were retreived. Films of water on the sensor causing the circuit to be closed are unlikely as the electrodes are on either side of the physical sensor body and the exposed part of the wire is not in contact with the body itself. In order for the circuit to close, the water in the channel would need to be at the height of both electrodes. It is possible however that the water level in the channel could be slightly below the level of the electrodes but still create a connection to the electrodes via a hydrogen bond. In this case however, the water level would need to be very close to that of the electrodes, implying that there is still water in the channel, thus not making this a false-positive.

You pointed out that there was a blurring of the lines between ephemeral streams and variable source area (P6383L12). In the case of this study, the only concern was with ephemeral streams, where the difference lies in the fact that ephemeral streams have defined channels, where the variable source area concept is looking at low relief areas on the landscape.

Responses to Reviewer #2

Major Concerns

1. The height has now been specified in Figure 1 (12.5mm). It is correct that flows below this level could be missed, however, there is a tradeoff between the minimal height measurable and the probability of the sensor electrodes being innundated with sediment. Also, having a lower electrode height resulted in higher levels of noise in lab tests due to water pooling on the base of the sensor. Based on the newly added results section where coalescence/disintegration are the dominant expansion/contraction models, it can be assumed that true flow events are not being missed, but rather just the pooling of water.

2. With regard to the angling of 45^{o}, the sensor was not innundated with sediment (the main concern of the test). "Refinements to the sensor" refers to different designs and sizes of sensors. This included changes in materials to try to reduce the cost, while maximizing the robustness of the sensor.

3. Figures have been addressed above

Minor Comments

1. Will take this into account and make it more succinct where possible.
2. I will try to expand the description more.
3. Figure addressed above.
4. The splitting up of these two figures was for the sake of clarity and size.
5. Figure addressed above.
6. Reference was in fact missing, but has been added.

7. The schematic was to show the general deposition/scouring around the sensor head under direct flow conditions over the longer tests.

8. Photo will be included as supplimental information (see photo above).

9. Figure addressed above.

10. The spatial resolution is able to be increased due to lower costs associated with the specialized sensor heads versus alternatives. As most studies are under financial constraints of some sort, having a specialized, inexpensive sensor does in fact allow for a greater spatial scale to be monitored.