

Technical Memorandum

From:	Jessie Cullen and Paul Guard	To:	Gordon Dwane
Date:	15 January 2019	CC:	
Subject:	Gladstone Sediment Flux Measurements		

1 Background

BMT was commissioned to undertake measurements of water and sediment fluxes across transects at the Port of Gladstone as part of the ongoing Sustainable Sediment Management Project. The data will be used to refine and improve the Gladstone TUFLOW FV model and to assist in the development of a quantitative sediment budget for the Port. A summary of the data collection campaign and sediment flux measurement for each transect is presented below.

2 Data Collection

Water velocity and suspended sediment concentrations were measured across transects at three locations (see Figure 1) over complete tidal cycles during large spring tides (with range up to 4.5m) on the 7th, 8th and 10th September 2018 and again during 'average' tides on the 12th, 13th and 15th September 2018.

- Transect A from Gatcombe Heads to Lilly's Beach;
- Transect B from South End on Curtis Island to North Point on Facing Island; and
- Transect C across The Narrows at Black Swan Island.

A downward facing Acoustic Doppler Current Profiler (ADCP) mounted to the BMT vessel 'Resolution II' was used to measure both the velocity profile and the suspended sediment concentration profile under the boat as it traversed each transect repeatedly over a complete tidal cycle (12.5 hours).

A Campbell Scientific OBS-3A turbidity probe was used at several locations to measure the turbidity profile and water quality samples were taken at known depths on the profile for subsequent analysis to determine the total suspended solids (TSS) concentration. The turbidity profiles and TSS measurements were then correlated with ADCP backscatter measurements to allow conversion of the ADCP backscatter data into TSS concentration data across each transect.

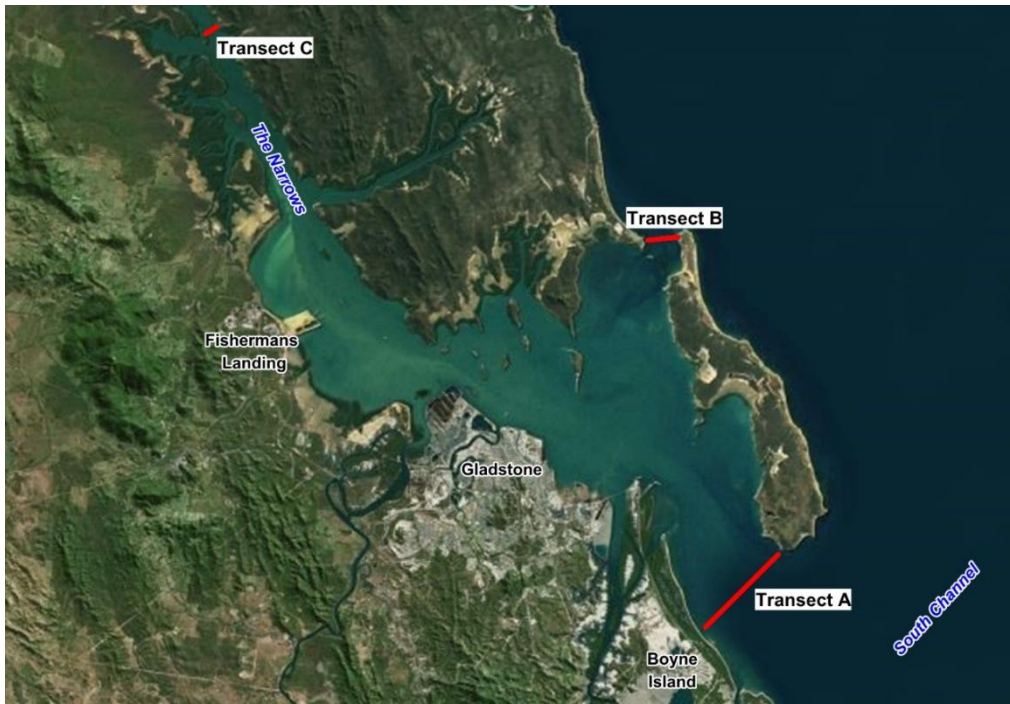


Figure 1 Transect Locations (Red Lines)

3 Data Presentation

For each of the measured transects, a curtain plot was developed which shows the calculated TSS concentrations along the transect as a function of chainage and elevation. Figure 2 shows an example of this curtain plot together with a plan view which shows the depth averaged TSS concentrations along the transect. The complete set of plots for the measured ADCP transects is presented in Appendix A.

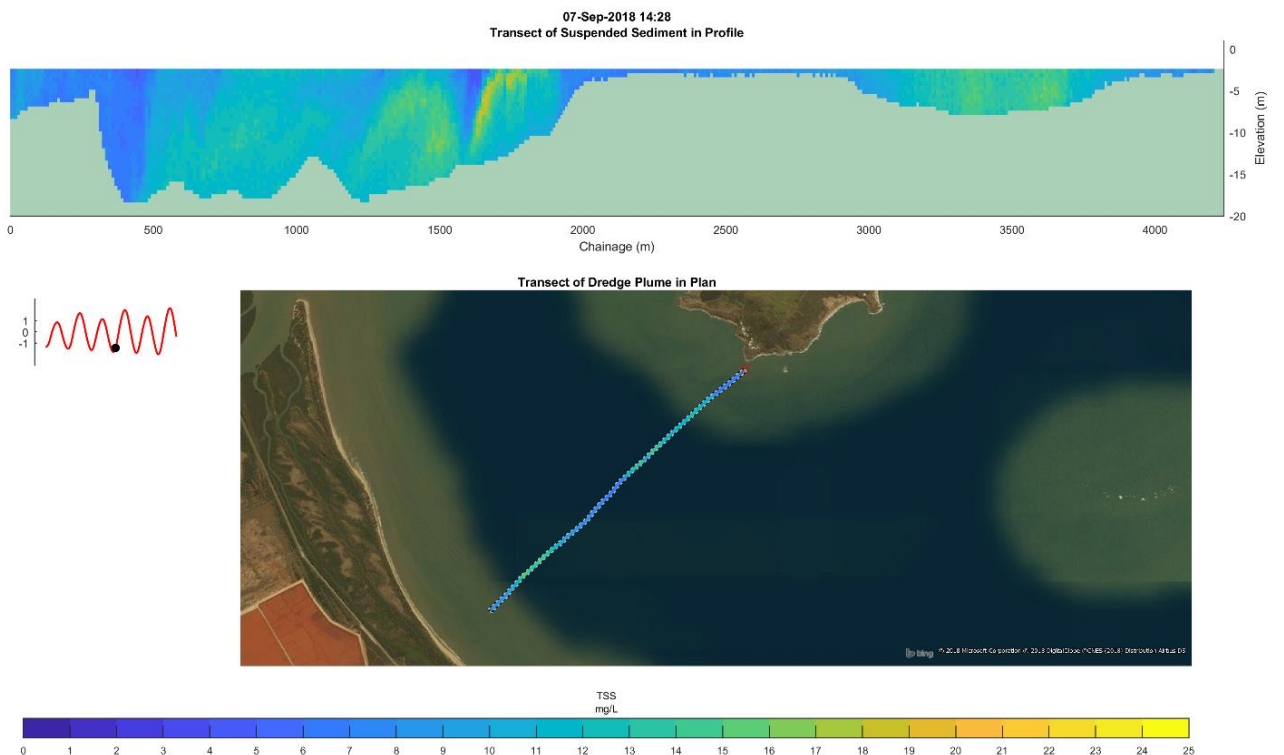


Figure 2 Example ADCP Transect Plot

3.1 Spring Tidal Range - Results

For each measured transect, the calculated TSS concentrations and water velocities were integrated to produce a measurement of the net sediment and water flux across the transect at that time. Time series of the total sediment flux and water level are presented in Figure 3 to Figure 5 for spring tidal range conditions. Accompanying each plot is tabulated data including the time of measurement, water level (relative to Mean Sea Level [m MSL]), total sediment flux, average sediment concentration and volumetric flow rate. Sediment flux and volumetric flow rate are positive into the harbour.

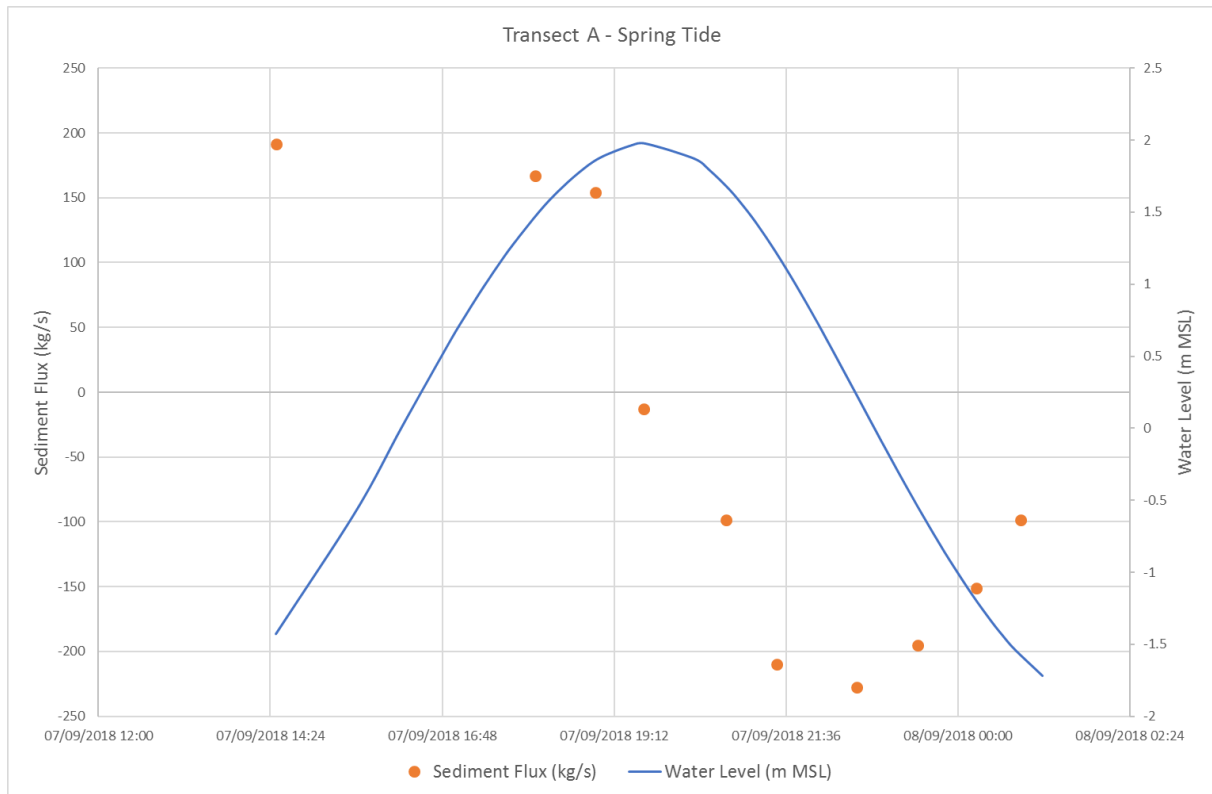


Figure 3 Sediment Flux – Spring Tide – Transect A

Table 1 Transect Data Collection Summary – Spring Tide – Transect A

Time	Water Level [m MSL]	Sediment Flux (kg/s)	Average Sediment Concentration (g/m ³)	Volumetric Flow Rate (m ³ /s)
07/09/2018 14:28	-1.43	192	10	17,223
07/09/2018 18:06	1.47	167	6	24,562
07/09/2018 18:56	1.86	154	8	20,634
07/09/2018 19:36	1.97	-13	8	-4,071
07/09/2018 20:46	1.68	-99	5	-17,695
07/09/2018 21:28	1.21	-210	6	-32,437
07/09/2018 22:35	0.23	-227	7	-30,637
07/09/2018 23:26	-0.55	-195	7	-28,706
08/09/2018 00:15	-1.20	-151	6	-23,592
08/09/2018 00:52	-1.58	-98	5	-17,375

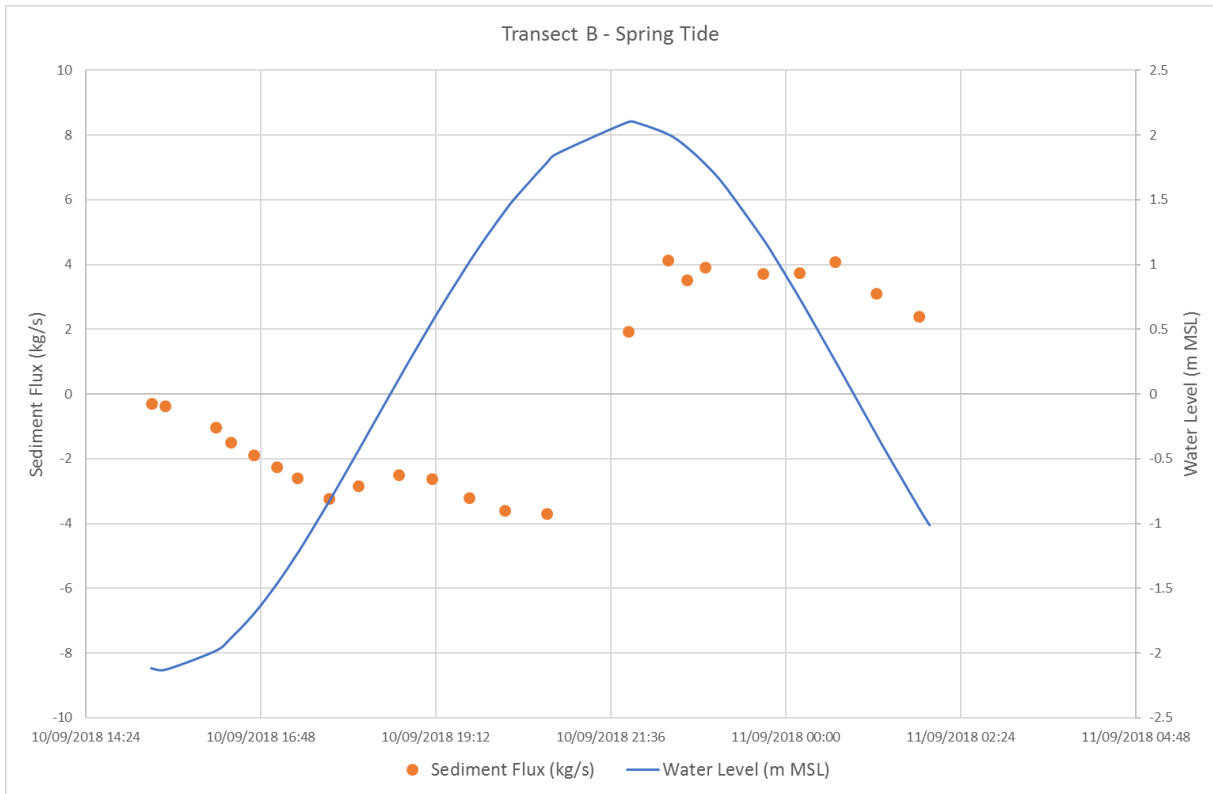


Figure 4 Sediment Flux – Spring Tide – Transect B

Table 2 Transect Data Collection Summary – Spring Tide – Transect B

Time	Water Level [m MSL]	Sediment Flux (kg/s)	Average Sediment Concentration (g/m ³)	Volumetric Flow Rate (m ³ /s)
10/09/2018 15:18	-2.12	0	6	-55
10/09/2018 15:29	-2.13	0	6	-59
10/09/2018 16:11	-1.99	-1	3	-310
10/09/2018 16:23	-1.89	-1	3	-467
10/09/2018 16:42	-1.70	-2	3	-518
10/09/2018 17:01	-1.47	-2	4	-624
10/09/2018 17:17	-1.24	-3	3	-830
10/09/2018 17:44	-0.83	-3	3	-1,145
10/09/2018 18:08	-0.44	-3	2	-1,508
10/09/2018 18:41	0.11	-3	1	-1,893
10/09/2018 19:09	0.56	-3	1	-2,178
10/09/2018 19:39	1.02	-3	1	-2,420
10/09/2018 20:09	1.41	-4	1	-2,531
10/09/2018 20:43	1.79	-4	2	-2,265
10/09/2018 21:50	2.10	2	2	1,005
10/09/2018 22:23	2.01	4	1	2,985
10/09/2018 22:38	1.91	4	1	2,782
10/09/2018 22:54	1.78	4	1	3,207
10/09/2018 23:41	1.20	4	1	2,926
11/09/2018 00:11	0.74	4	2	2,188
11/09/2018 00:40	0.26	4	2	1,671
11/09/2018 01:14	-0.31	3	3	1,092
11/09/2018 01:49	-0.88	2	3	806

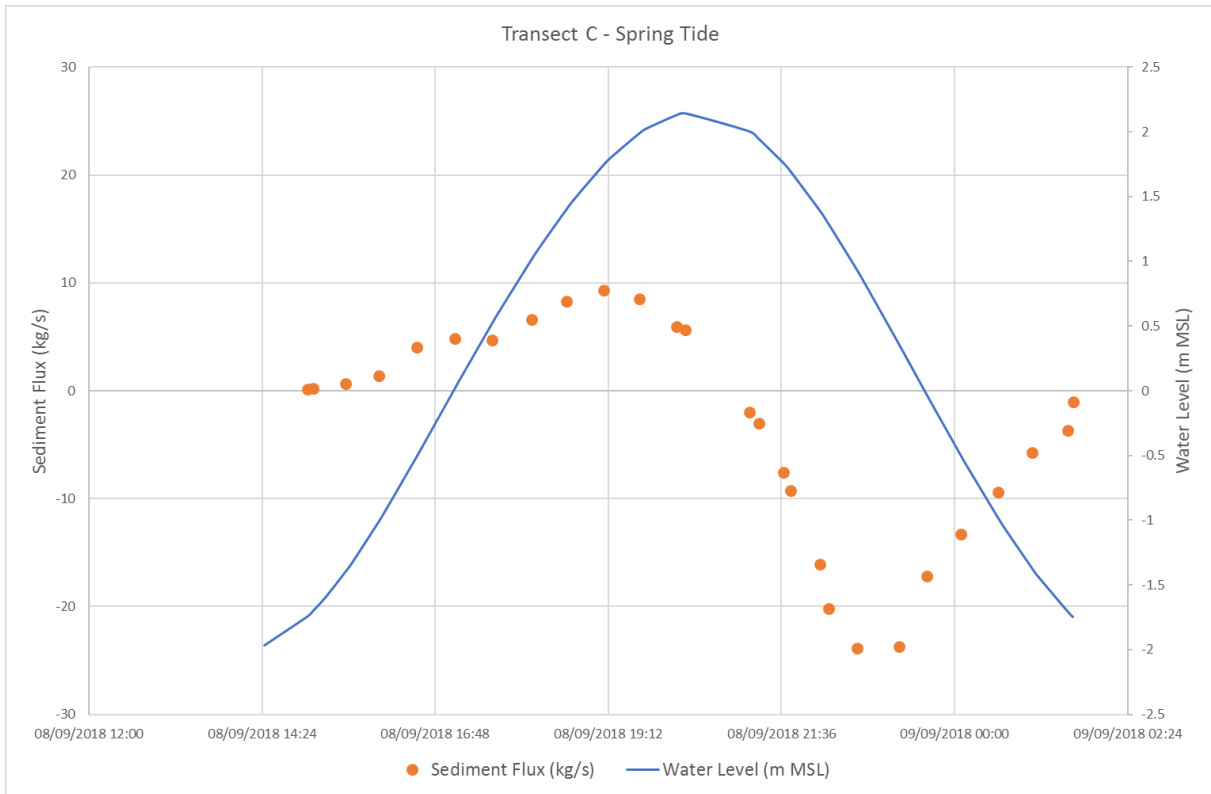


Figure 5 Sediment Flux – Spring Tide – Transect C

Table 3 Transect Data Collection Summary – Spring Tide – Transect C

Time	Water Level [m MSL]	Sediment Flux (kg/s)	Average Sediment Concentration (g/m ³)	Volumetric Flow Rate (m ³ /s)
08/09/2018 15:02	-1.74	0	11	16
08/09/2018 15:06	-1.70	0	11	19
08/09/2018 15:33	-1.40	1	12	53
08/09/2018 16:00	-1.02	1	15	100
08/09/2018 16:32	-0.51	4	21	208
08/09/2018 17:04	0.01	5	18	267
08/09/2018 17:35	0.51	5	15	289
08/09/2018 18:07	1.01	7	18	360
08/09/2018 18:37	1.40	8	17	468
08/09/2018 19:07	1.74	9	17	536
08/09/2018 19:37	1.99	9	16	480
08/09/2018 20:08	2.13	6	15	392
08/09/2018 20:16	2.14	6	14	383
08/09/2018 21:09	2.00	-2	11	-189
08/09/2018 21:17	1.95	-3	11	-274
08/09/2018 21:37	1.76	-8	13	-627
08/09/2018 21:43	1.70	-9	13	-727
08/09/2018 22:08	1.39	-16	18	-920
08/09/2018 22:15	1.29	-20	20	-1,009
08/09/2018 22:38	0.93	-24	26	-883
08/09/2018 23:13	0.36	-24	33	-702
08/09/2018 23:36	-0.03	-17	33	-522
09/09/2018 00:05	-0.50	-13	31	-389
09/09/2018 00:36	-0.99	-9	35	-263
09/09/2018 01:04	-1.37	-6	33	-183
09/09/2018 01:34	-1.71	-4	29	-129
09/09/2018 01:38	-1.75	-1	31	-51

3.2 Average Tidal Range Conditions

Time series of the total sediment flux and water level across each transect during “average” tidal range conditions are presented in Figure 6 to Figure 8. Accompanying each plot is tabulated data including the time of measurement, total sediment flux, average sediment concentration and volumetric flow rate. Sediment flux and volumetric flow rate are positive into the harbour.

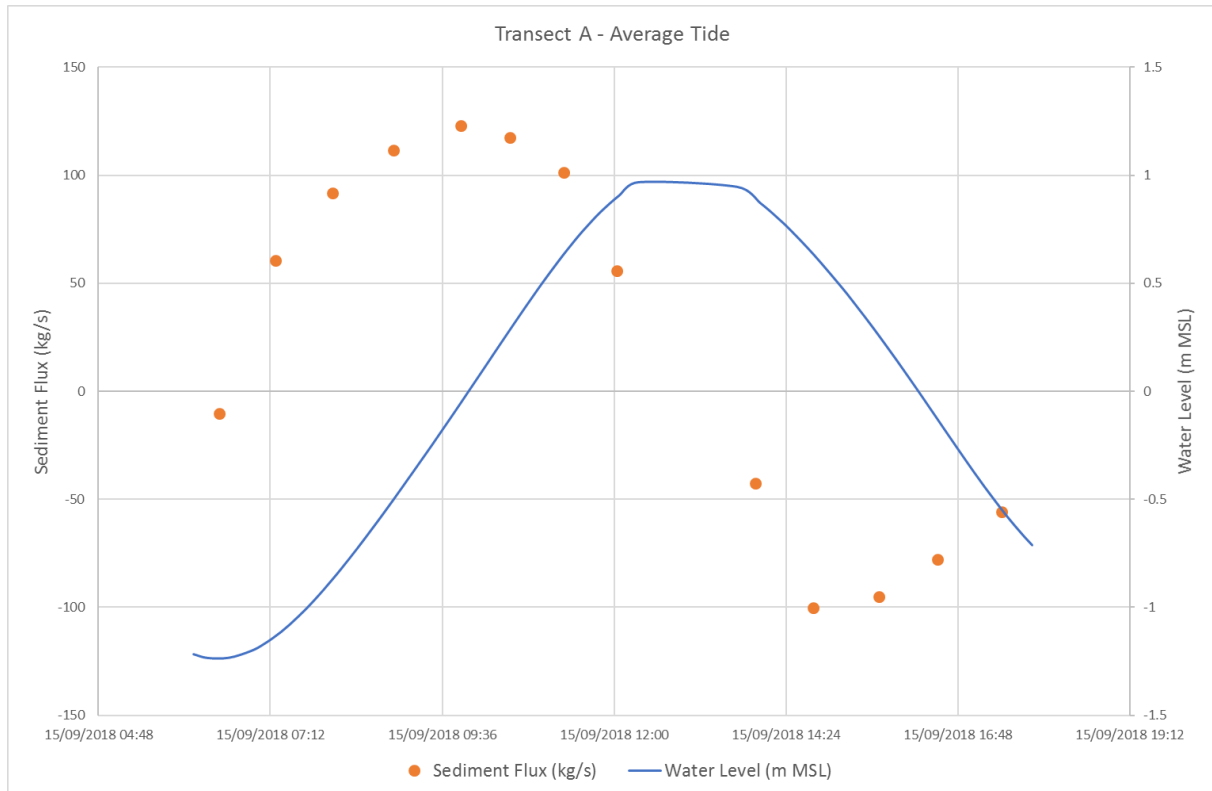


Figure 6 Sediment Flux – Average Tide – Transect A

Table 4 Transect Data Collection Summary – Average Tide – Transect A

Time	Water Level [m MSL]	Sediment Flux (kg/s)	Average Sediment Concentration (g/m ³)	Volumetric Flow Rate (m ³ /s)
15/09/2018 06:29	-1.24	-10	8	-1,300
15/09/2018 07:16	-1.14	60	8	7,834
15/09/2018 08:04	-0.87	92	8	11,901
15/09/2018 08:55	-0.50	111	8	14,440
15/09/2018 09:51	-0.05	123	8	15,993
15/09/2018 10:32	0.28	117	8	15,343
15/09/2018 11:17	0.63	101	7	13,404
15/09/2018 12:02	0.90	56	6	9,539
15/09/2018 13:58	0.89	-43	6	-7,785
15/09/2018 14:46	0.64	-100	6	-18,459
15/09/2018 15:42	0.25	-95	6	-16,935
15/09/2018 16:31	-0.13	-78	6	-13,736
15/09/2018 17:24	-0.55	-56	6	-10,163

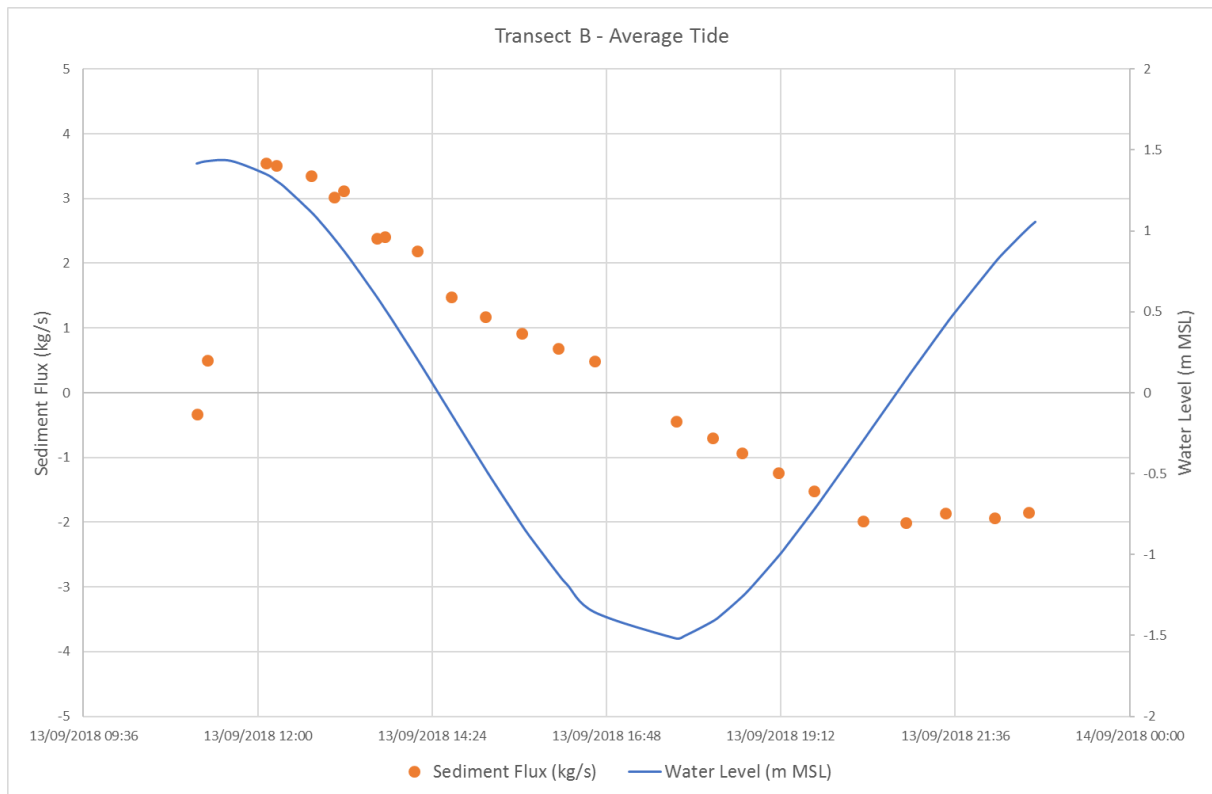


Figure 7 Sediment Flux – Average Tide – Transect B

Table 5 Transect Data Collection Summary – Average Tide – Transect B

Time	Water Level [m MSL]	Sediment Flux (kg/s)	Average Sediment Concentration (g/m ³)	Volumetric Flow Rate (m ³ /s)
13/09/2018 11:09	1.42	-0.3	2.1	-152
13/09/2018 11:18	1.43	0.5	2.1	247
13/09/2018 12:06	1.35	3.5	1.6	2,244
13/09/2018 12:15	1.31	3.5	1.6	2,244
13/09/2018 12:44	1.12	3.3	1.5	2,188
13/09/2018 13:03	0.95	3.0	1.6	1,928
13/09/2018 13:11	0.88	3.1	1.6	1,992
13/09/2018 13:38	0.60	2.4	1.5	1,555
13/09/2018 13:44	0.52	2.4	1.6	1,535
13/09/2018 14:11	0.21	2.2	1.8	1,251
13/09/2018 14:39	-0.13	1.5	1.9	799
13/09/2018 15:07	-0.46	1.2	2.0	605
13/09/2018 15:37	-0.81	0.9	2.0	460
13/09/2018 16:08	-1.12	0.7	2.1	324
13/09/2018 16:38	-1.36	0.5	2.1	225
13/09/2018 17:45	-1.52	-0.4	2.0	-214
13/09/2018 18:15	-1.41	-0.7	1.8	-387
13/09/2018 18:39	-1.26	-0.9	1.7	-529
13/09/2018 19:09	-1.01	-1.2	1.7	-705
13/09/2018 19:39	-0.72	-1.5	1.6	-907
13/09/2018 20:19	-0.30	-2.0	1.7	-1,168
13/09/2018 20:55	0.08	-2.0	1.6	-1,228
13/09/2018 21:27	0.42	-1.9	1.6	-1,150
13/09/2018 22:08	0.80	-1.9	1.6	-1,178
13/09/2018 22:36	1.02	-1.8	1.7	-1,082

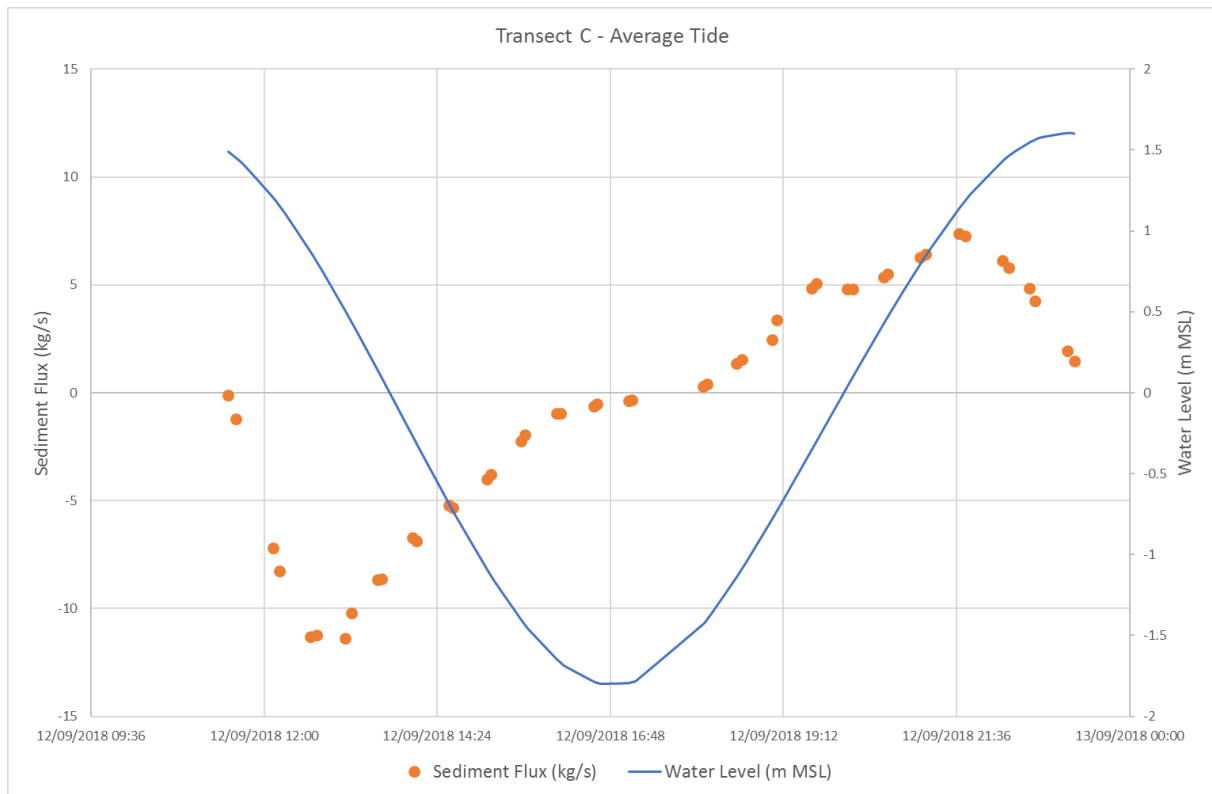


Figure 8 Sediment Flux – Average Tide – Transect C

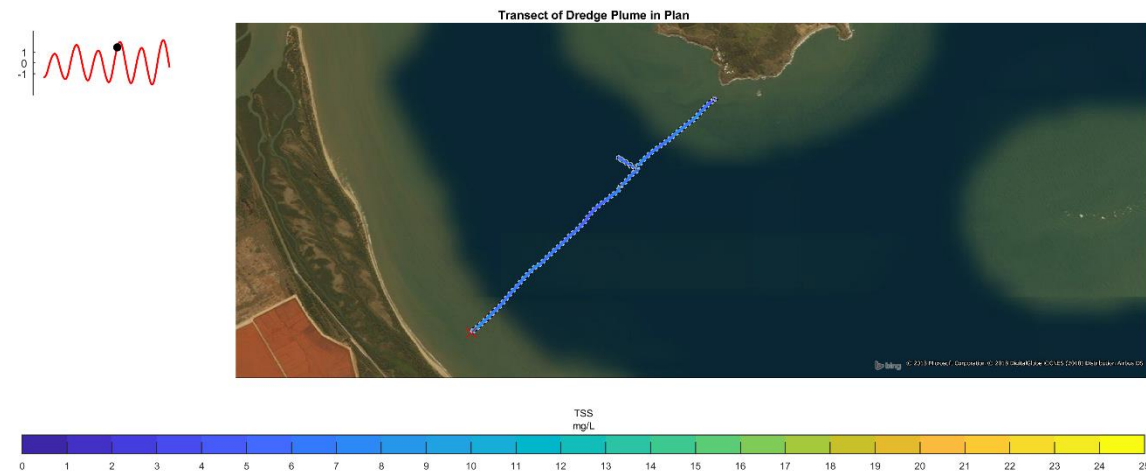
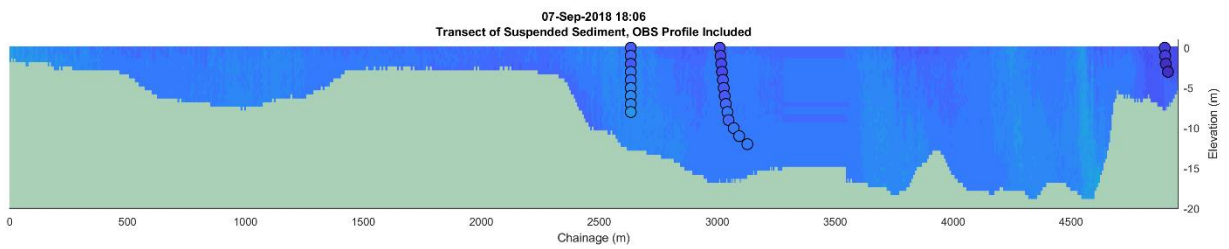
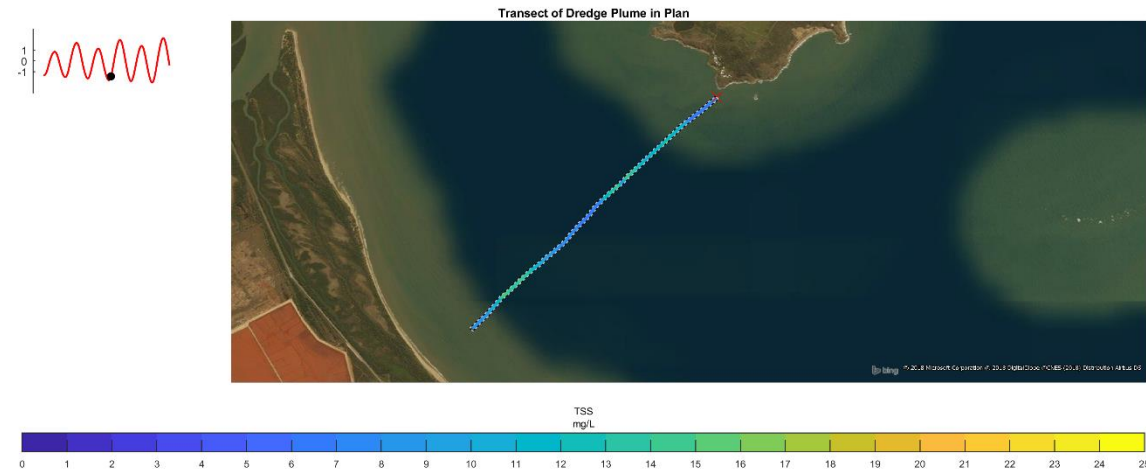
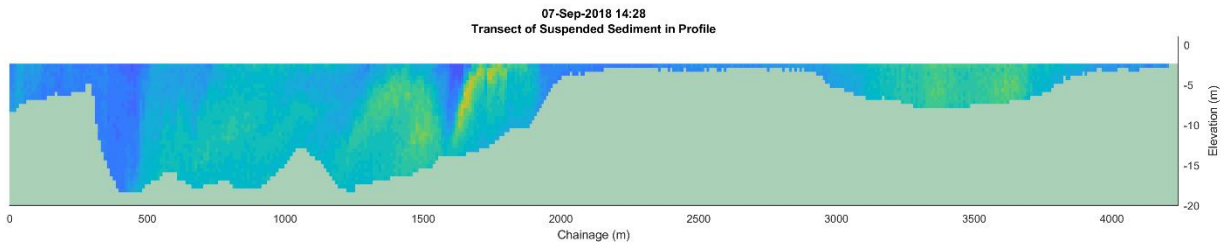
Table 6 Transect Data Collection Summary – Average Tide – Transect C

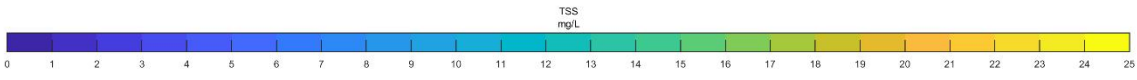
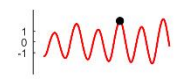
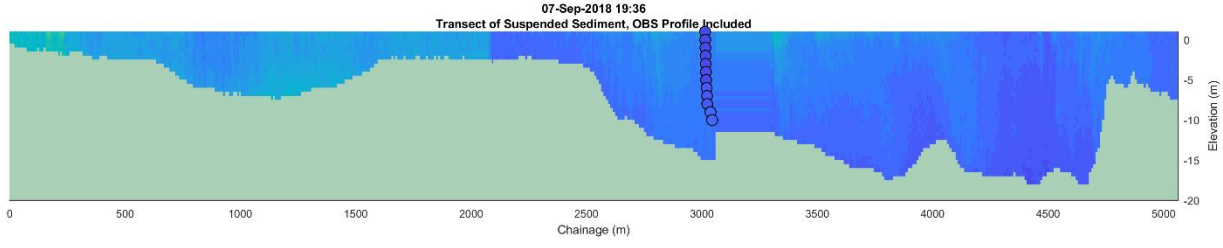
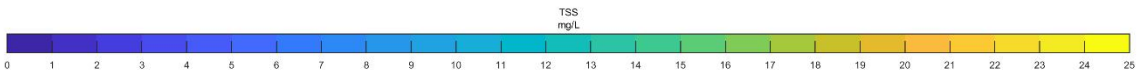
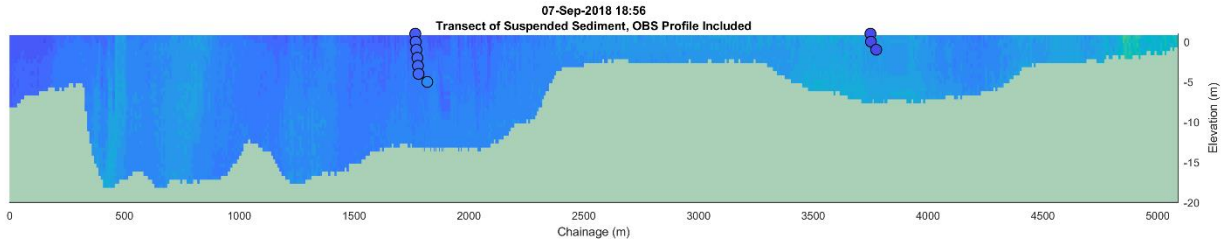
Time	Water Level [m MSL]	Sediment Flux (kg/s)	Average Sediment Concentration (g/m ³)	Volumetric Flow Rate (m ³ /s)
12/09/2018 11:30	1.49	0	19	-7
12/09/2018 11:36	1.45	-1	19	-63
12/09/2018 12:07	1.20	-7	18	-387
12/09/2018 12:12	1.15	-8	19	-434
12/09/2018 12:38	0.87	-11	22	-505
12/09/2018 12:43	0.81	-11	22	-507
12/09/2018 13:07	0.51	-11	23	-470
12/09/2018 13:12	0.44	-10	24	-421
12/09/2018 13:34	0.14	-9	24	-358
12/09/2018 13:37	0.09	-9	24	-356
12/09/2018 14:03	-0.27	-7	24	-278
12/09/2018 14:06	-0.32	-7	24	-281
12/09/2018 14:33	-0.69	-5	24	-213
12/09/2018 14:36	-0.73	-5	25	-213
12/09/2018 15:05	-1.09	-4	26	-154
12/09/2018 15:08	-1.13	-4	27	-143
12/09/2018 15:33	-1.41	-2	25	-93
12/09/2018 15:37	-1.43	-2	23	-85
12/09/2018 16:03	-1.65	-1	19	-49
12/09/2018 16:06	-1.67	-1	20	-49
12/09/2018 16:34	-1.79	-1	18	-33
12/09/2018 16:37	-1.79	-1	18	-29
12/09/2018 17:03	-1.79	0	17	-21
12/09/2018 17:05	-1.79	0	17	-20
12/09/2018 18:05	-1.43	0	18	16
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12/09/2018 18:33	-1.14	1	21	65
12/09/2018 18:37	-1.09	2	20	76

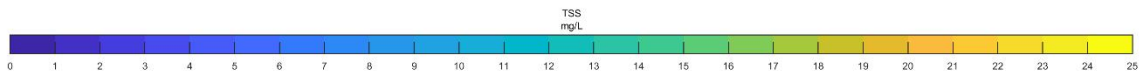
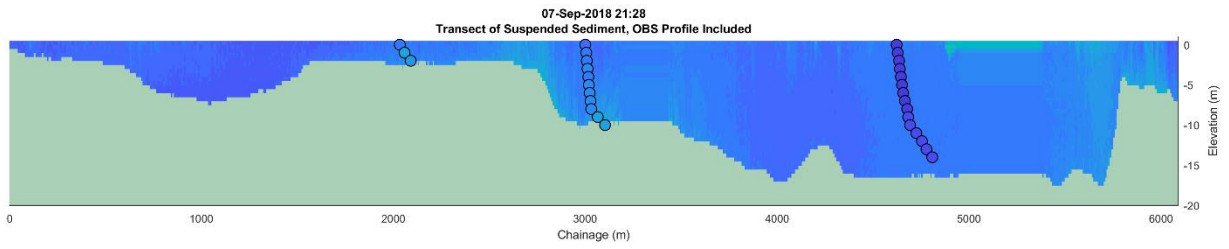
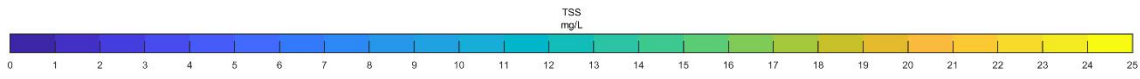
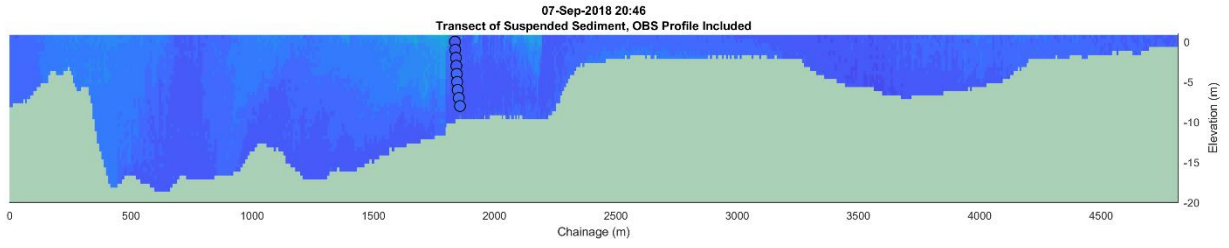
Time	Water Level [m MSL]	Sediment Flux (kg/s)	Average Sediment Concentration (g/m ³)	Volumetric Flow Rate (m ³ /s)
12/09/2018 19:02	-0.78	2	24	124
12/09/2018 19:06	-0.73	3	23	154
12/09/2018 19:35	-0.35	5	23	220
12/09/2018 19:39	-0.30	5	23	228
12/09/2018 20:05	0.04	5	20	243
12/09/2018 20:09	0.10	5	19	242
12/09/2018 20:35	0.42	5	20	258
12/09/2018 20:38	0.47	6	20	261
12/09/2018 21:05	0.79	6	21	298
12/09/2018 21:10	0.84	6	21	296
12/09/2018 21:38	1.14	7	22	324
12/09/2018 21:43	1.19	7	21	327
12/09/2018 22:14	1.43	6	20	289
12/09/2018 22:19	1.46	6	20	276
12/09/2018 22:36	1.55	5	20	226
12/09/2018 22:41	1.56	4	20	200
12/09/2018 23:08	1.60	2	19	90
12/09/2018 23:13	1.60	1	19	65

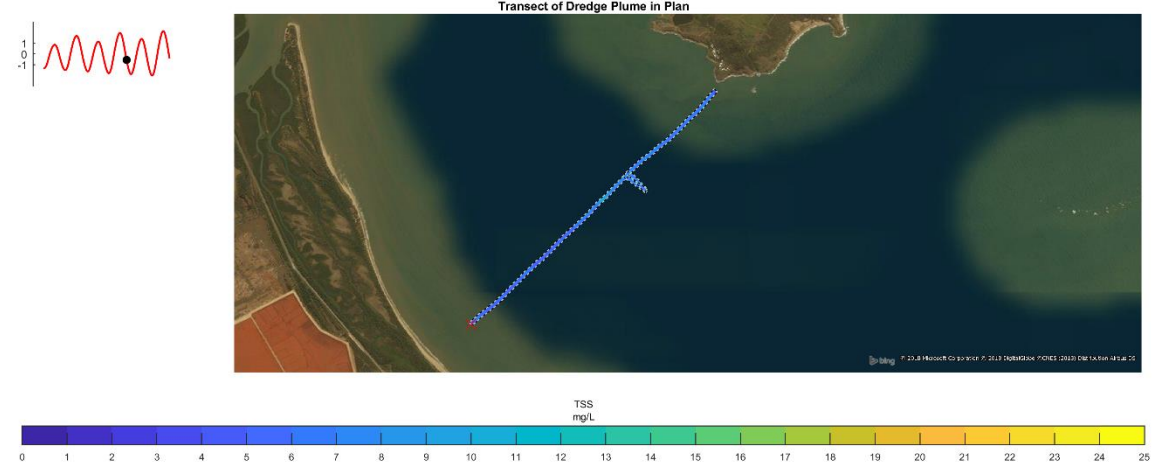
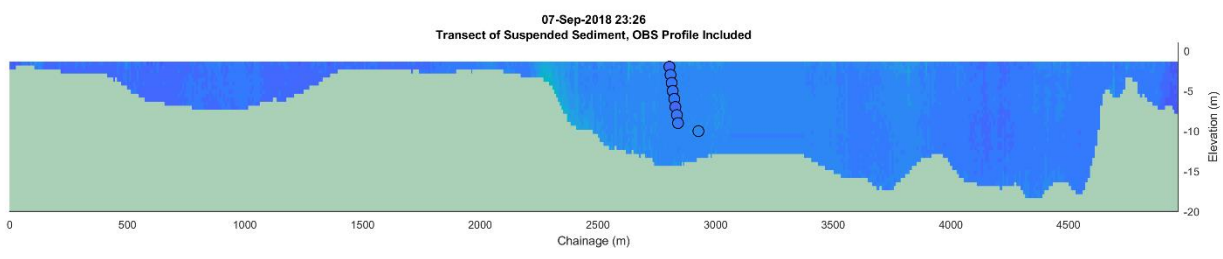
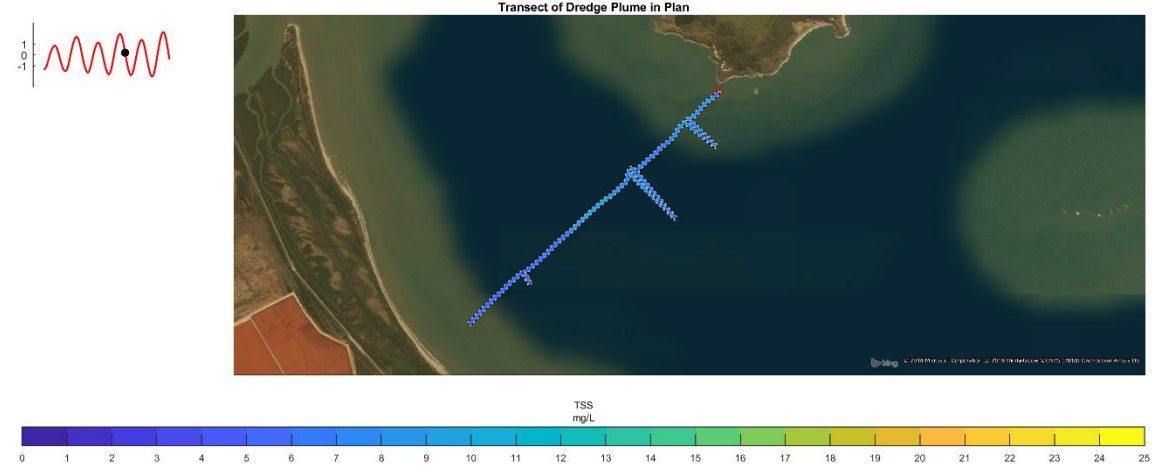
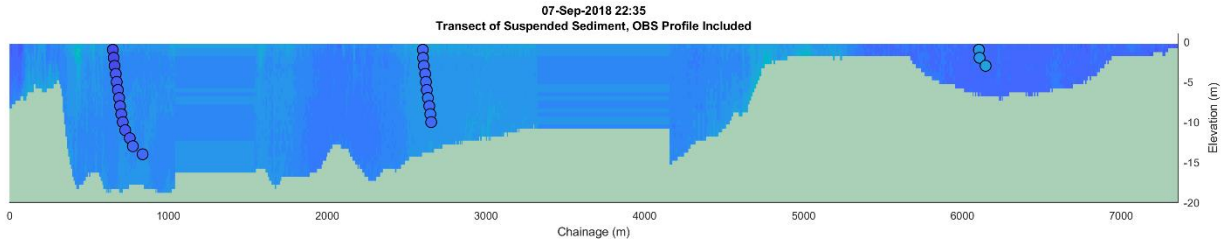
Appendix A

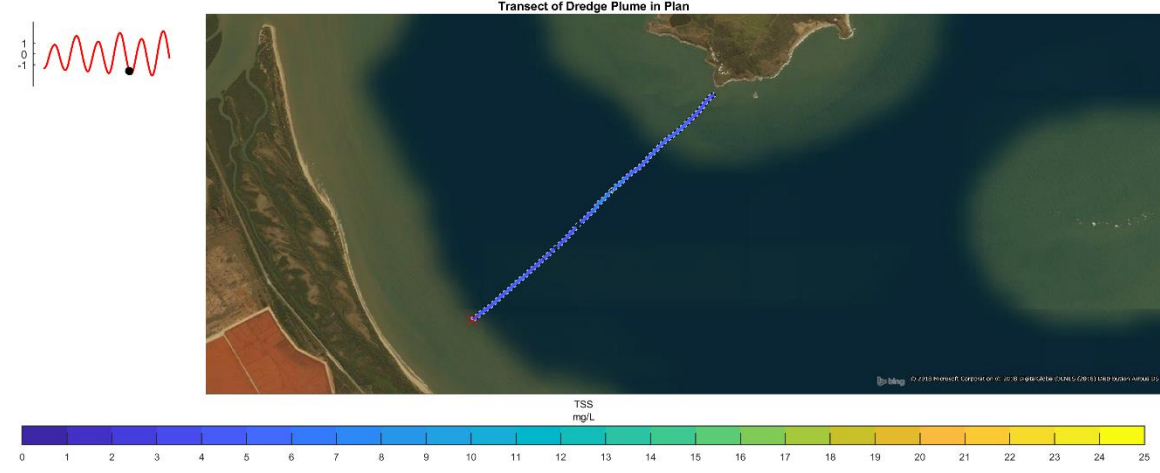
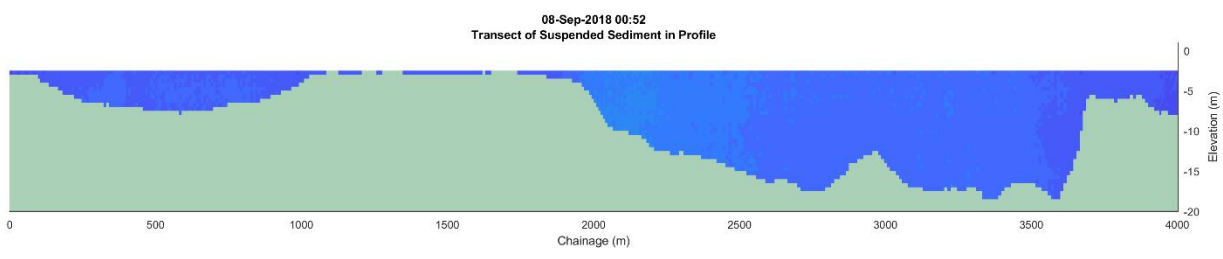
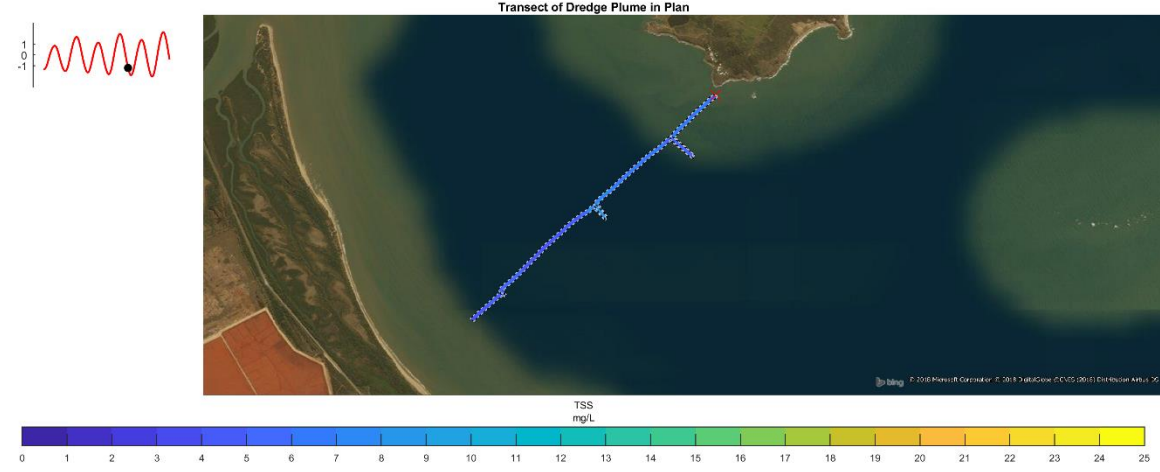
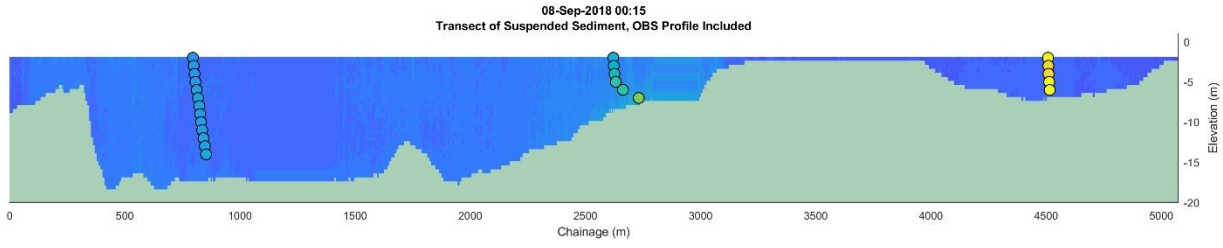
Transect A - Gatcombe Heads to Lilly's Beach – Spring Tide



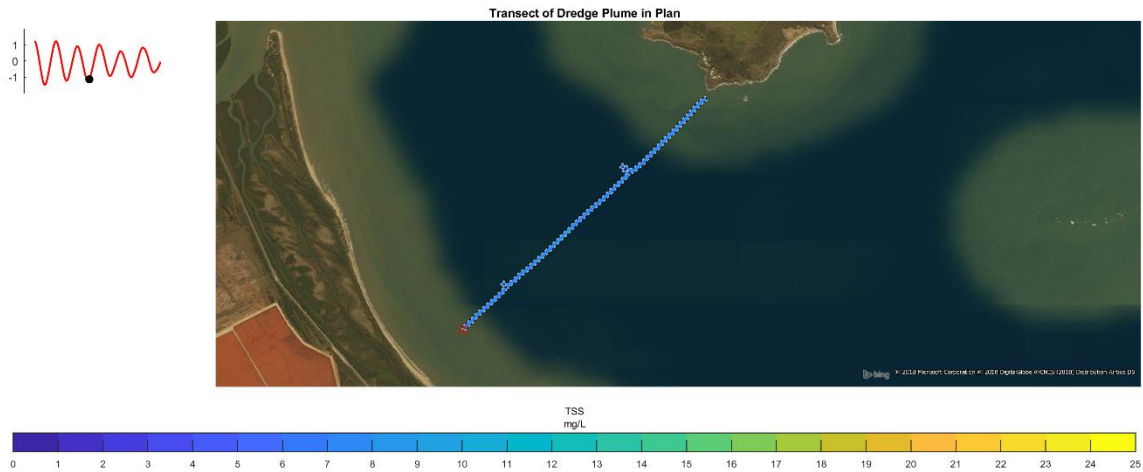
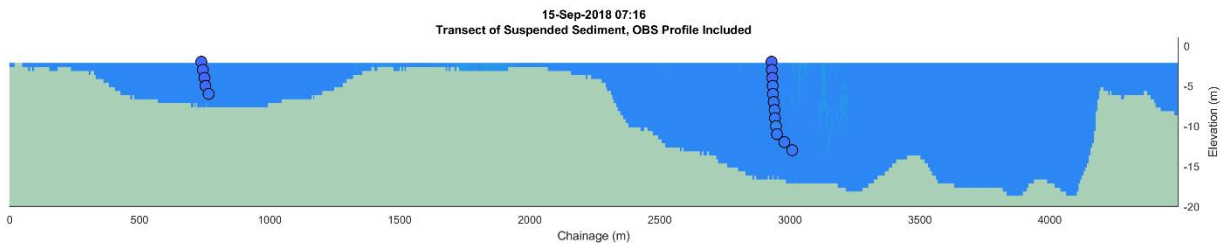
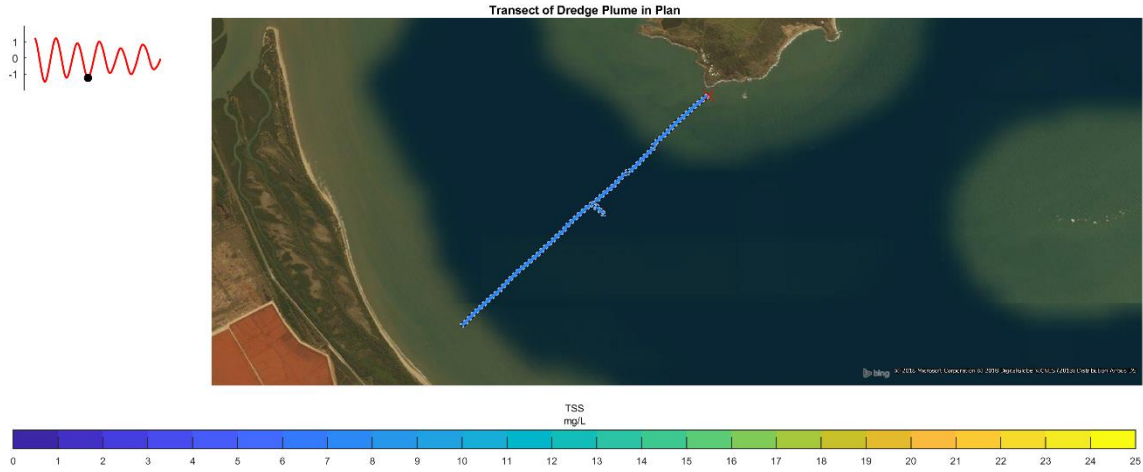
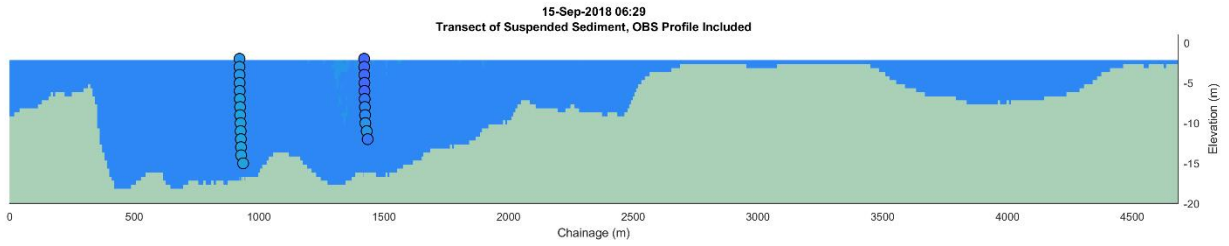


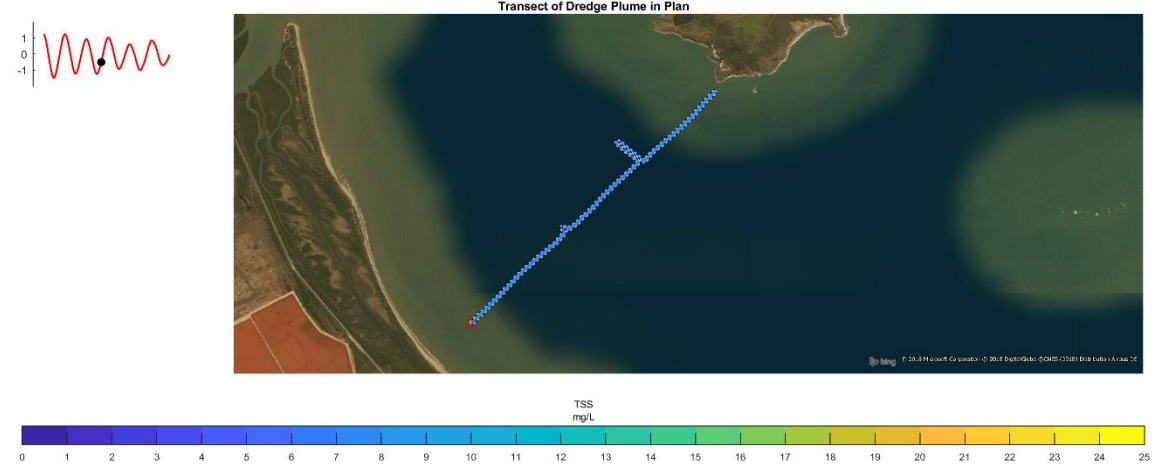
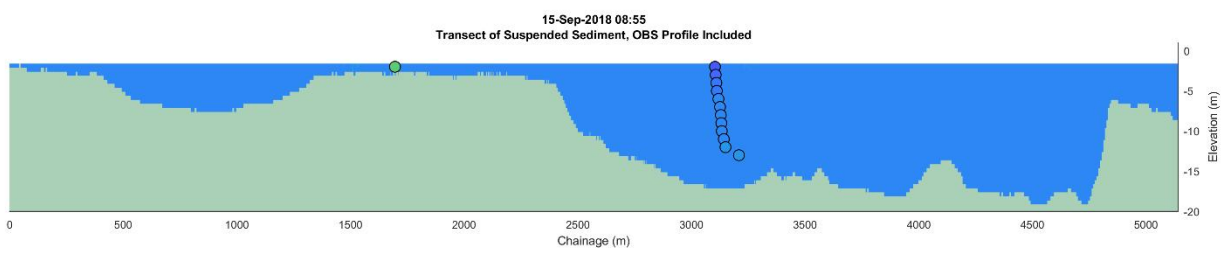
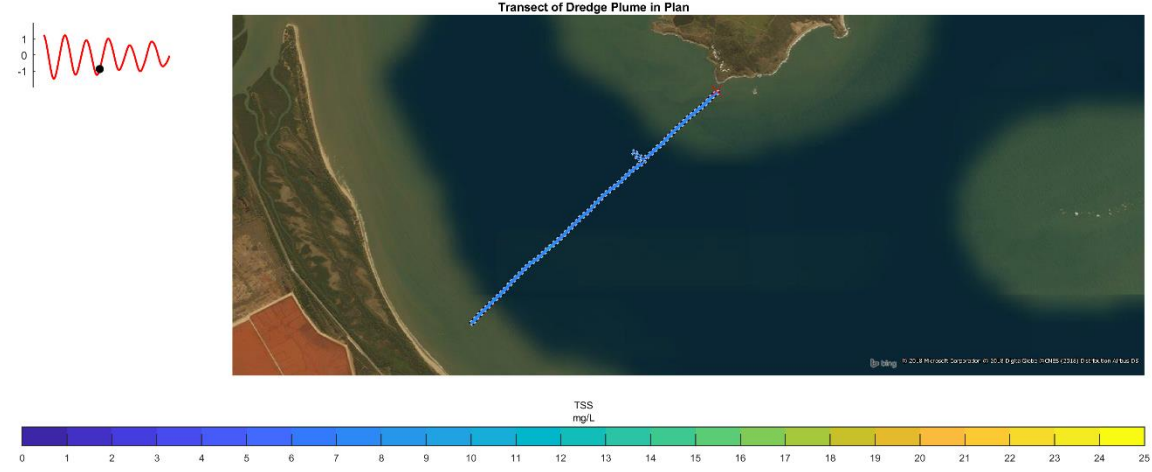
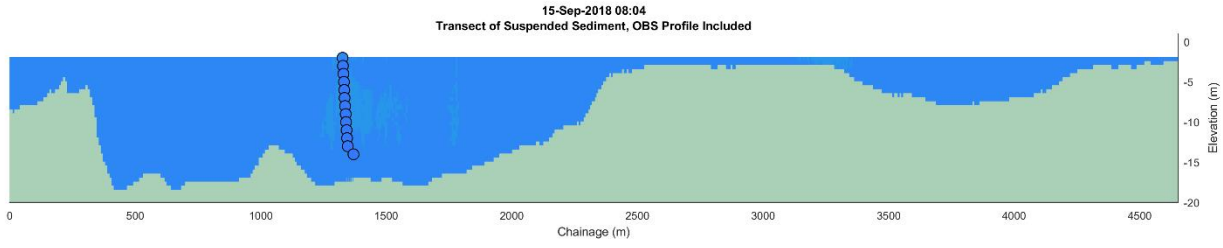


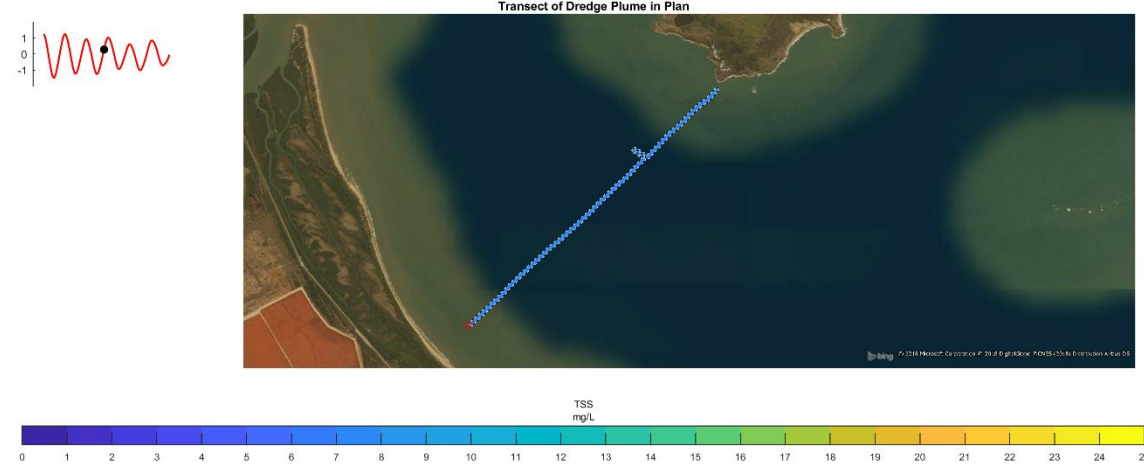
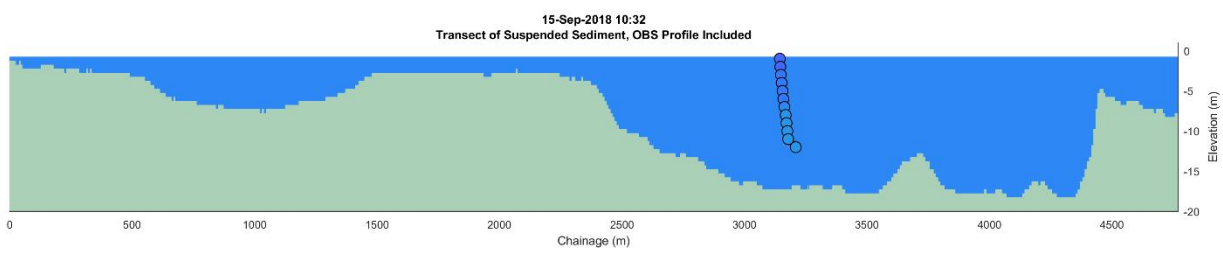
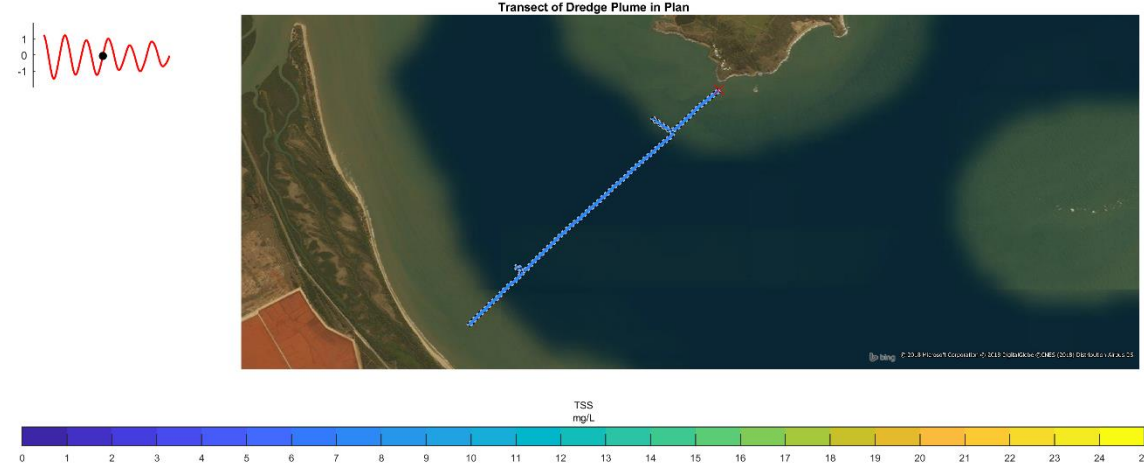
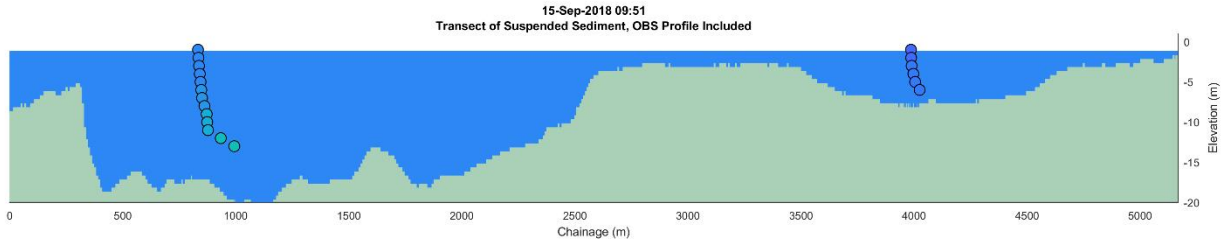


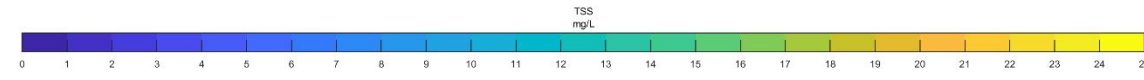
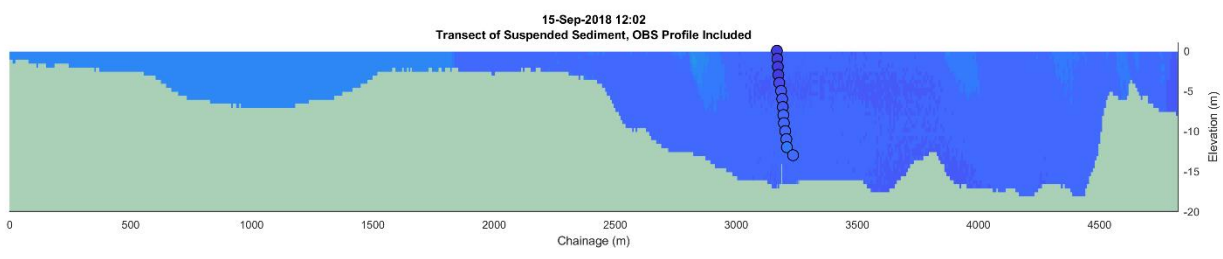
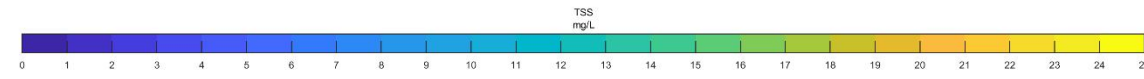
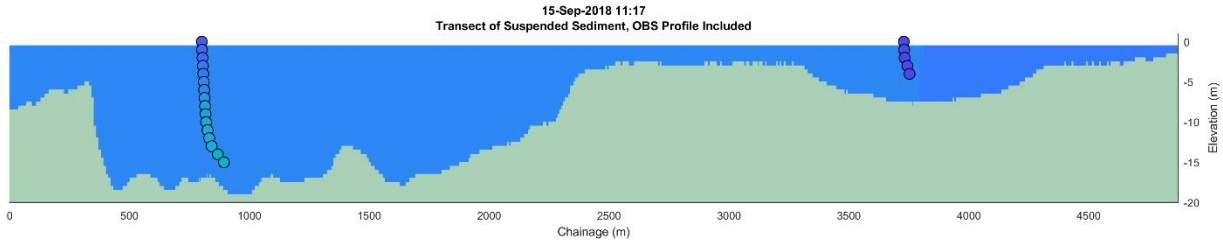


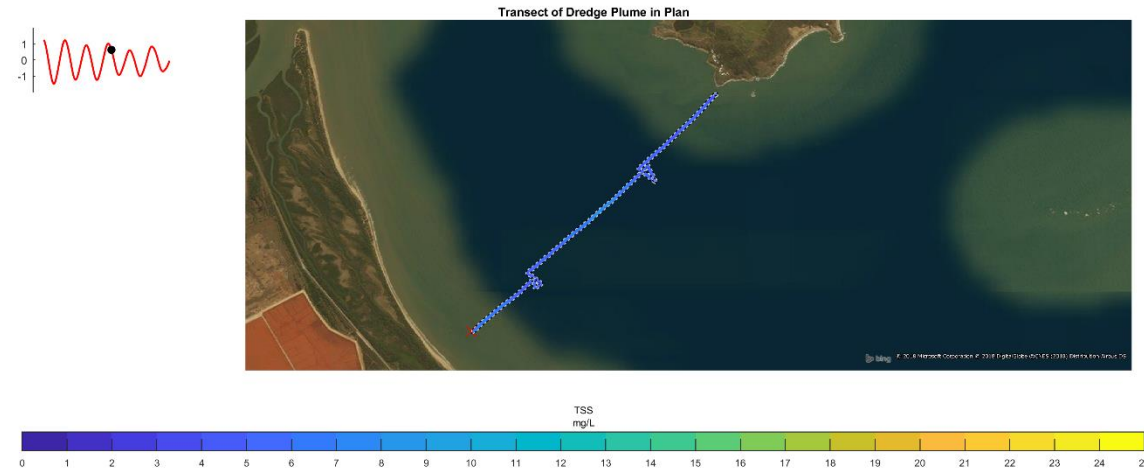
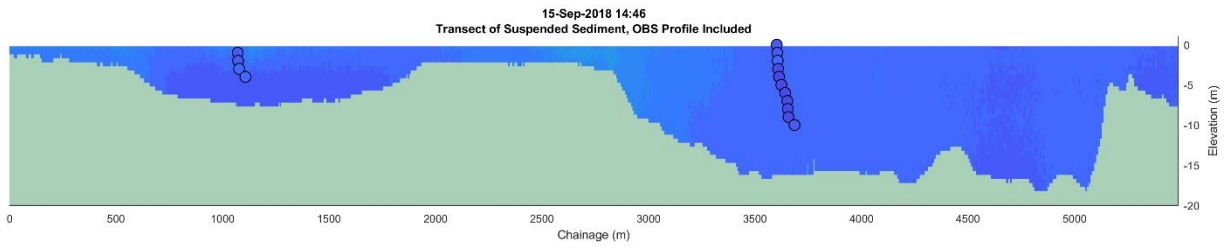
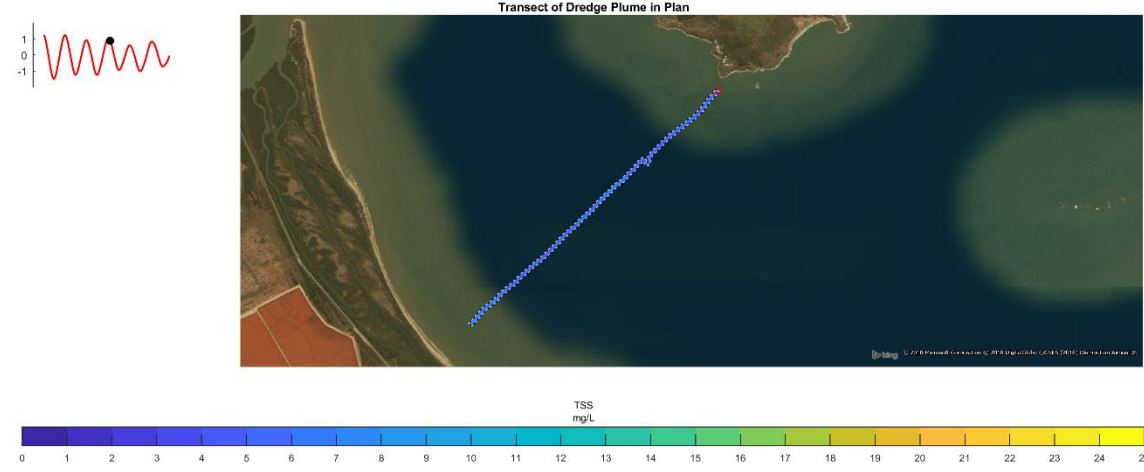
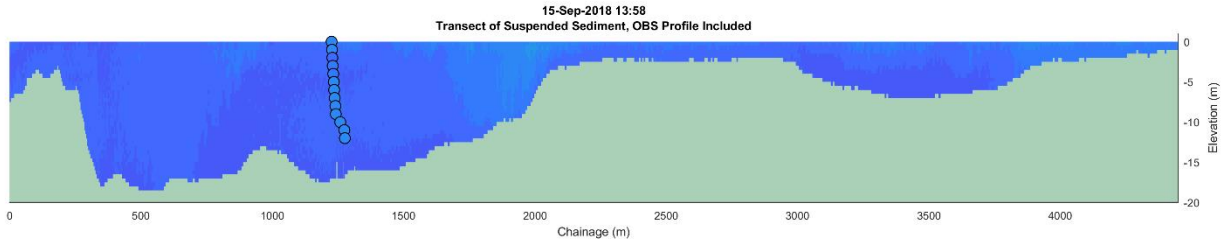
Transect A - Gatcombe Heads to Lilly's Beach – Average Tide

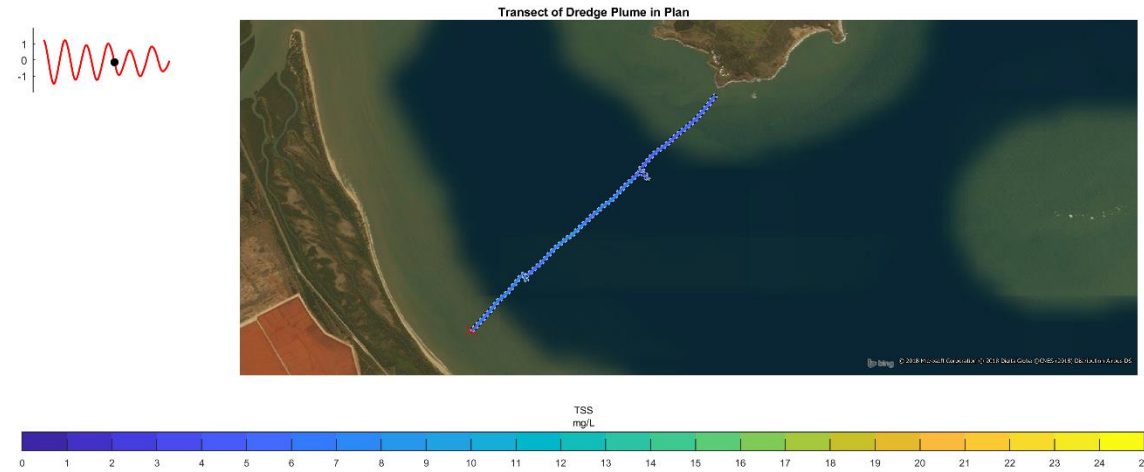
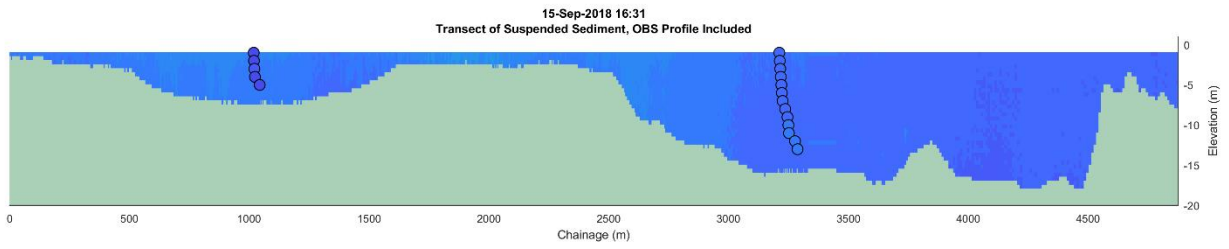
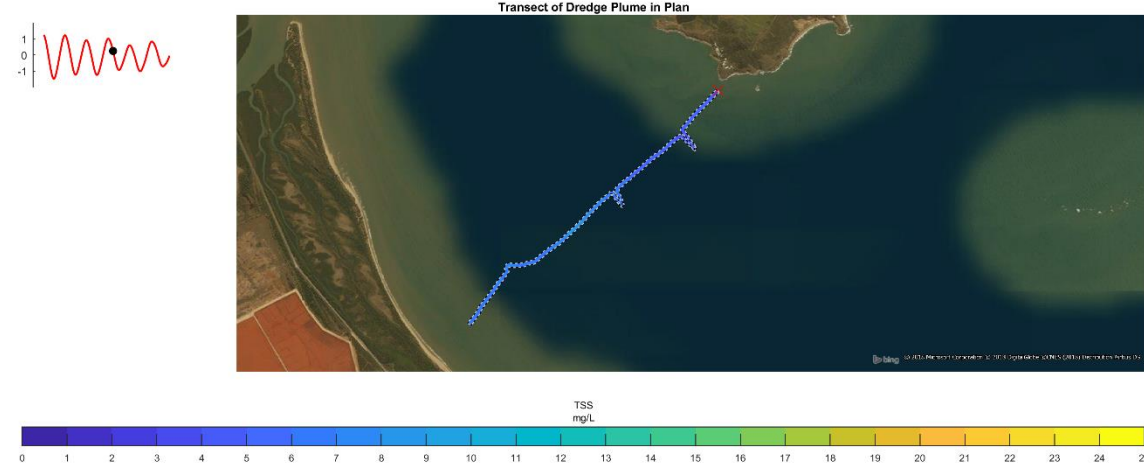
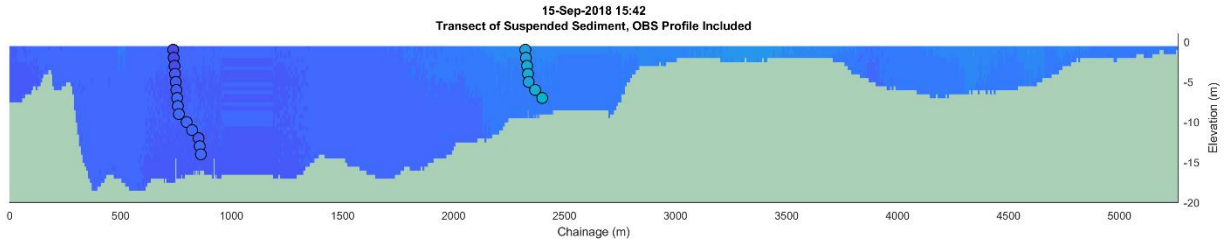


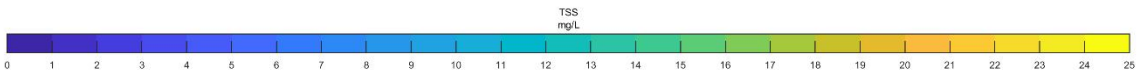
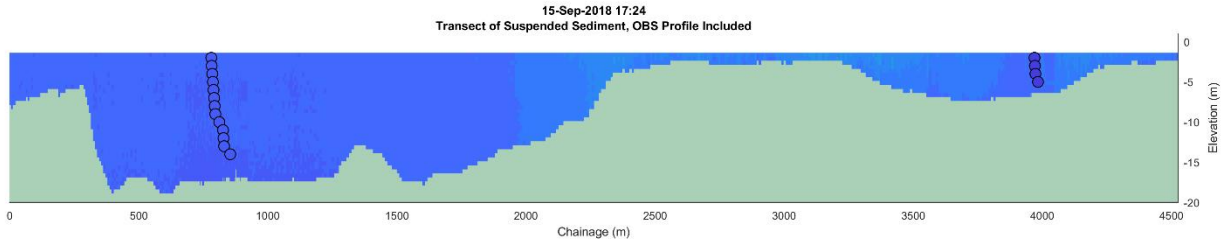






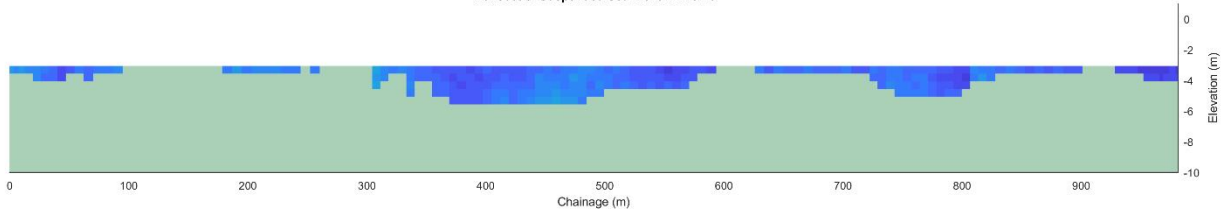




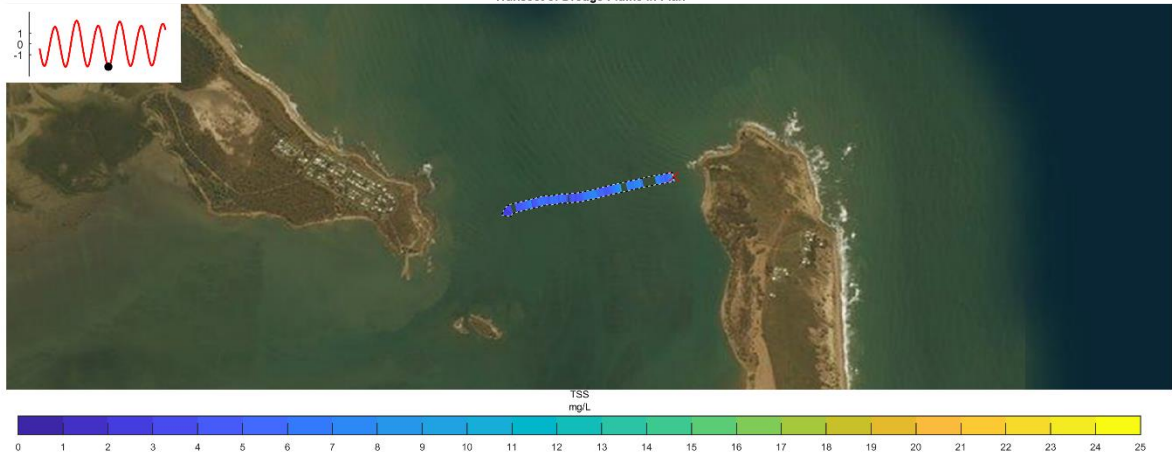


Transect B - South End on Curtis island to North Point on Facing Island – Spring Tide

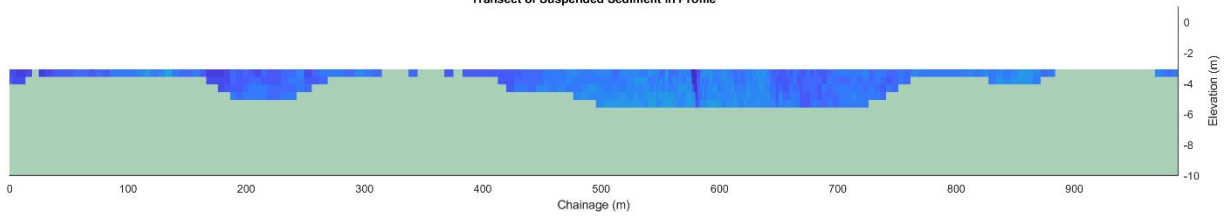
10-Sep-2018 15:18
Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



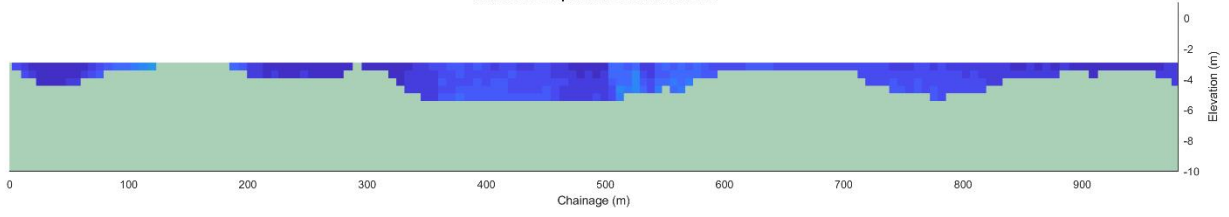
10-Sep-2018 15:29
Transect of Suspended Sediment in Profile



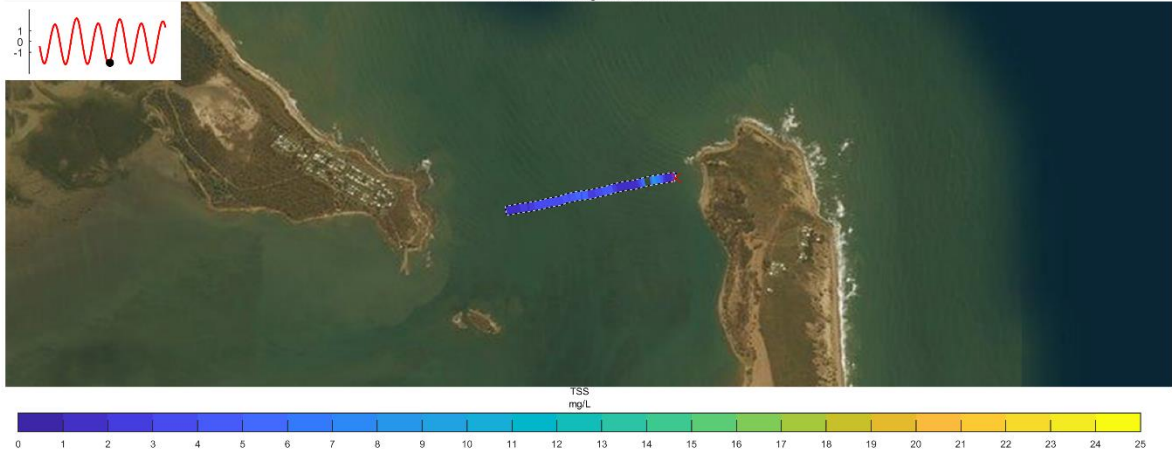
Transect of Dredge Plume in Plan



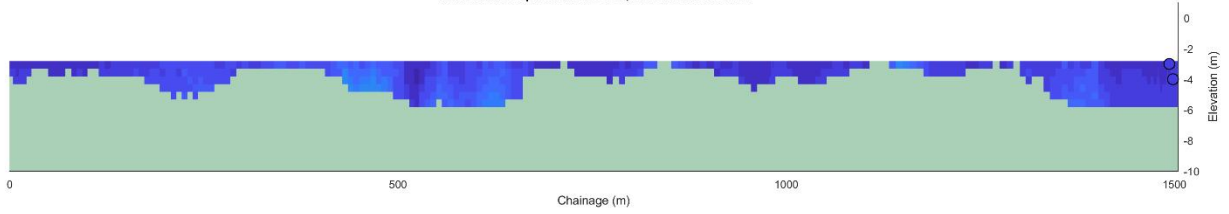
10-Sep-2018 16:11
Transect of Suspended Sediment in Profile



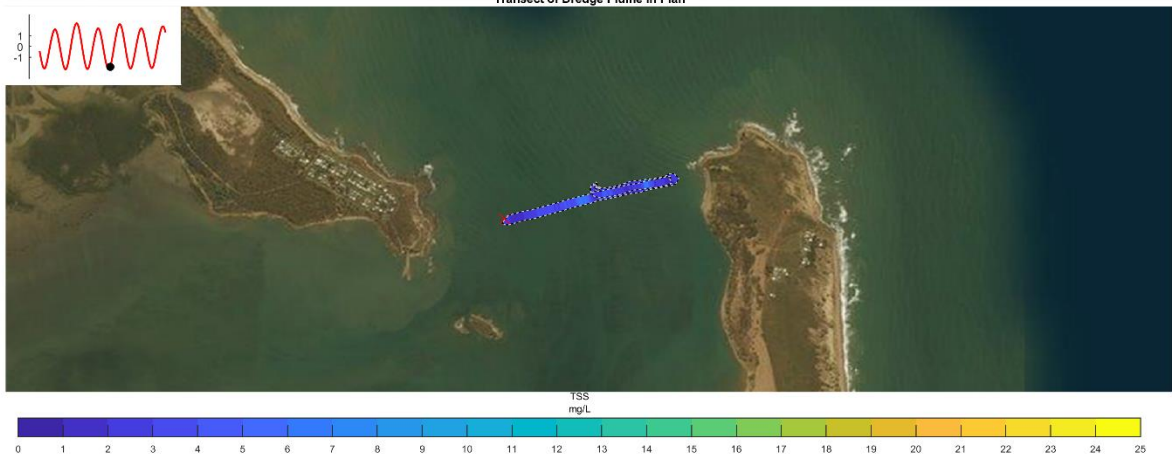
Transect of Dredge Plume in Plan



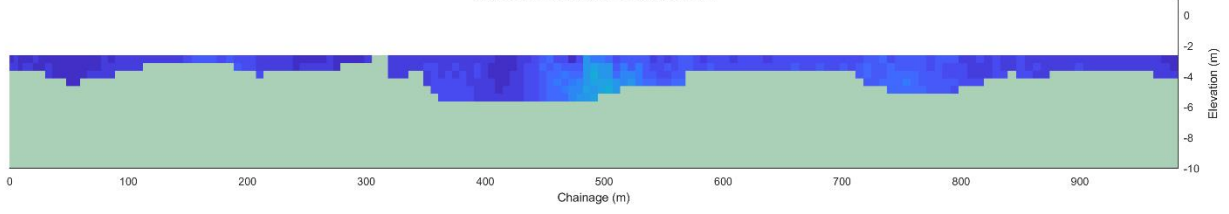
10-Sep-2018 16:23
Transect of Suspended Sediment, OBS Profile Included



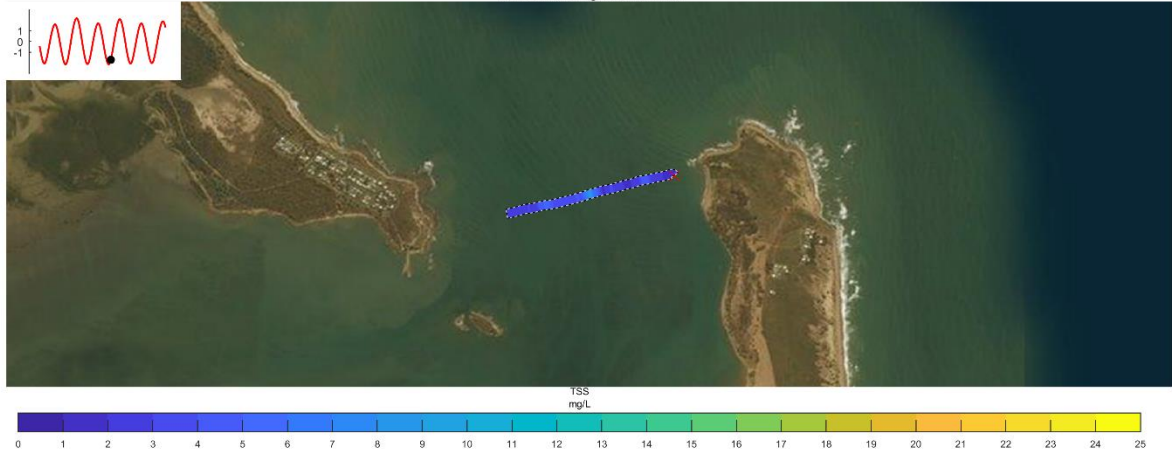
Transect of Dredge Plume in Plan



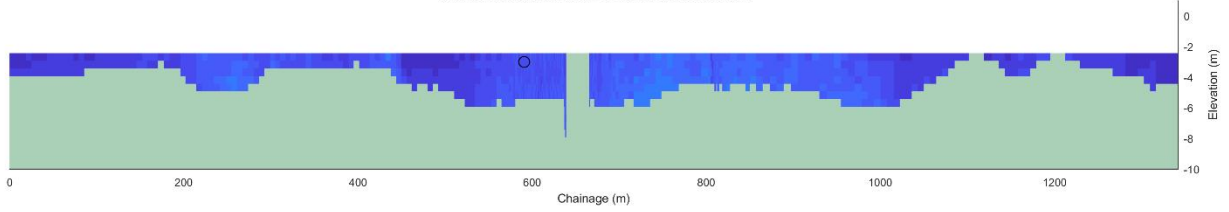
10-Sep-2018 16:42
Transect of Suspended Sediment in Profile



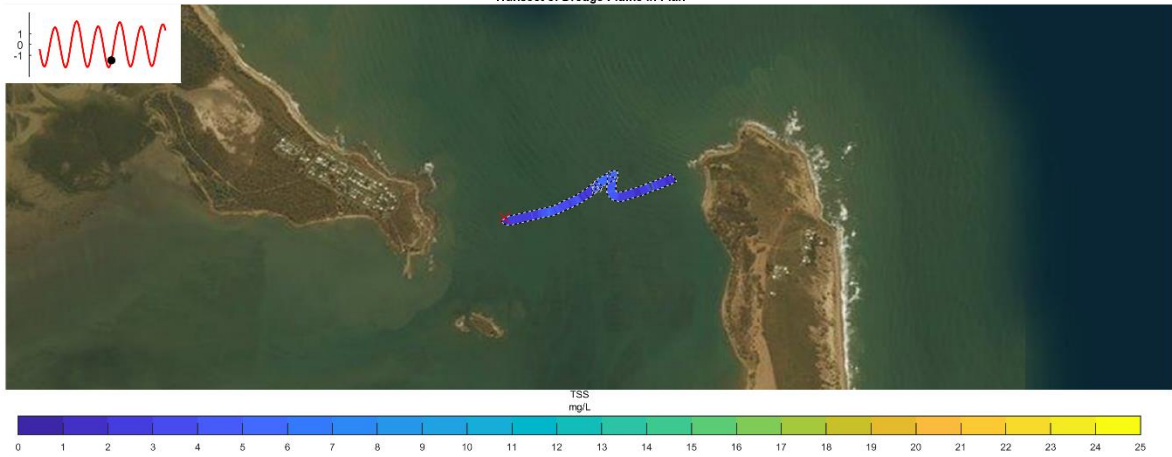
Transect of Dredge Plume in Plan



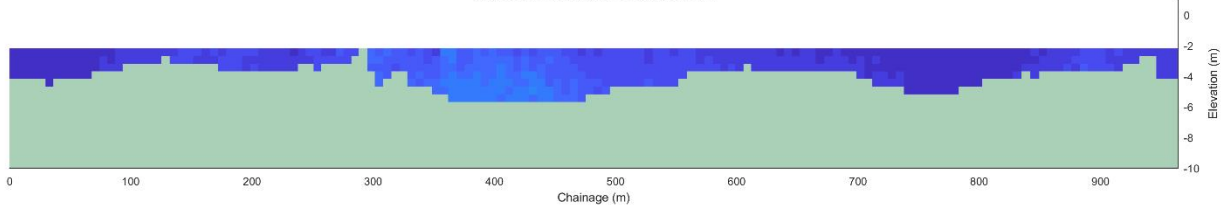
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Transect of Suspended Sediment, OBS Profile Included



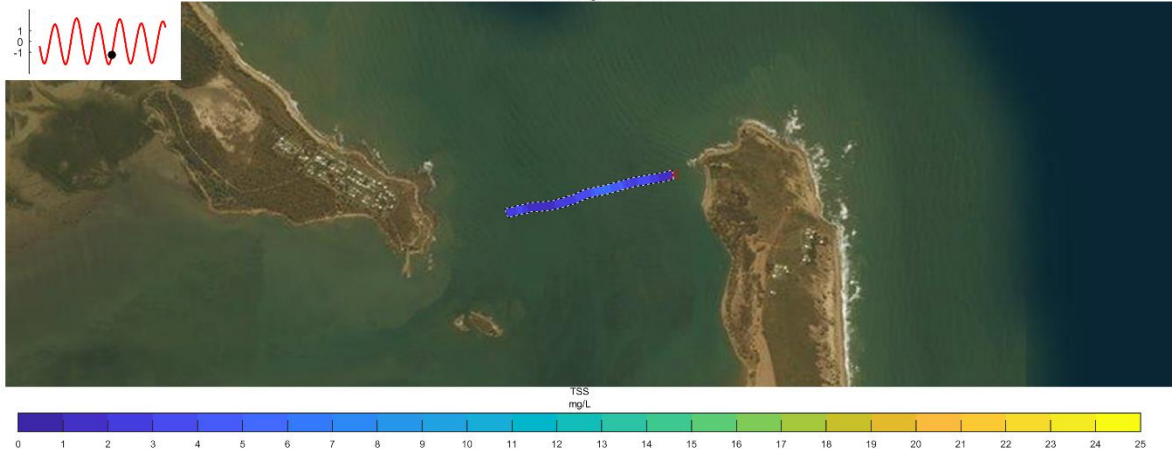
Transect of Dredge Plume in Plan



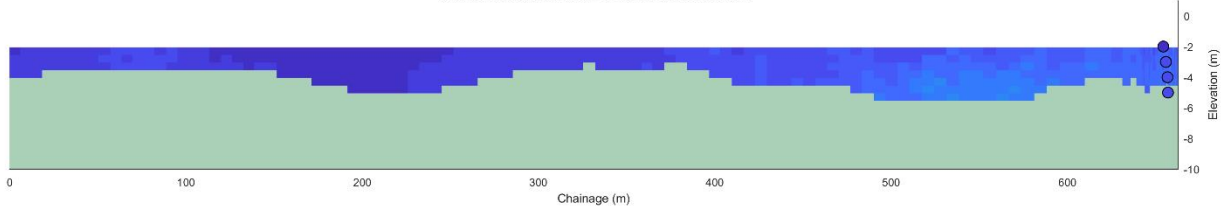
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Transect of Suspended Sediment in Profile



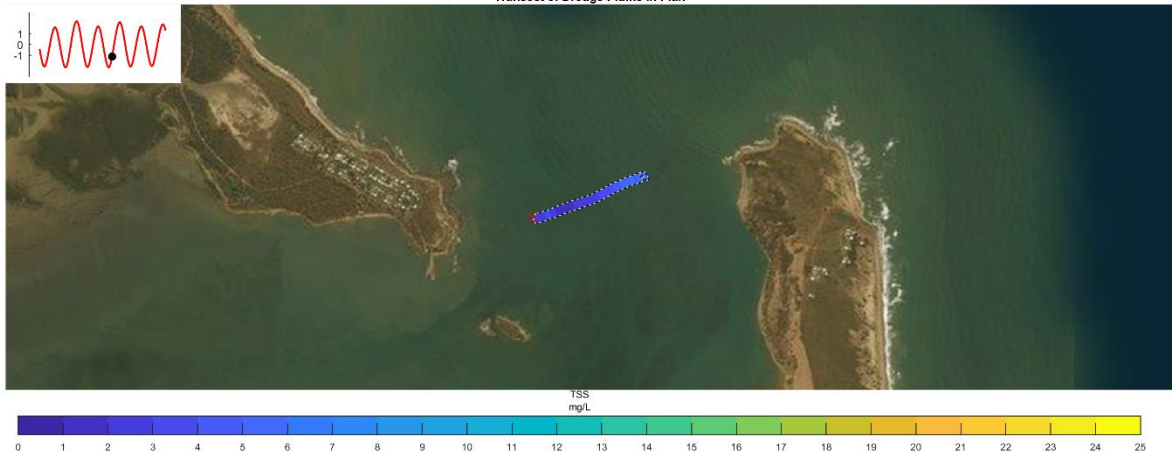
Transect of Dredge Plume in Plan



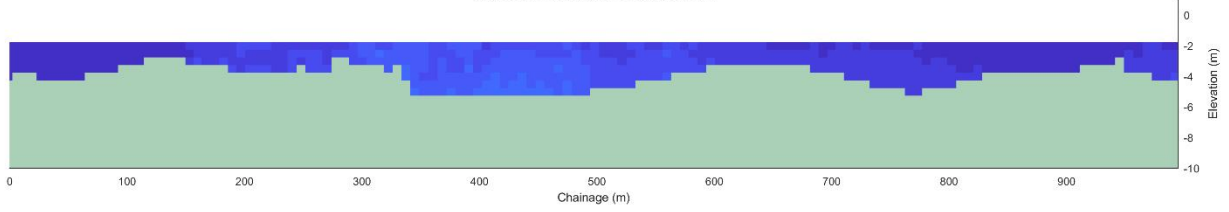
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Transect of Suspended Sediment, OBS Profile Included



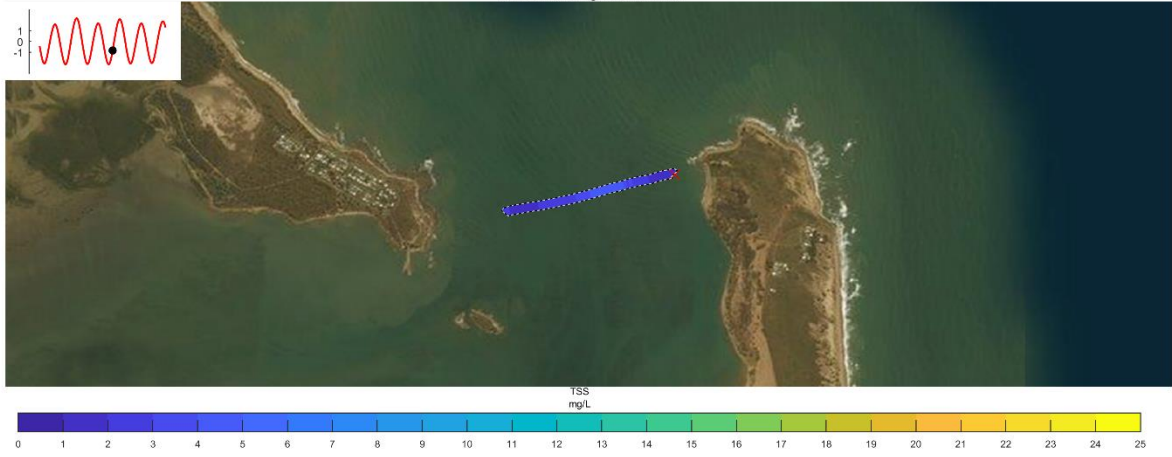
Transect of Dredge Plume in Plan



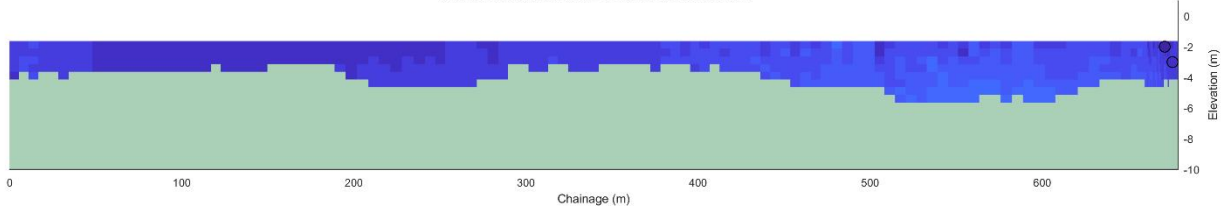
10-Sep-2018 17:44
Transect of Suspended Sediment in Profile



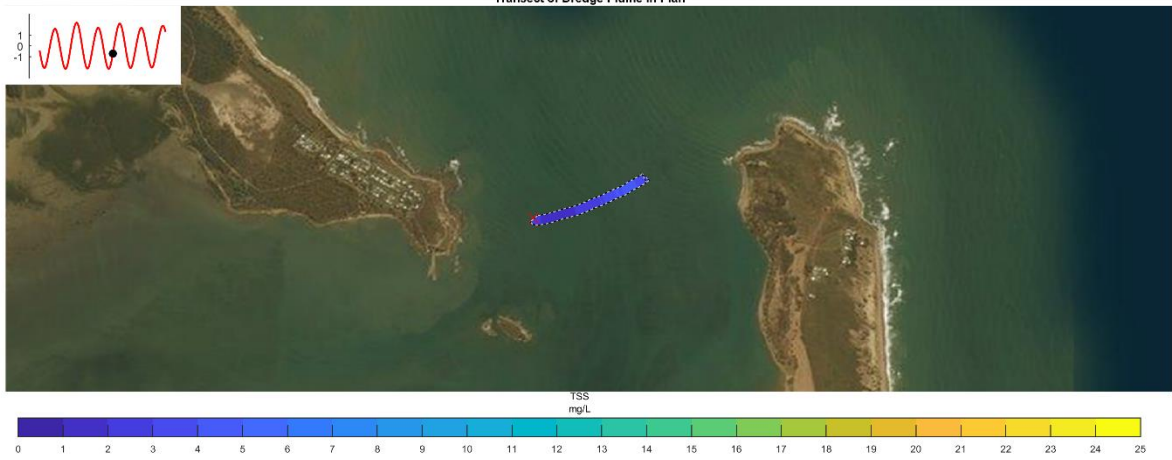
Transect of Dredge Plume in Plan



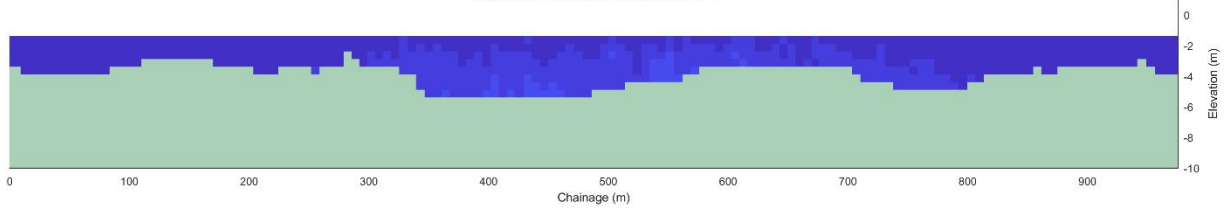
10-Sep-2018 17:52
Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



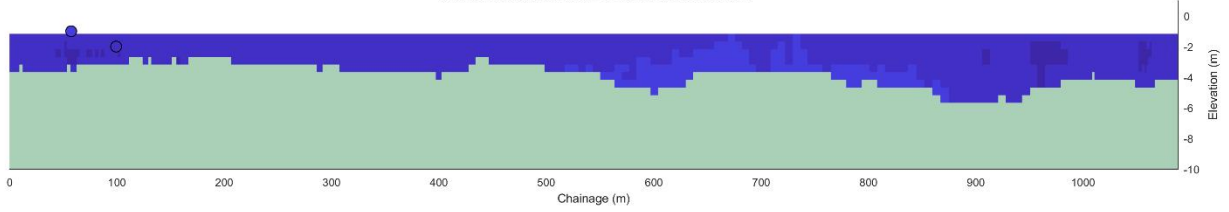
10-Sep-2018 18:08
Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



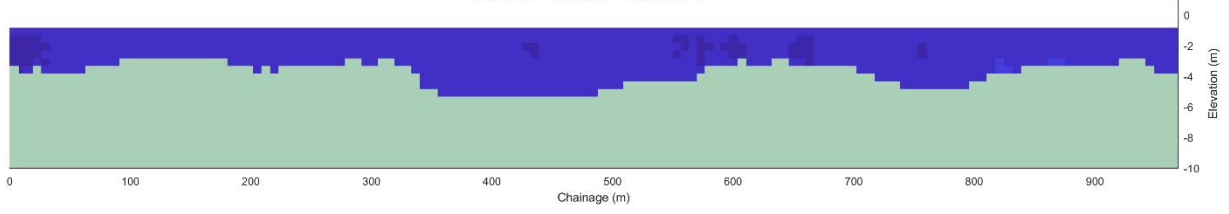
10-Sep-2018 18:20
Transect of Suspended Sediment, OBS Profile Included



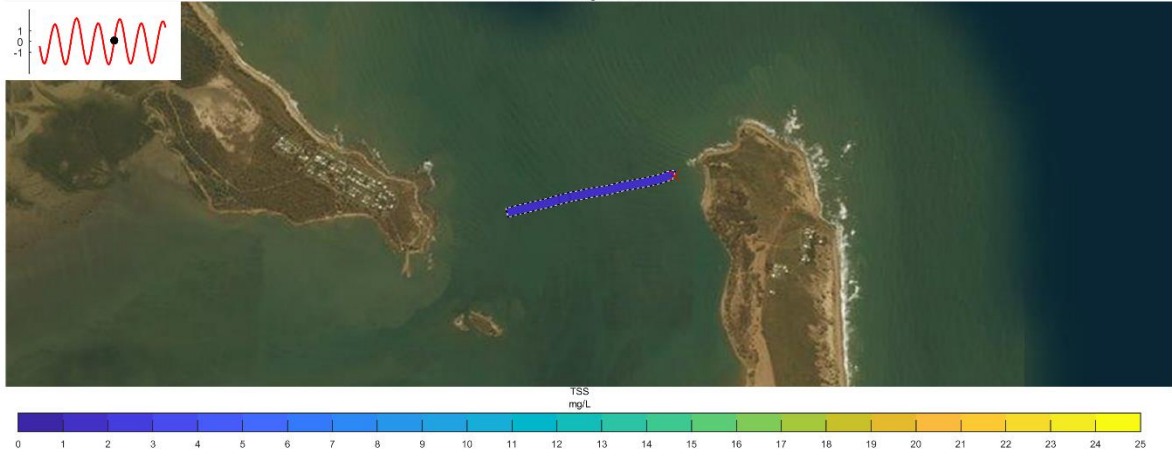
Transect of Dredge Plume in Plan



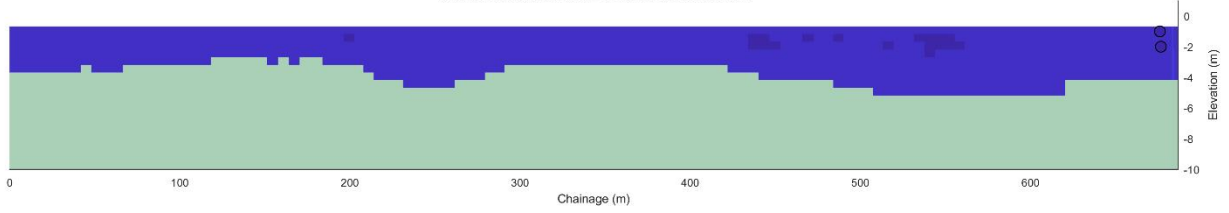
10-Sep-2018 18:41
Transect of Suspended Sediment in Profile



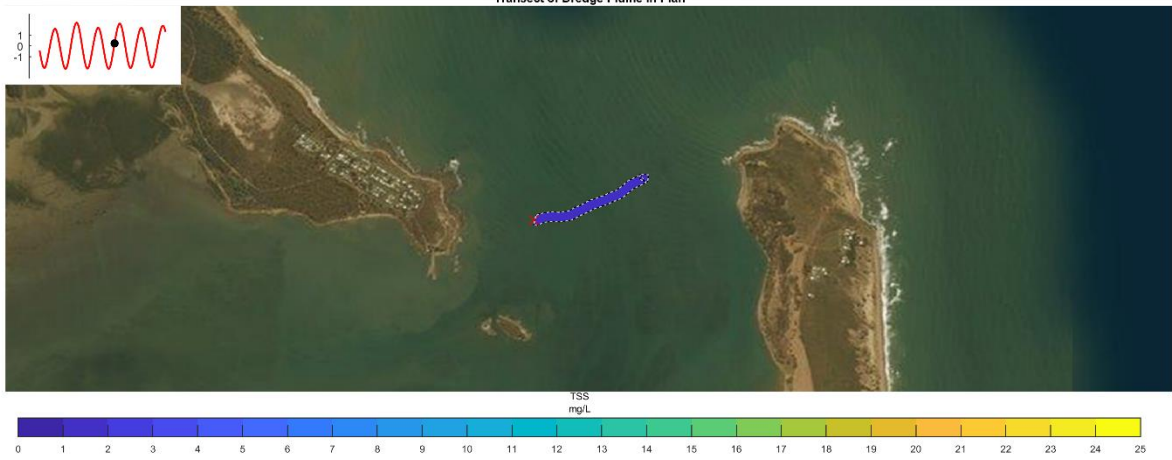
Transect of Dredge Plume in Plan



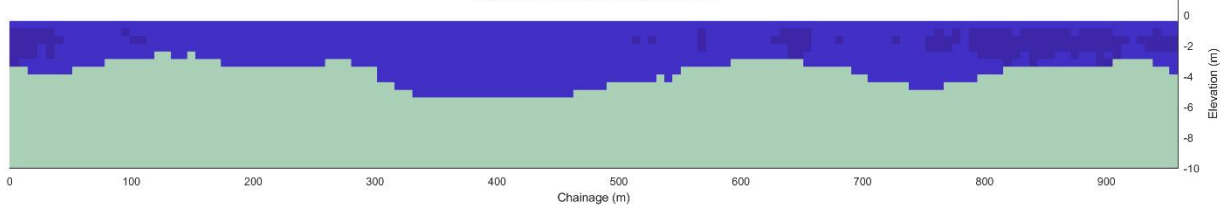
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Transect of Suspended Sediment, OBS Profile Included



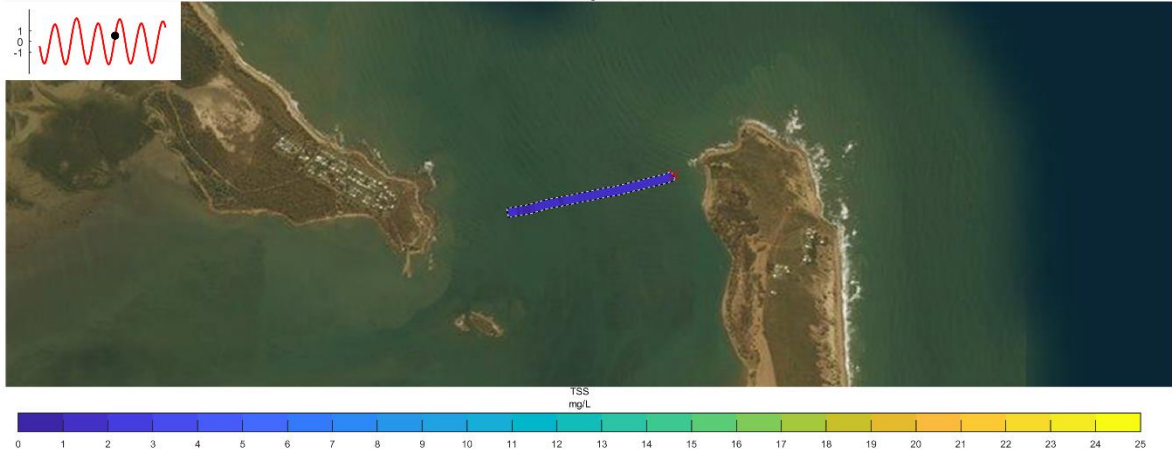
Transect of Dredge Plume in Plan



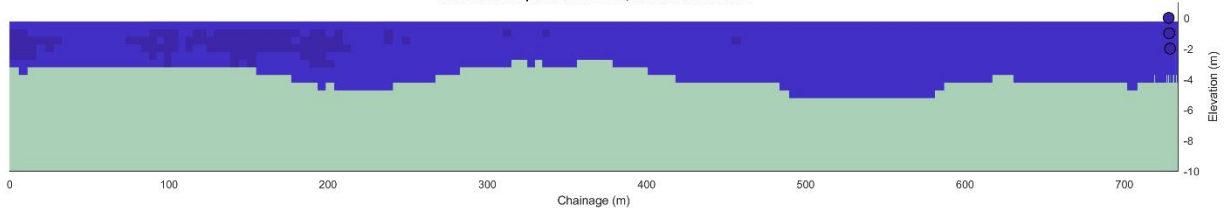
10-Sep-2018 19:09
Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan

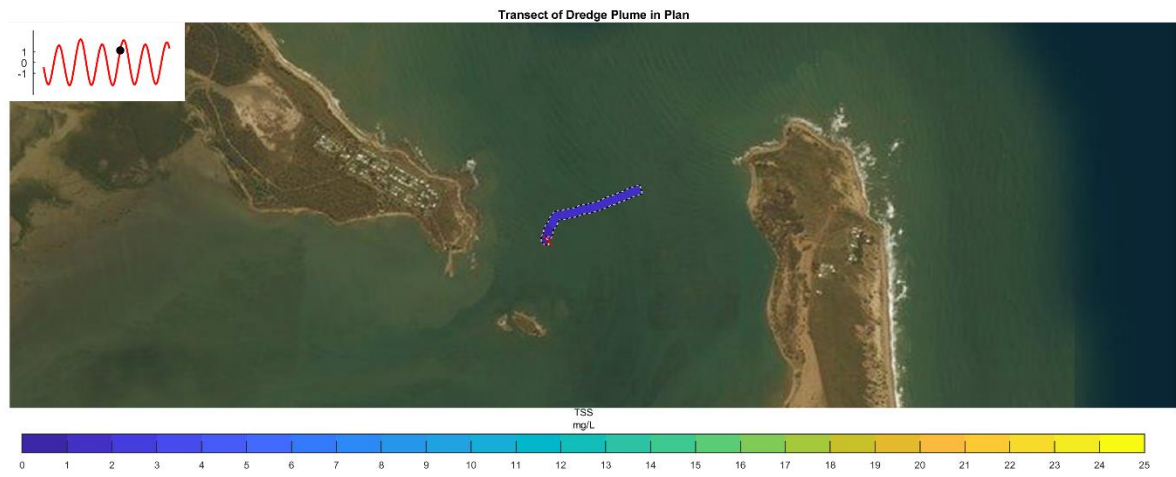
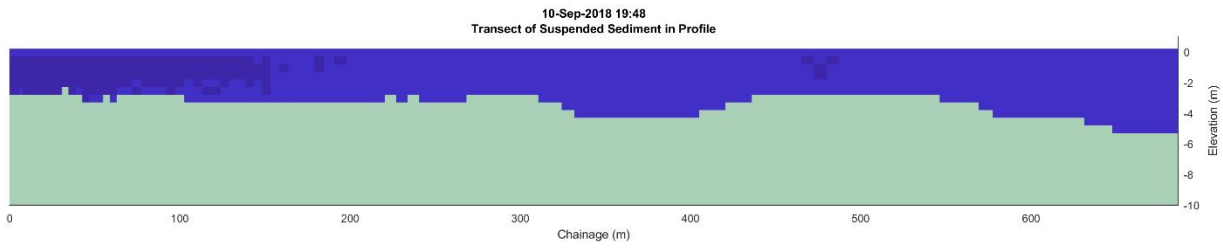
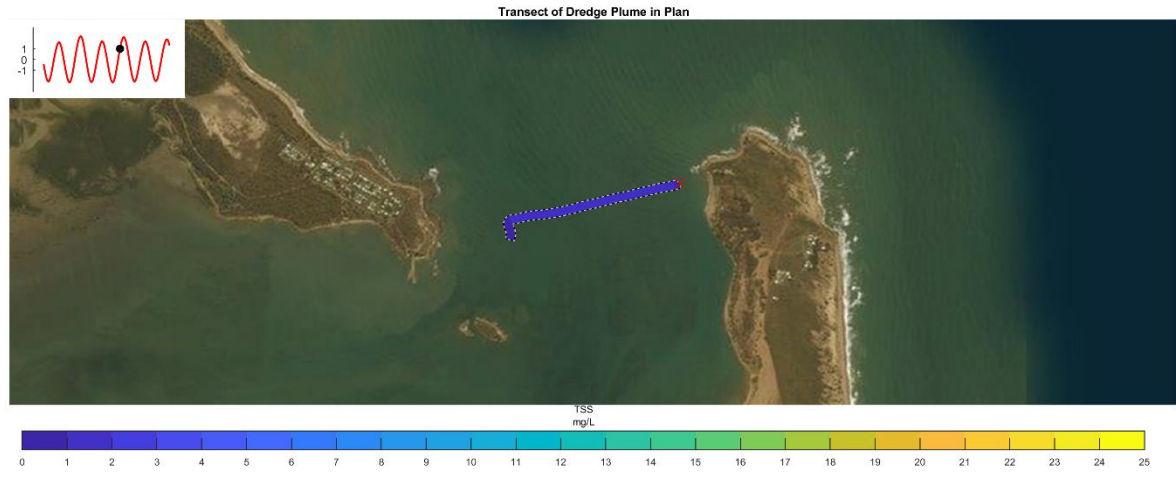
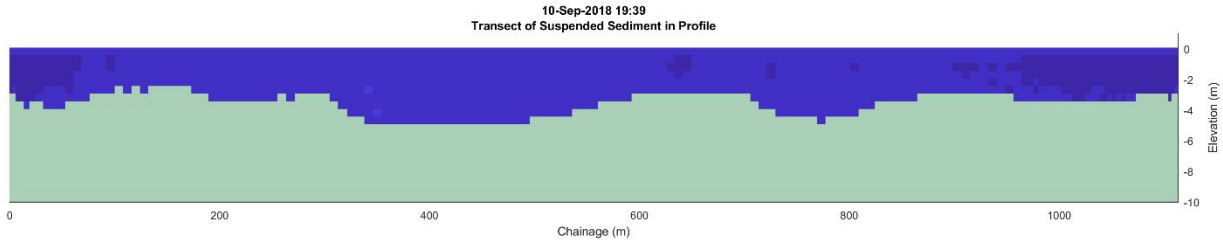


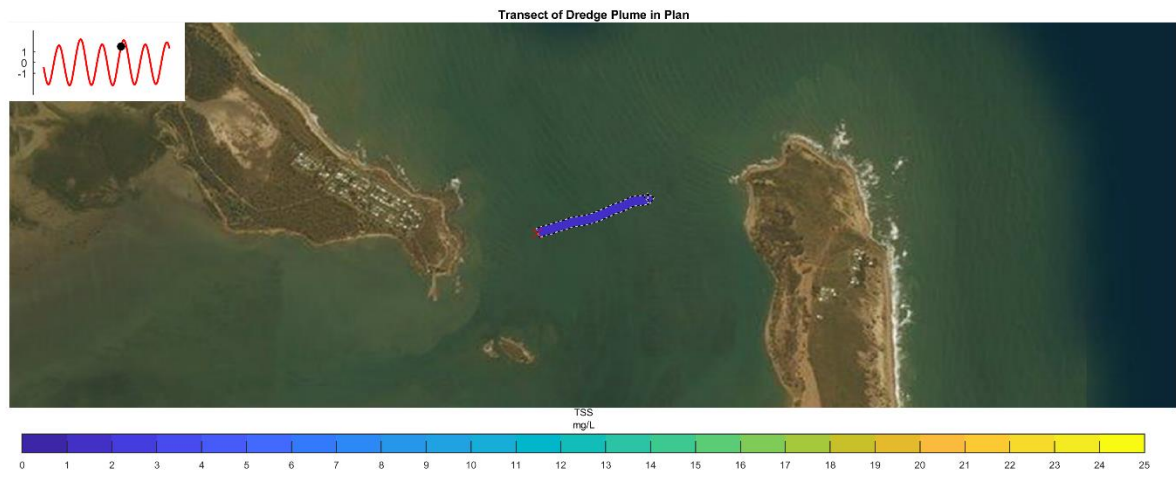
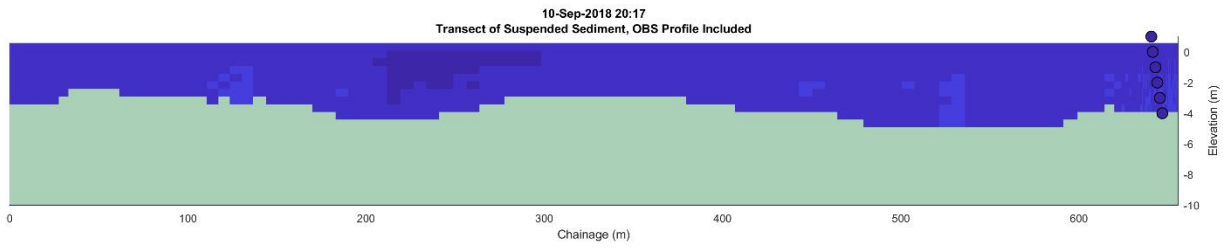
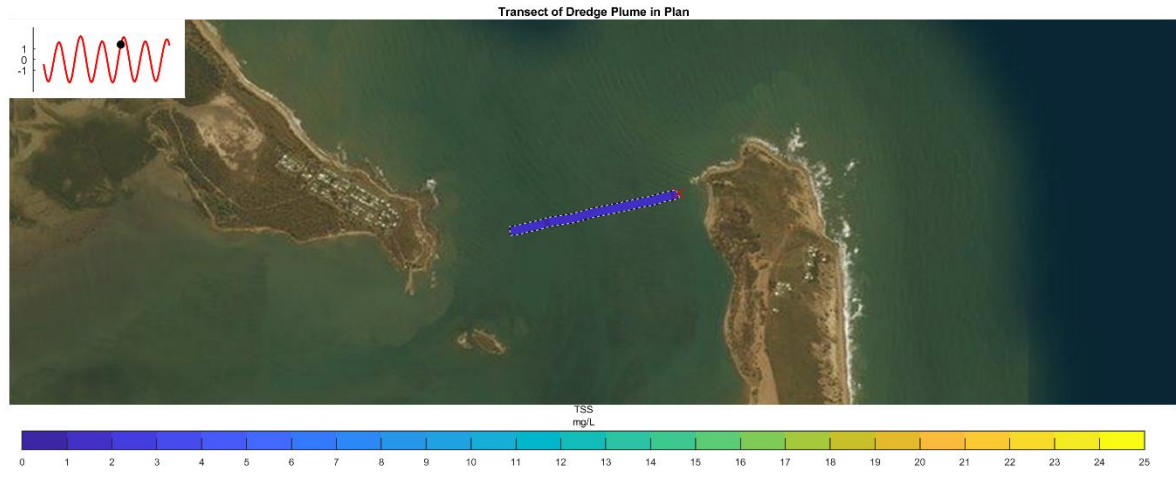
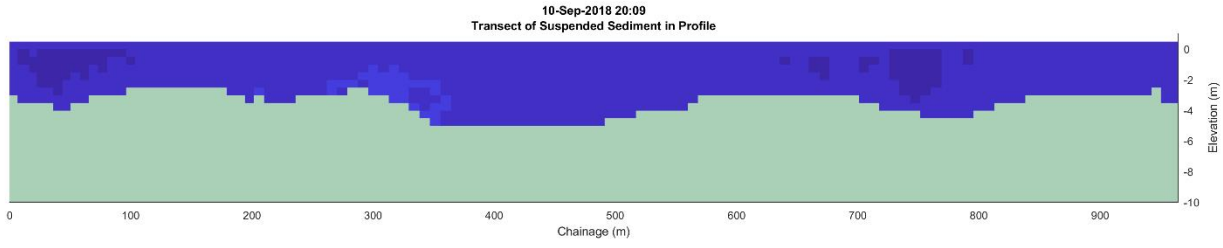
10-Sep-2018 19:18
Transect of Suspended Sediment, OBS Profile Included

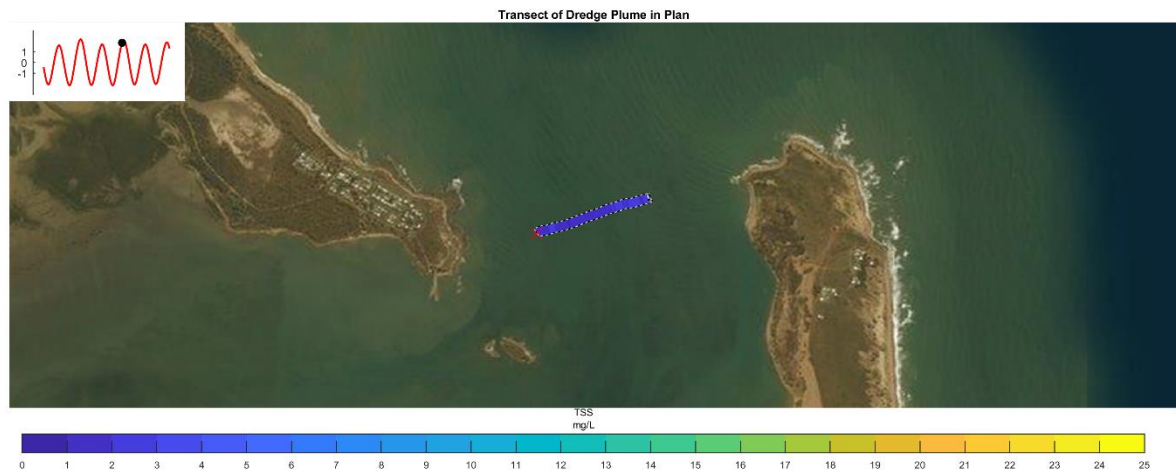
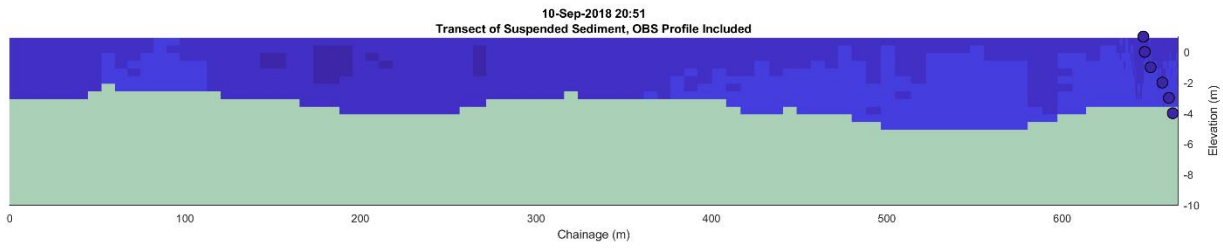
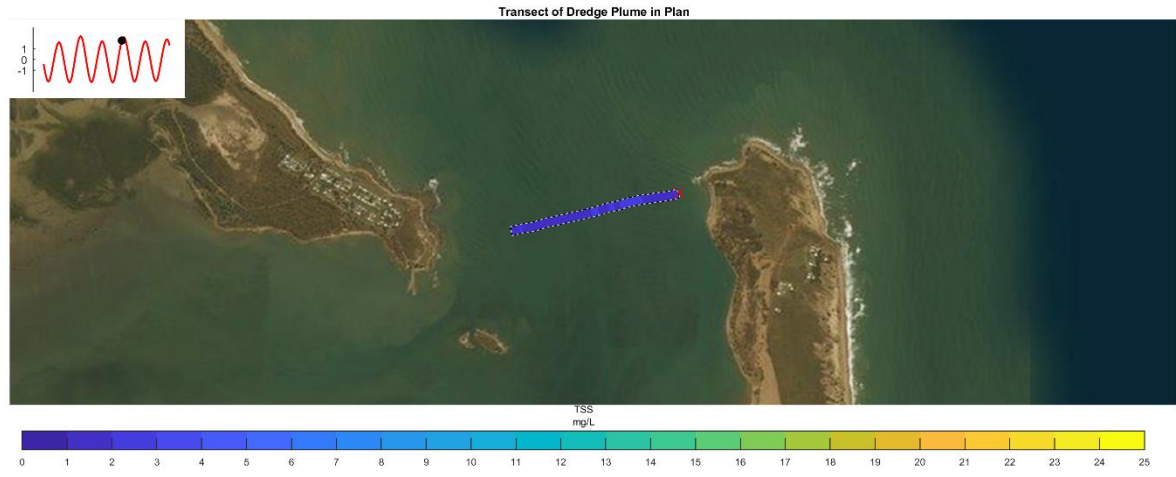
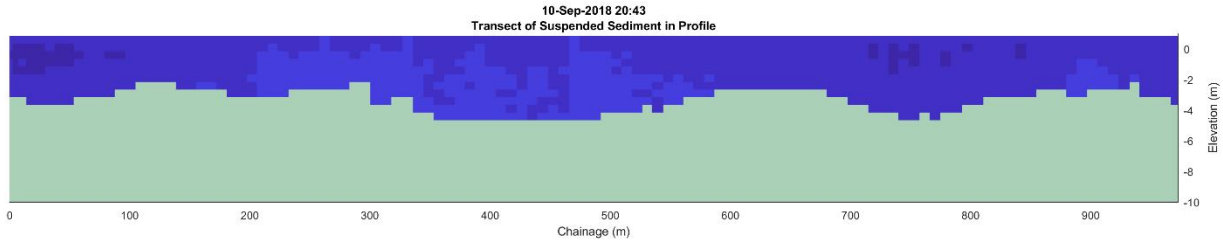


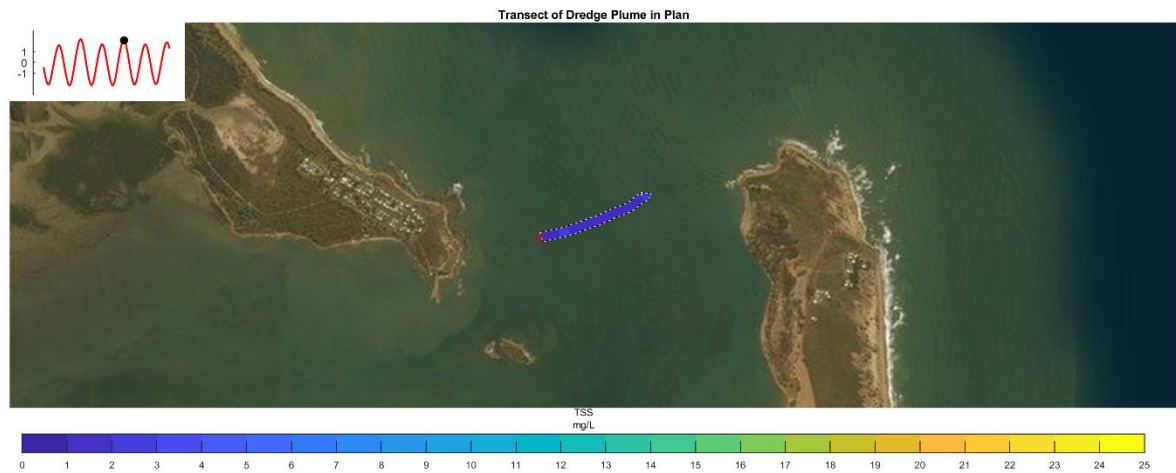
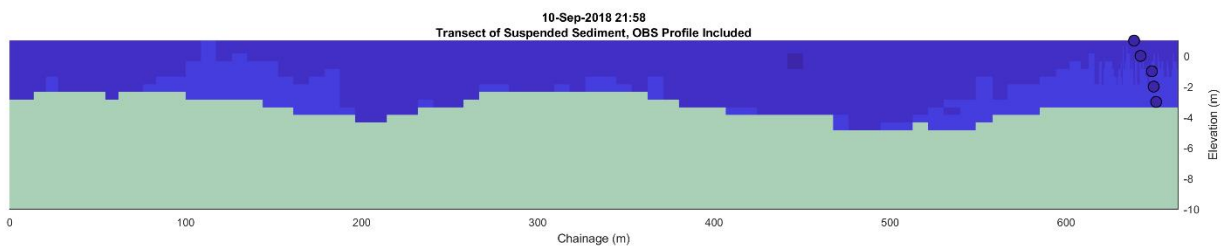
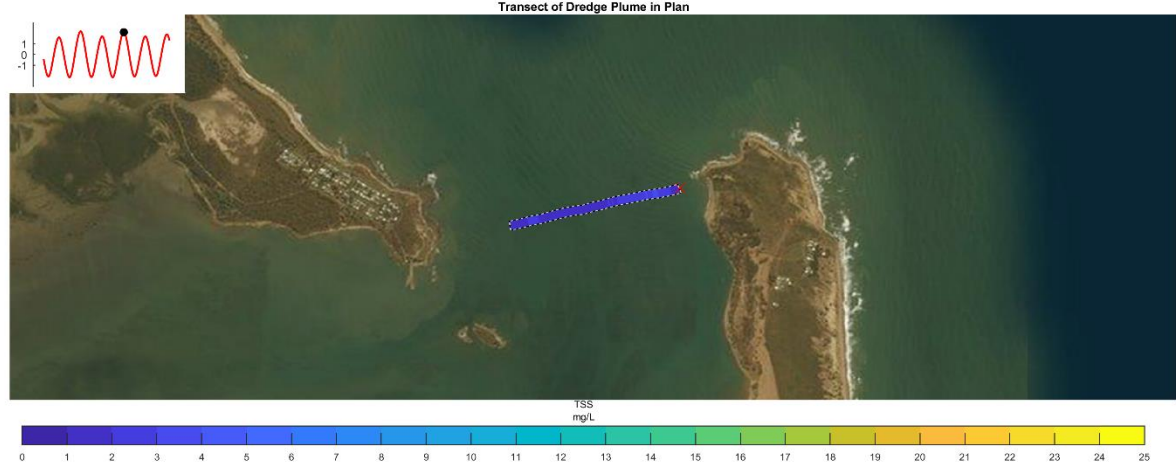
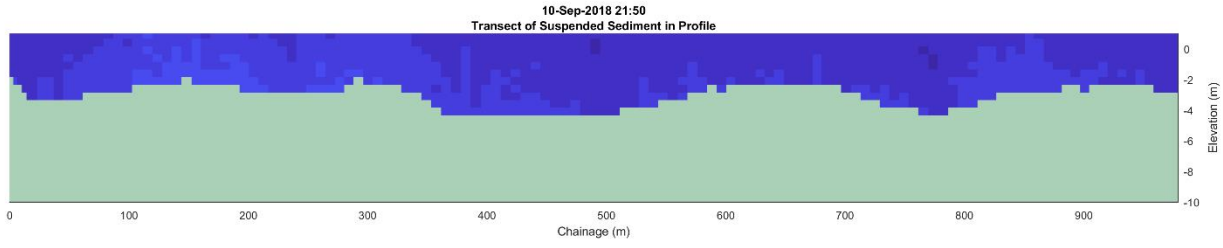
Transect of Dredge Plume in Plan

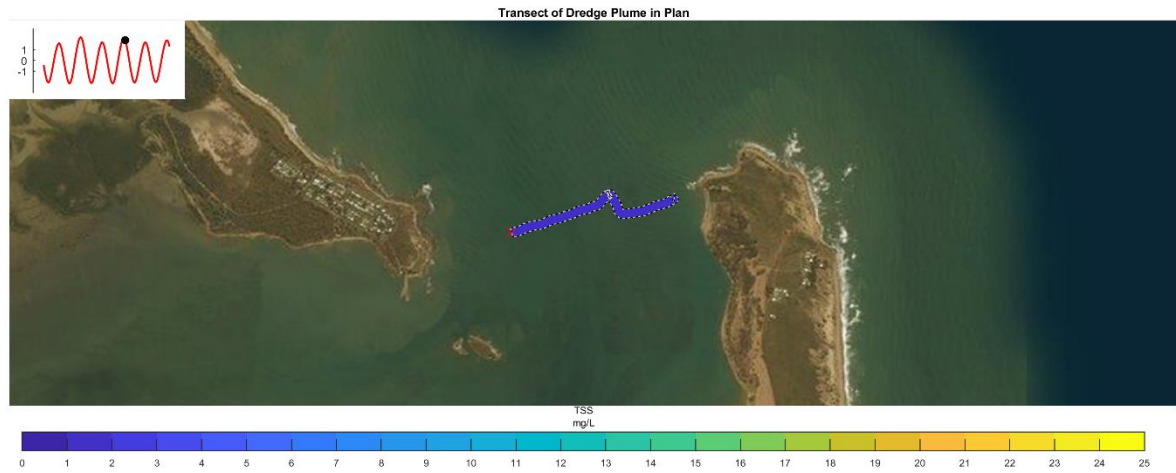
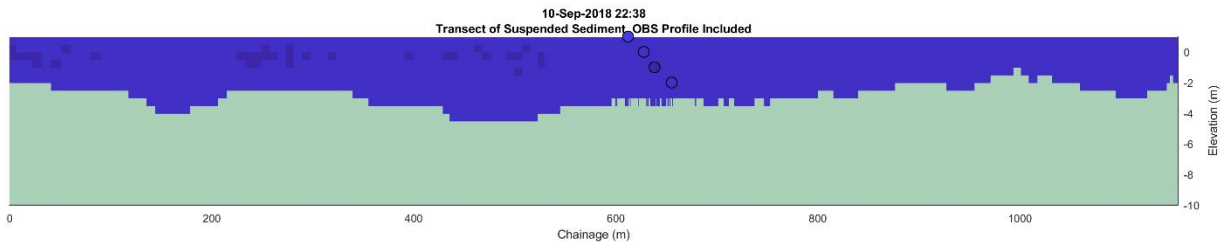
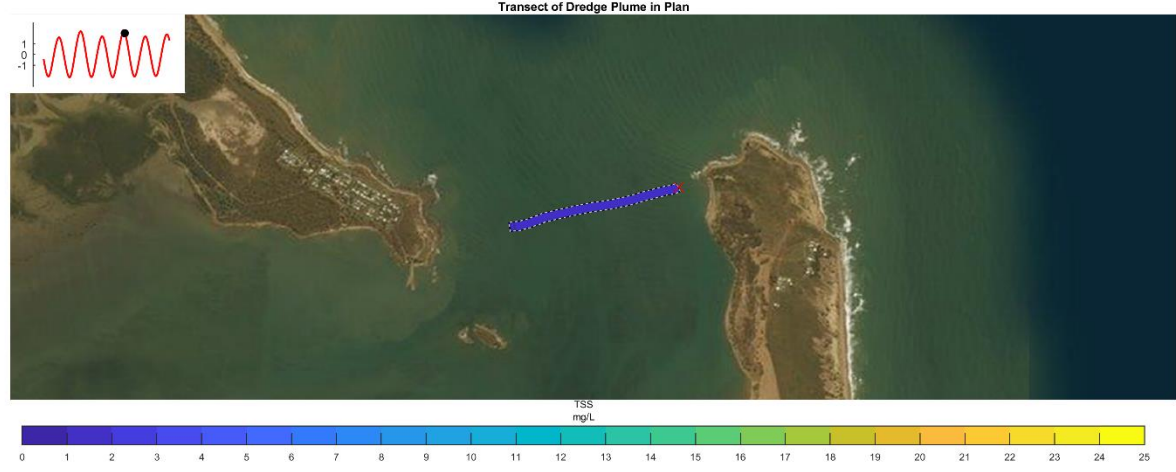
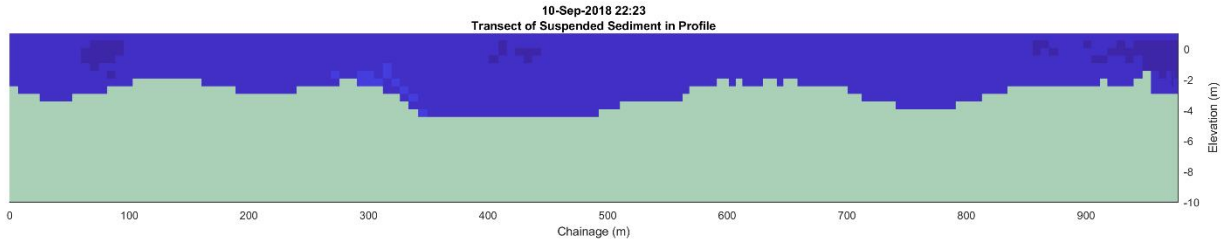


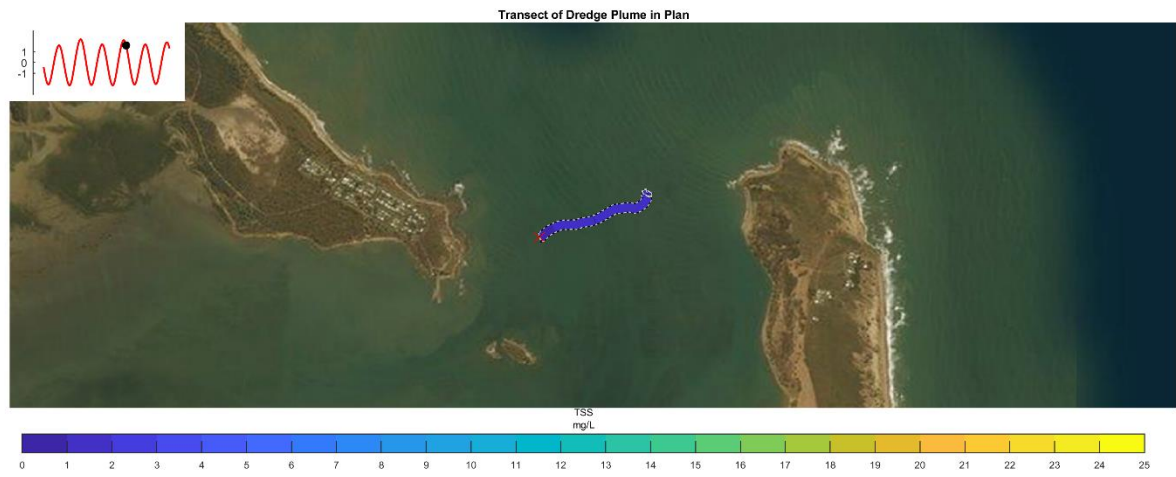
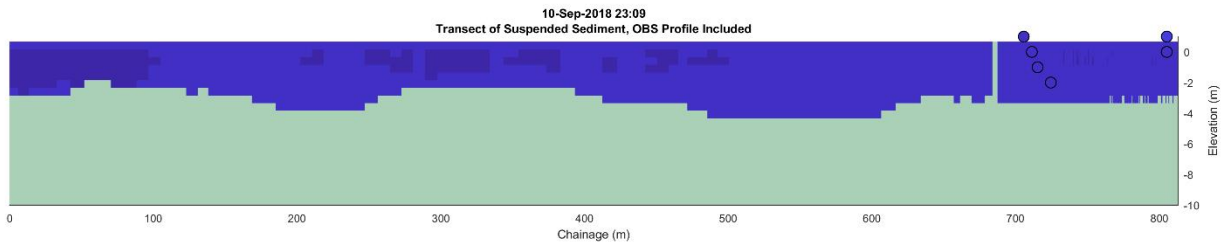
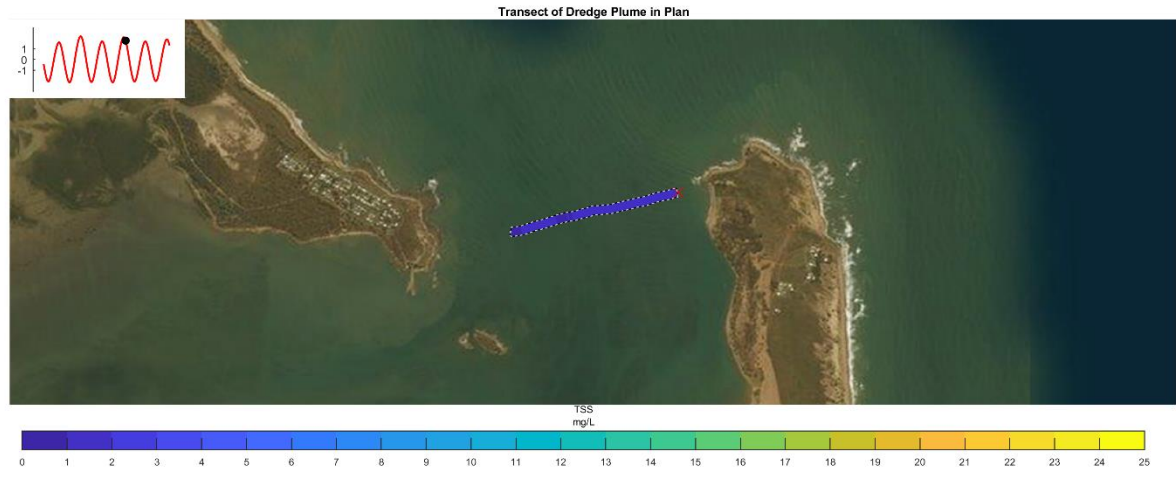
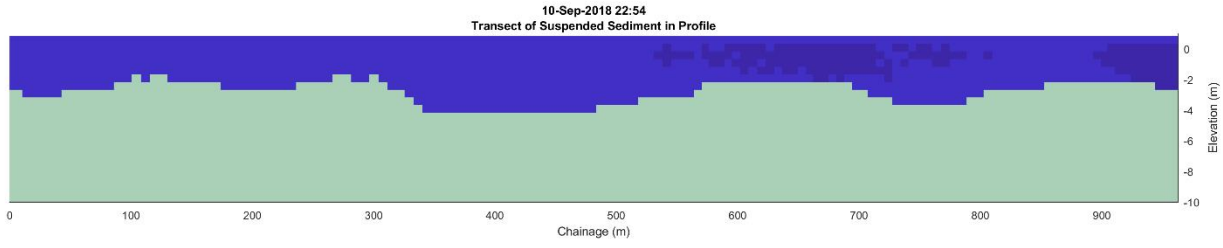


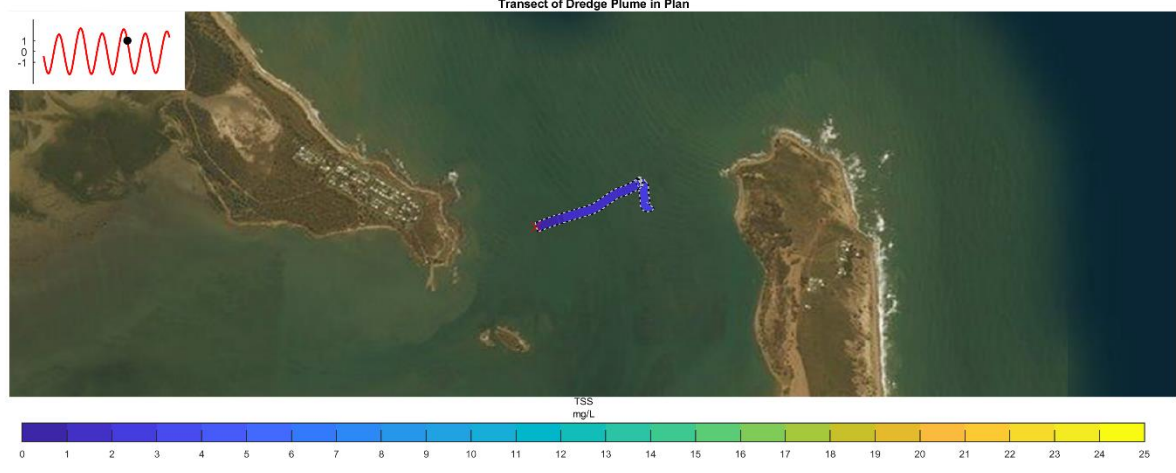
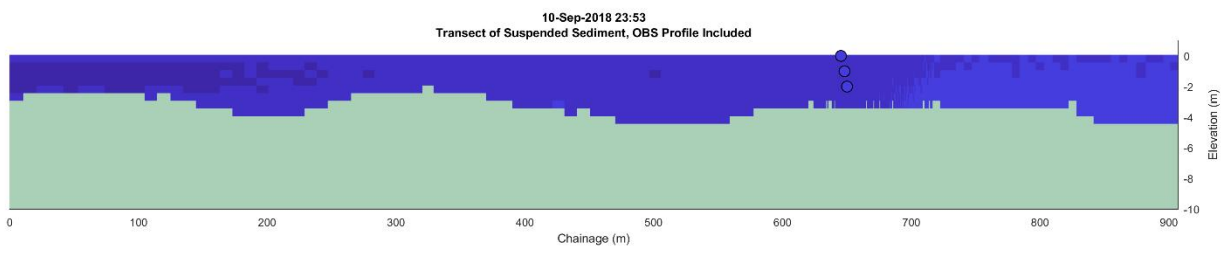
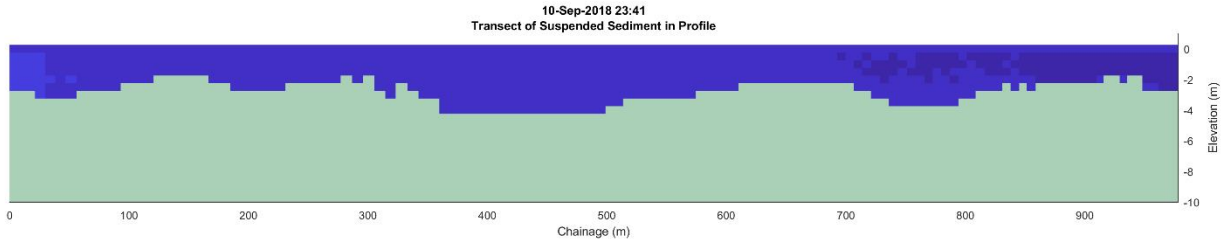




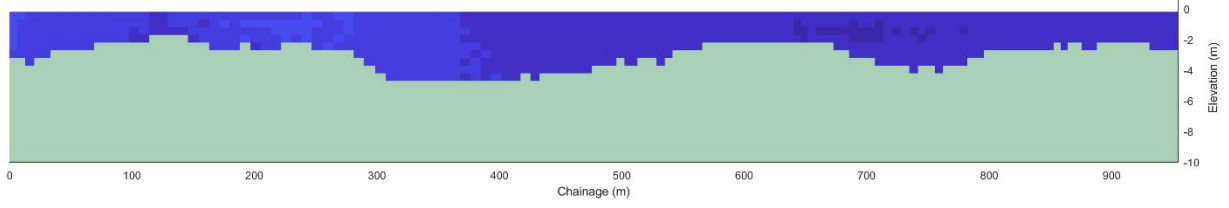




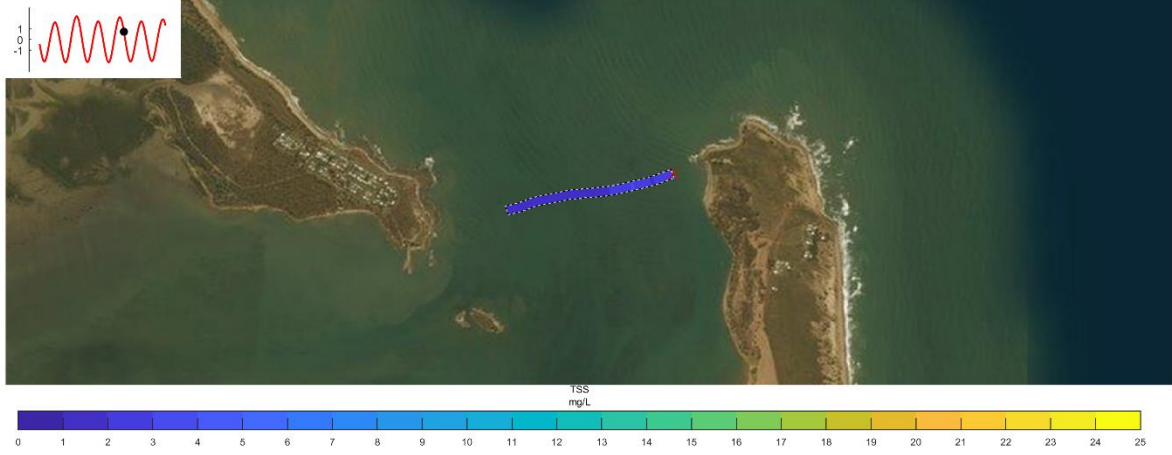




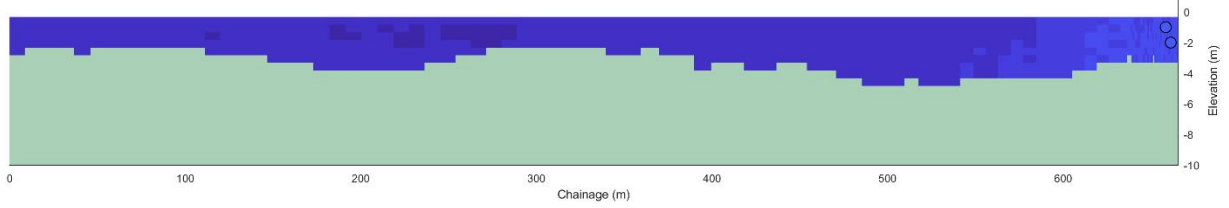
11-Sep-2018 00:11
Transect of Suspended Sediment in Profile



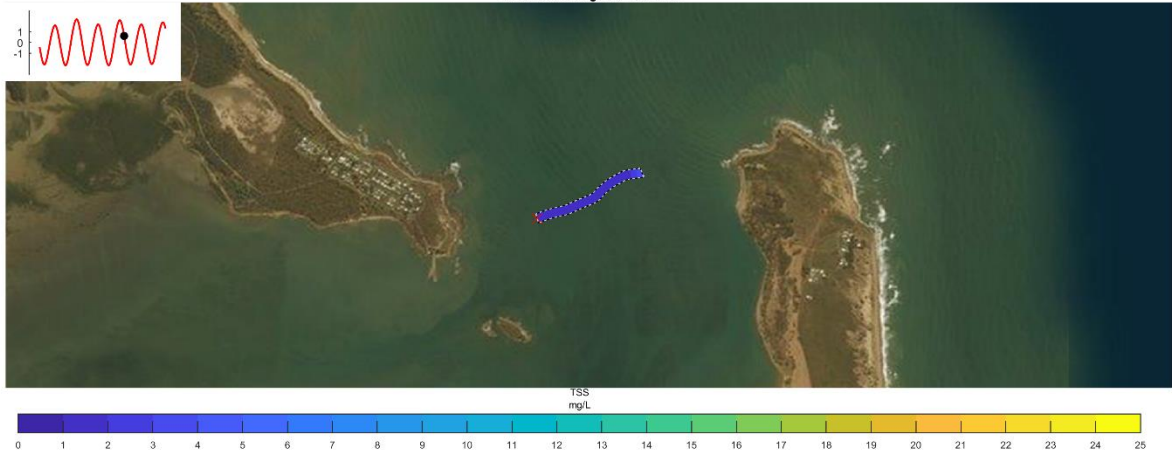
Transect of Dredge Plume in Plan

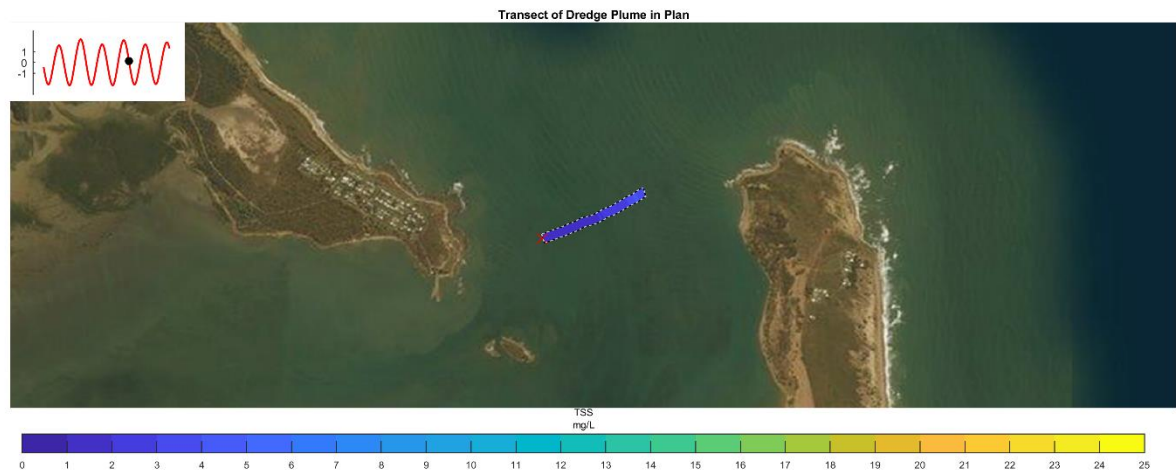
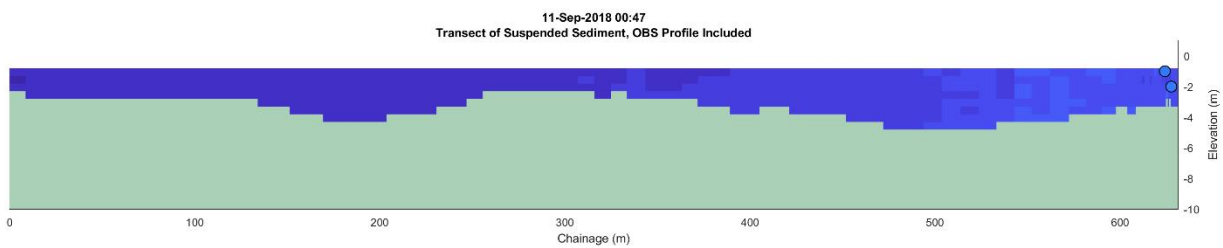
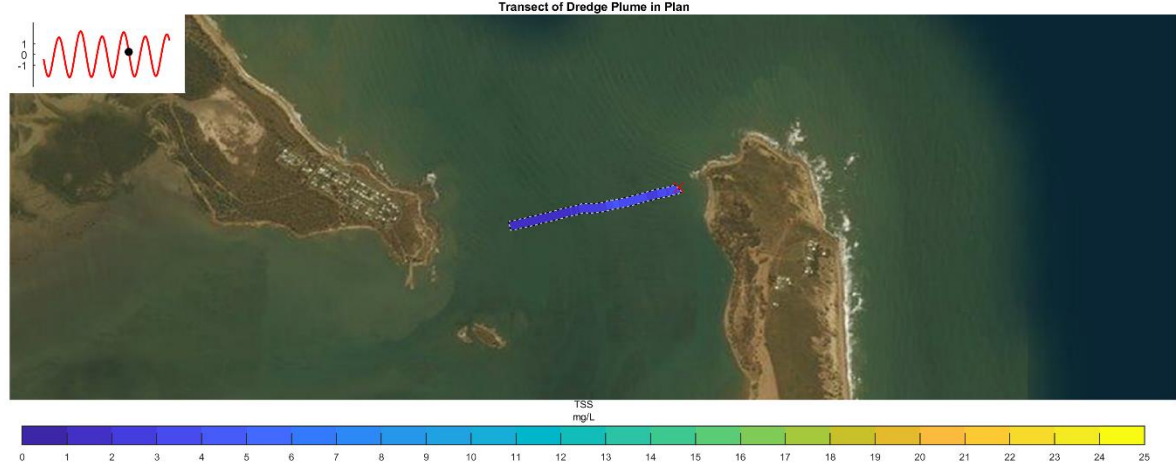
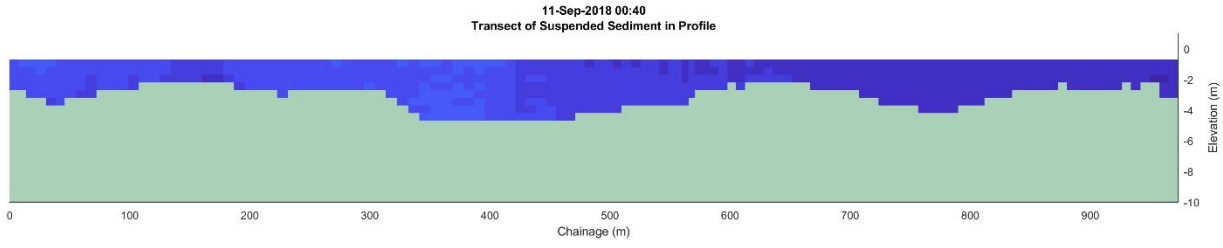


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Transect of Suspended Sediment, OBS Profile Included

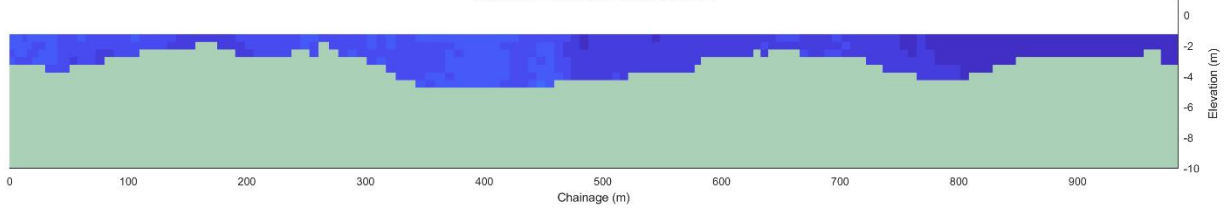


Transect of Dredge Plume in Plan

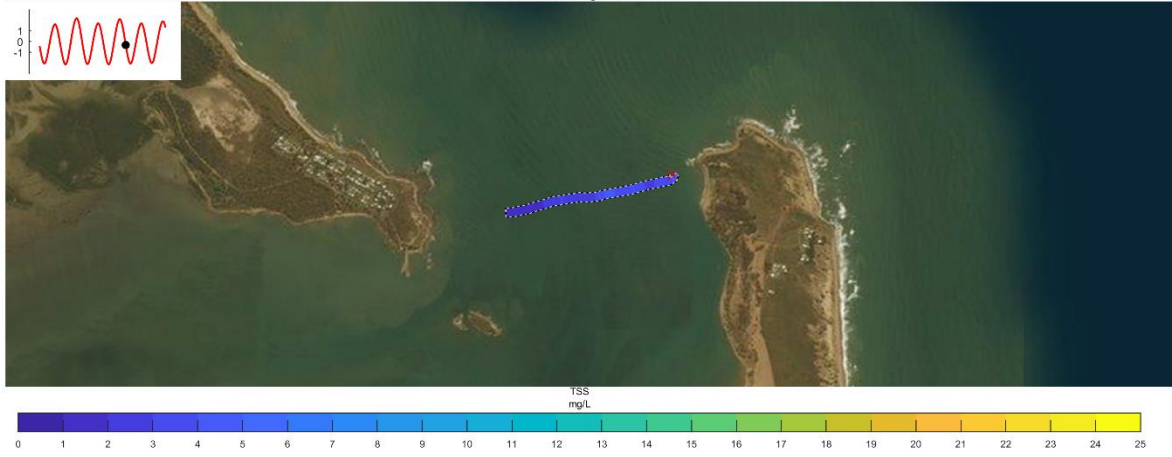




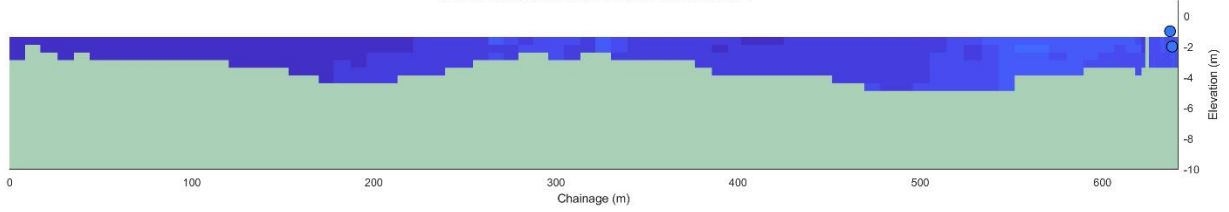
11-Sep-2018 01:14
Transect of Suspended Sediment in Profile



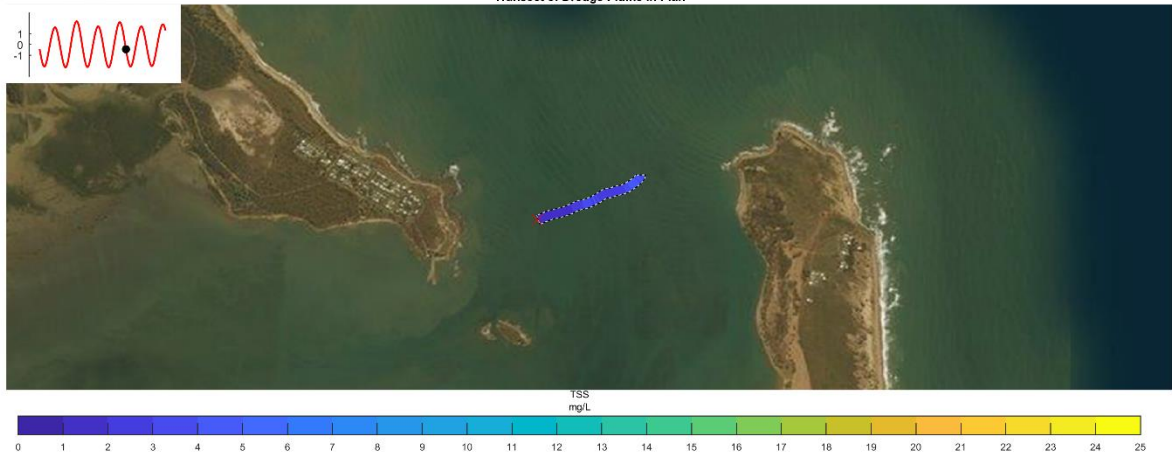
Transect of Dredge Plume in Plan



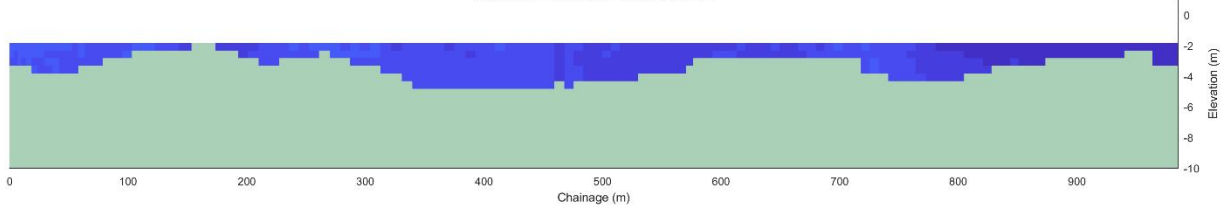
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Transect of Suspended Sediment, OBS Profile Included



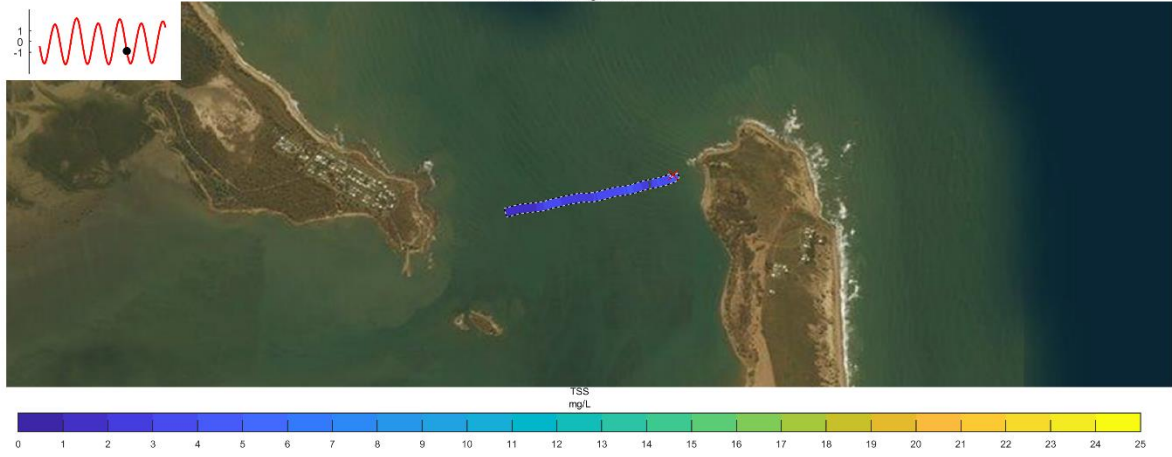
Transect of Dredge Plume in Plan



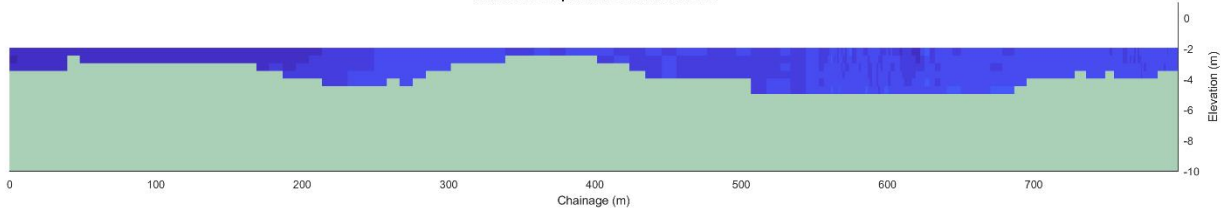
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Transect of Suspended Sediment in Profile



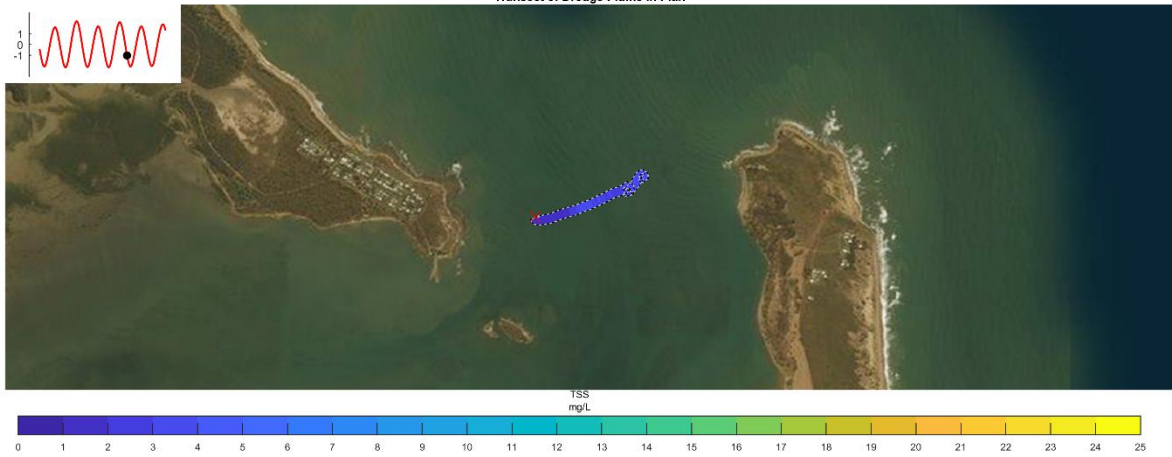
Transect of Dredge Plume in Plan



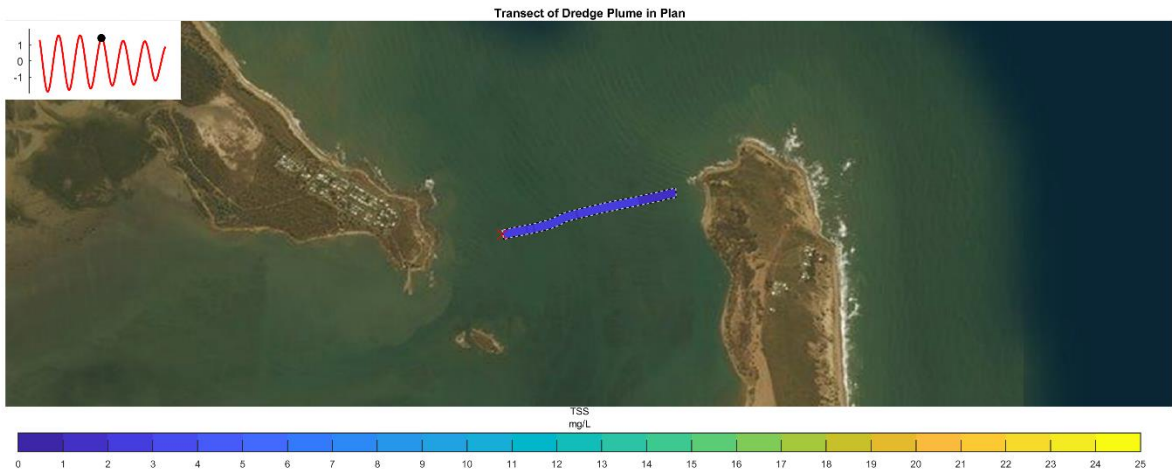
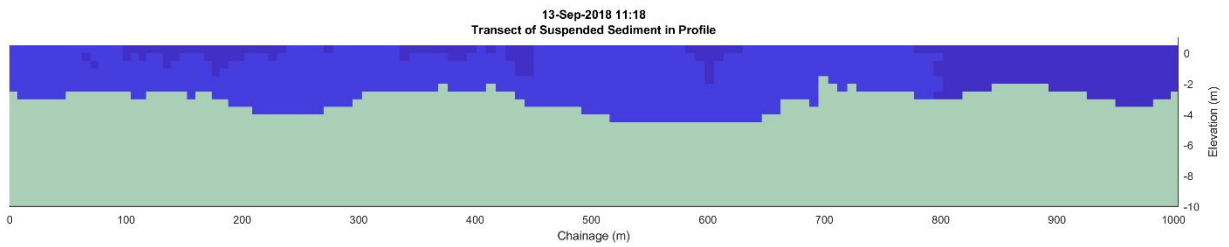
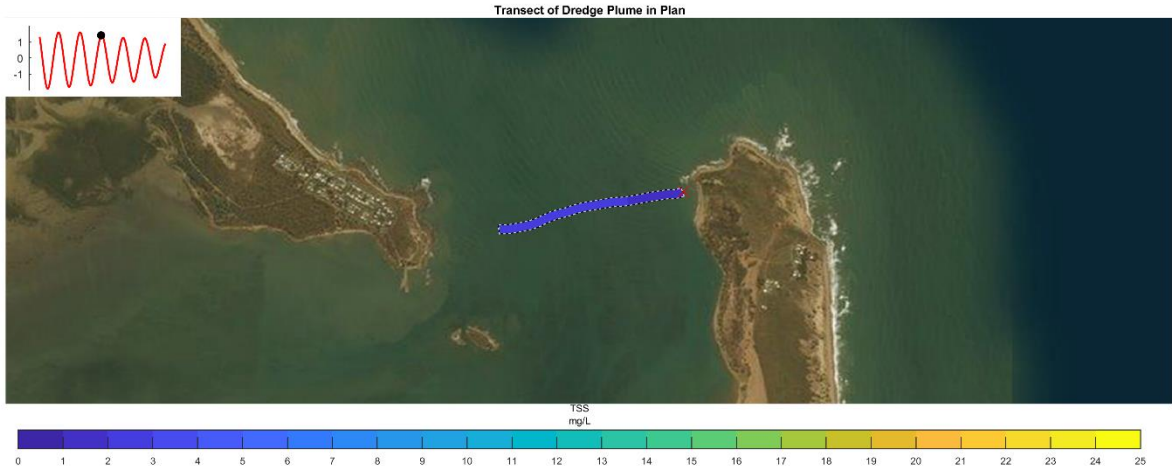
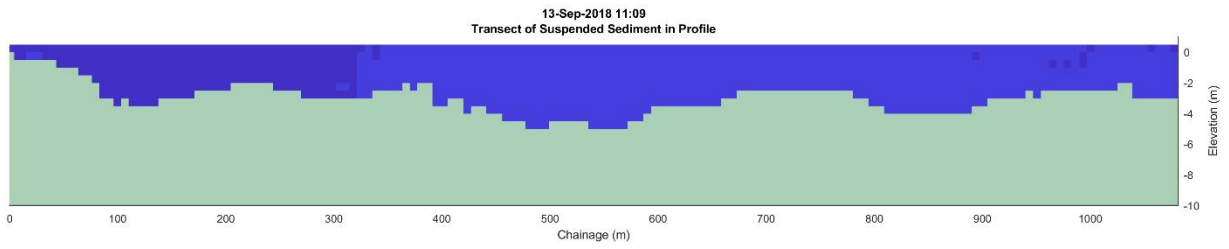
11-Sep-2018 01:58
Transect of Suspended Sediment in Profile

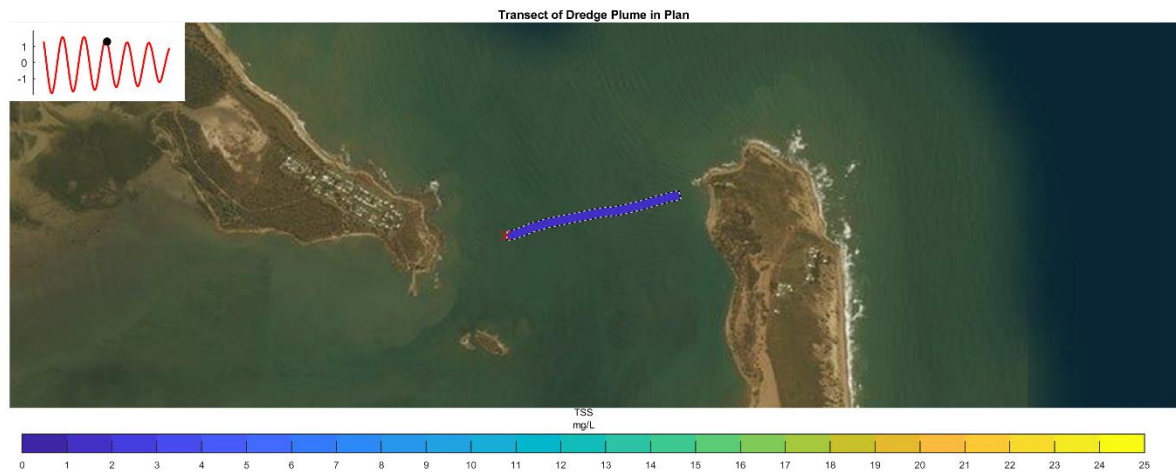
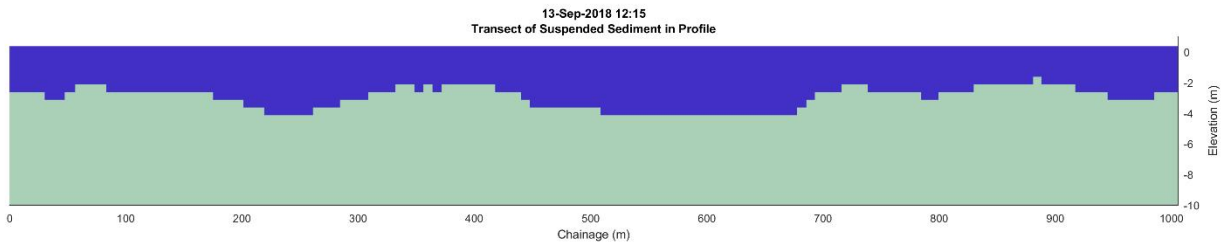
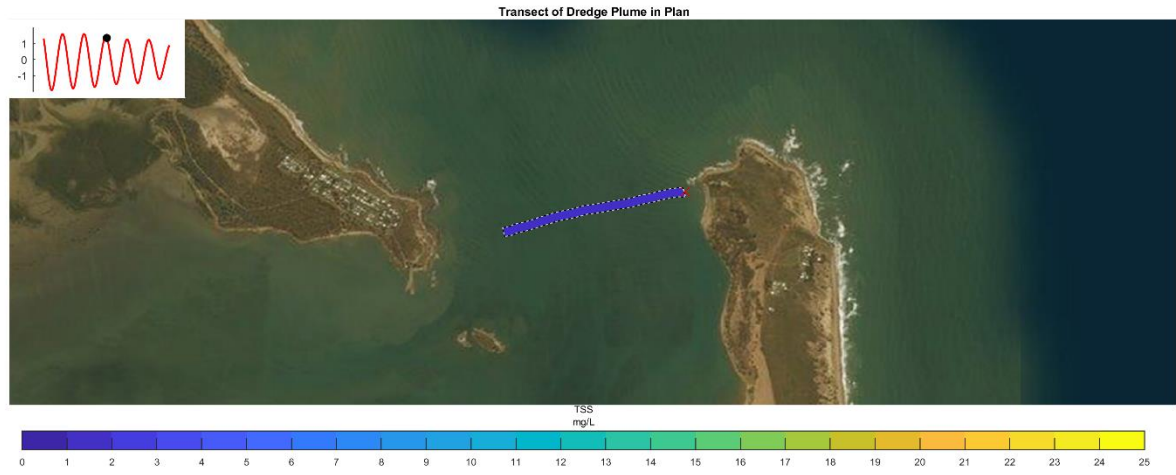
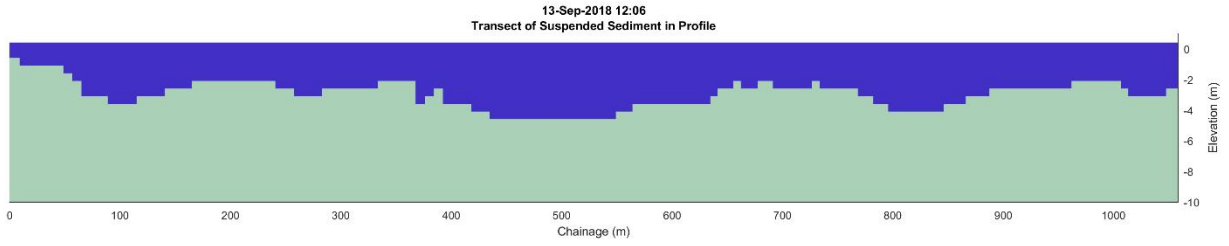


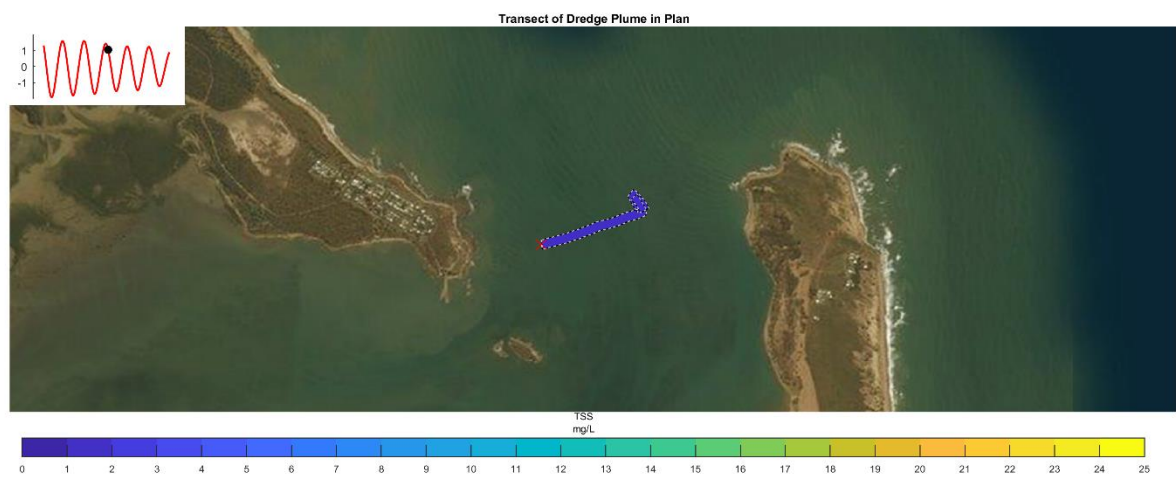
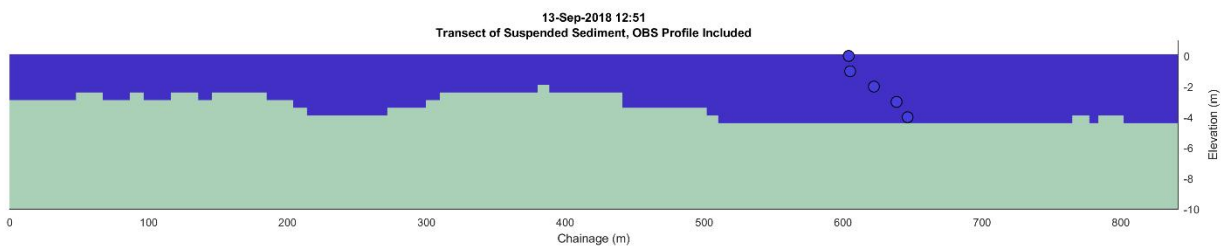
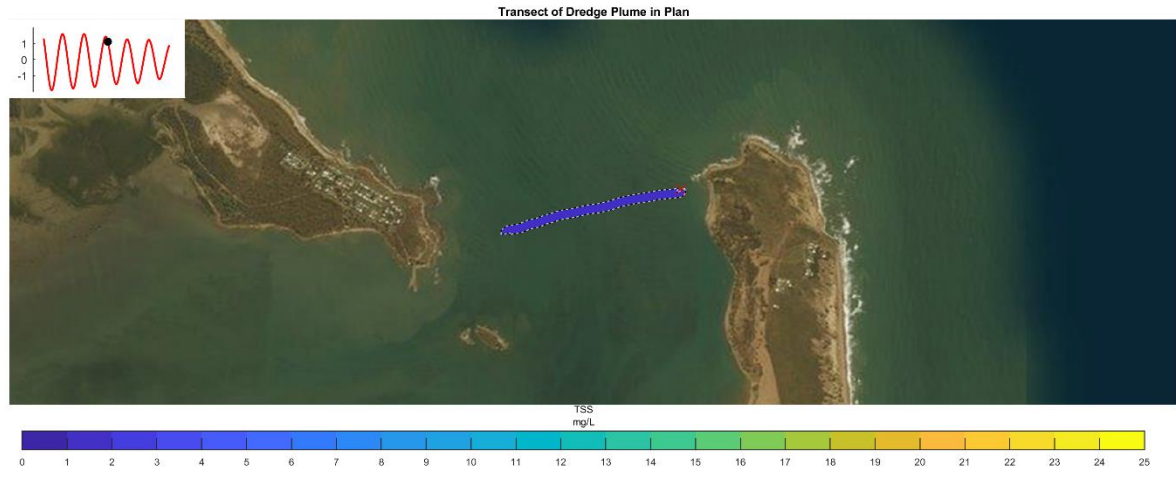
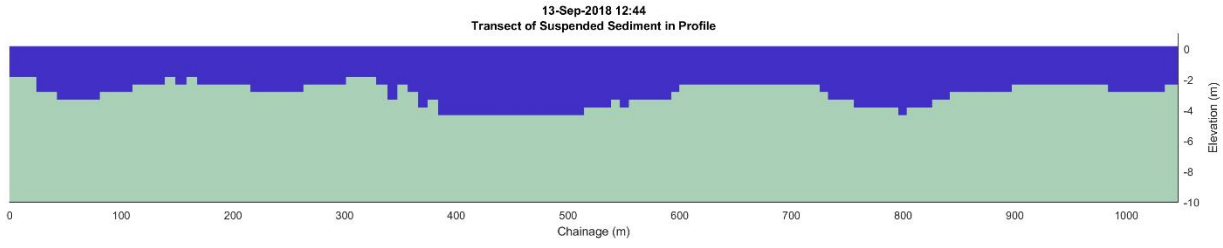
Transect of Dredge Plume in Plan

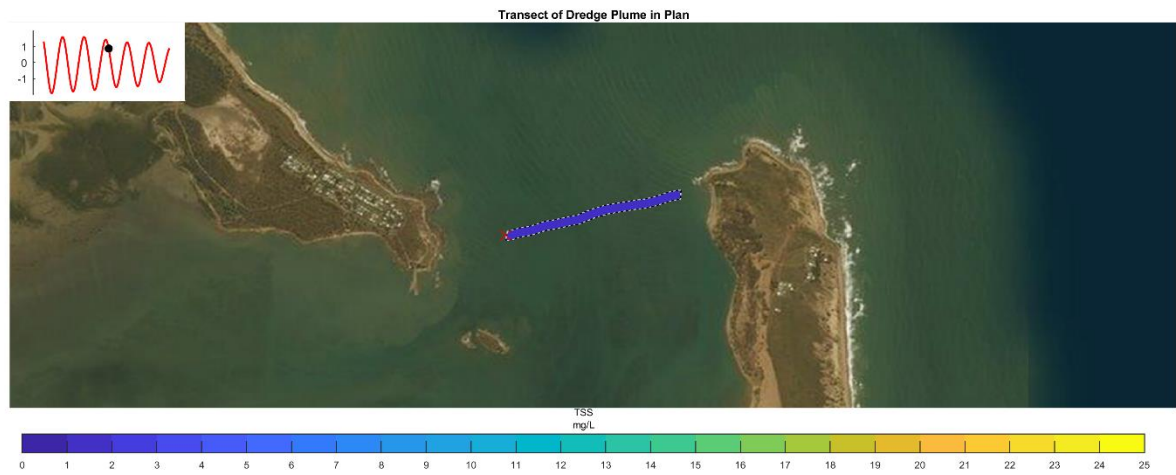
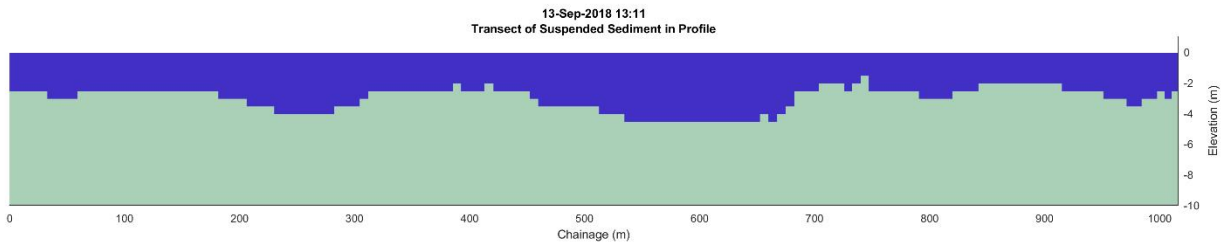
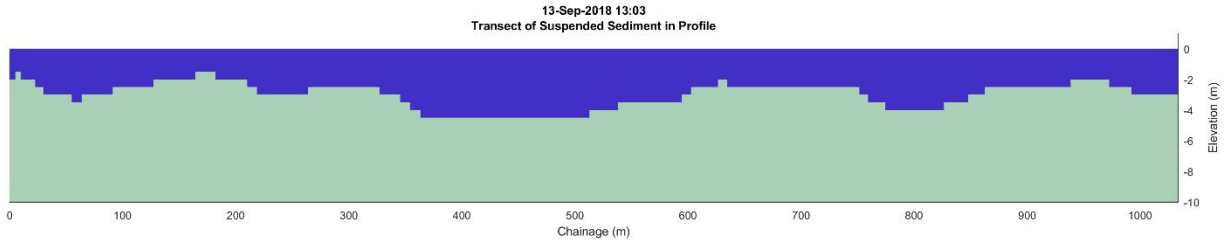


Transect B - South End on Curtis island to North Point on Facing Island – Average Tide

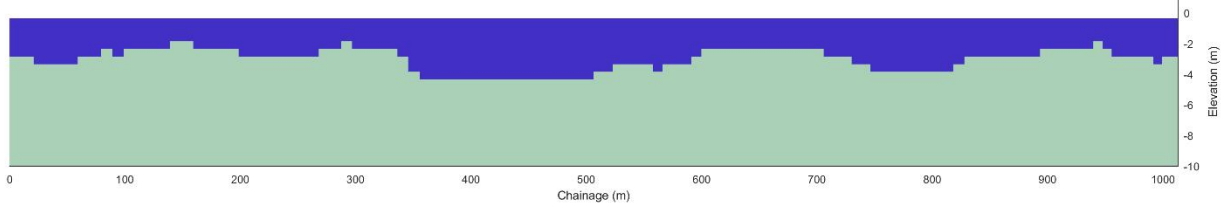




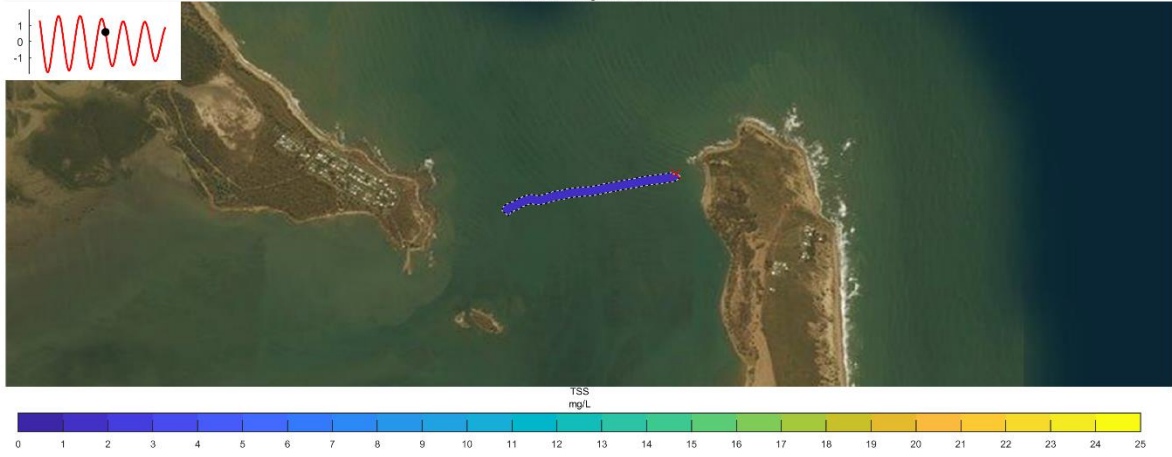




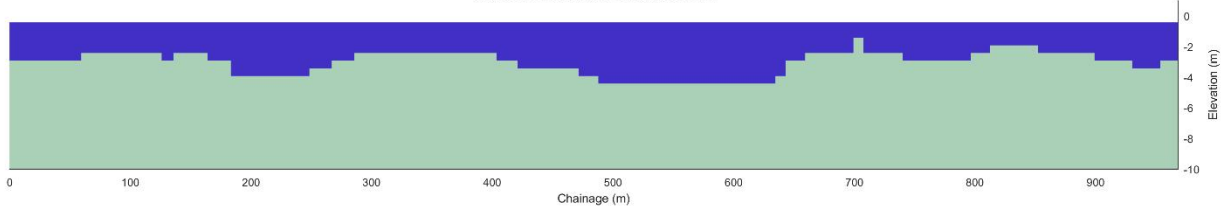
13-Sep-2018 13:38
Transect of Suspended Sediment in Profile



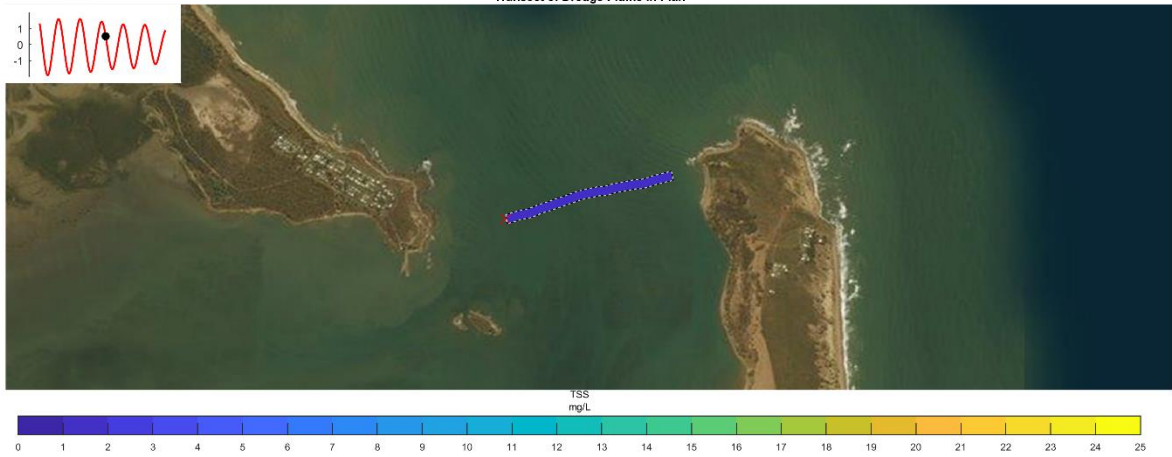
Transect of Dredge Plume in Plan

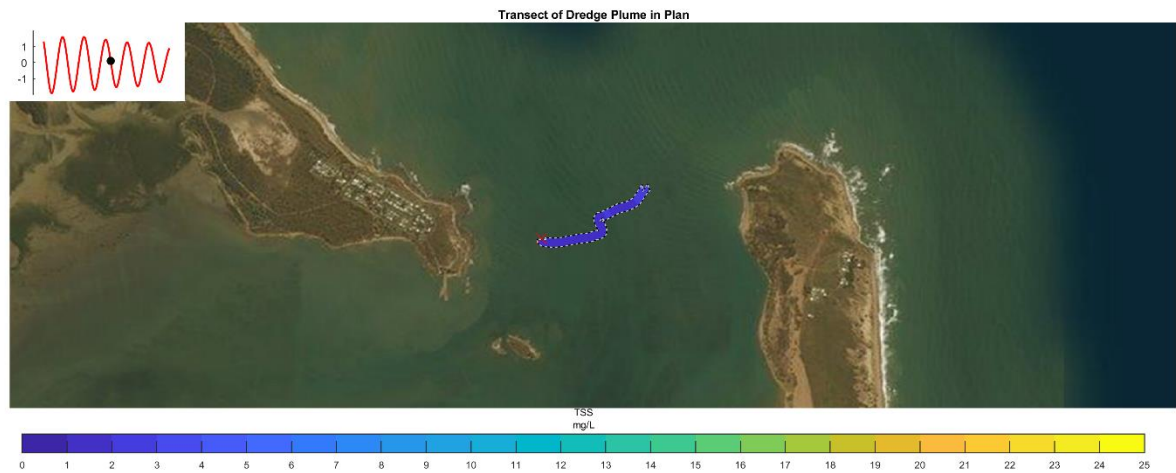
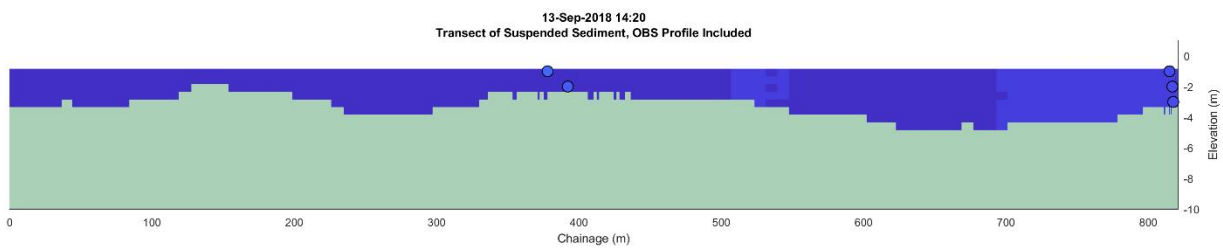
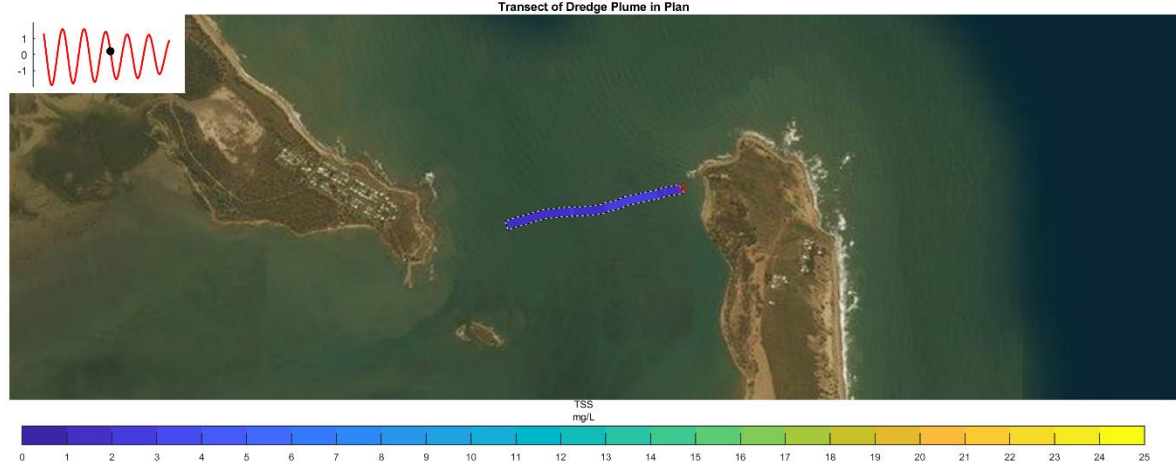
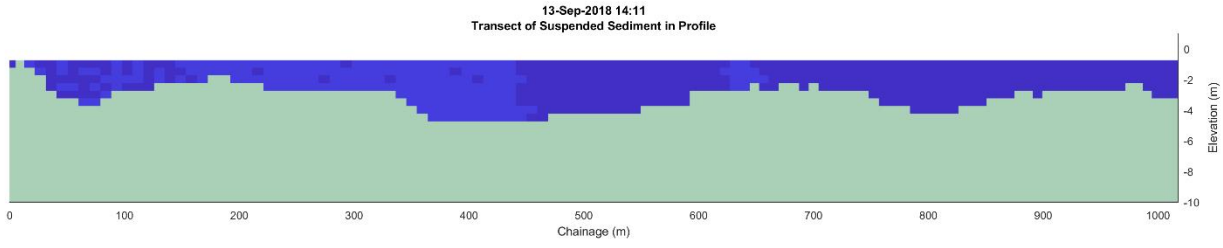


13-Sep-2018 13:44
Transect of Suspended Sediment in Profile

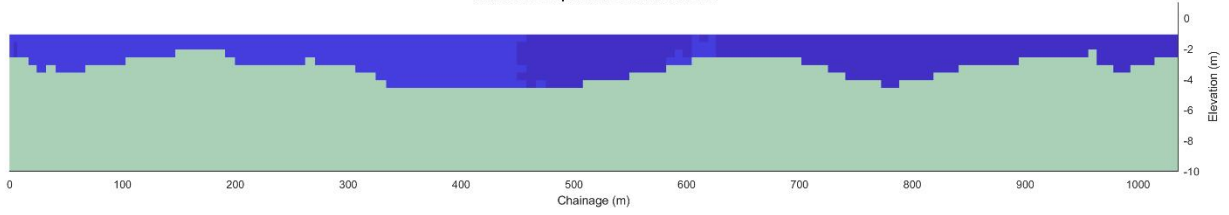


Transect of Dredge Plume in Plan

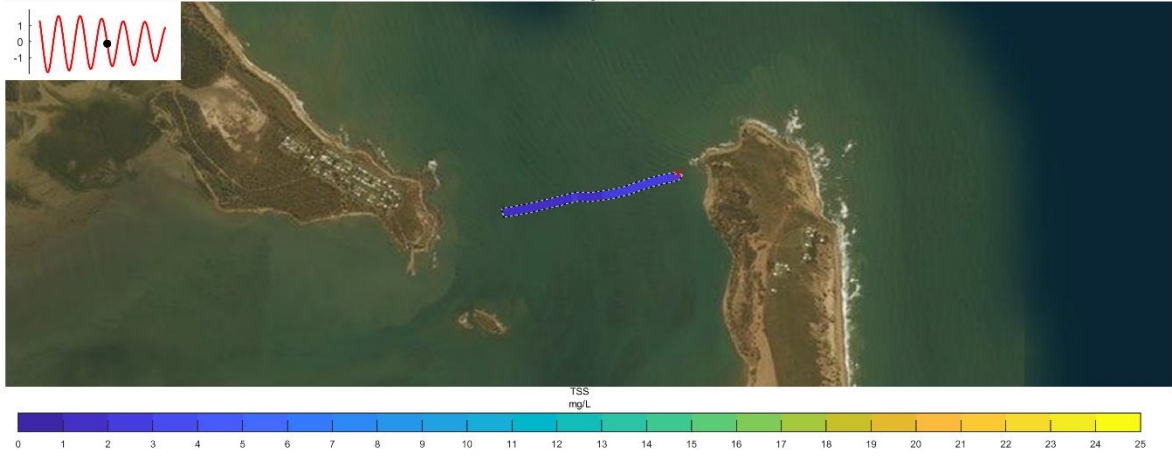




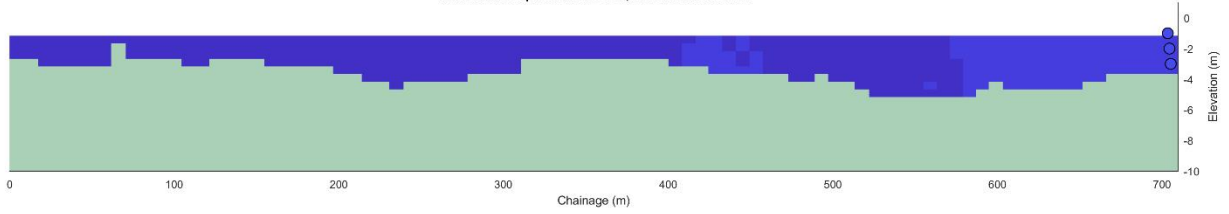
13-Sep-2018 14:39
Transect of Suspended Sediment in Profile



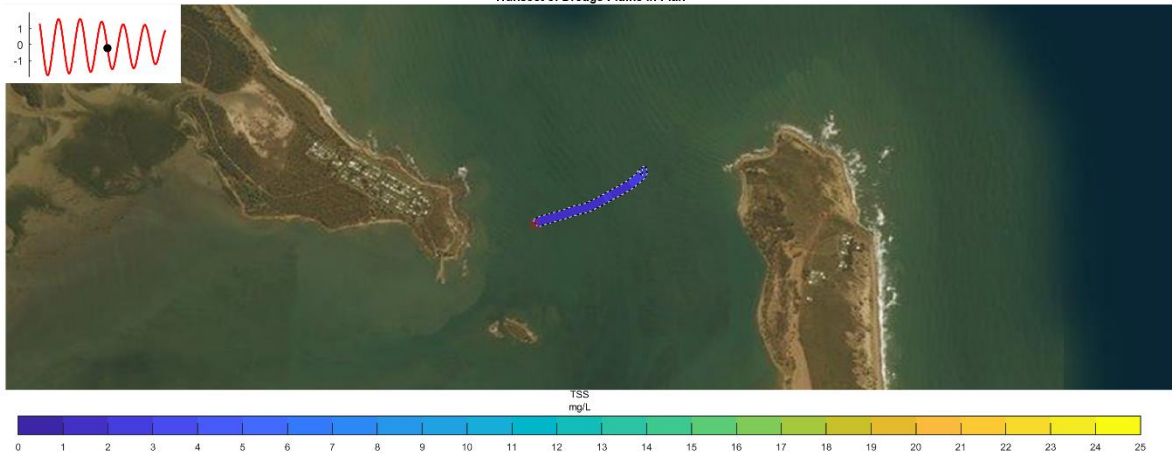
Transect of Dredge Plume in Plan



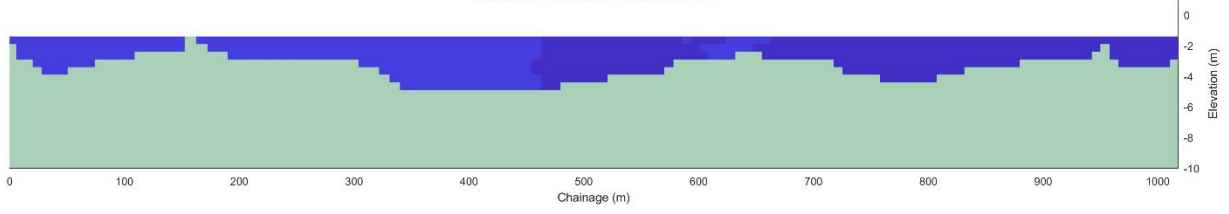
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Transect of Suspended Sediment, OBS Profile Included



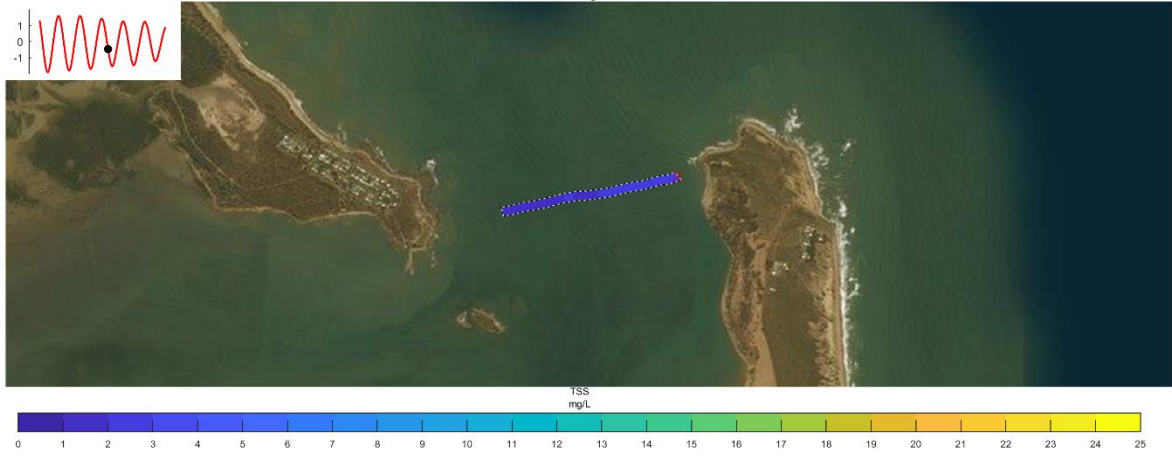
Transect of Dredge Plume in Plan



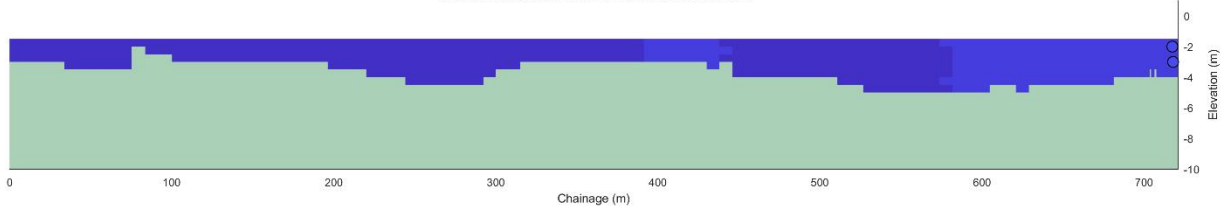
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Transect of Suspended Sediment in Profile



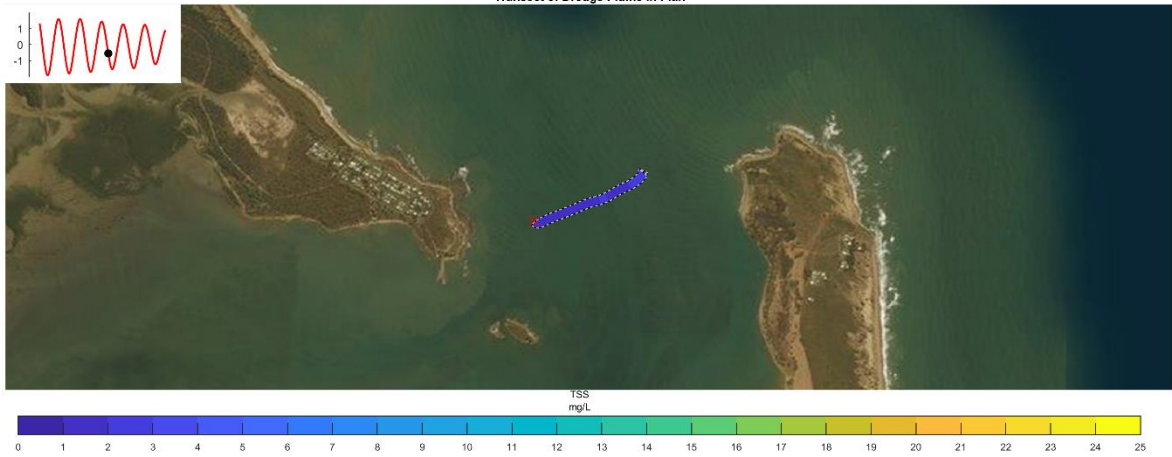
Transect of Dredge Plume in Plan



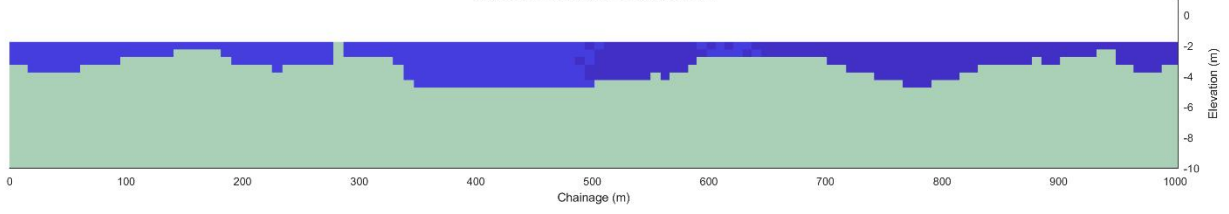
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Transect of Suspended Sediment, OBS Profile Included



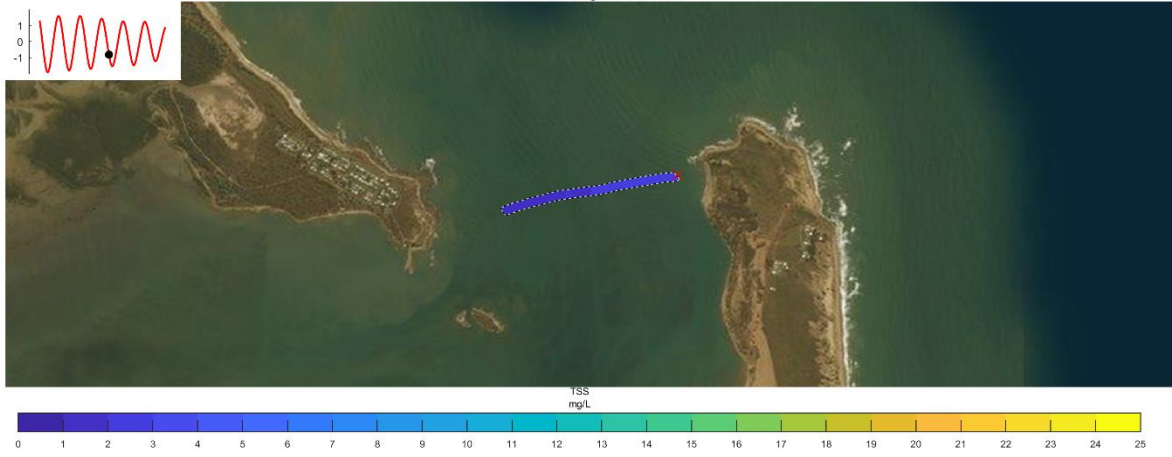
Transect of Dredge Plume in Plan



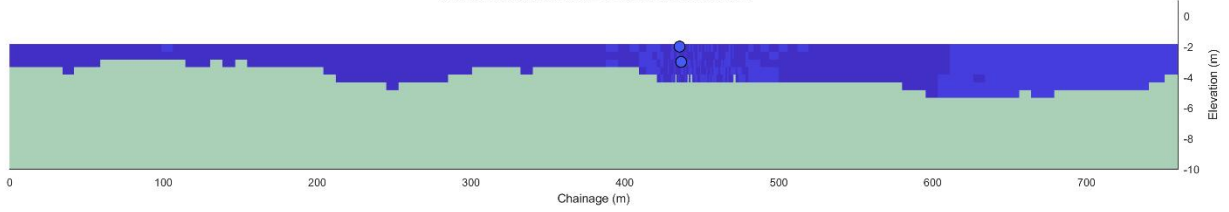
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Transect of Suspended Sediment in Profile



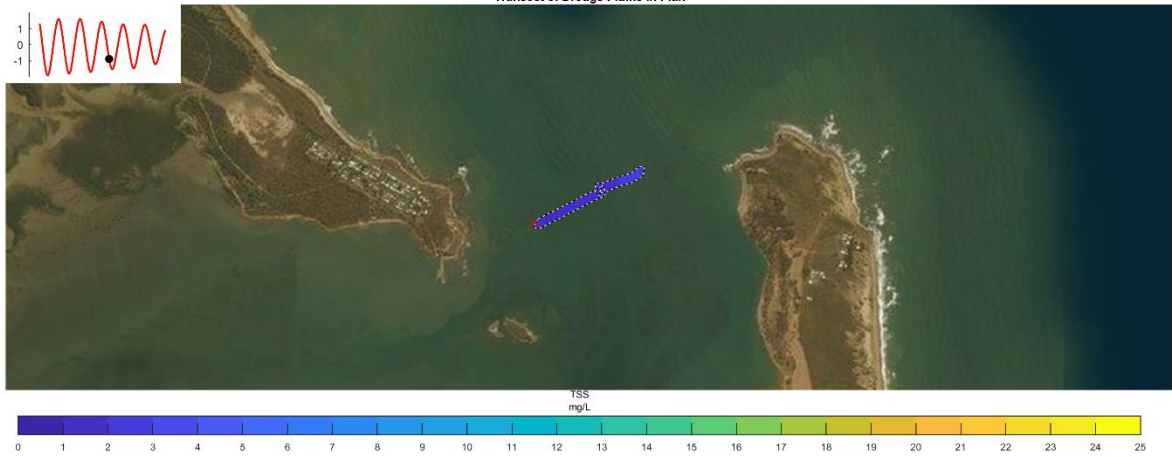
Transect of Dredge Plume in Plan



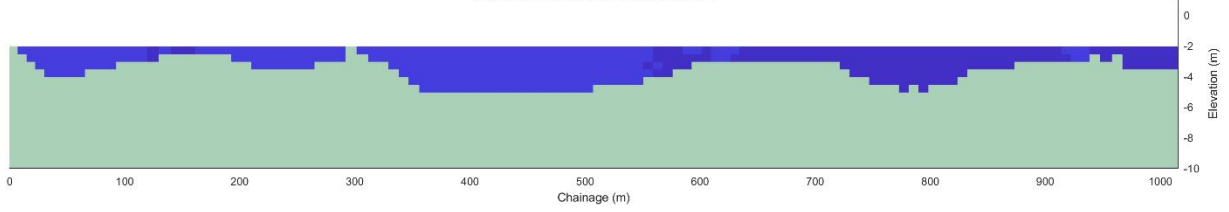
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Transect of Suspended Sediment, OBS Profile Included



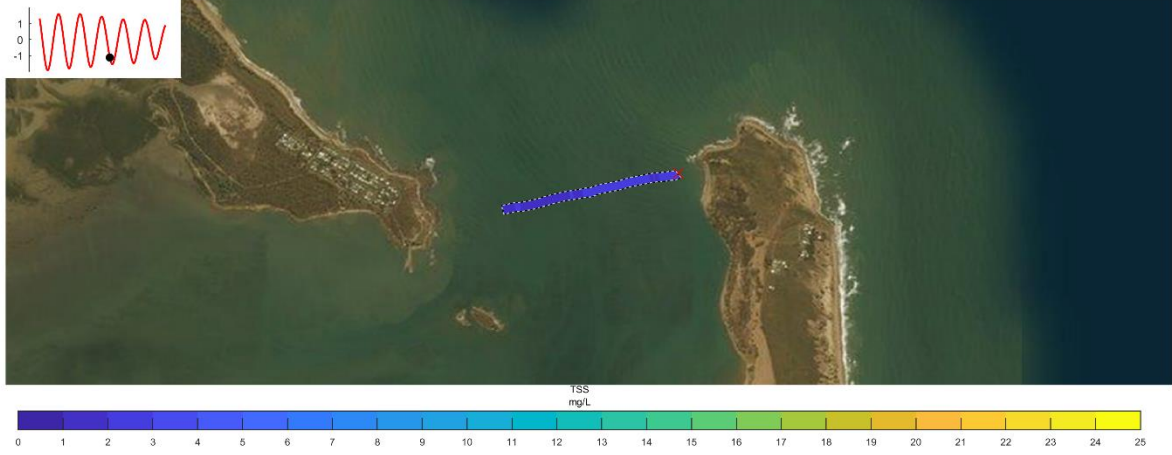
Transect of Dredge Plume in Plan



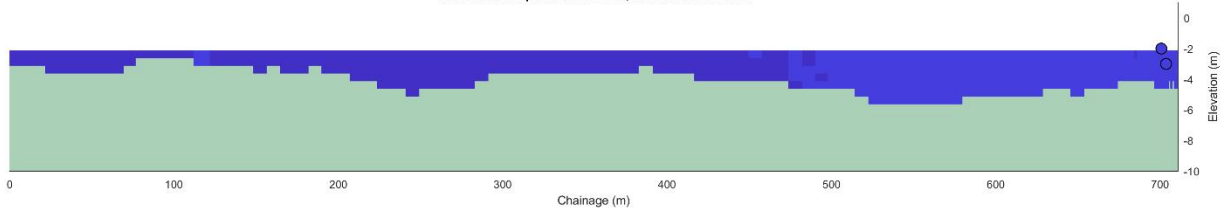
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Transect of Suspended Sediment in Profile



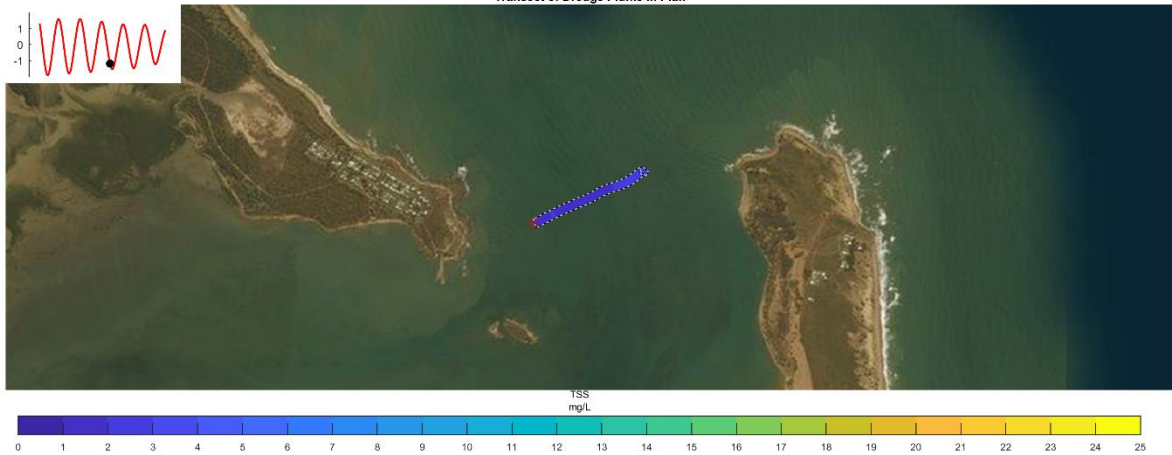
Transect of Dredge Plume in Plan



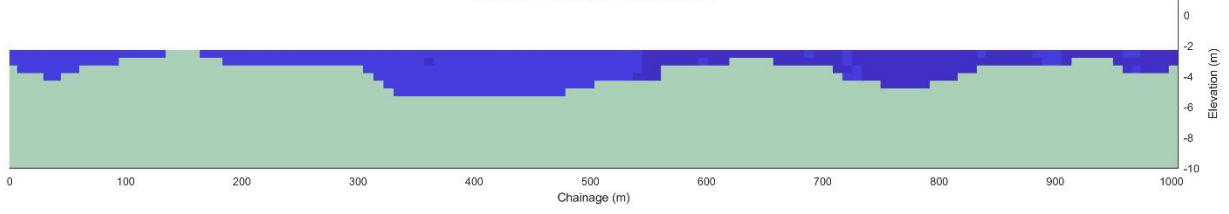
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Transect of Suspended Sediment, OBS Profile Included



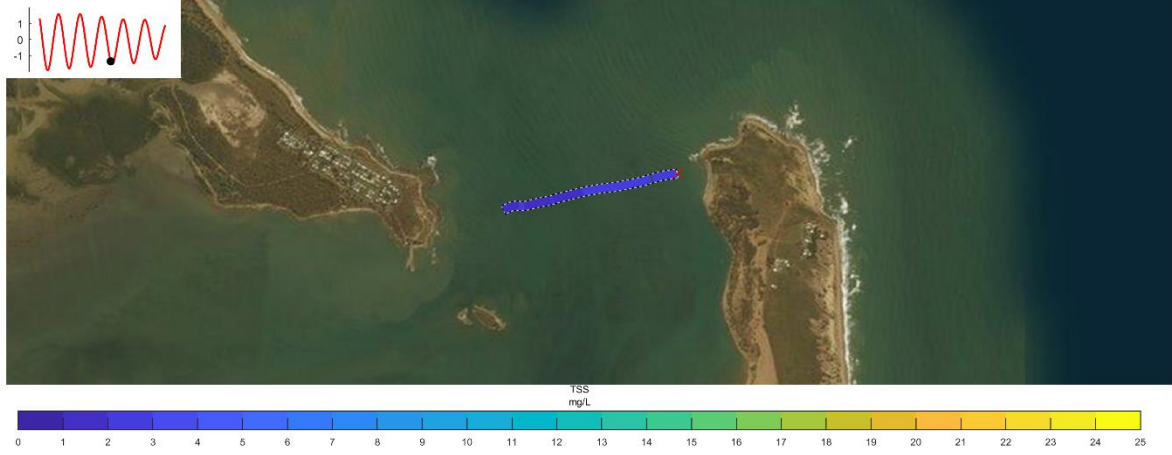
Transect of Dredge Plume in Plan



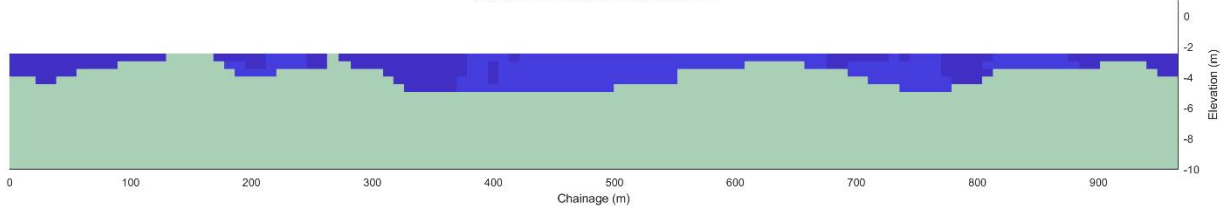
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Transect of Suspended Sediment in Profile



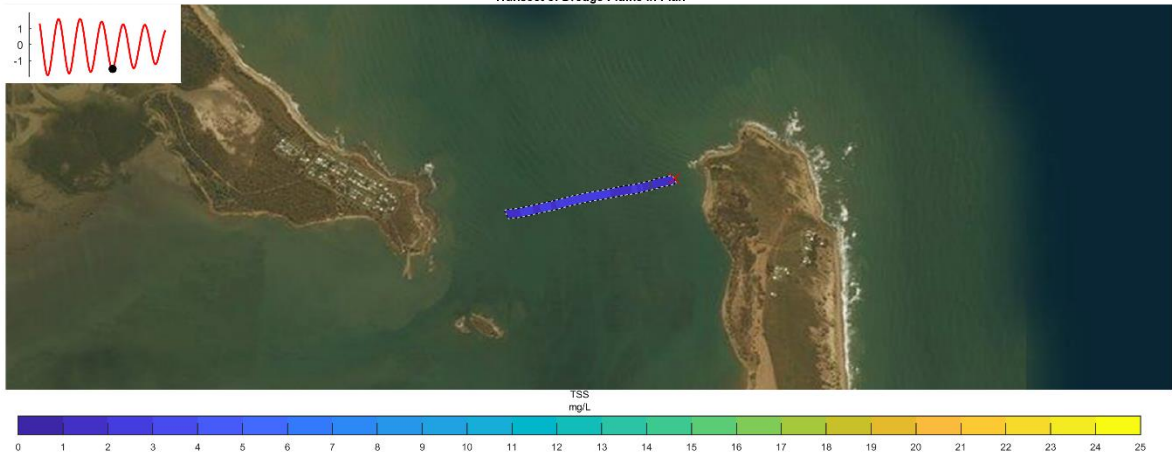
Transect of Dredge Plume in Plan



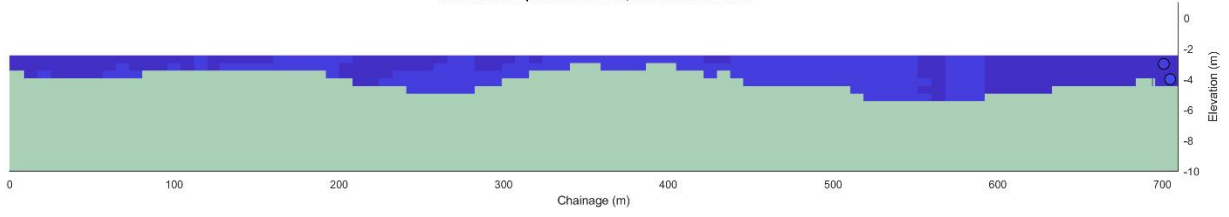
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Transect of Suspended Sediment in Profile



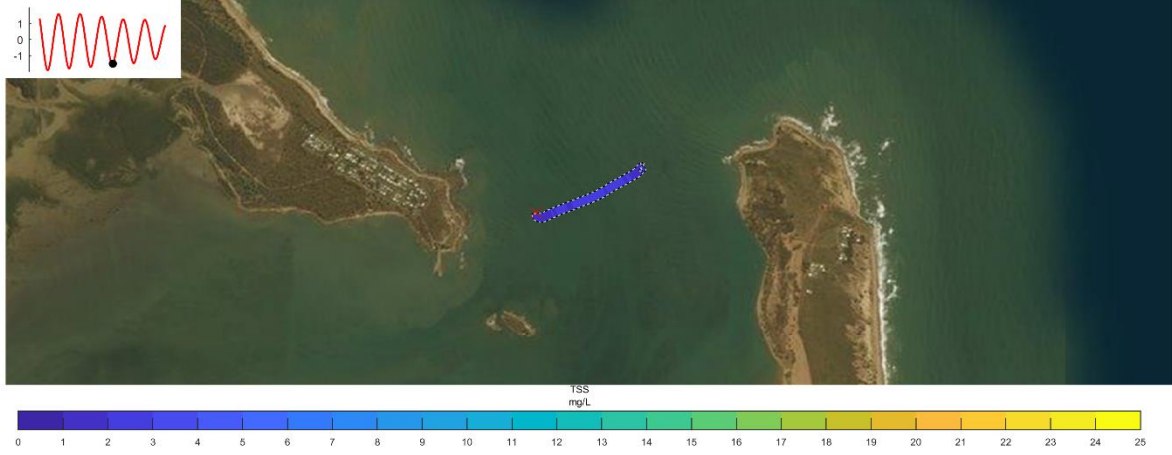
Transect of Dredge Plume in Plan



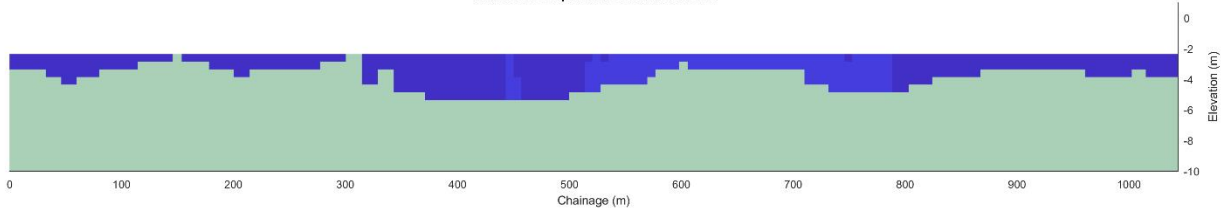
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Transect of Suspended Sediment, OBS Profile Included



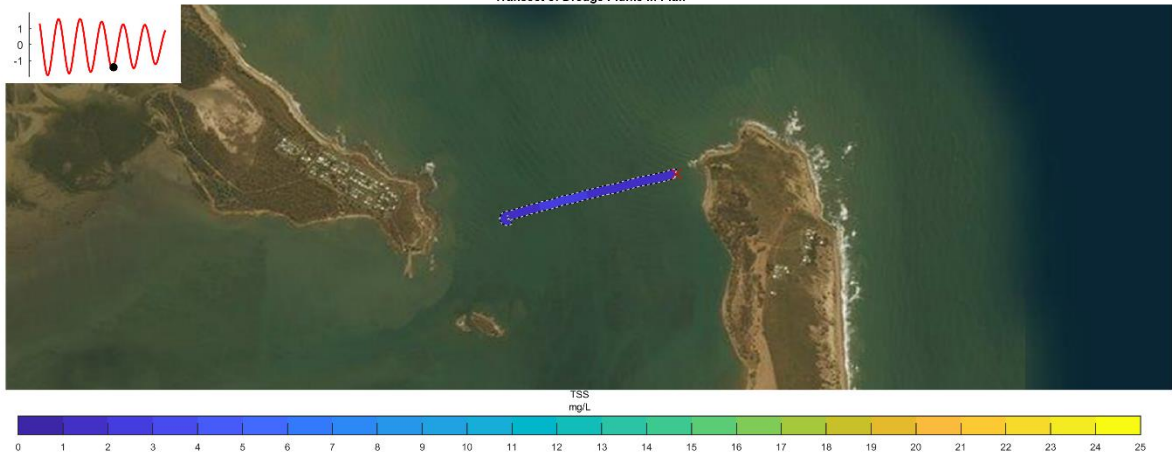
Transect of Dredge Plume in Plan



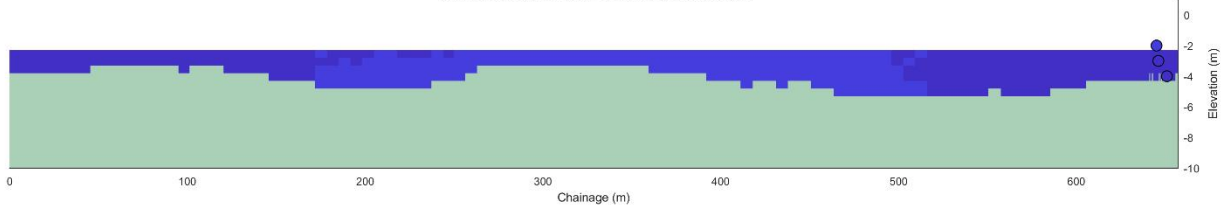
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Transect of Suspended Sediment in Profile



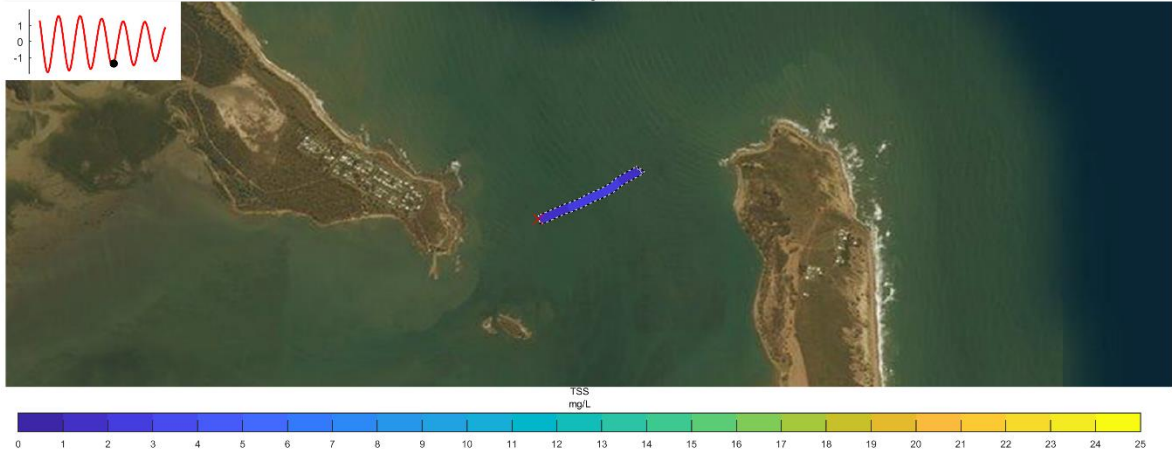
Transect of Dredge Plume in Plan



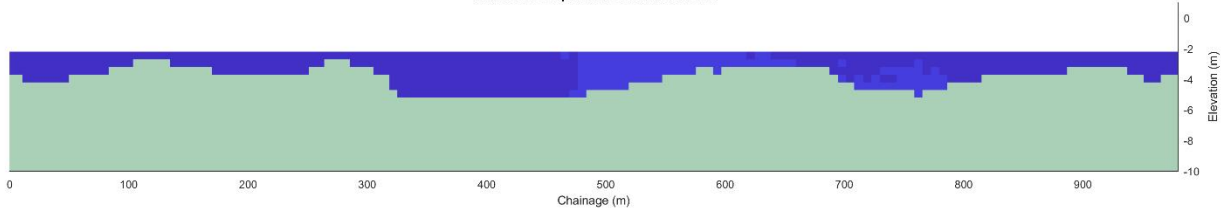
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Transect of Suspended Sediment, OBS Profile Included



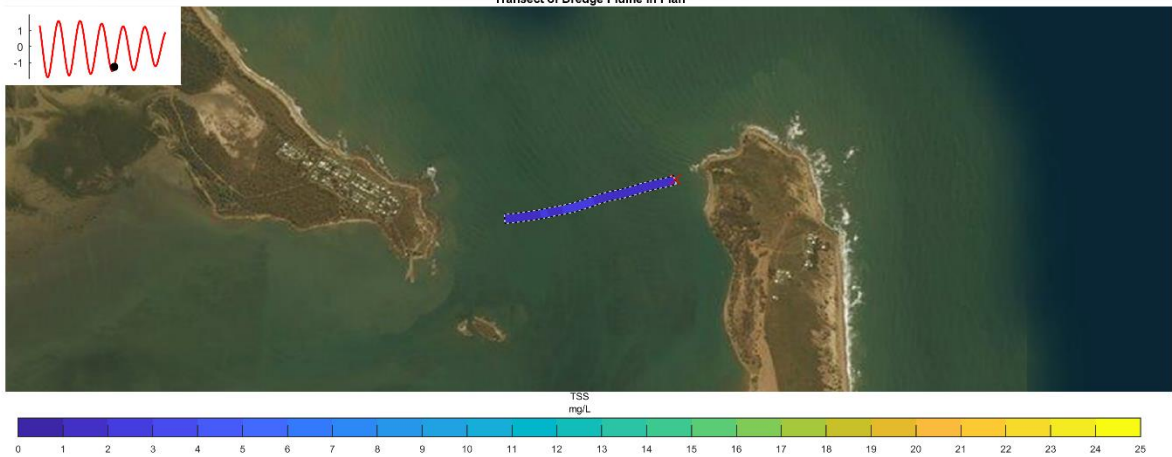
Transect of Dredge Plume in Plan



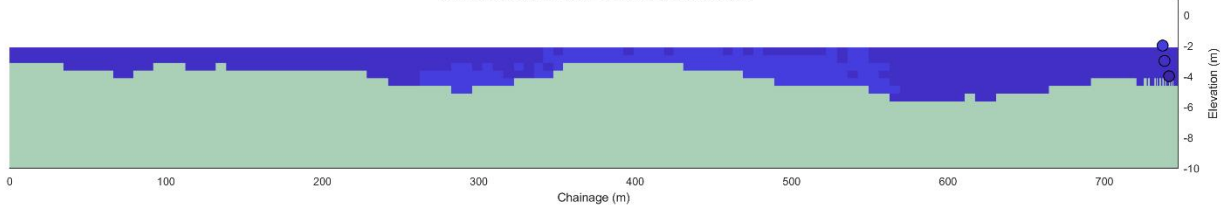
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Transect of Suspended Sediment in Profile



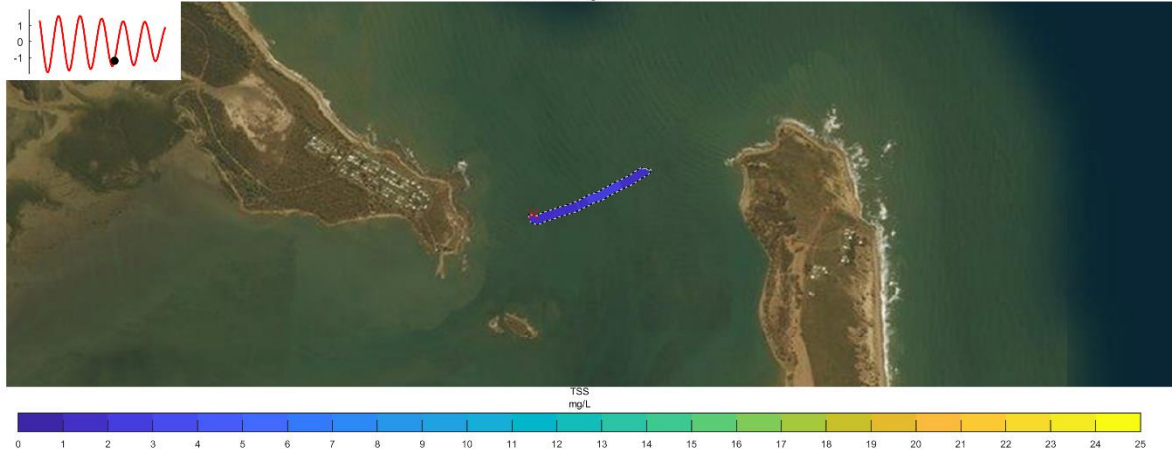
Transect of Dredge Plume in Plan



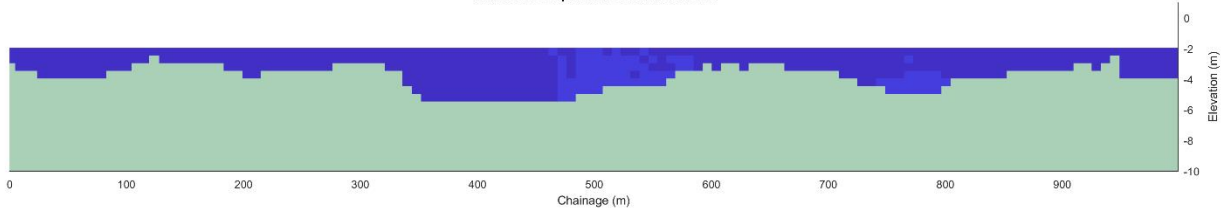
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Transect of Suspended Sediment, OBS Profile Included



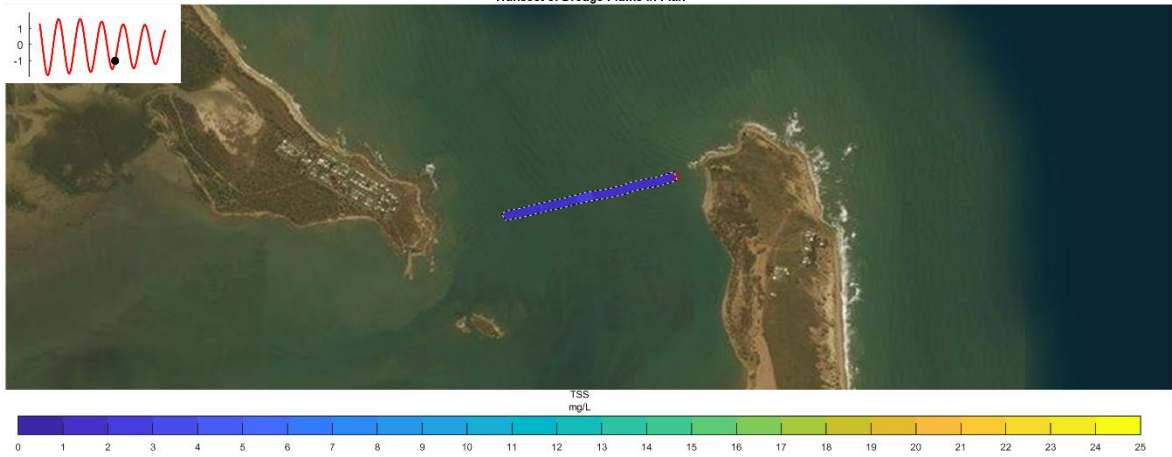
Transect of Dredge Plume in Plan



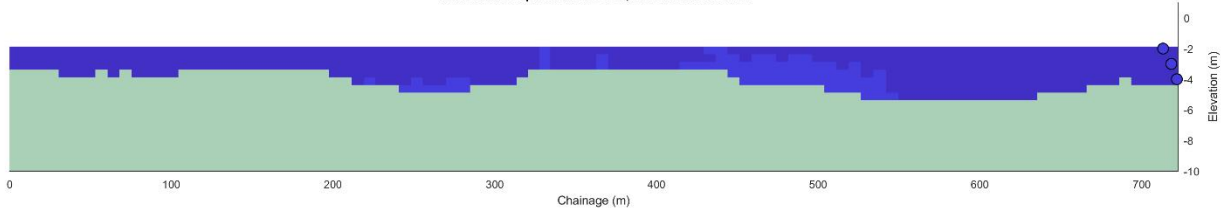
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Transect of Suspended Sediment in Profile



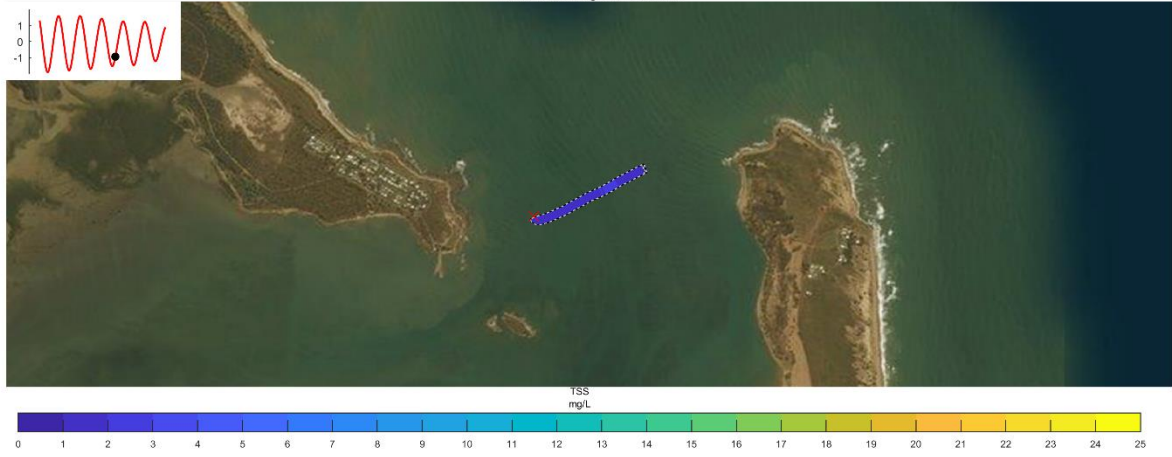
Transect of Dredge Plume in Plan



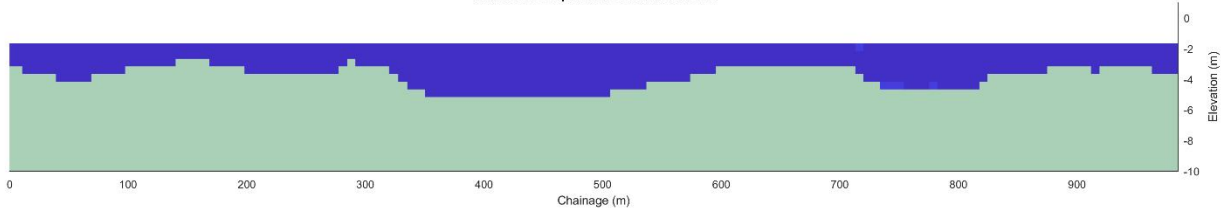
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Transect of Suspended Sediment, OBS Profile Included



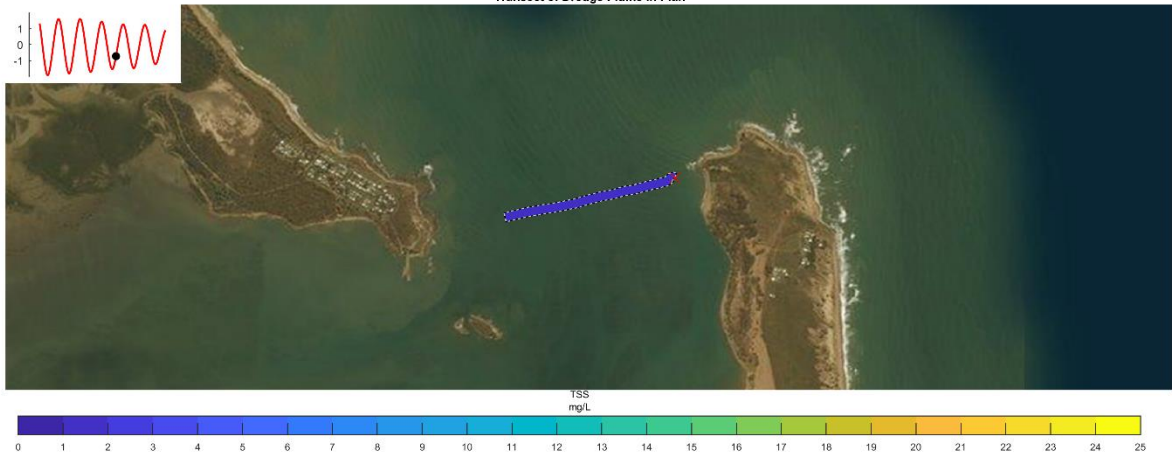
Transect of Dredge Plume in Plan



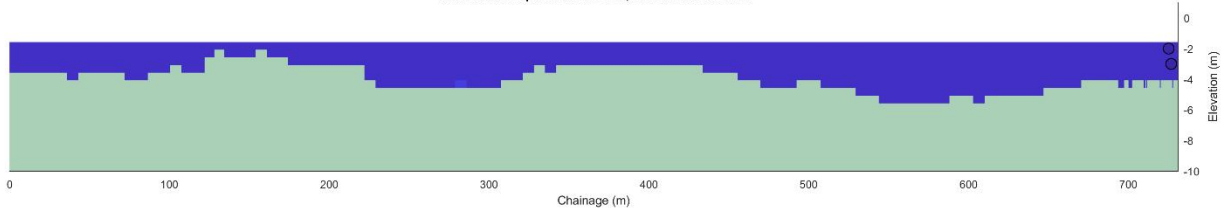
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Transect of Suspended Sediment in Profile



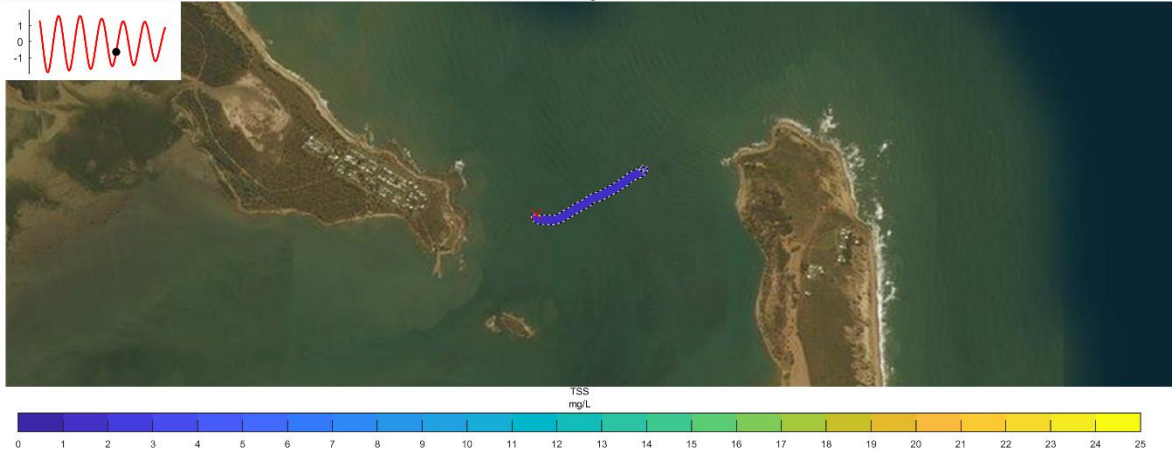
Transect of Dredge Plume in Plan



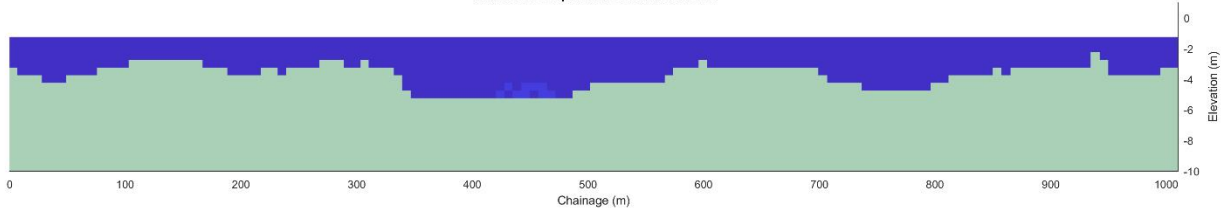
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Transect of Suspended Sediment, OBS Profile Included



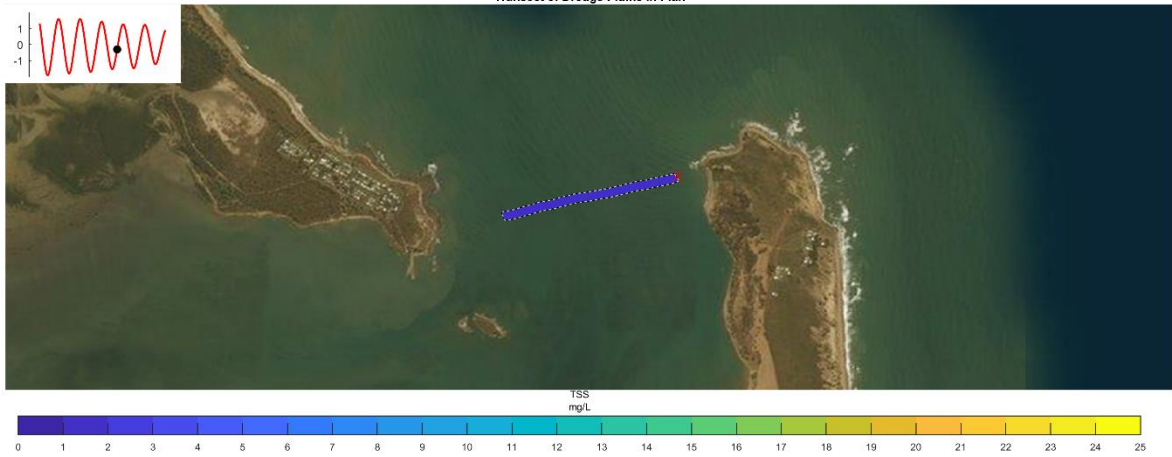
Transect of Dredge Plume in Plan



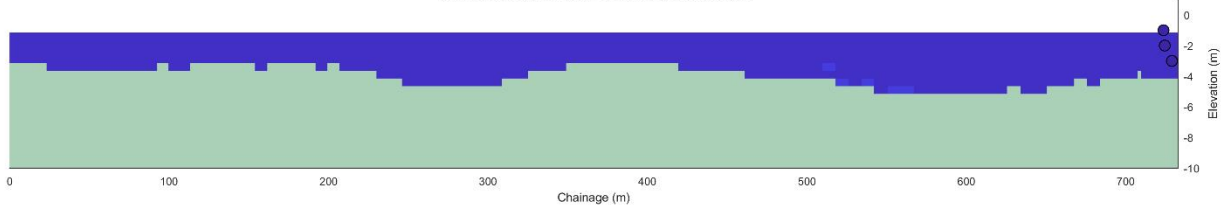
13-Sep-2018 20:19
Transect of Suspended Sediment in Profile



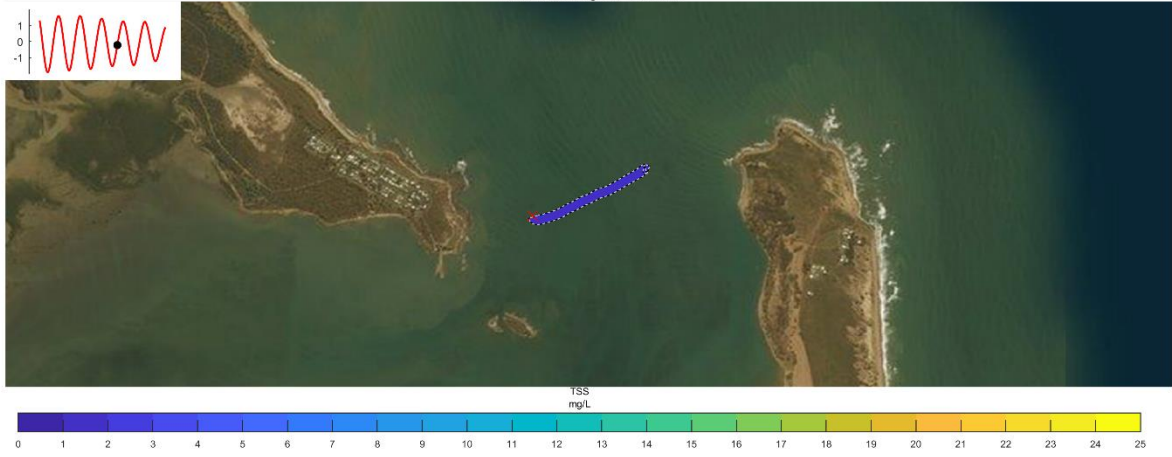
Transect of Dredge Plume in Plan



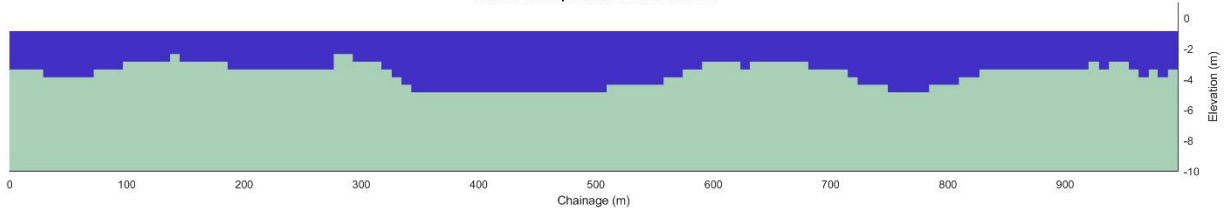
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Transect of Suspended Sediment, OBS Profile Included



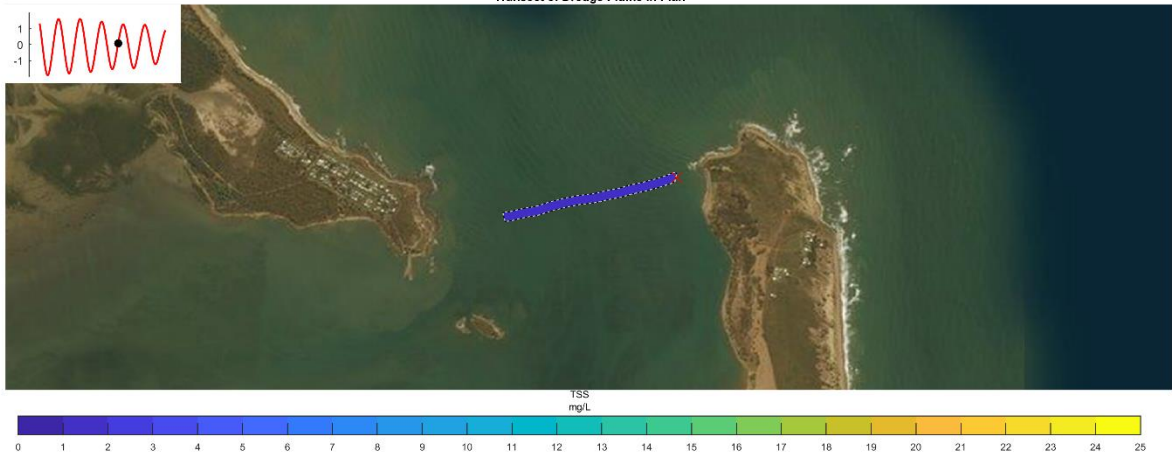
Transect of Dredge Plume in Plan



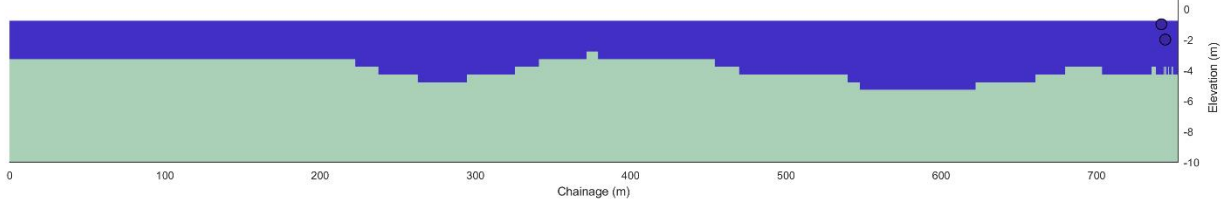
13-Sep-2018 20:55
Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



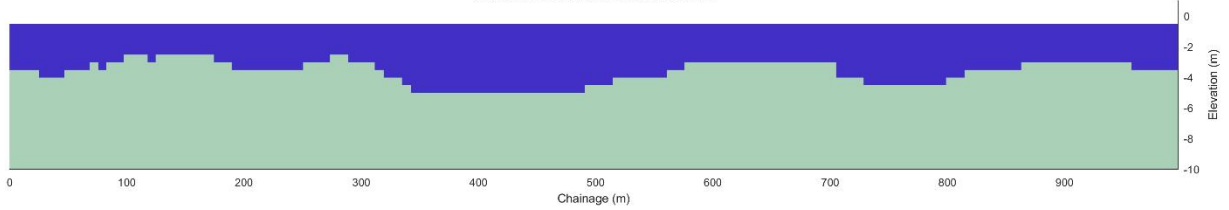
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Transect of Suspended Sediment, OBS Profile Included



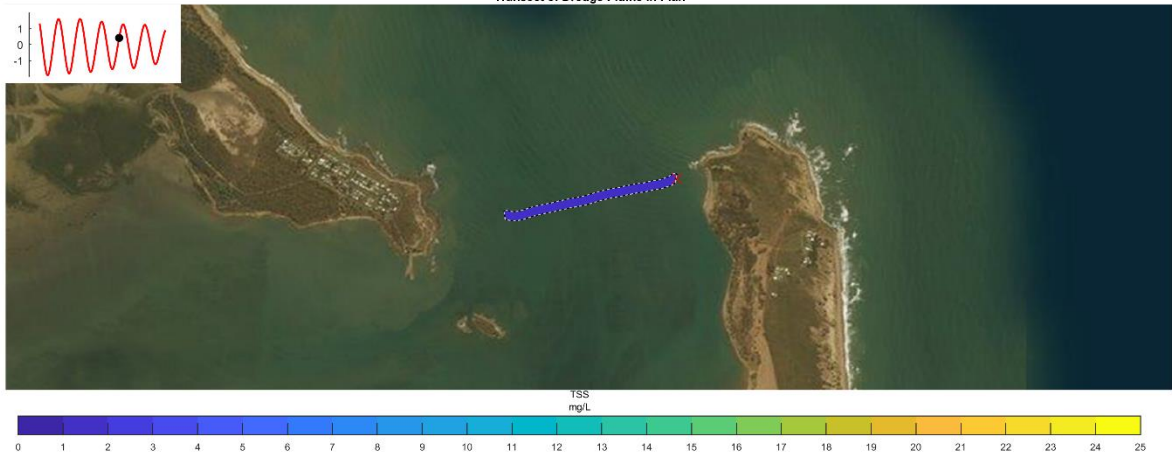
Transect of Dredge Plume in Plan



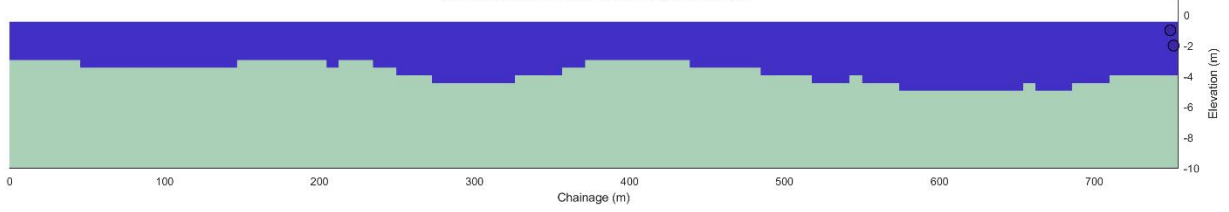
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Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



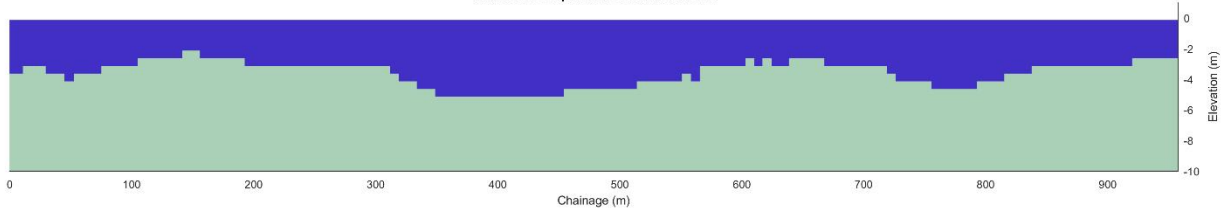
13-Sep-2018 21:35
Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan

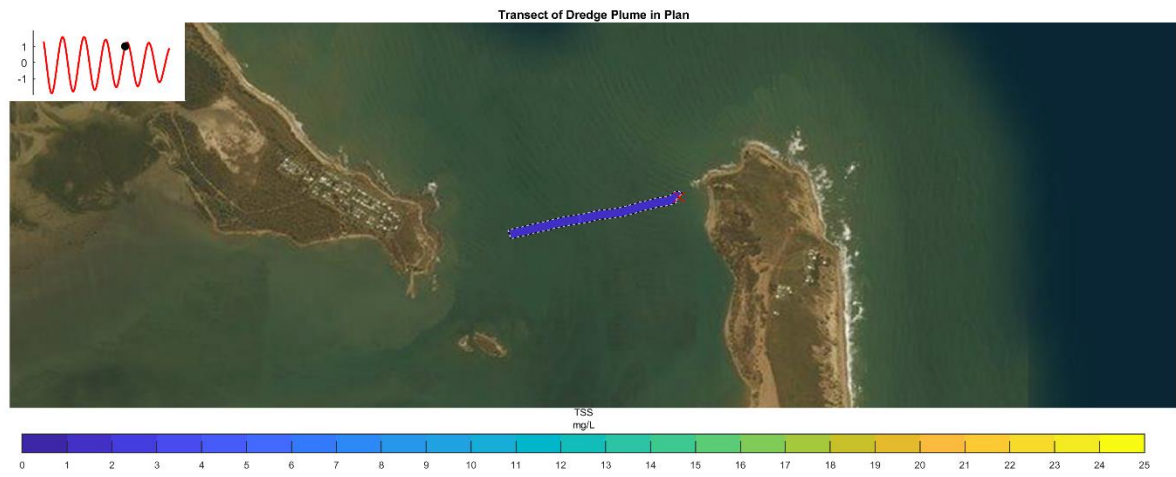
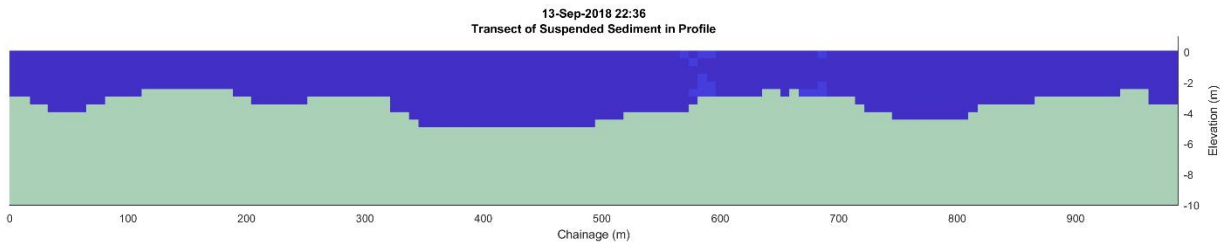
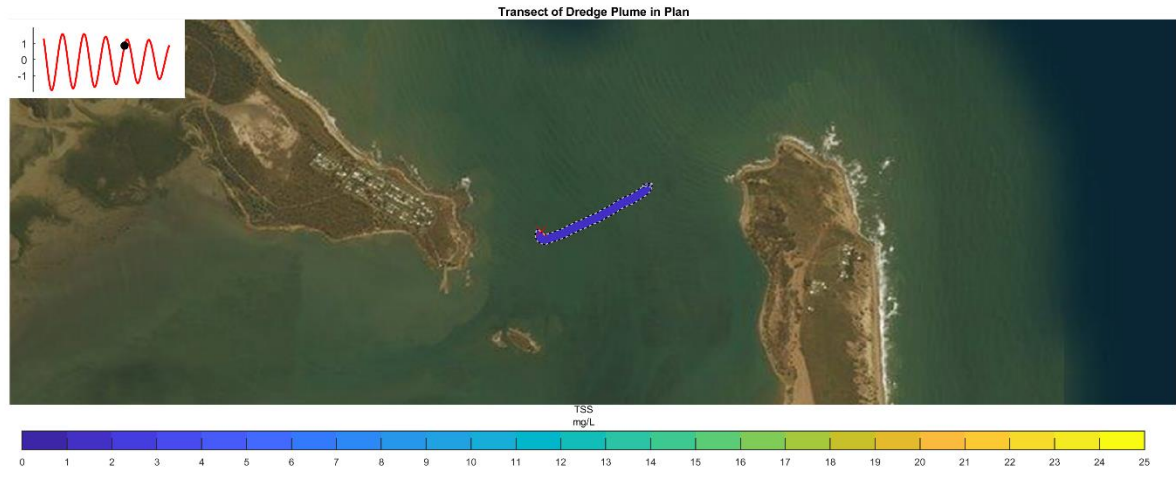
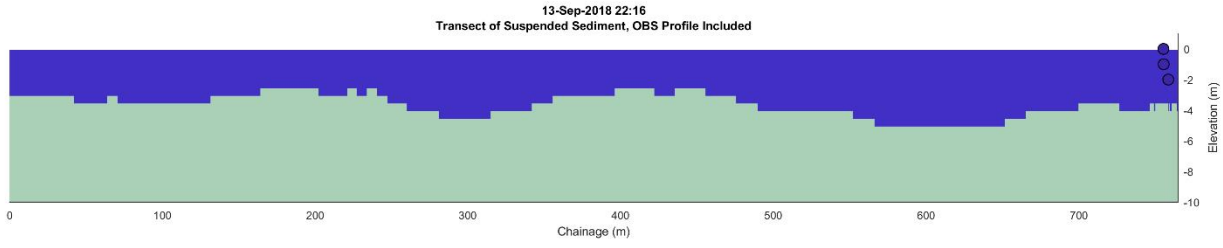


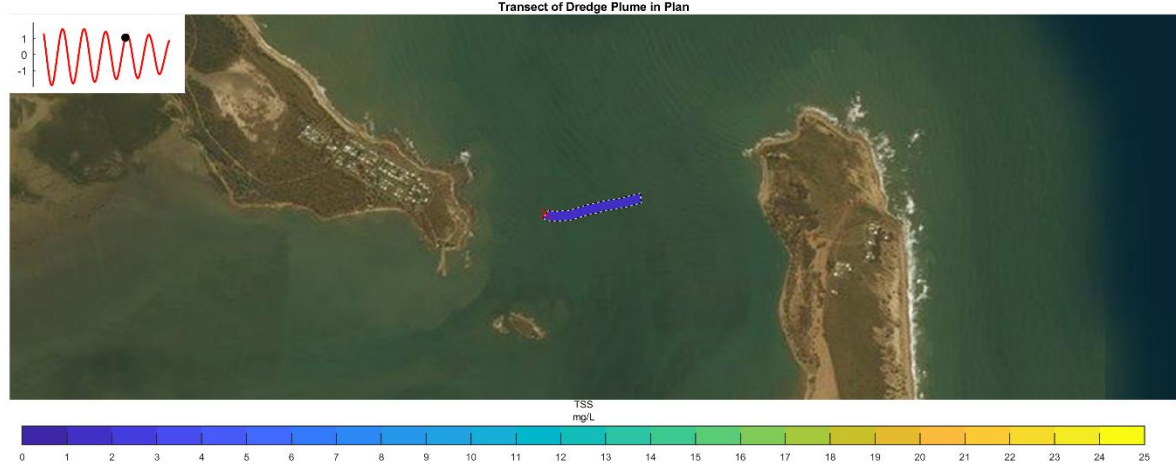
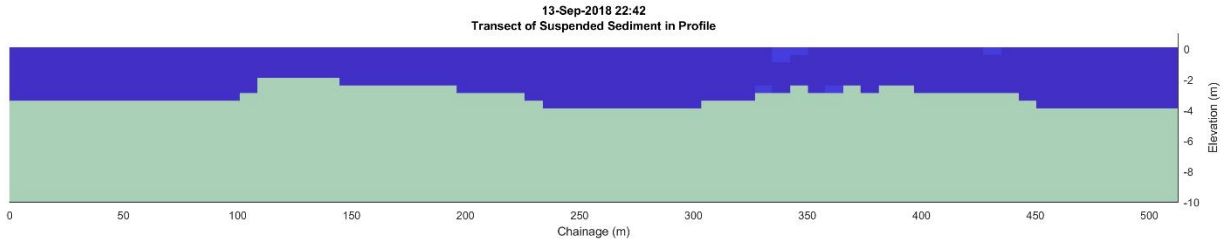
13-Sep-2018 22:08
Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan

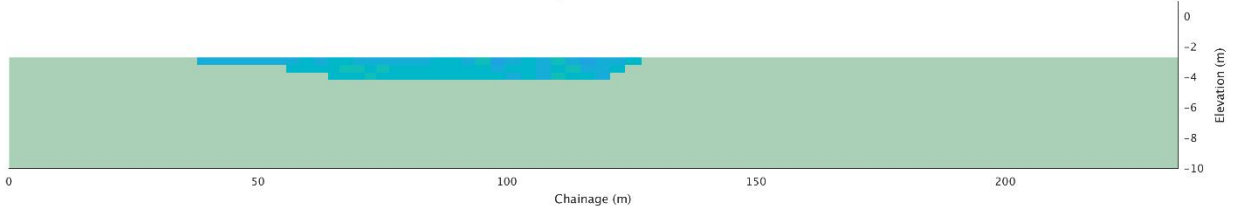




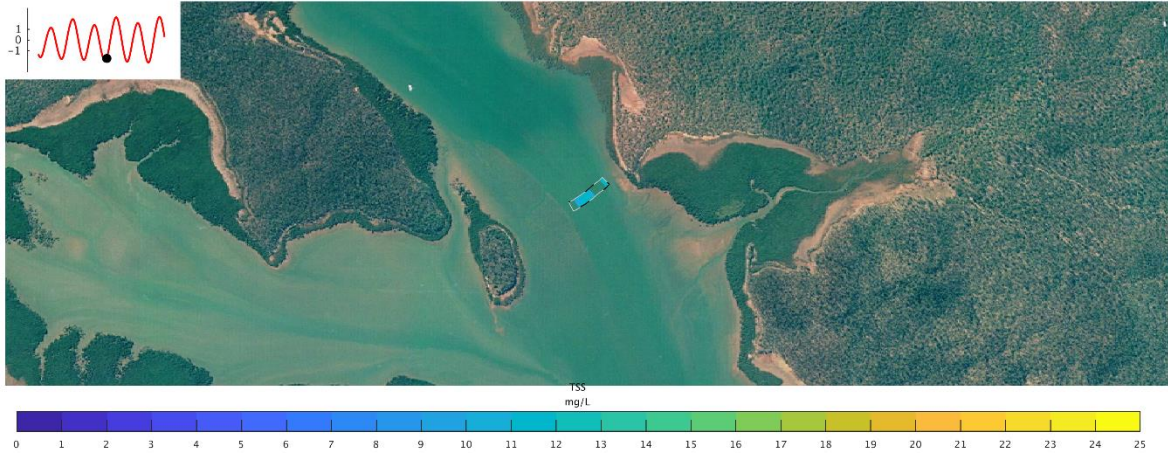


Transect C – The Narrows– Spring Tide

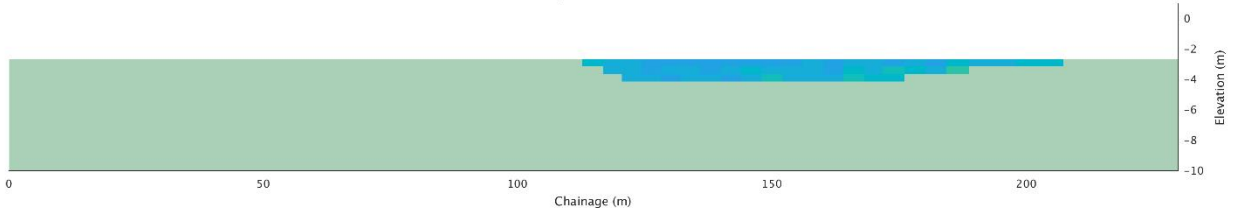
08-Sep-2018 15:02
Transect of Suspended Sediment in Profile



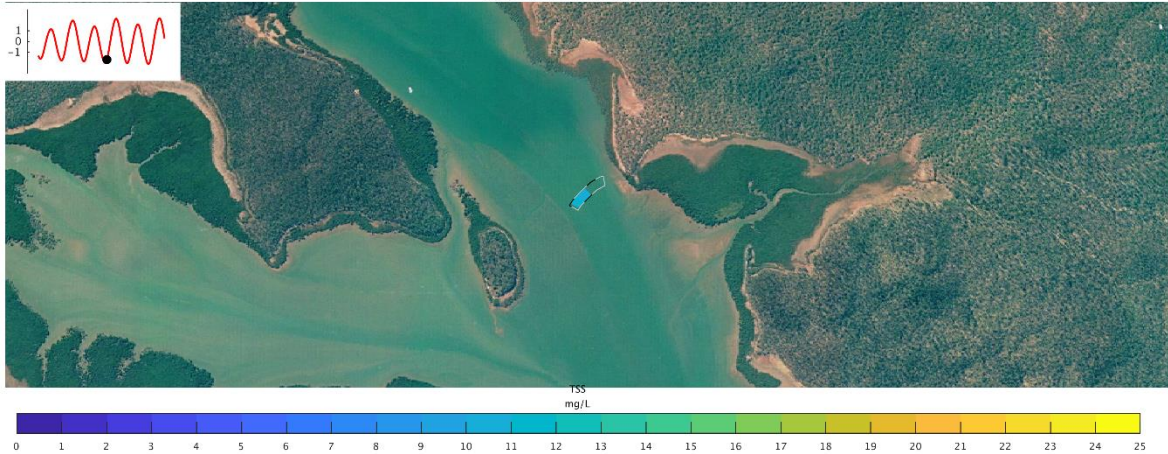
Transect of Dredge Plume in Plan



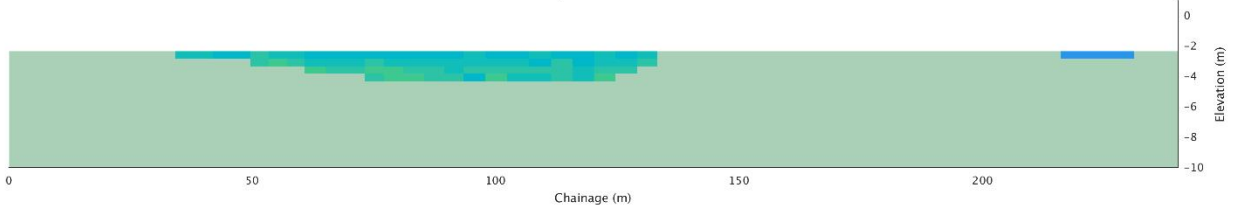
08-Sep-2018 15:06
Transect of Suspended Sediment in Profile



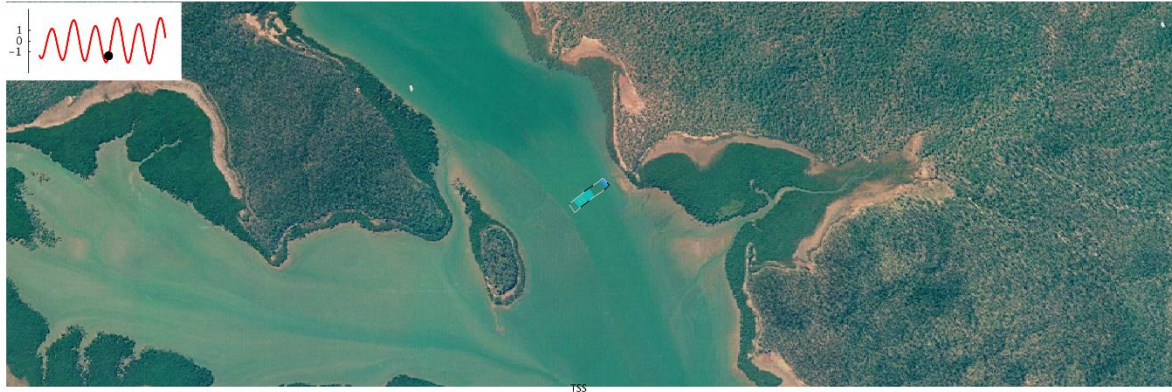
Transect of Dredge Plume in Plan



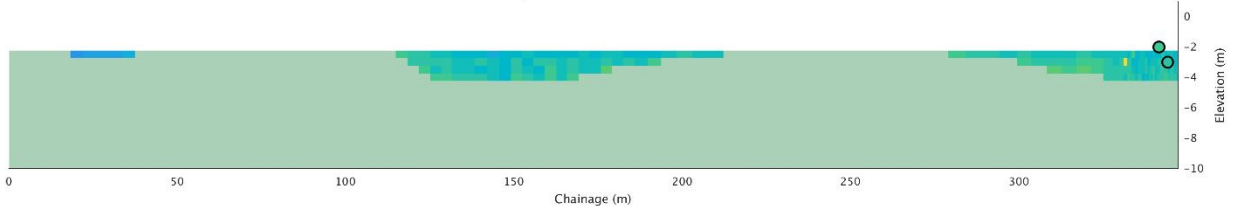
08-Sep-2018 15:33
Transect of Suspended Sediment in Profile



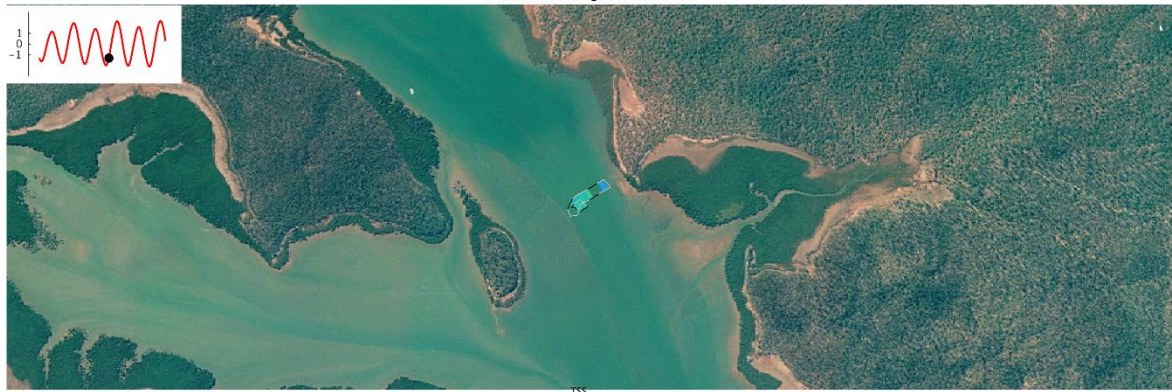
Transect of Dredge Plume in Plan



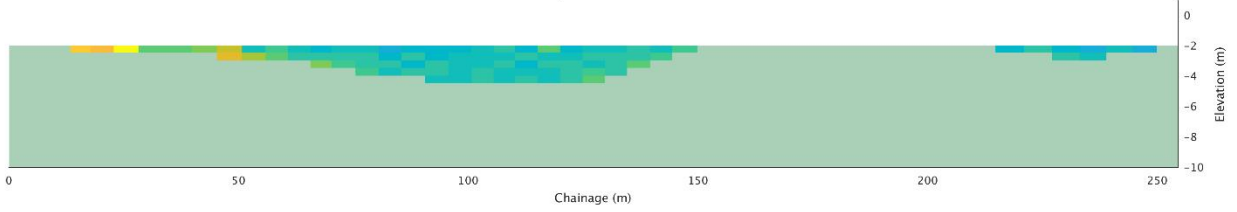
08-Sep-2018 15:39
Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



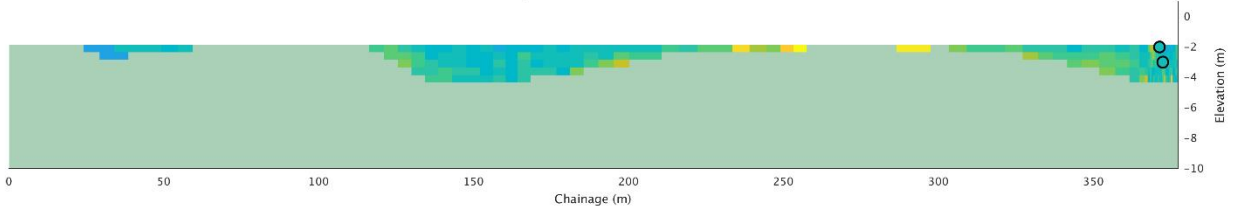
08-Sep-2018 16:00
Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



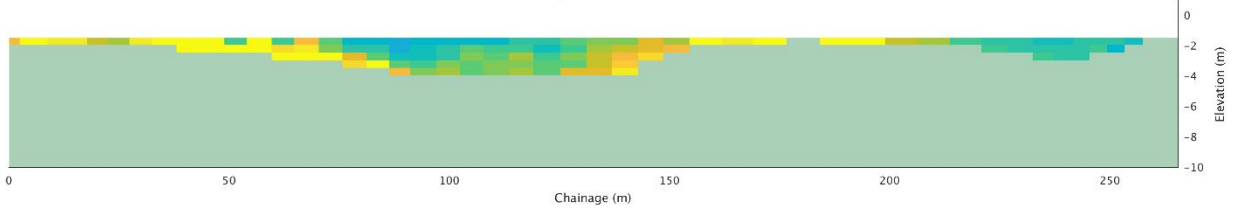
08-Sep-2018 16:05
Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



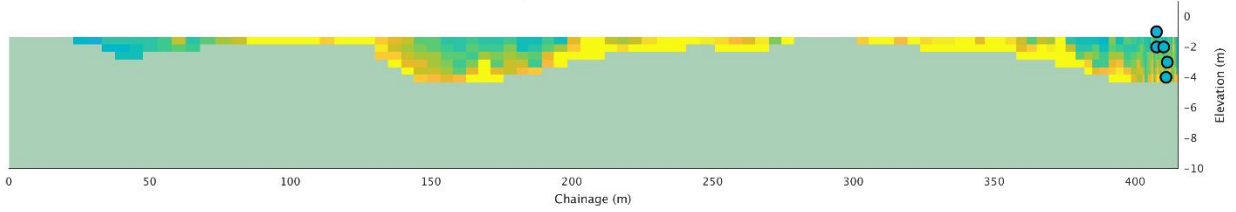
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Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



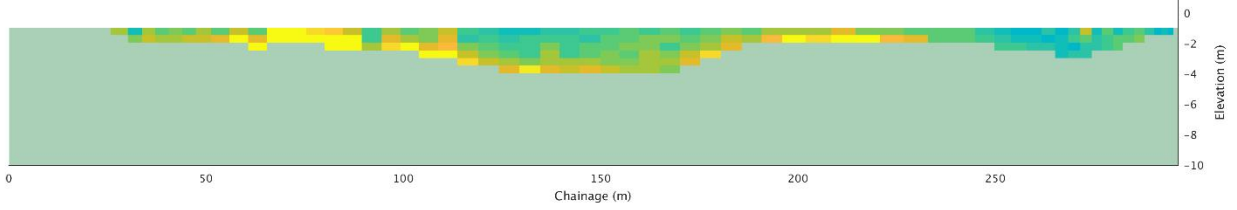
08-Sep-2018 16:38
Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



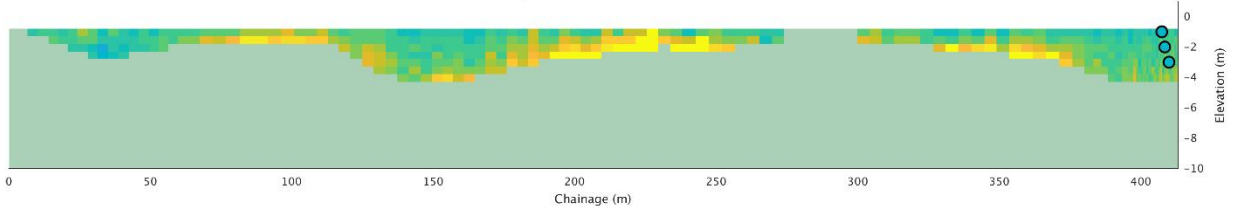
08-Sep-2018 17:04
Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



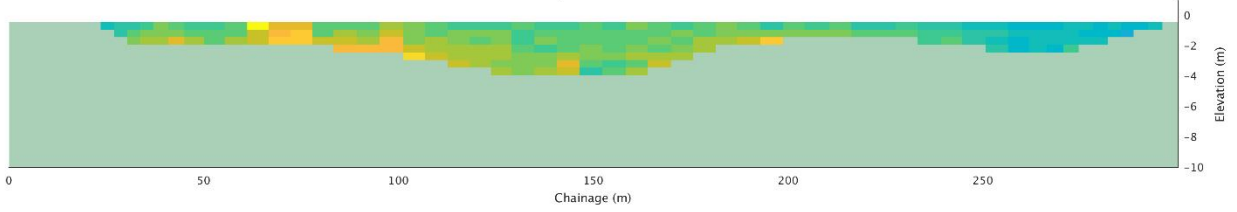
08-Sep-2018 17:10
Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



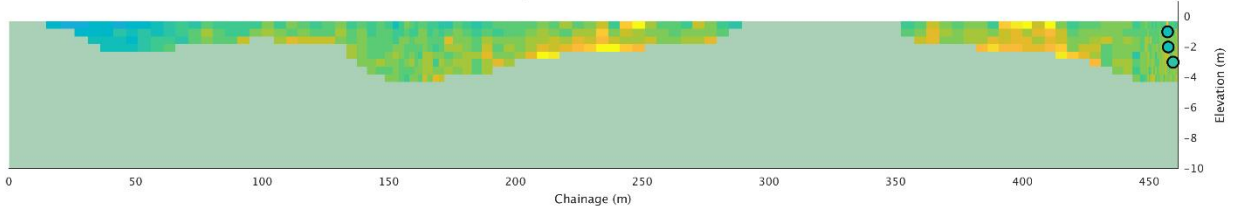
08-Sep-2018 17:35
Transect of Suspended Sediment in Profile



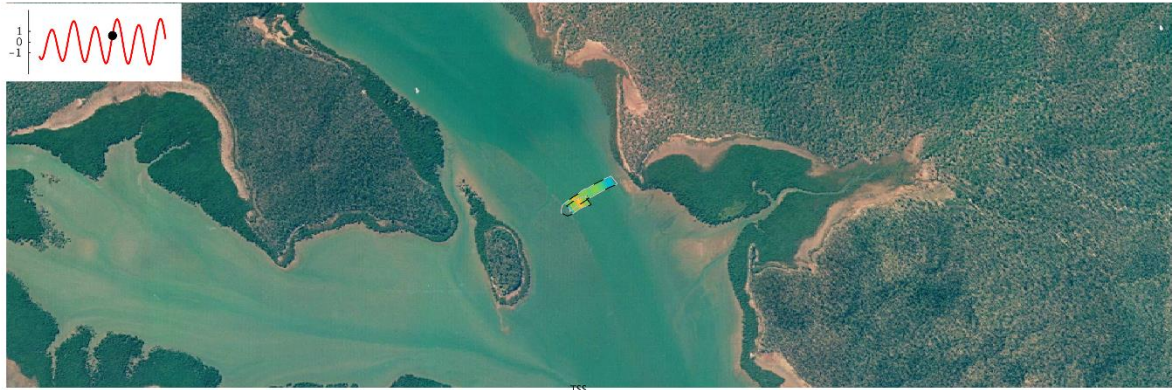
Transect of Dredge Plume in Plan



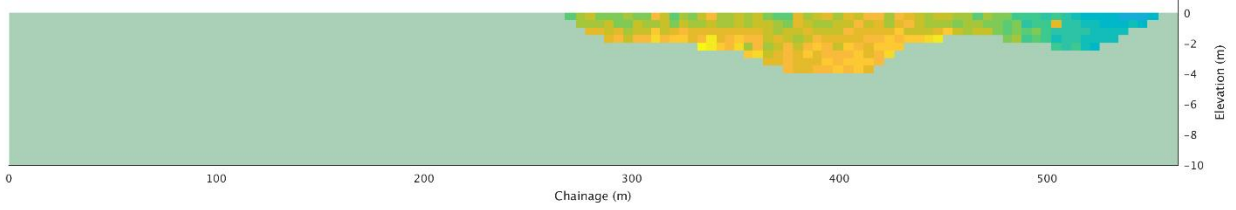
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Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



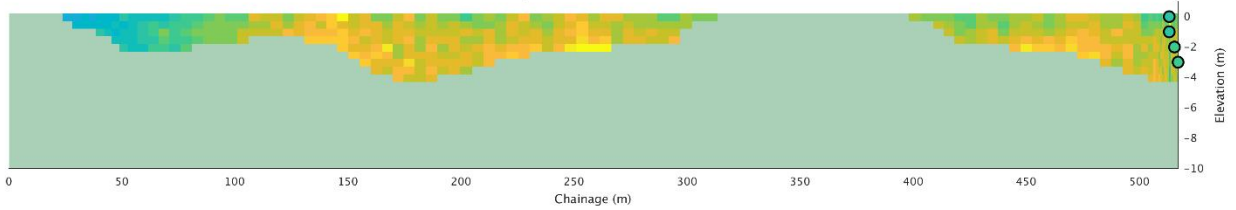
08-Sep-2018 18:07
Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan

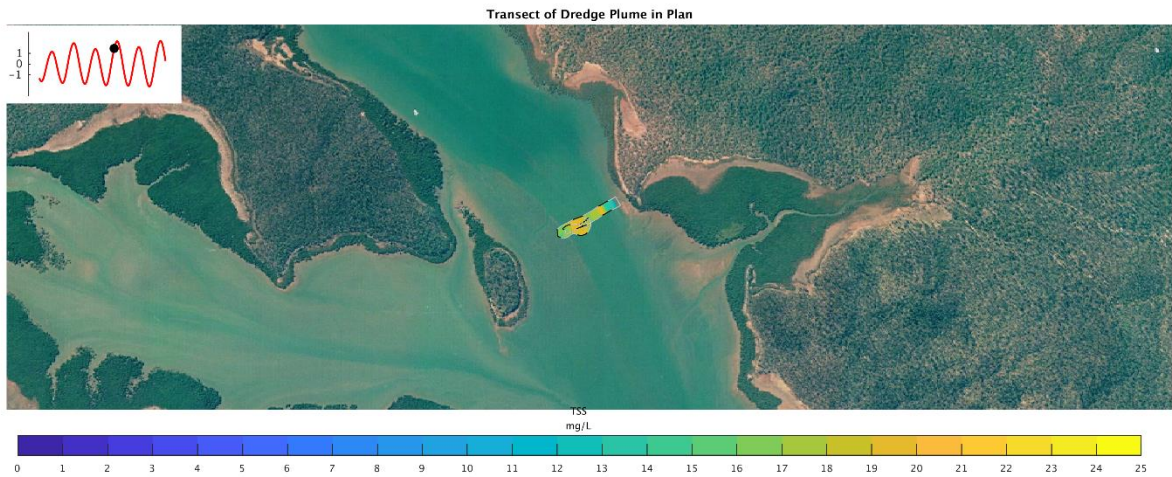
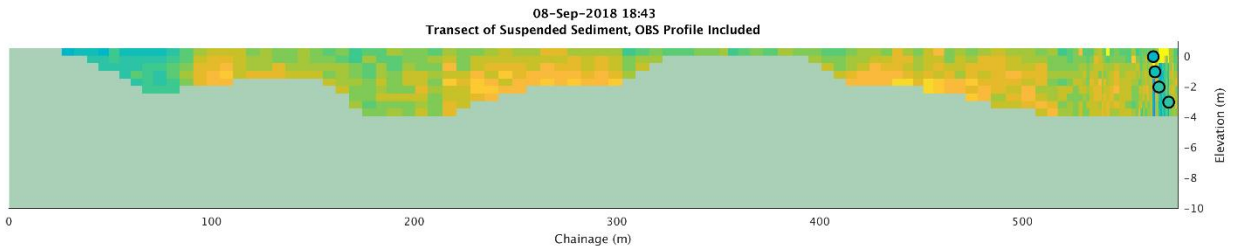
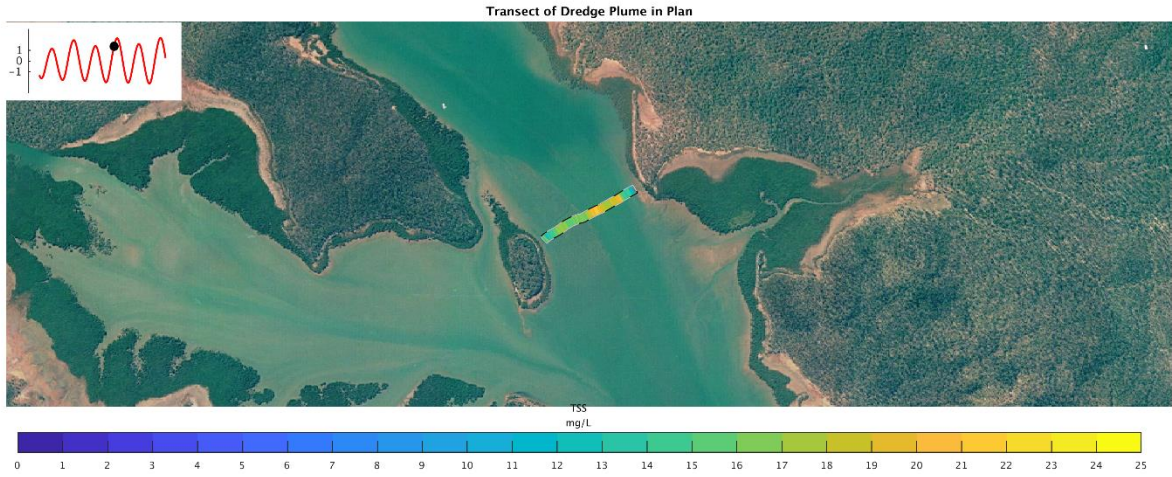
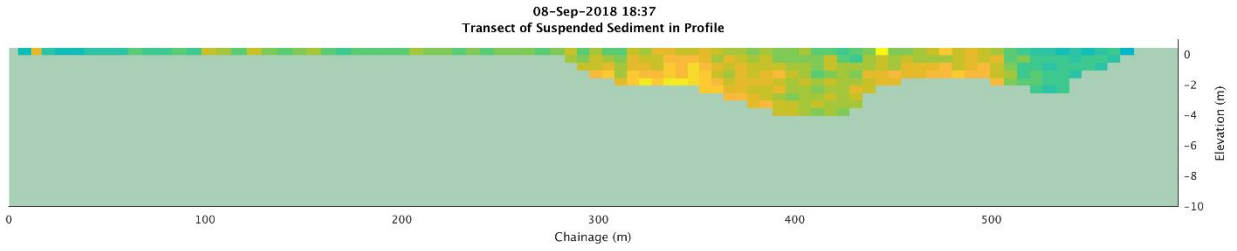


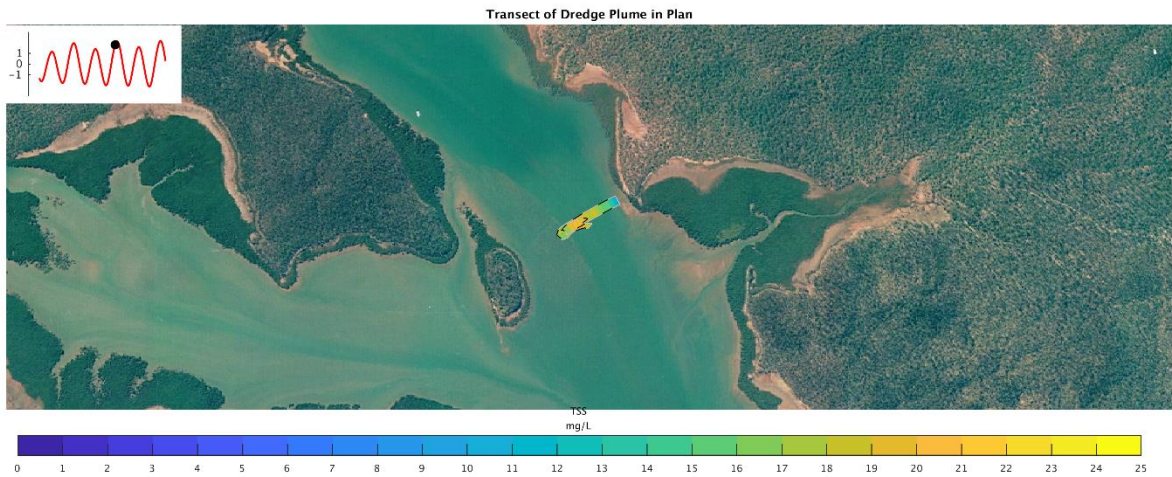
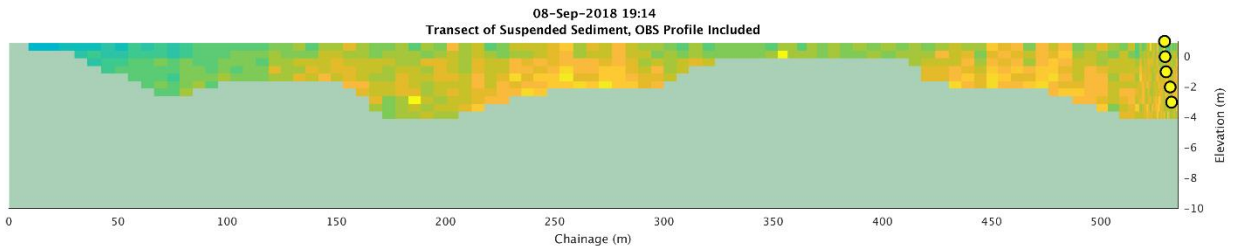
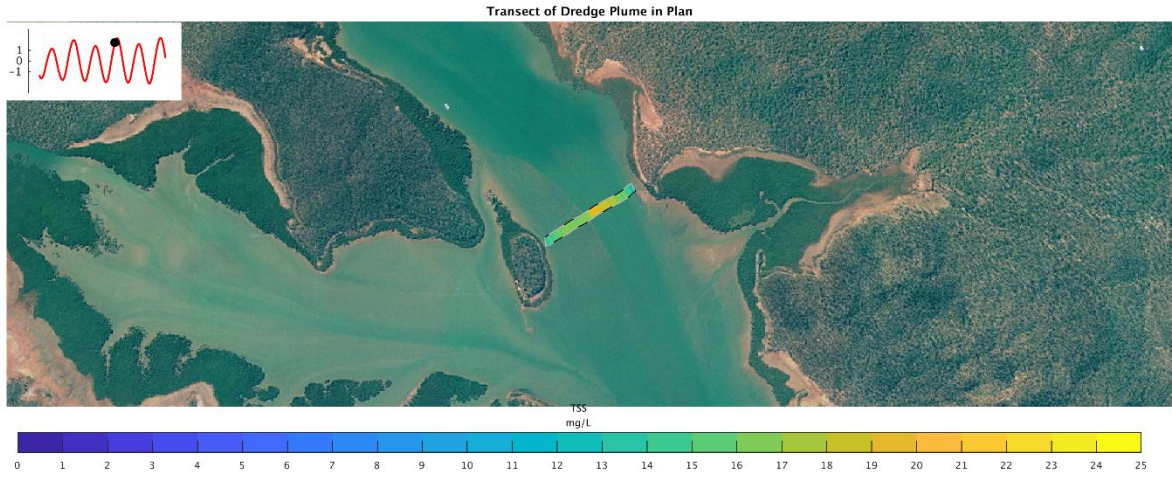
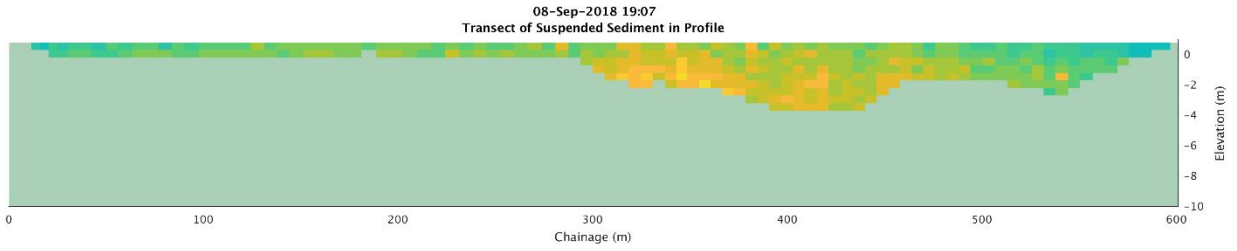
08-Sep-2018 18:15
Transect of Suspended Sediment, OBS Profile Included

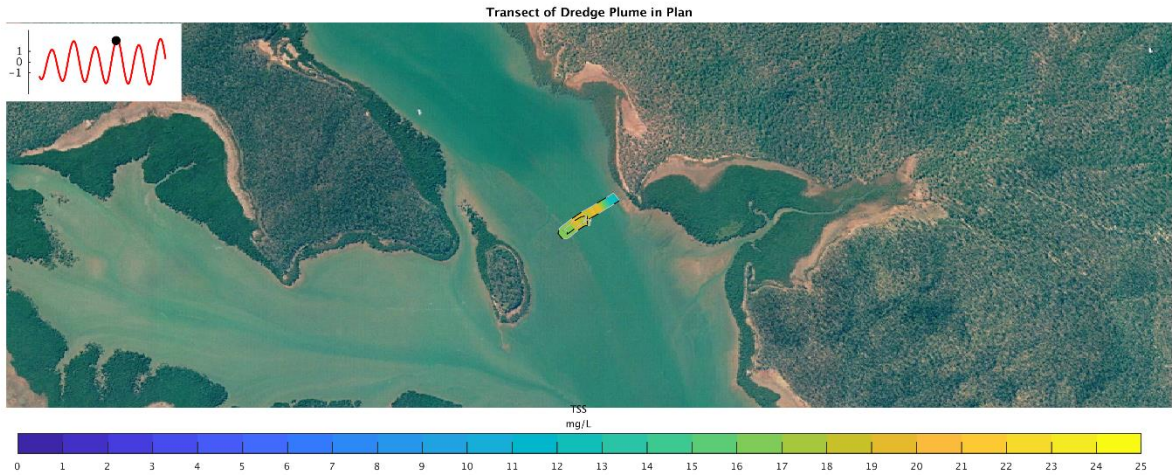
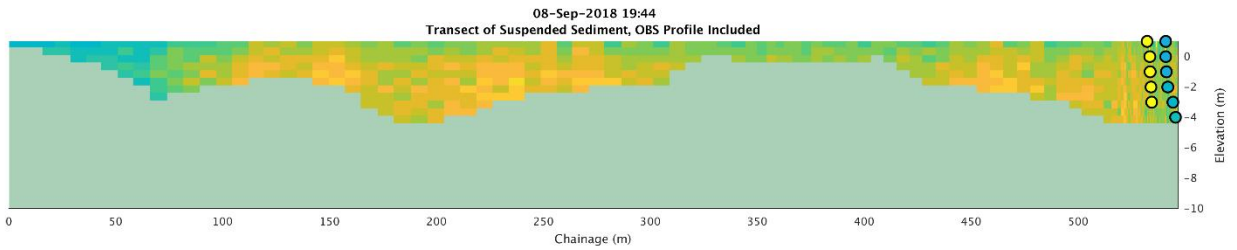
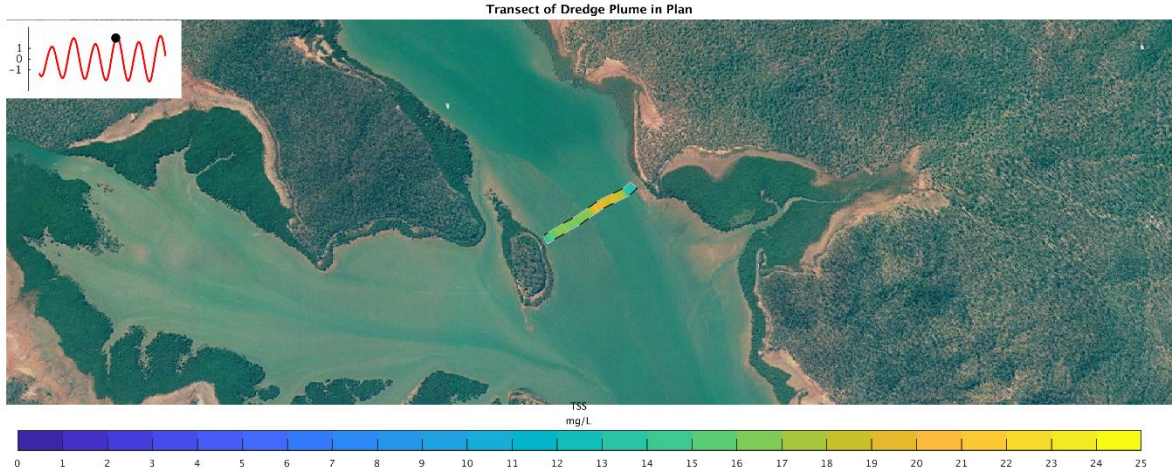
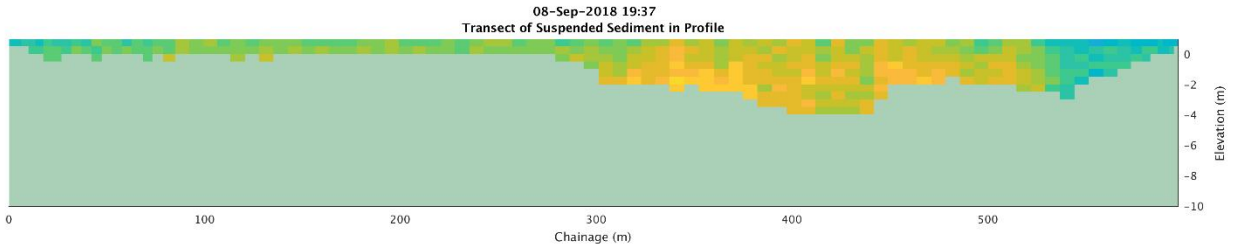


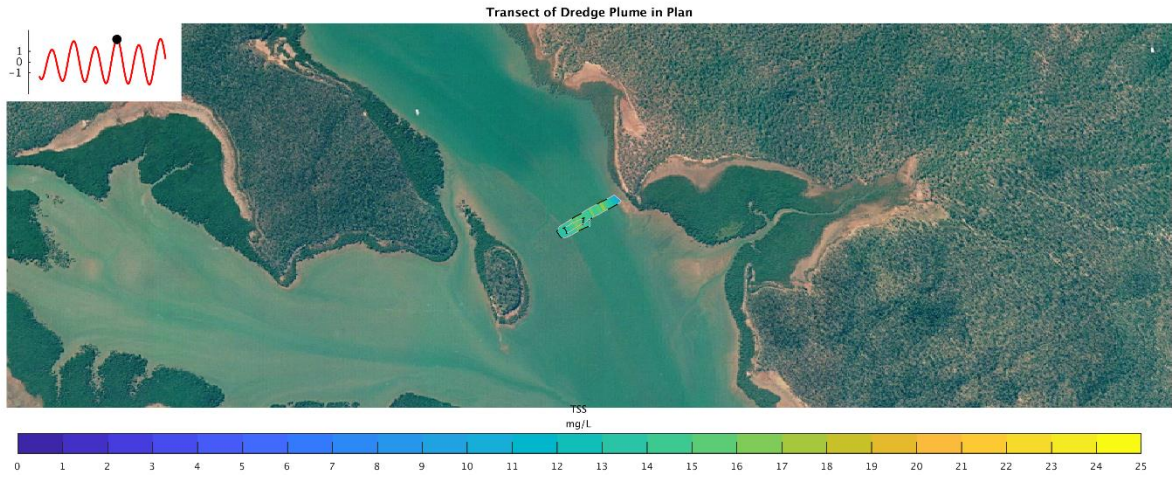
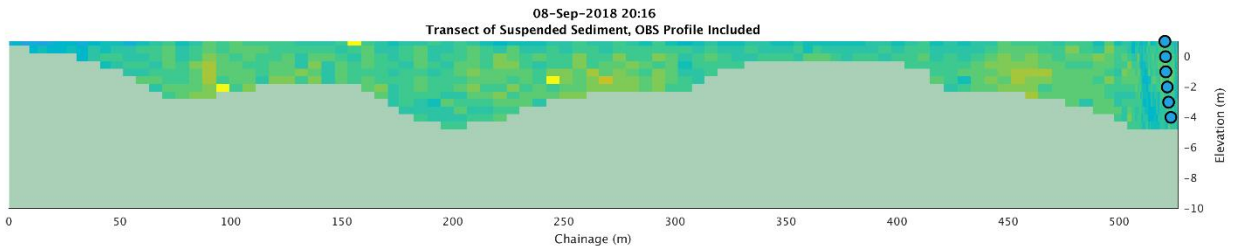
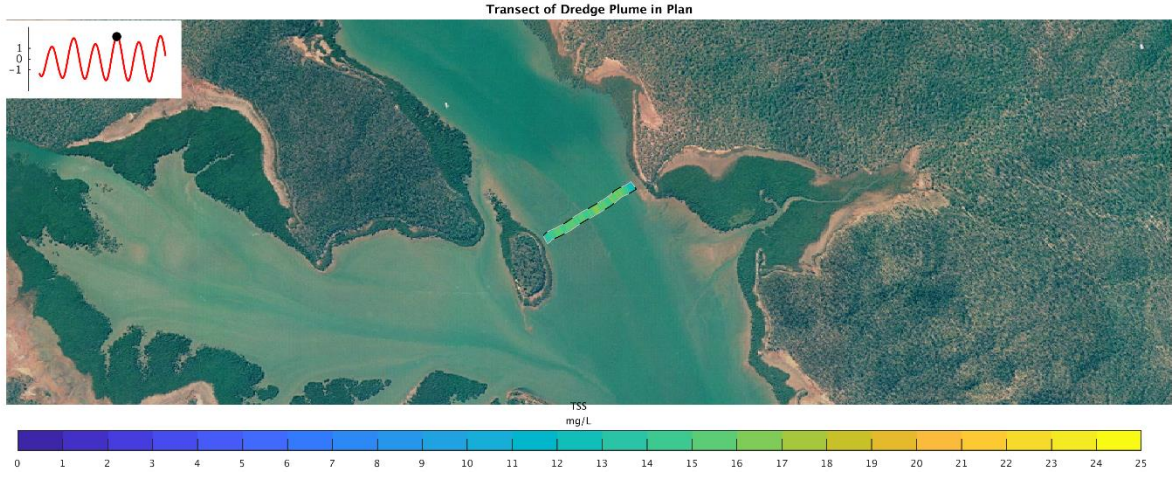
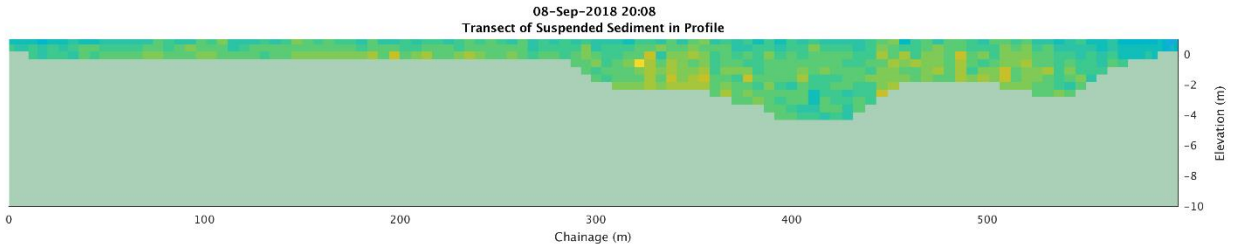
Transect of Dredge Plume in Plan

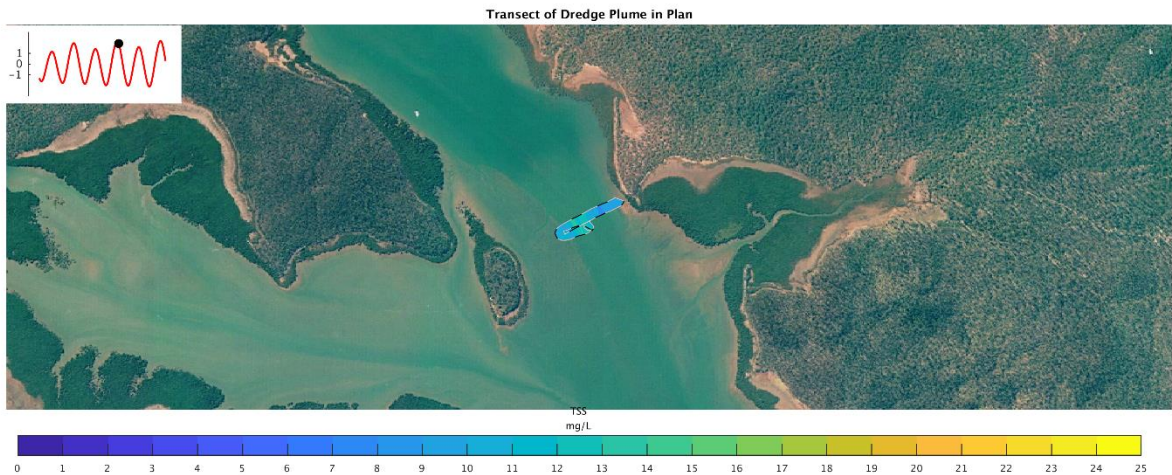
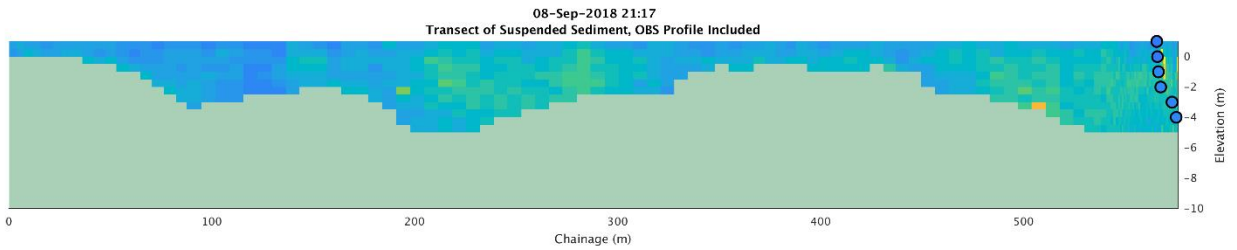
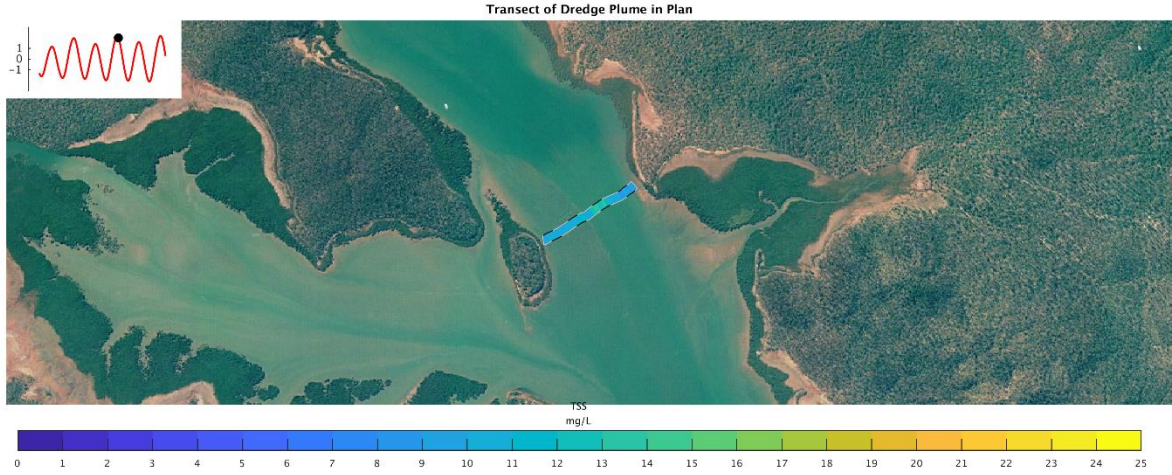
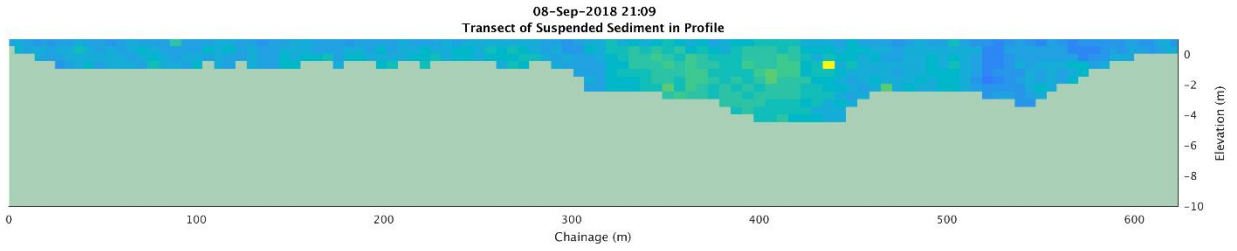


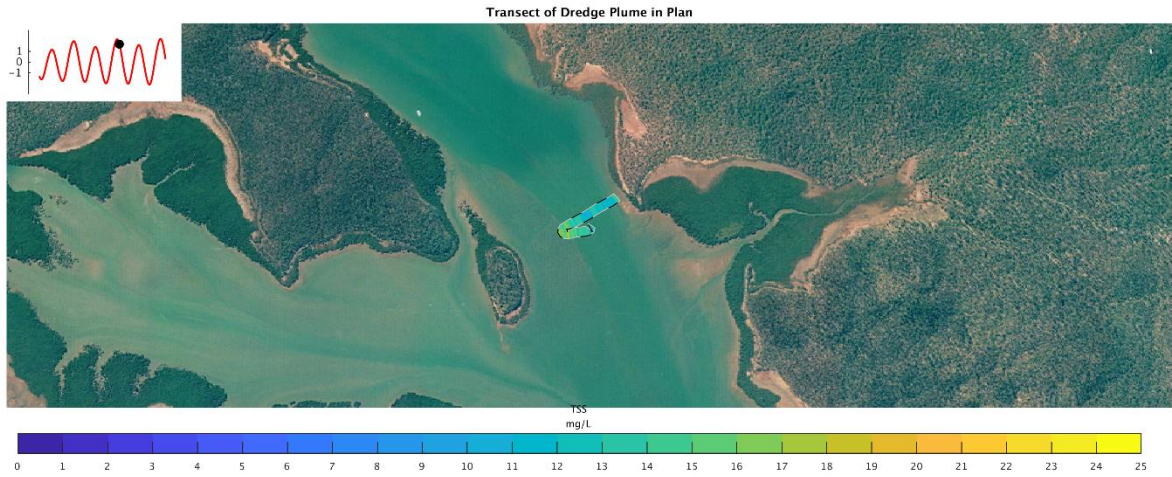
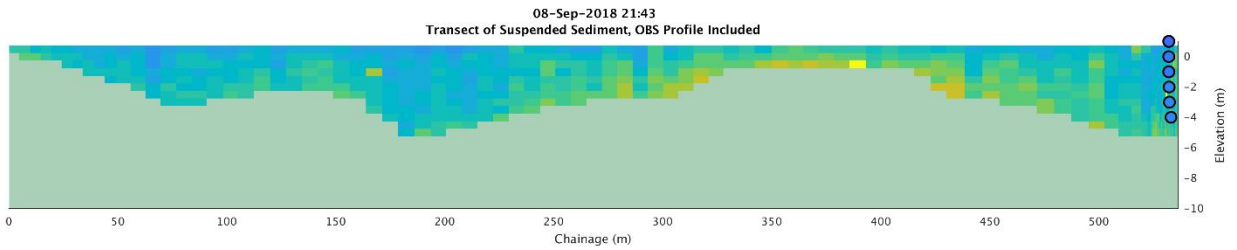
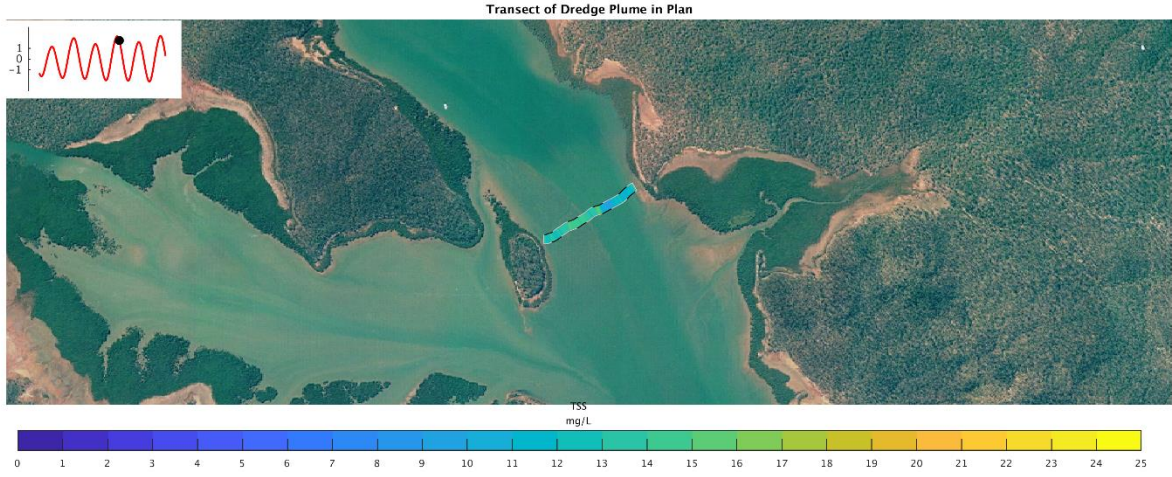
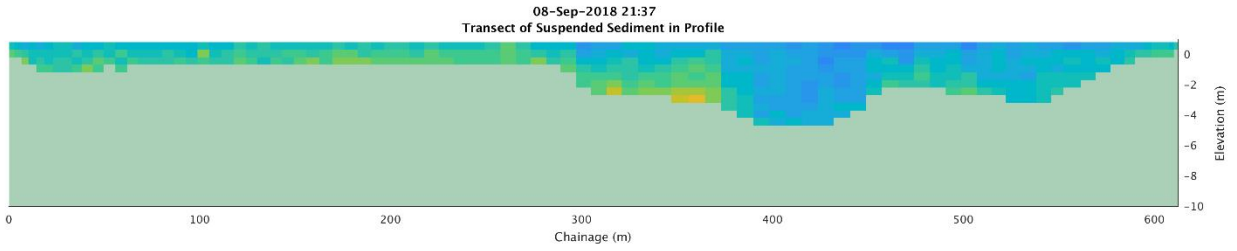


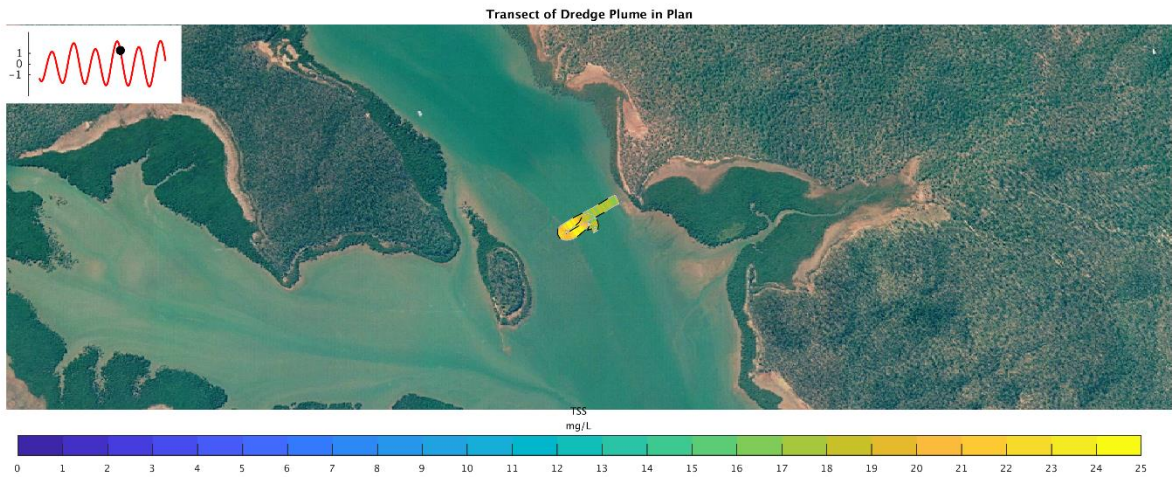
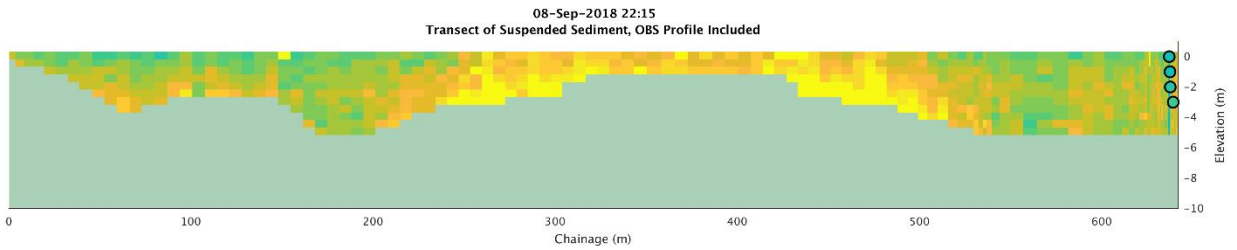
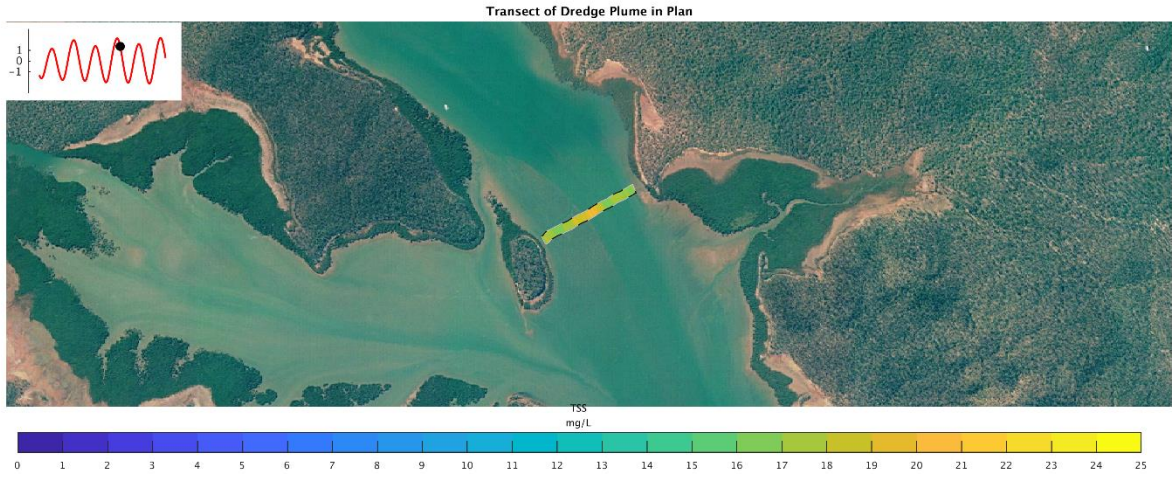
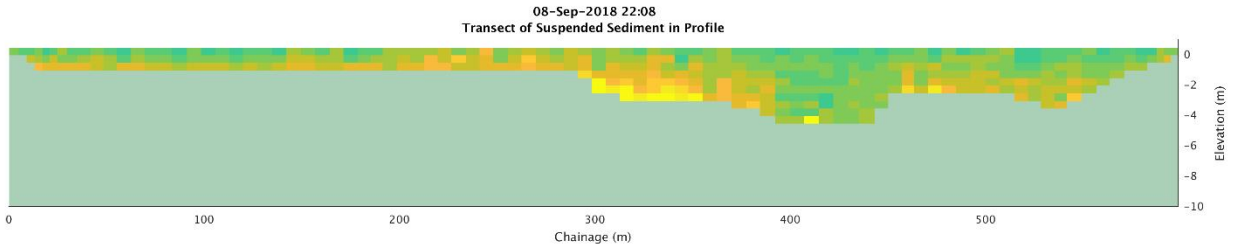




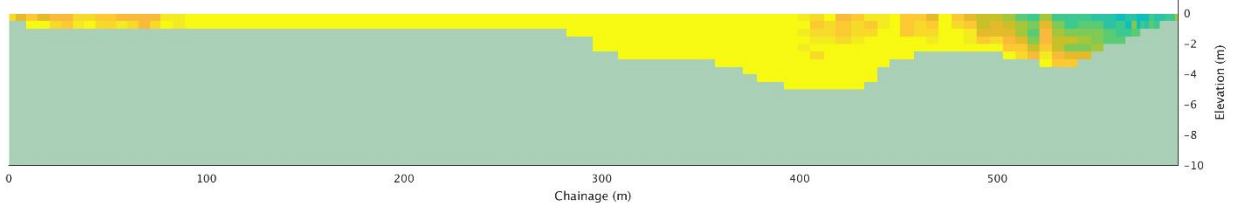








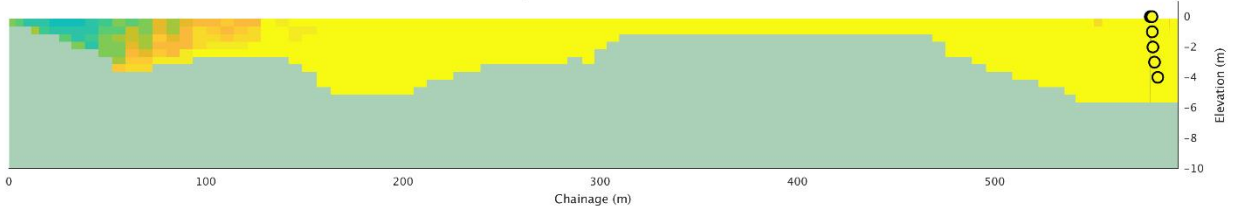
08-Sep-2018 22:38
Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



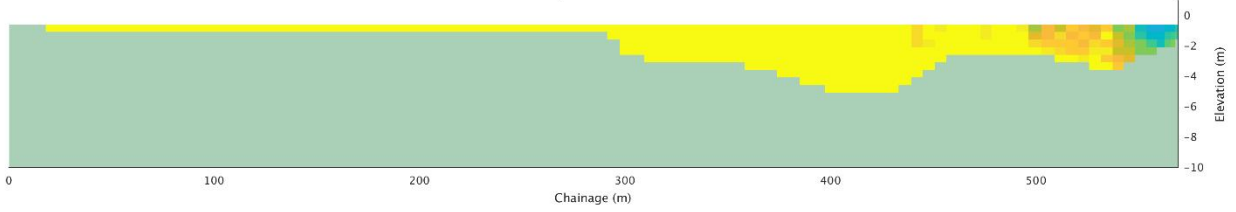
08-Sep-2018 22:45
Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



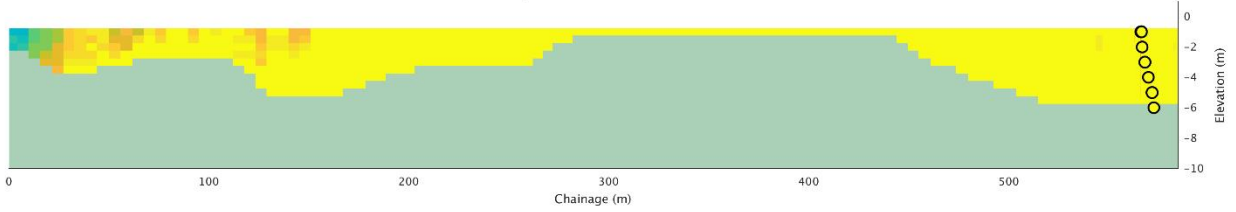
08-Sep-2018 23:13
Transect of Suspended Sediment in Profile



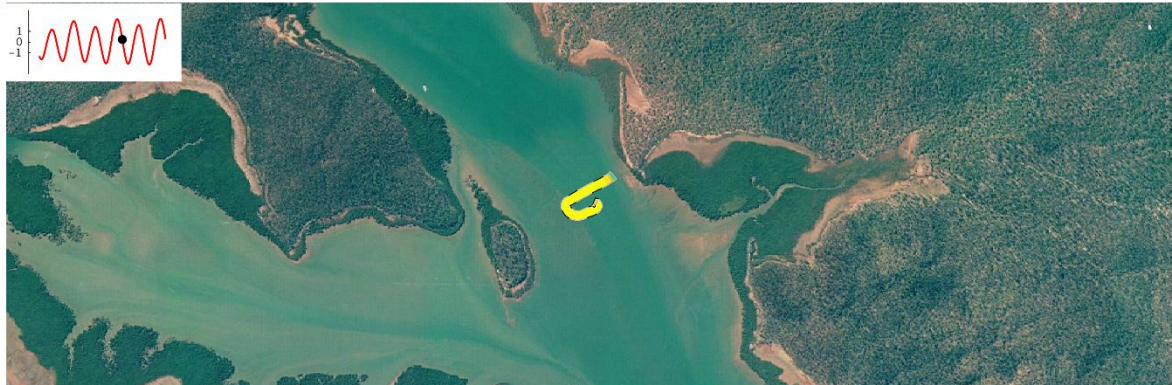
Transect of Dredge Plume in Plan



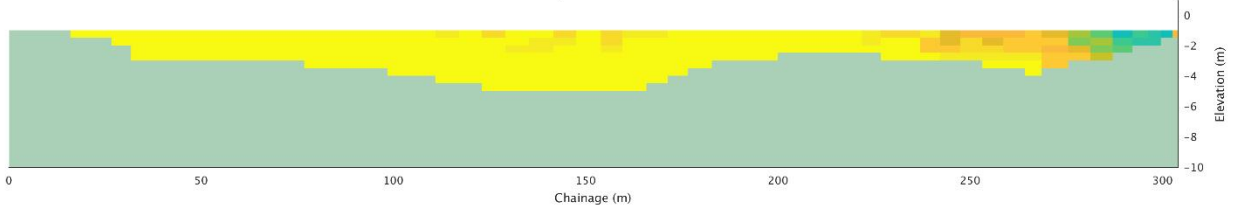
08-Sep-2018 23:21
Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



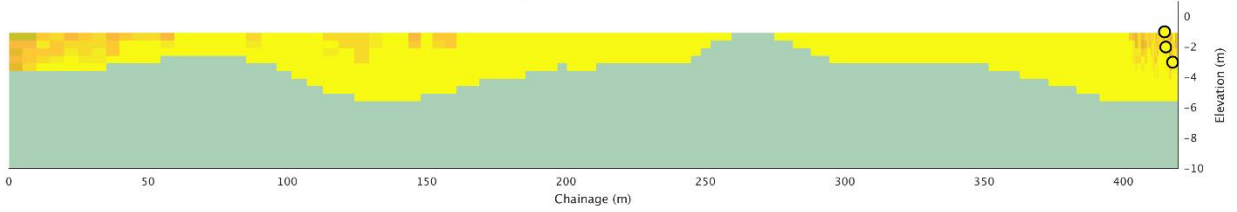
08-Sep-2018 23:36
Transect of Suspended Sediment in Profile



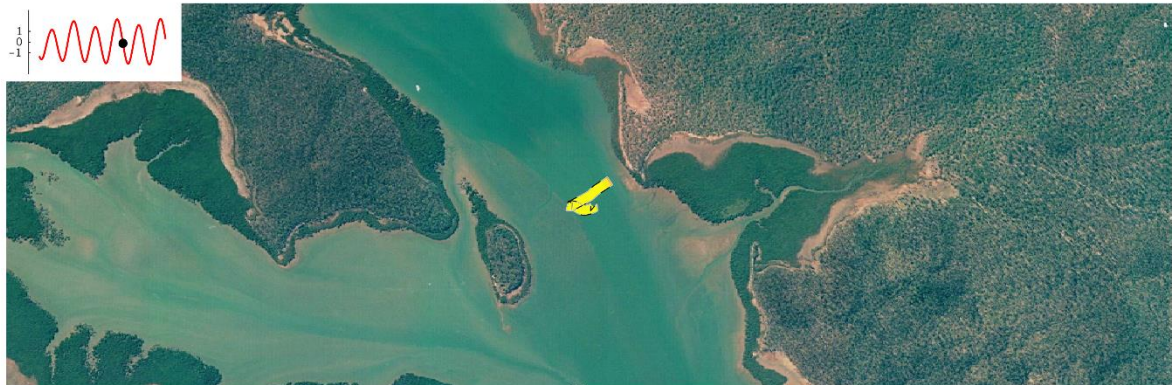
Transect of Dredge Plume in Plan



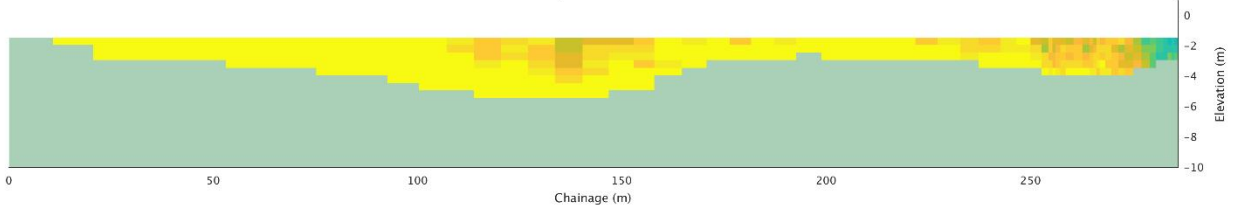
08-Sep-2018 23:42
Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



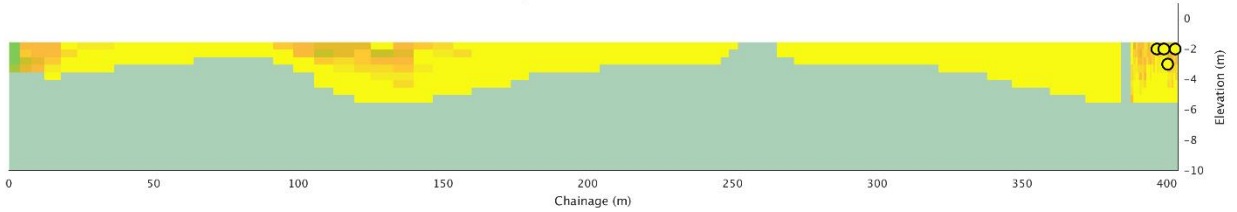
09-Sep-2018 00:05
Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



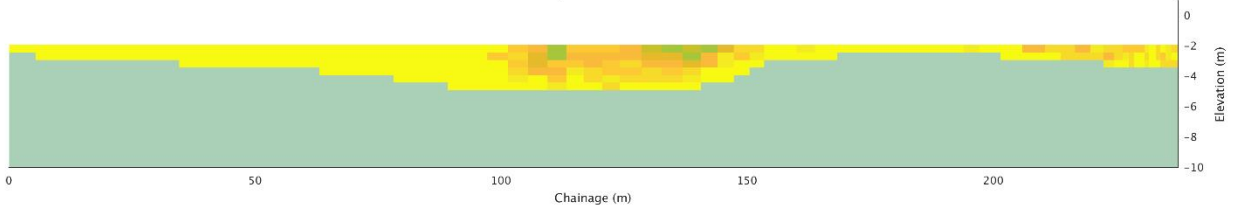
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Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



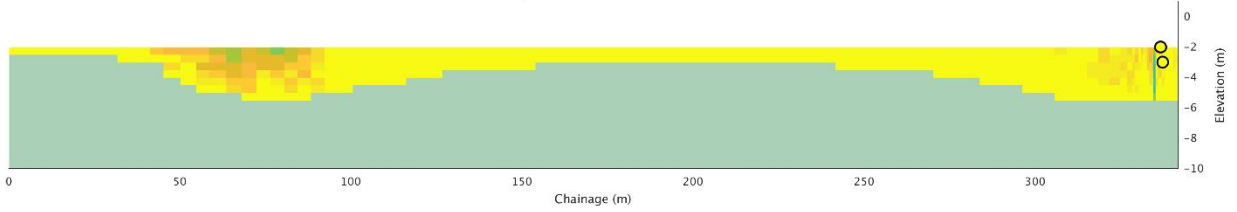
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Transect of Suspended Sediment in Profile



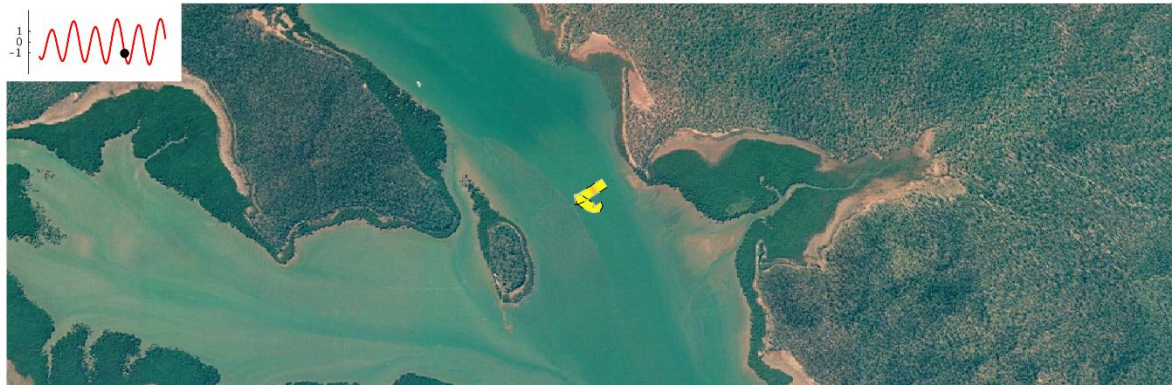
Transect of Dredge Plume in Plan



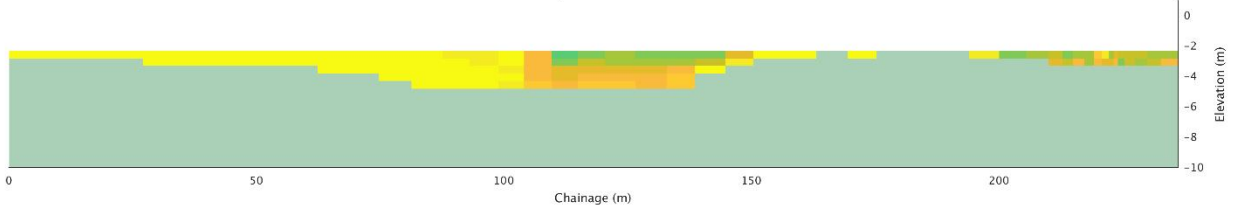
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Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



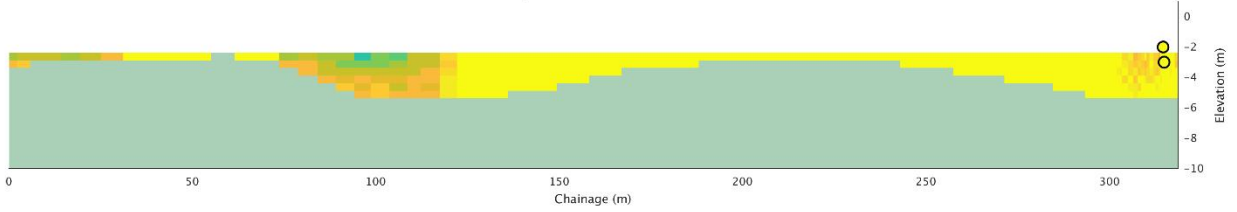
09-Sep-2018 01:04
Transect of Suspended Sediment in Profile



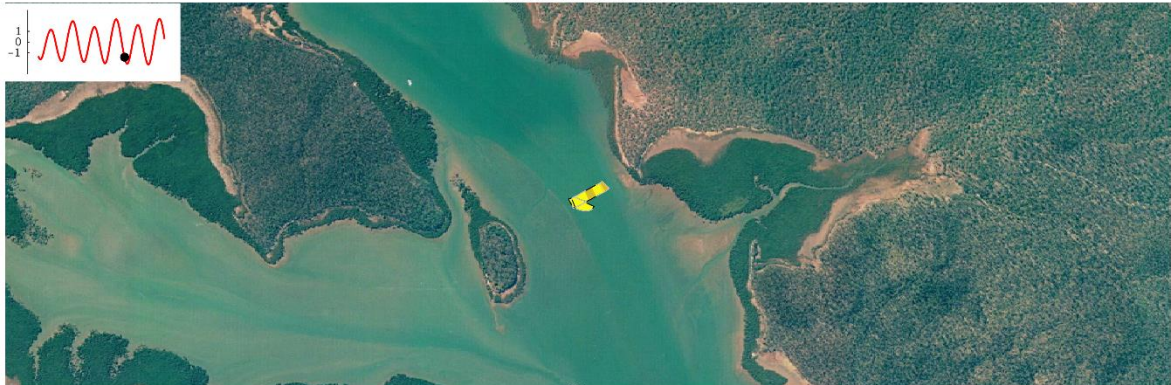
Transect of Dredge Plume in Plan



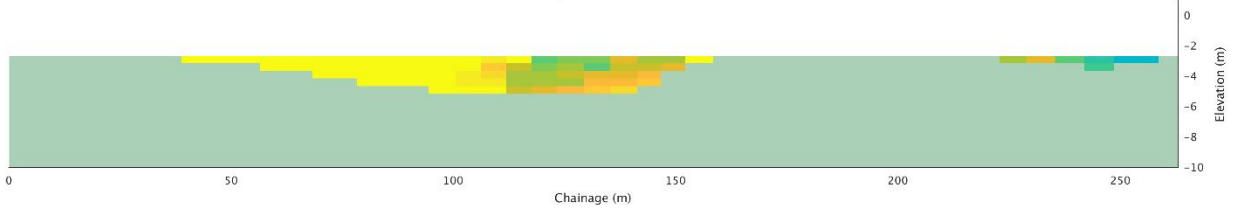
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Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



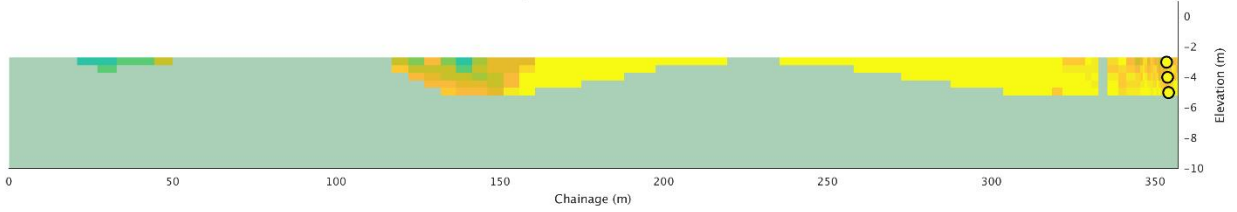
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Transect of Suspended Sediment in Profile



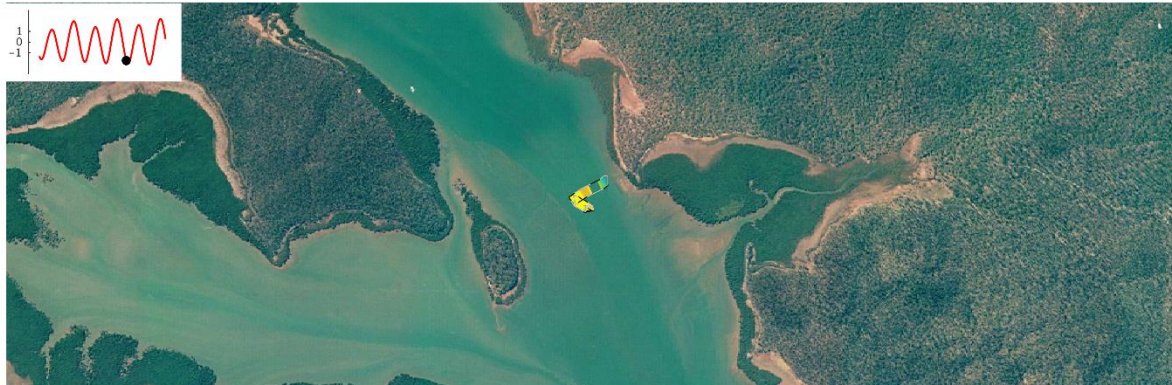
Transect of Dredge Plume in Plan



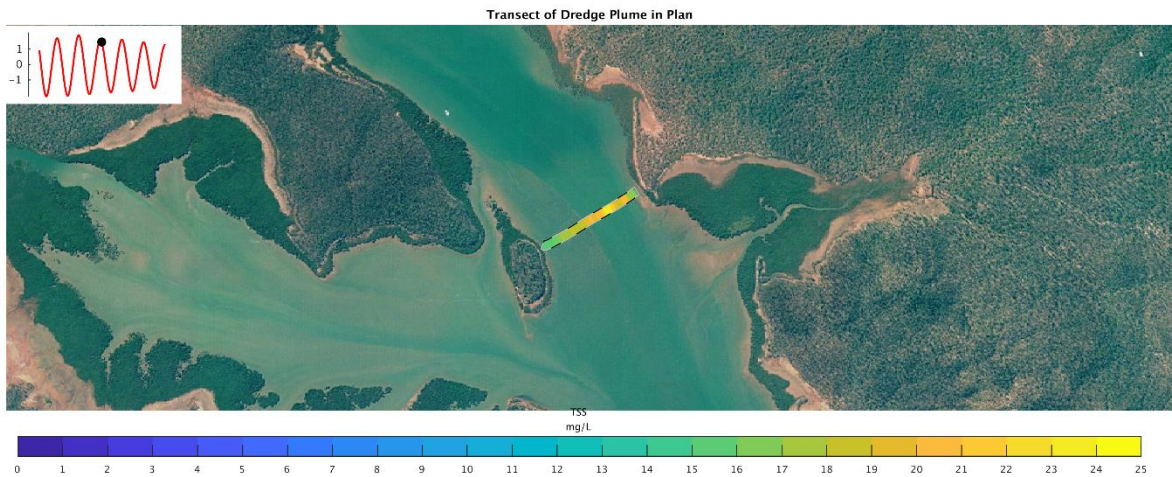
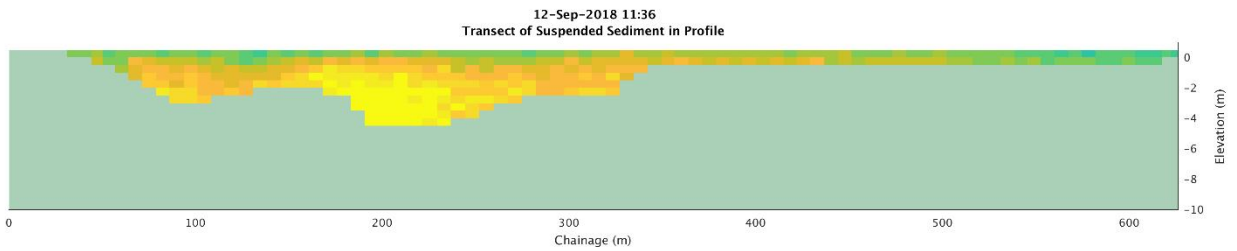
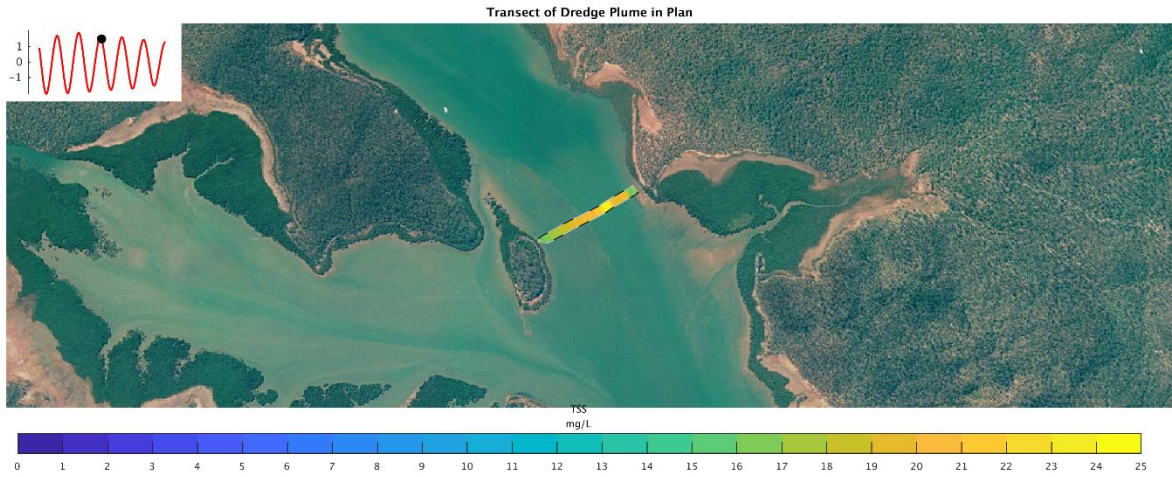
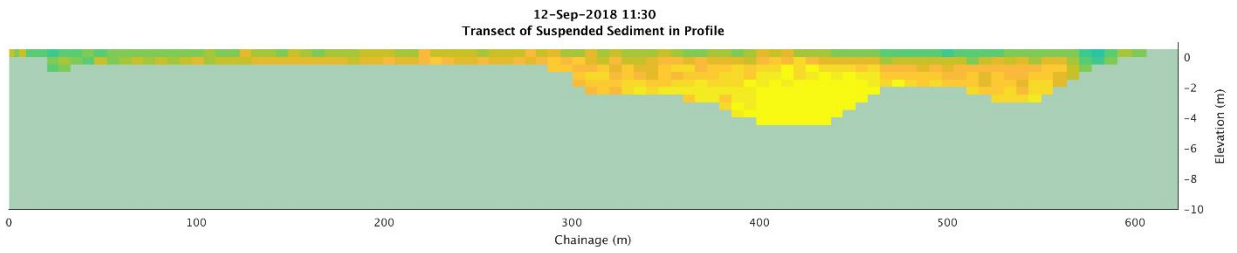
09-Sep-2018 01:38
Transect of Suspended Sediment, OBS Profile Included

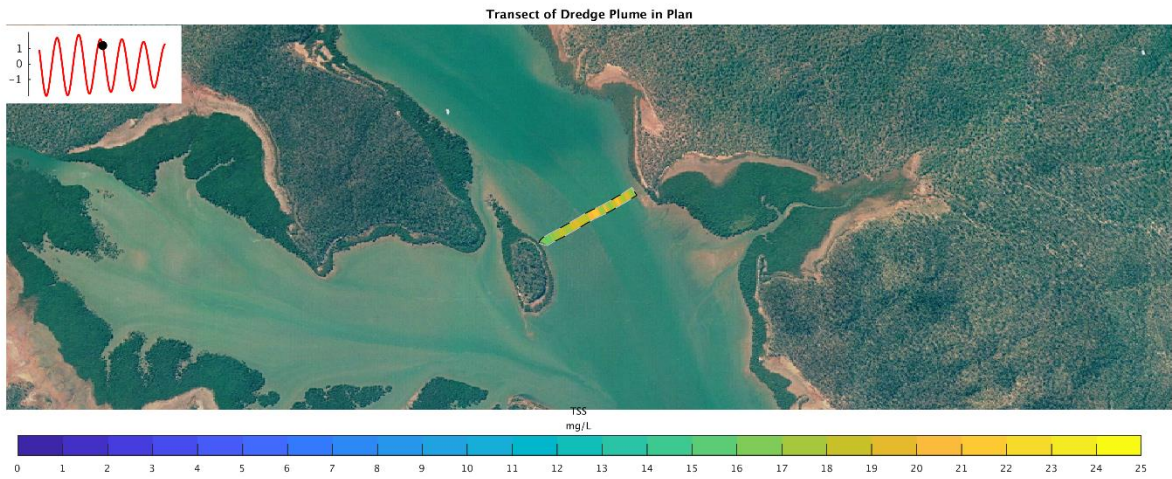
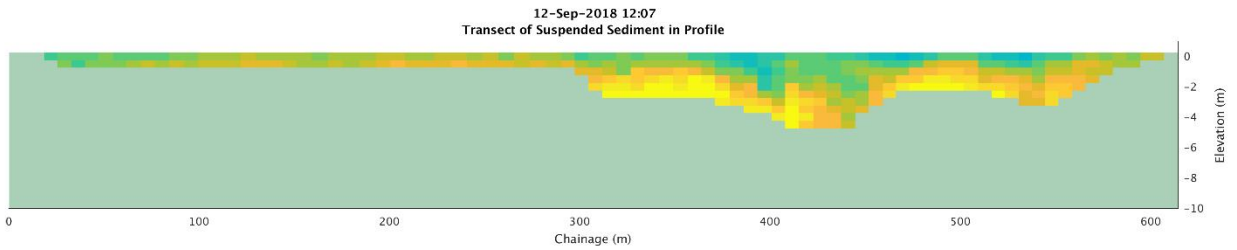
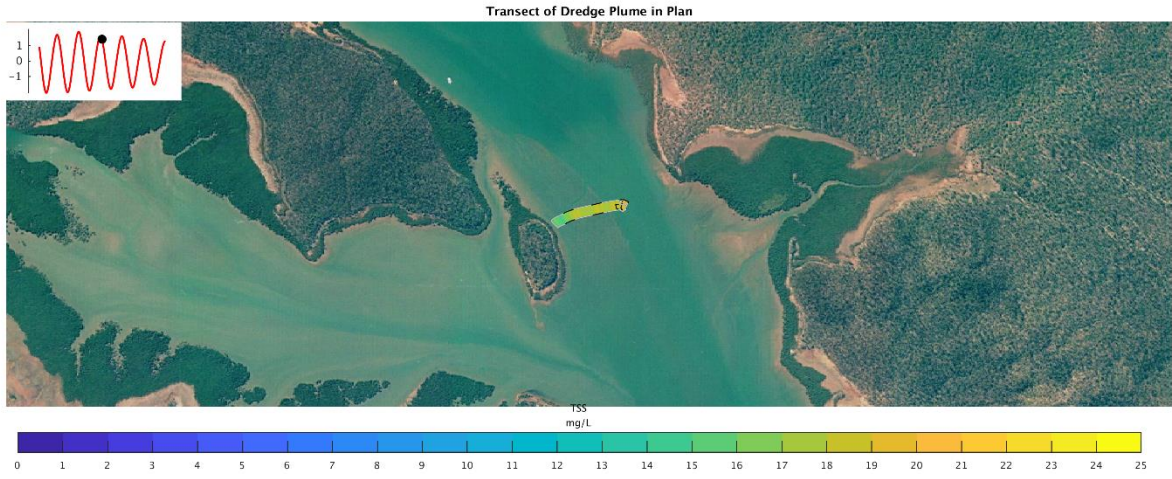
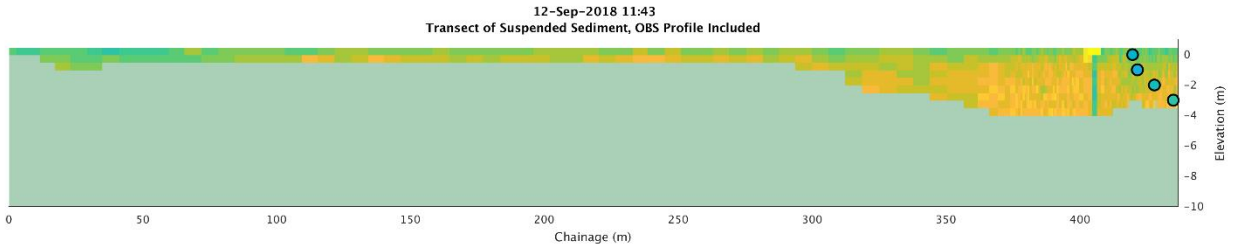


Transect of Dredge Plume in Plan

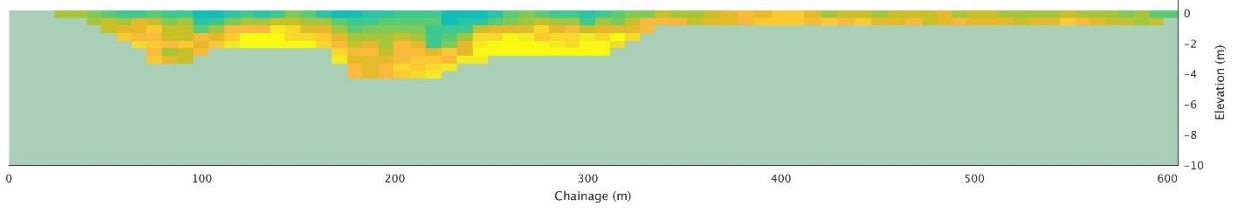


Transect C – The Narrows– Average Tide





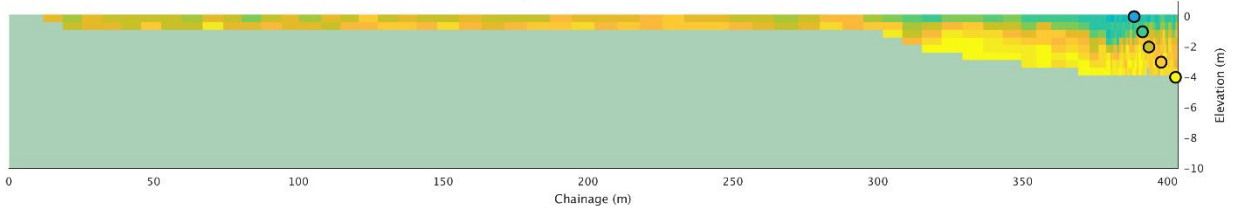
12-Sep-2018 12:12
Transect of Suspended Sediment in Profile



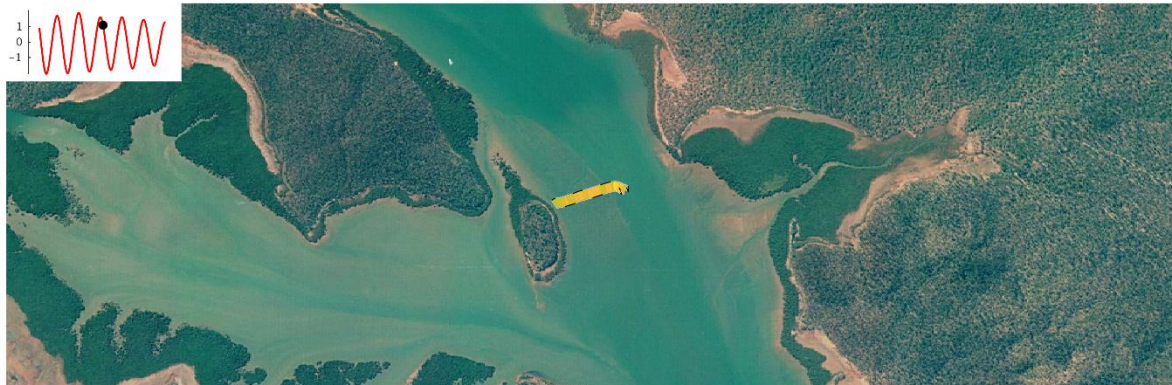
Transect of Dredge Plume in Plan



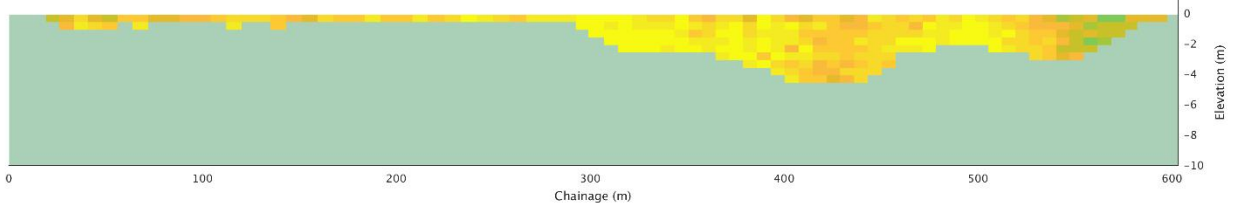
12-Sep-2018 12:18
Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



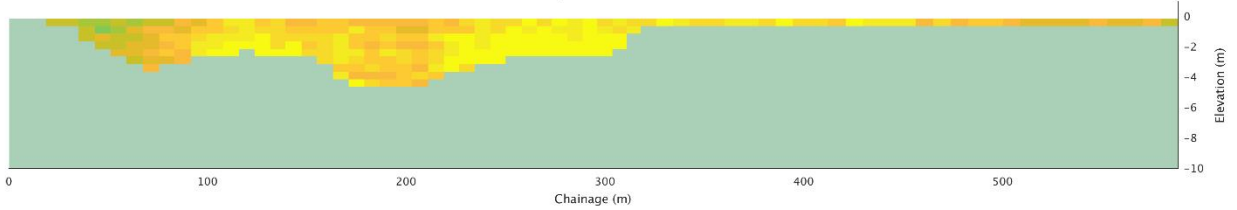
12-Sep-2018 12:38
Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



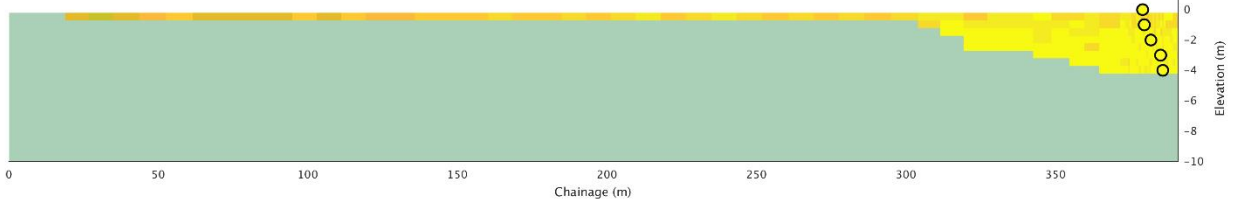
12-Sep-2018 12:43
Transect of Suspended Sediment in Profile



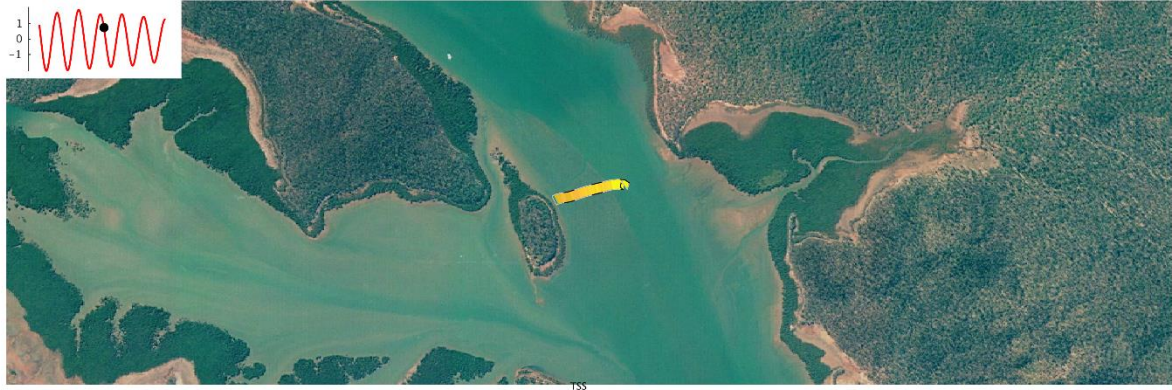
Transect of Dredge Plume in Plan



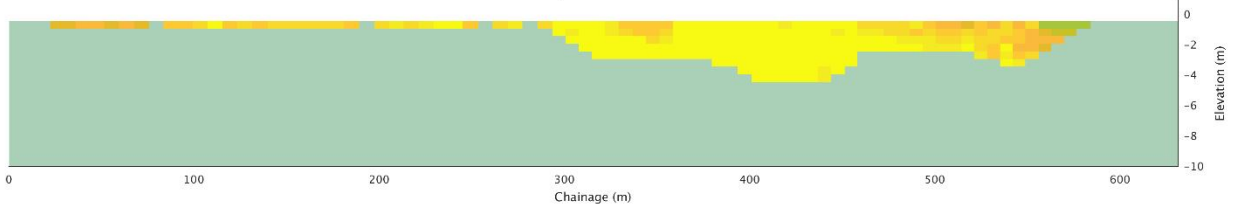
12-Sep-2018 12:48
Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



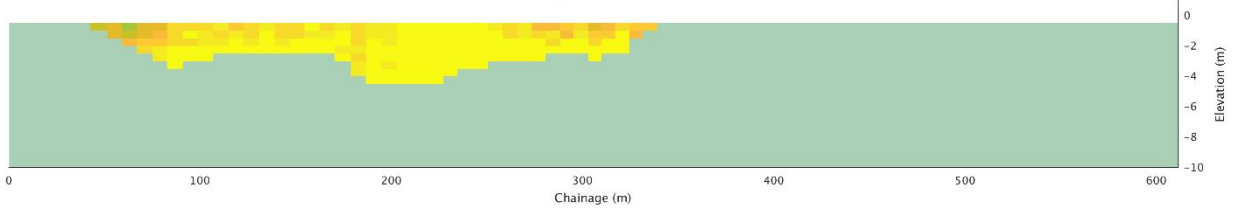
12-Sep-2018 13:07
Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



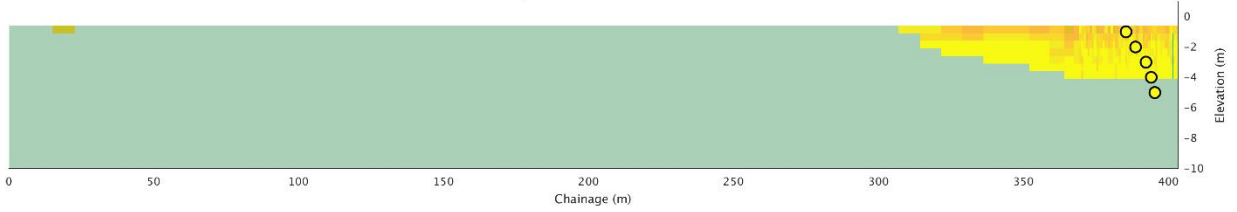
12-Sep-2018 13:12
Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



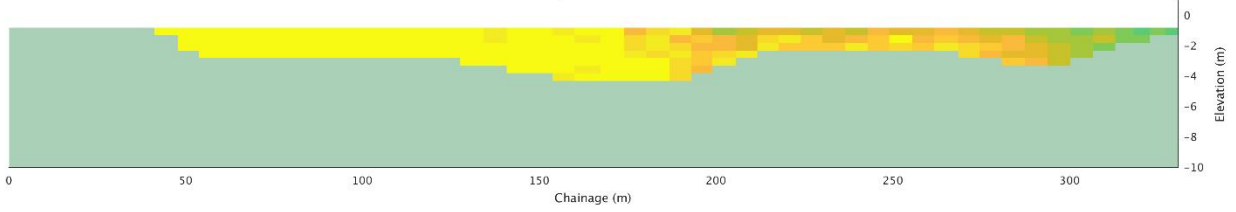
12-Sep-2018 13:18
Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



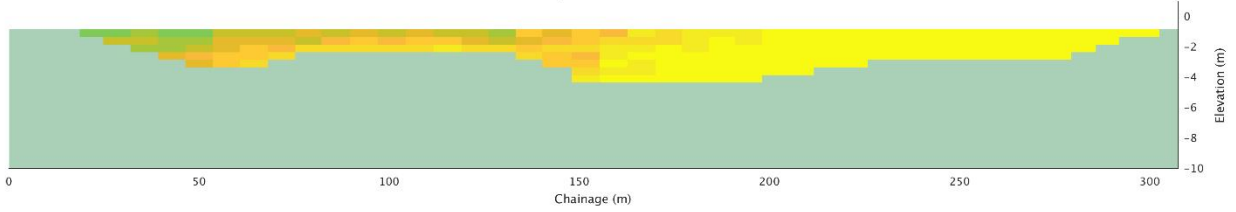
12-Sep-2018 13:34
Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



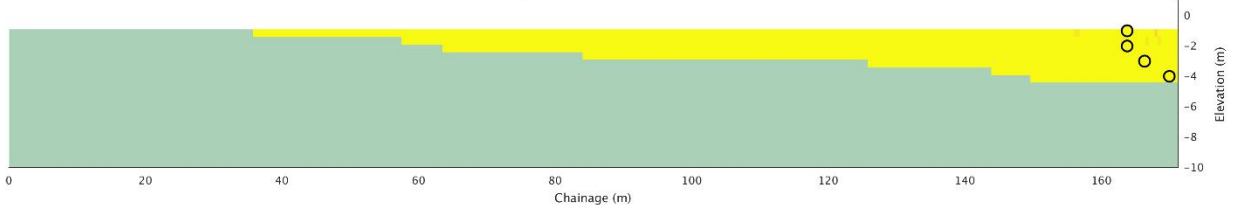
12-Sep-2018 13:37
Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



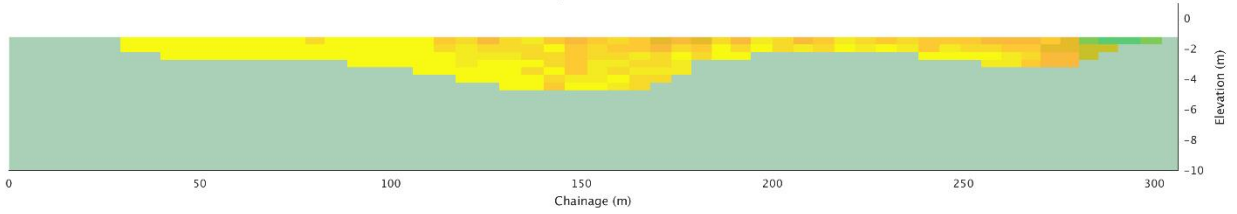
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Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



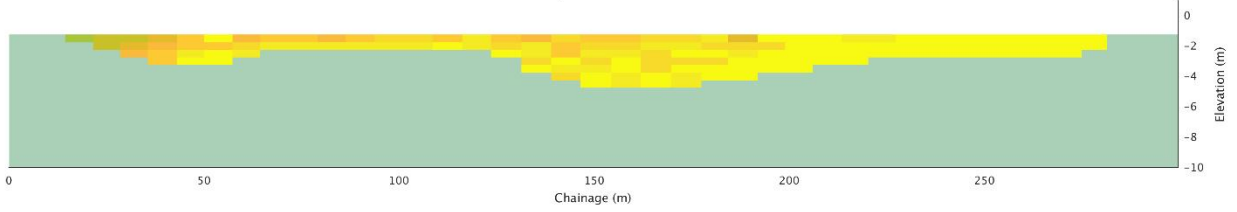
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Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



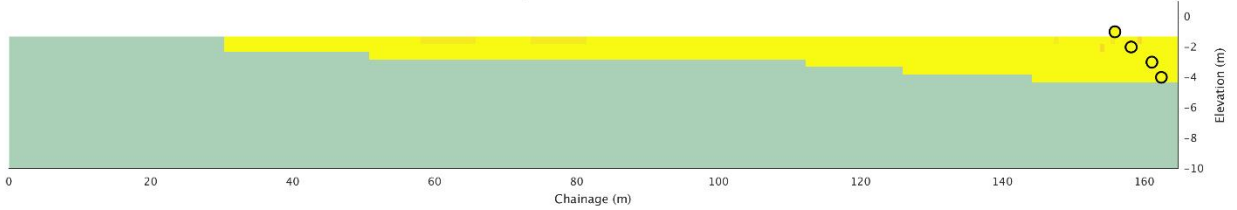
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Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



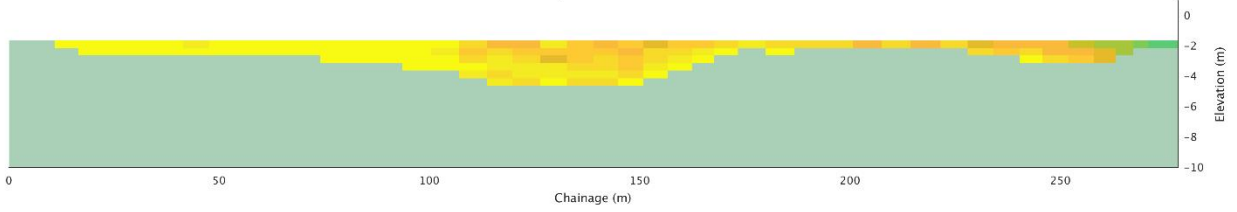
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Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



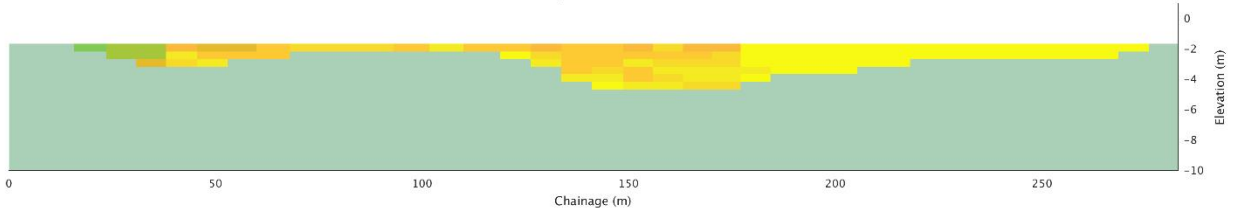
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Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



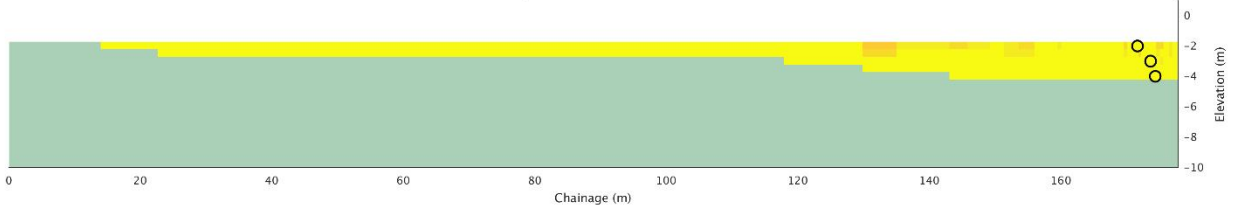
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Transect of Suspended Sediment in Profile



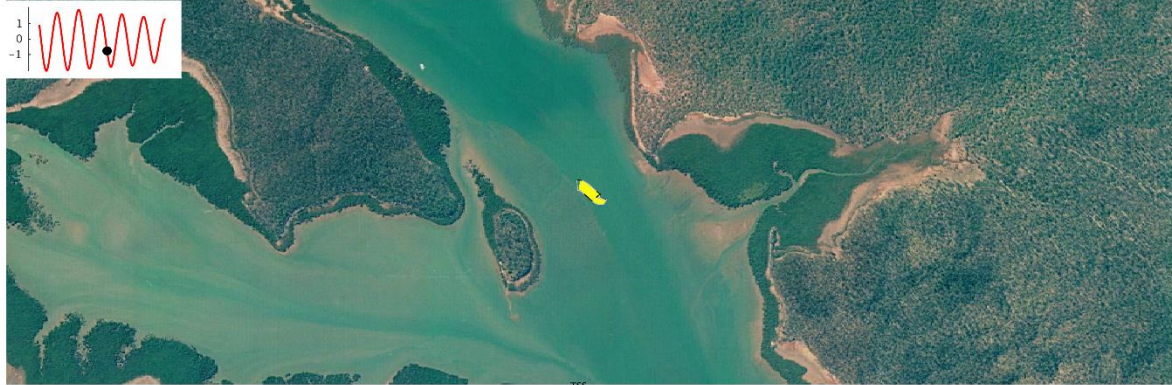
Transect of Dredge Plume in Plan



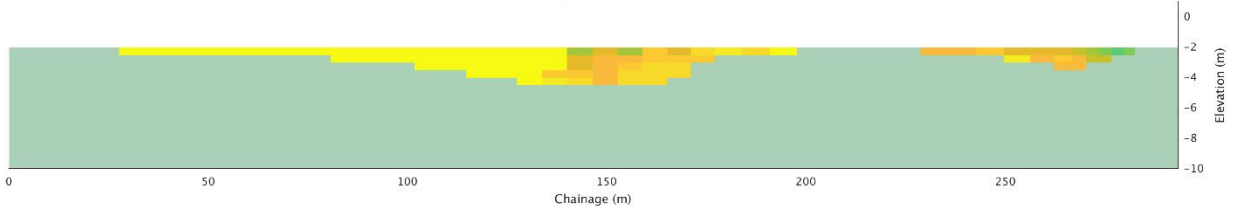
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Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



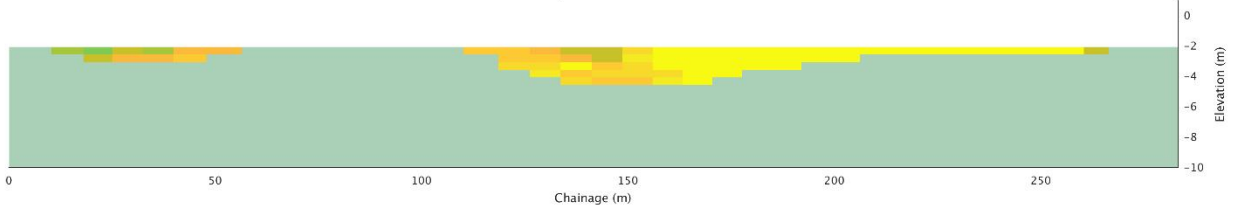
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Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



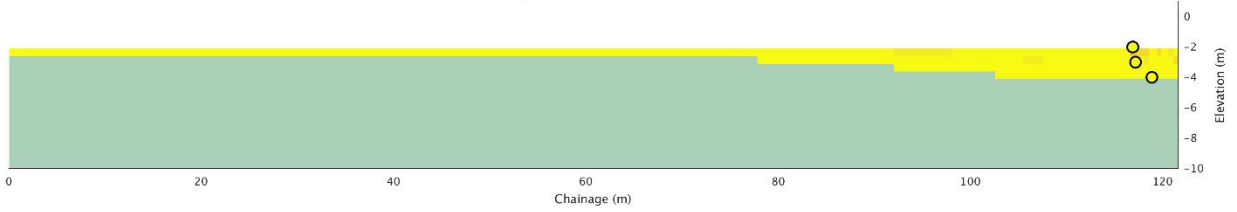
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Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



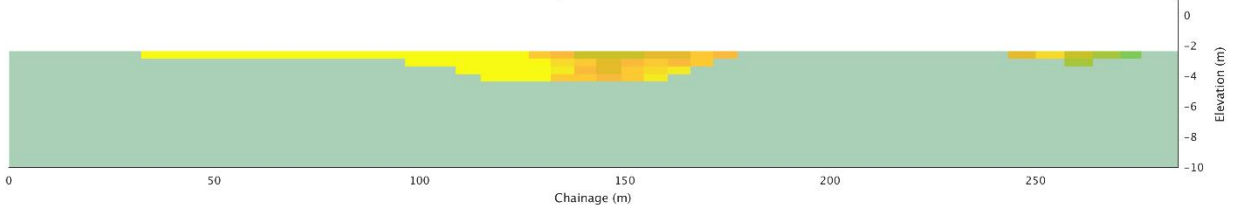
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Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



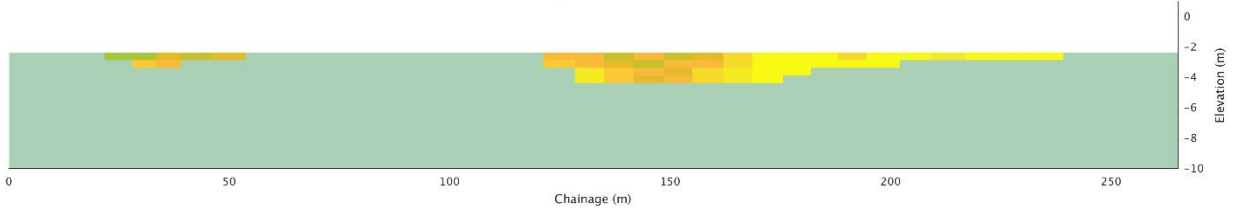
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Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



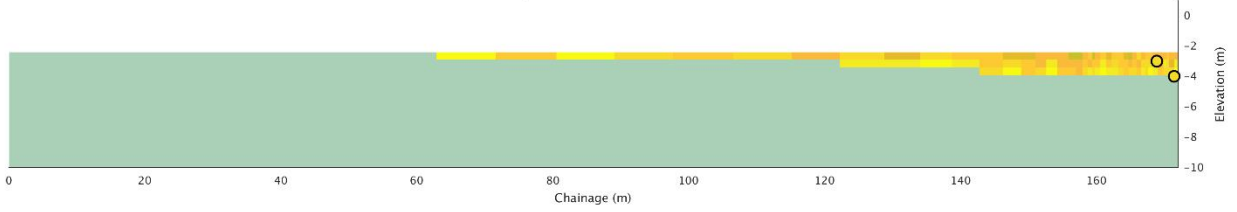
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Transect of Suspended Sediment in Profile



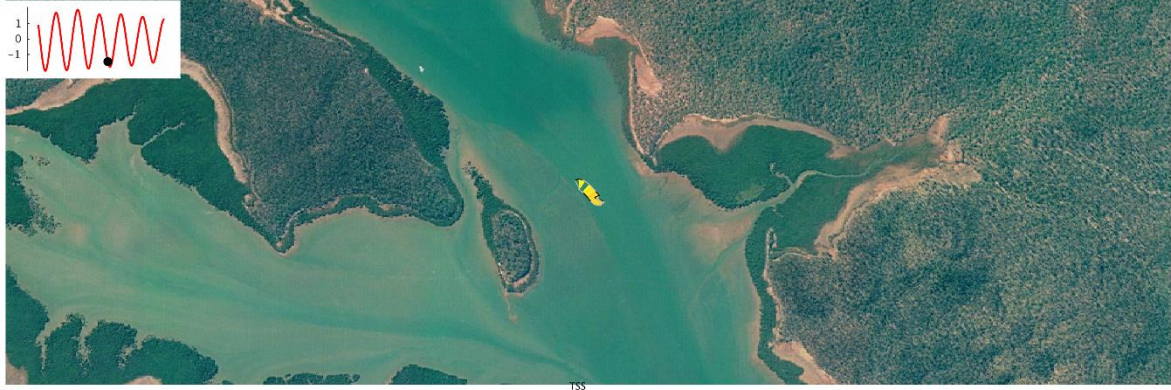
Transect of Dredge Plume in Plan



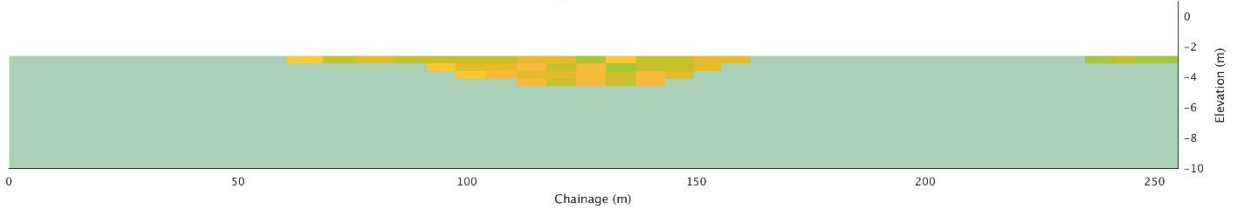
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Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



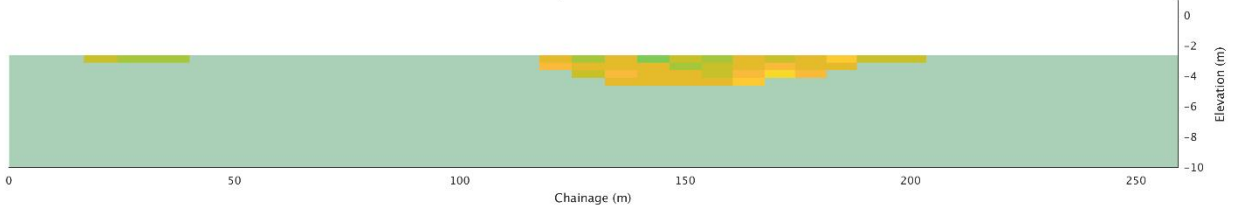
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Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



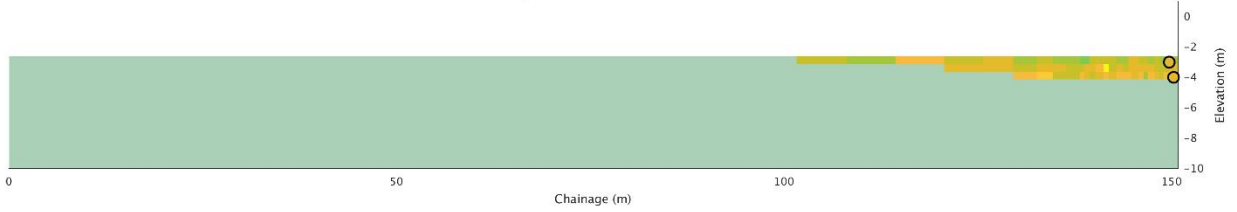
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Transect of Suspended Sediment in Profile



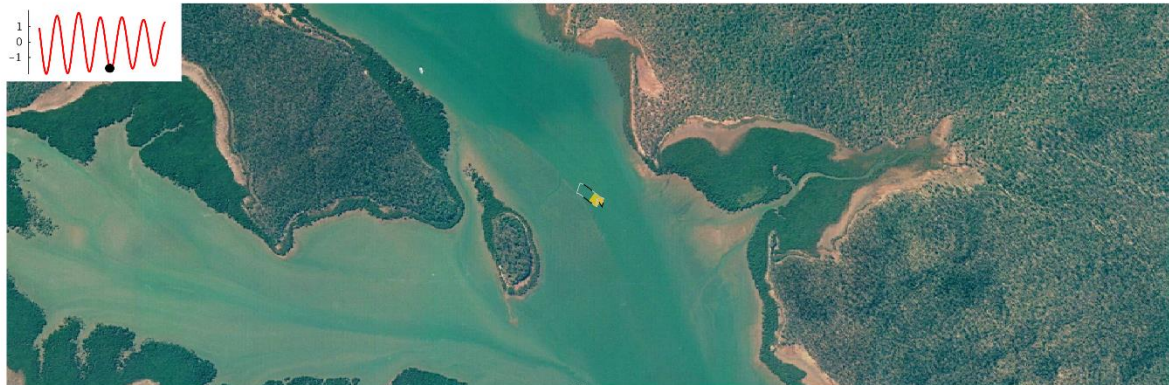
Transect of Dredge Plume in Plan



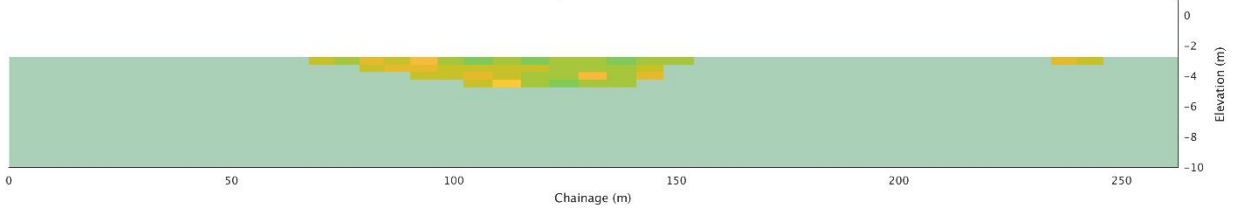
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Transect of Suspended Sediment, OBS Profile Included



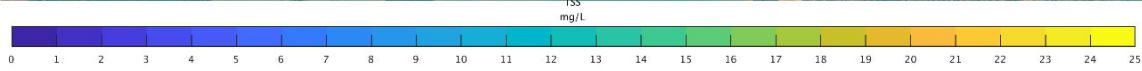
Transect of Dredge Plume in Plan



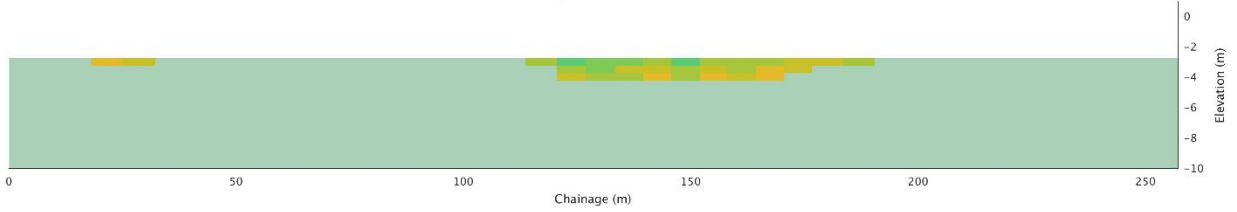
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Transect of Suspended Sediment in Profile



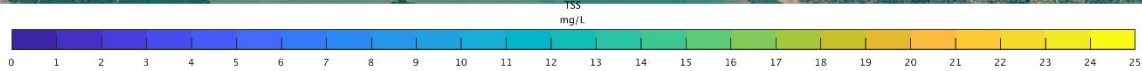
Transect of Dredge Plume in Plan



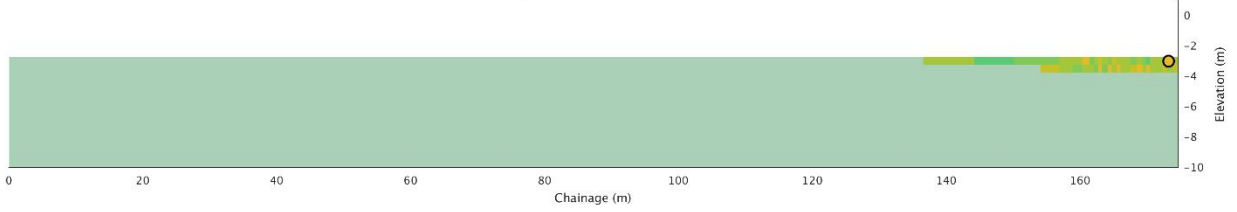
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Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



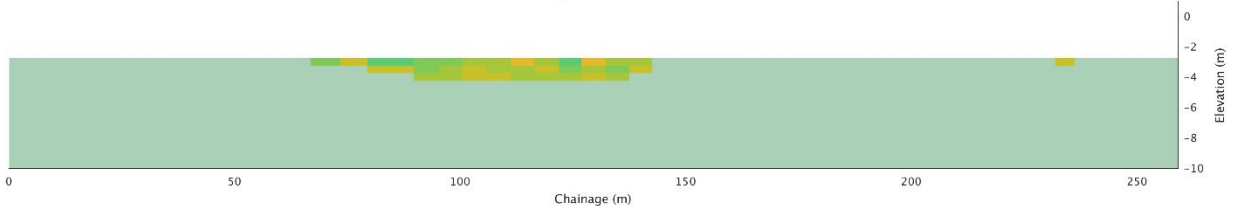
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Transect of Suspended Sediment, OBS Profile Included



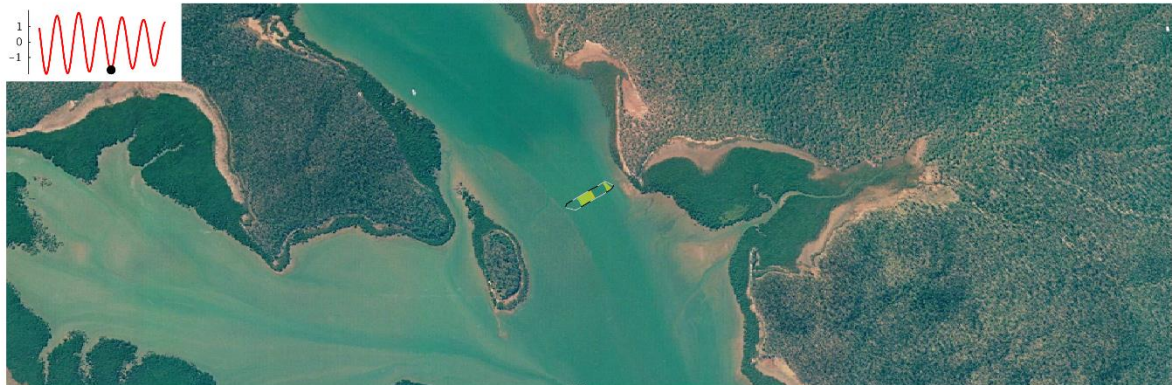
Transect of Dredge Plume in Plan



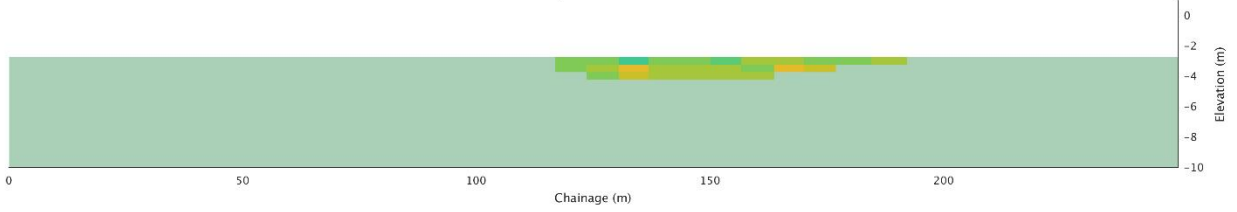
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Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



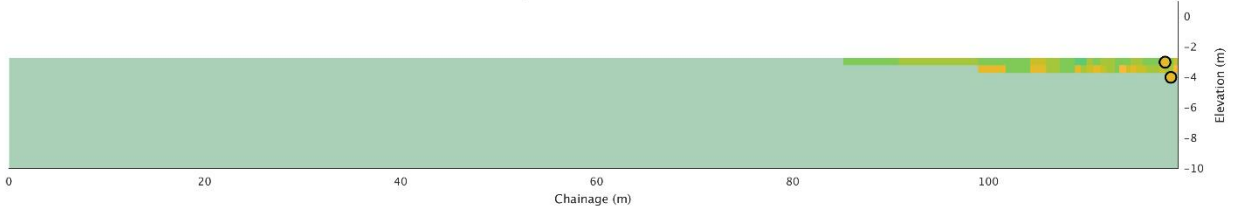
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Transect of Suspended Sediment in Profile



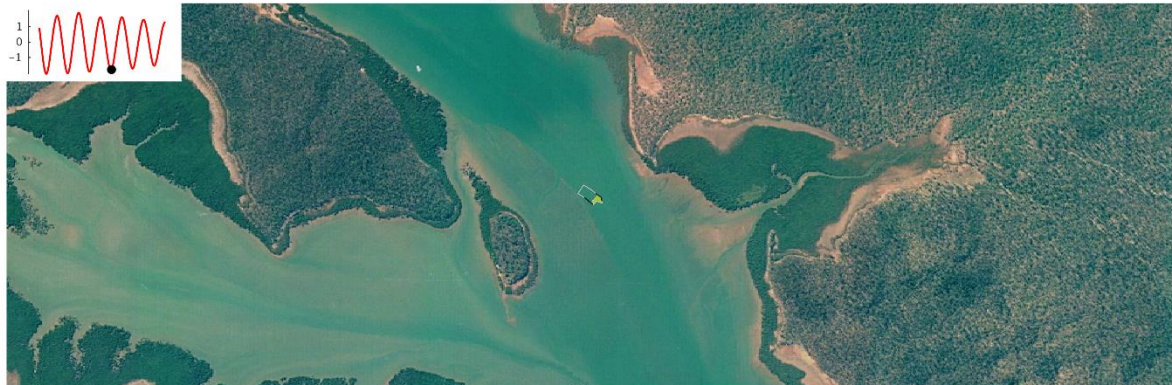
Transect of Dredge Plume in Plan



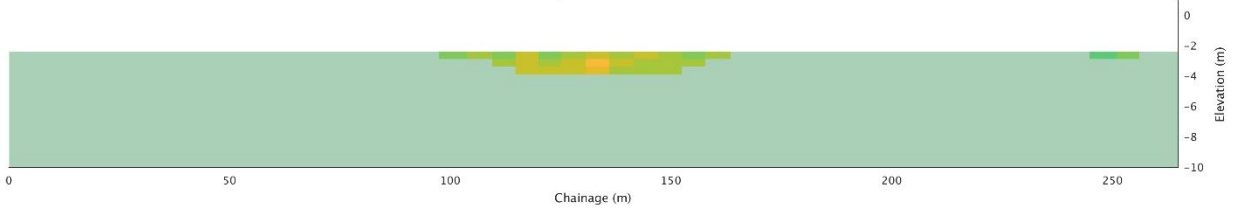
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Transect of Suspended Sediment, OBS Profile Included



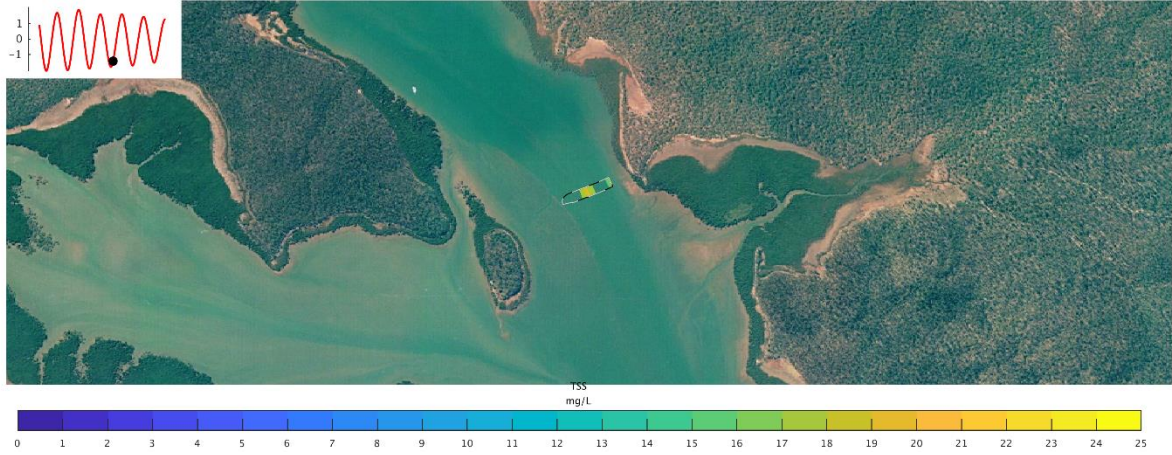
Transect of Dredge Plume in Plan



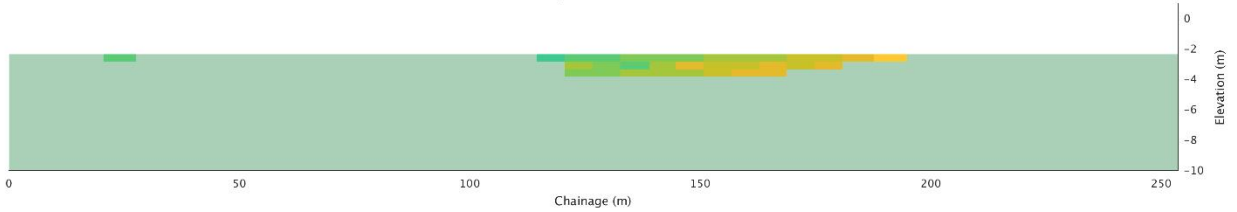
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Transect of Suspended Sediment in Profile



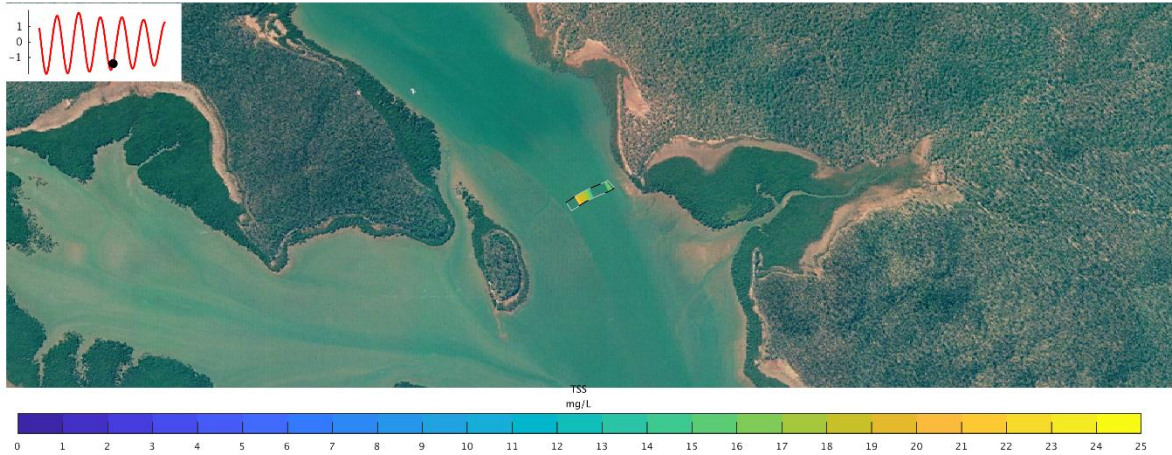
Transect of Dredge Plume in Plan



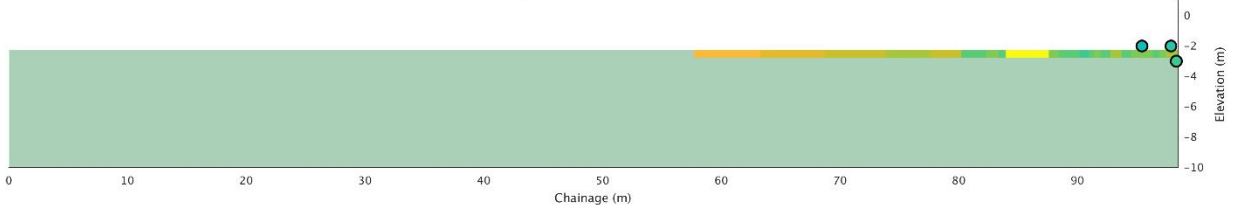
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Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



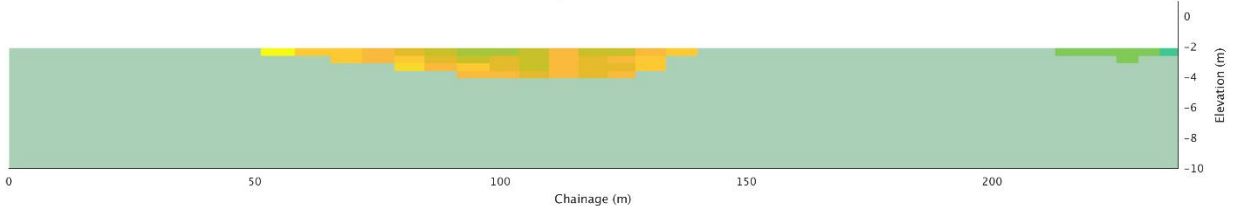
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Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



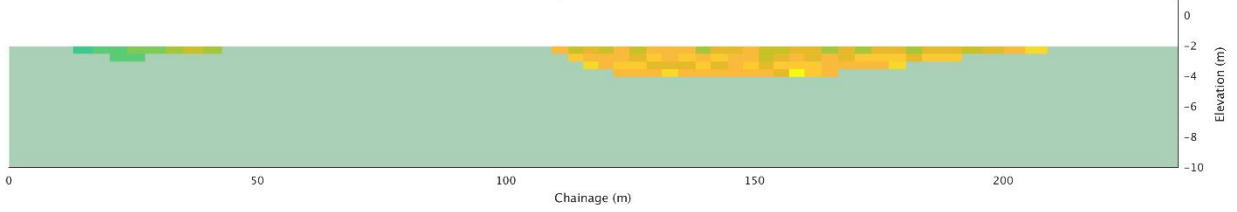
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Transect of Suspended Sediment in Profile



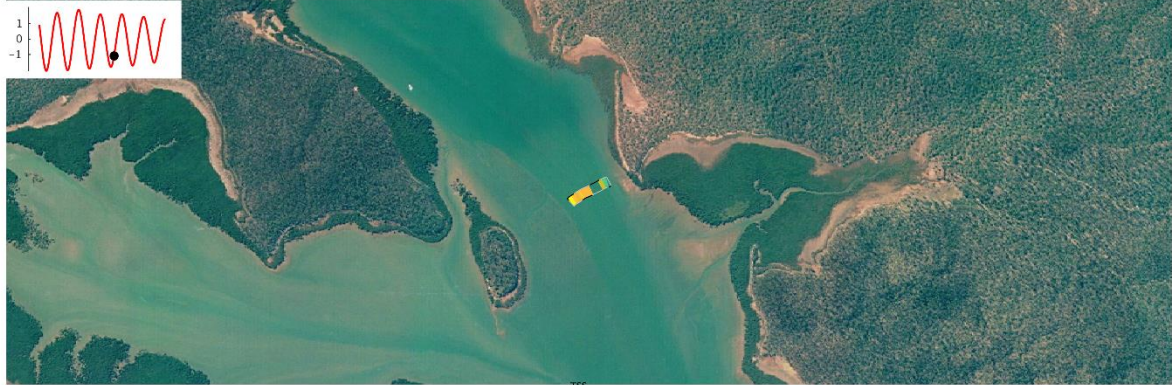
Transect of Dredge Plume in Plan



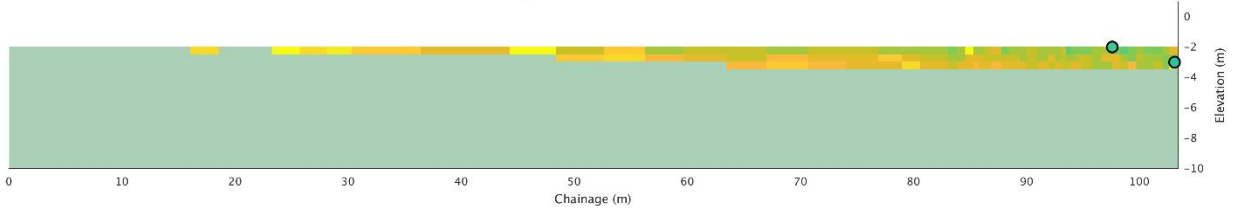
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Transect of Suspended Sediment in Profile



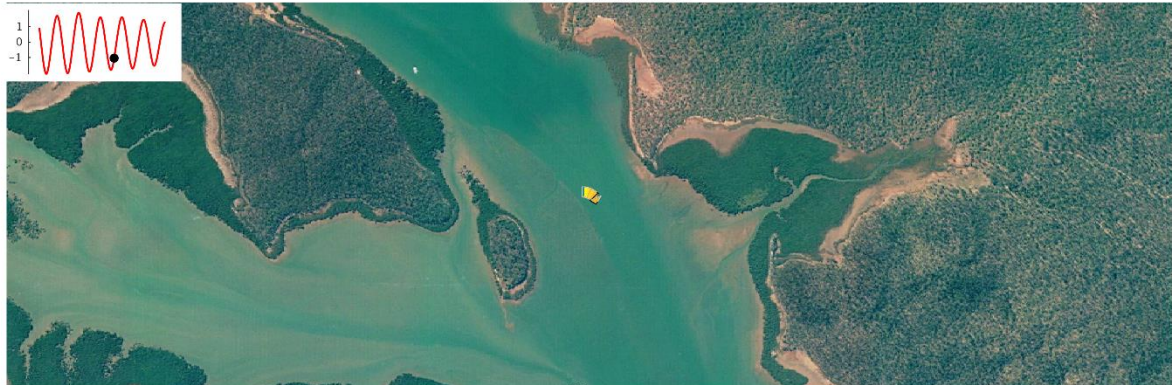
Transect of Dredge Plume in Plan



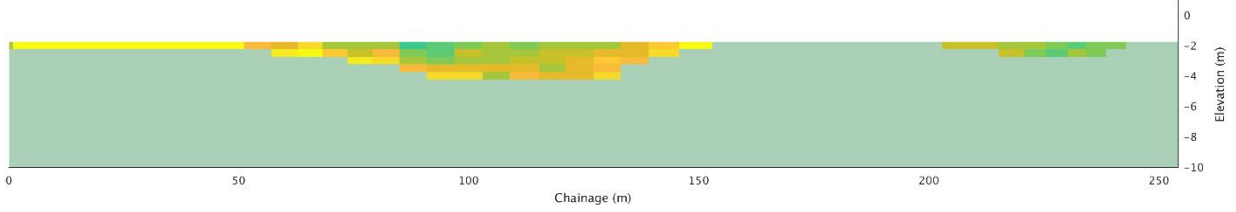
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Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



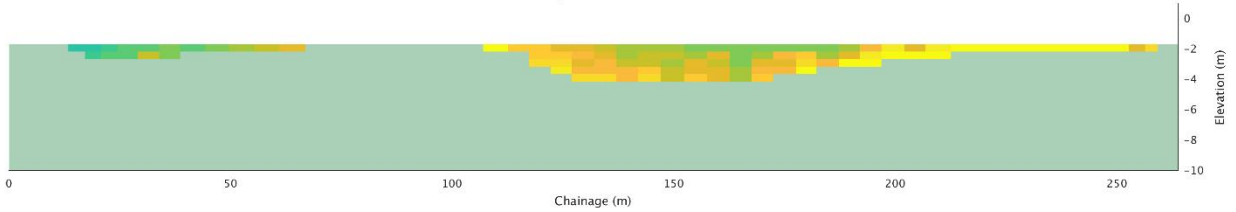
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Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



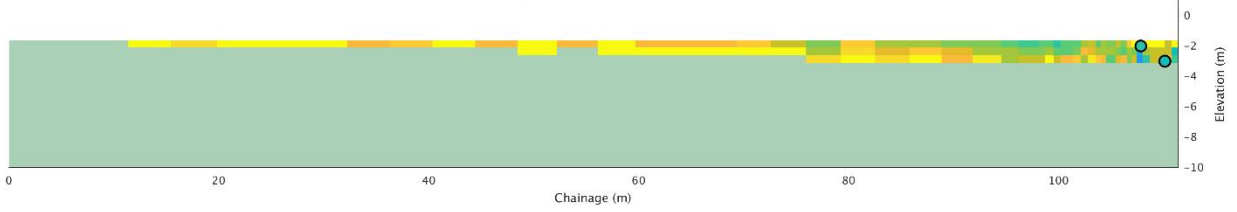
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Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



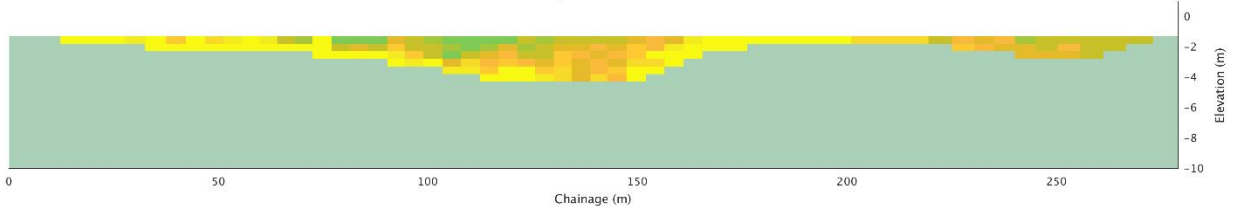
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Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



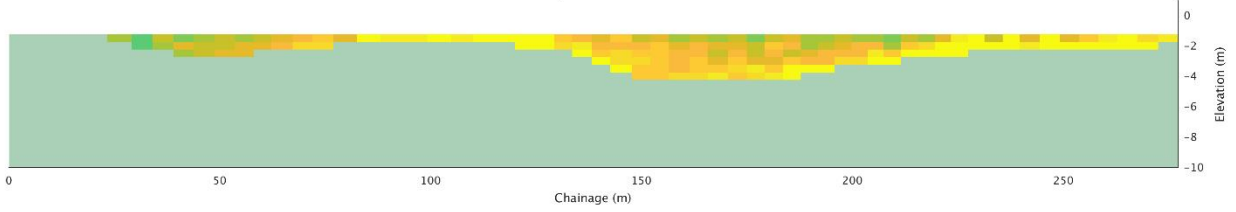
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Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



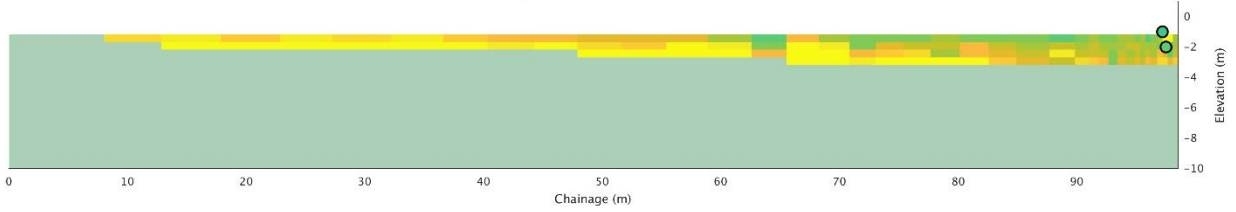
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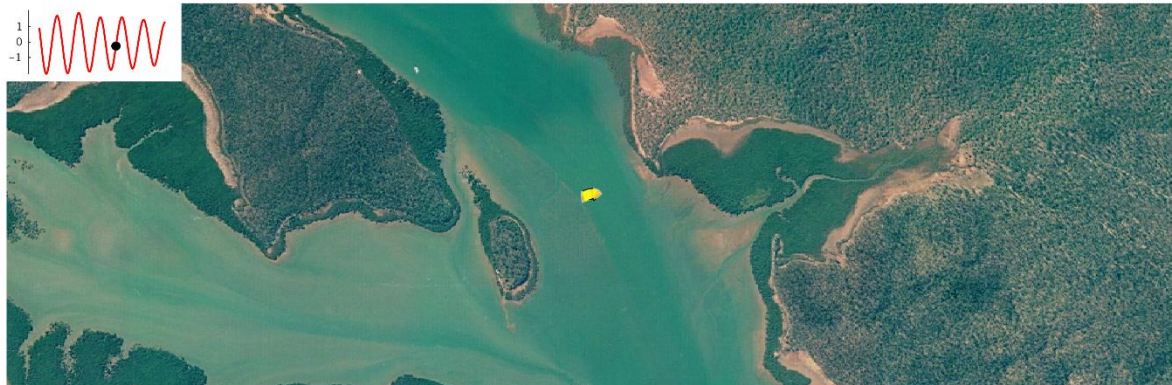
Transect of Dredge Plume in Plan



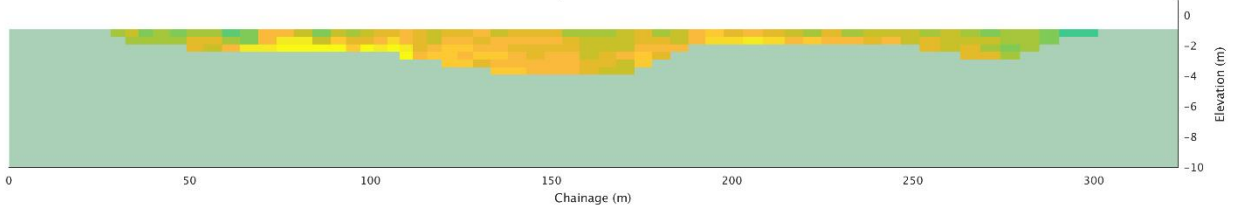
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Transect of Suspended Sediment, OBS Profile Included



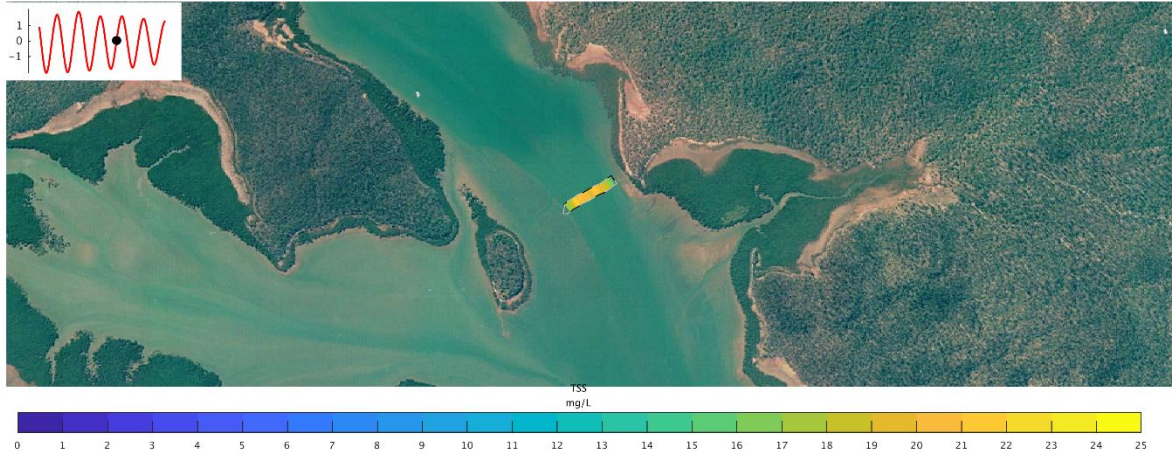
Transect of Dredge Plume in Plan



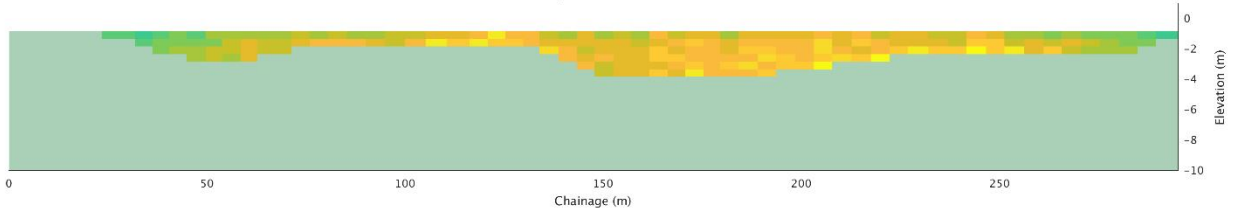
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Transect of Suspended Sediment in Profile



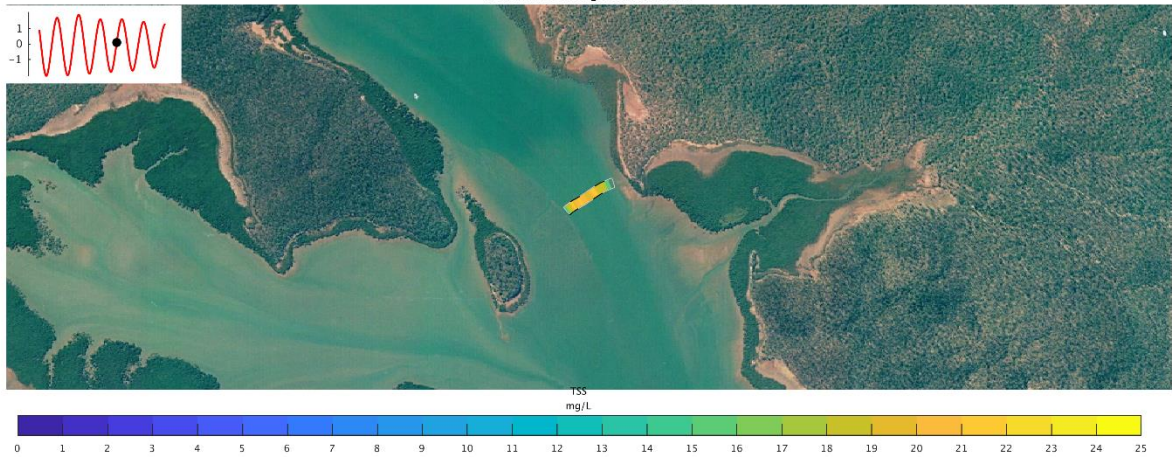
Transect of Dredge Plume in Plan



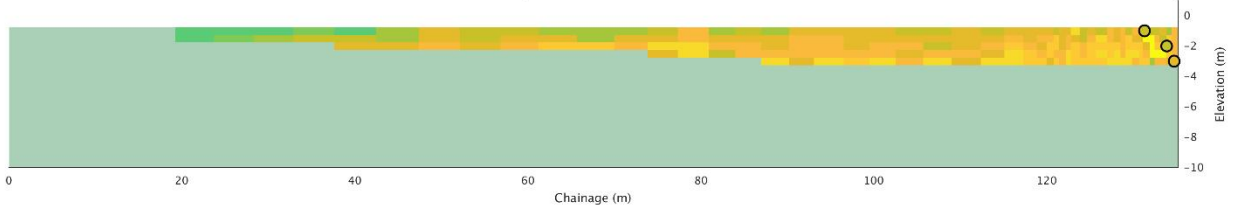
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Transect of Suspended Sediment in Profile



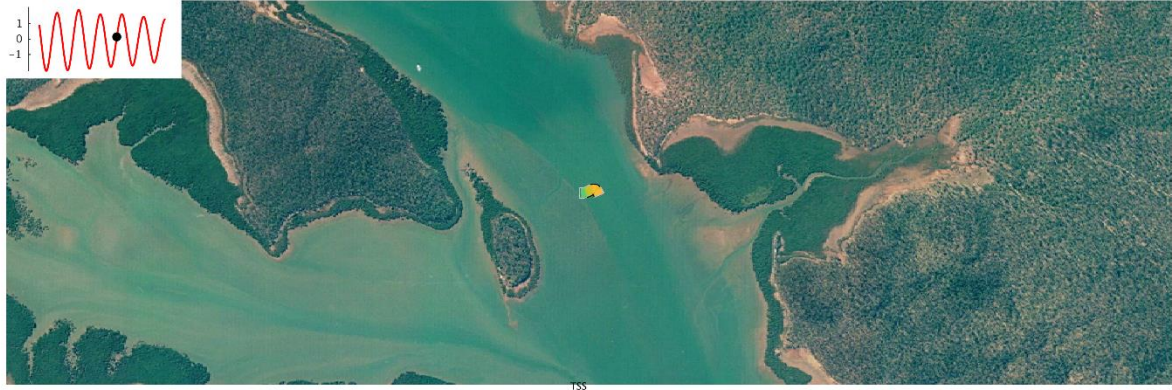
Transect of Dredge Plume in Plan



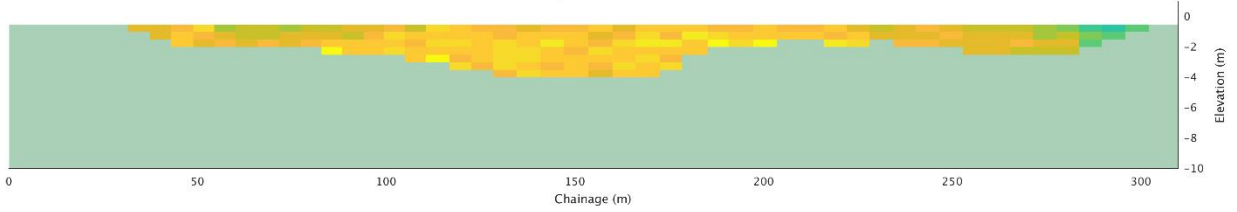
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Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



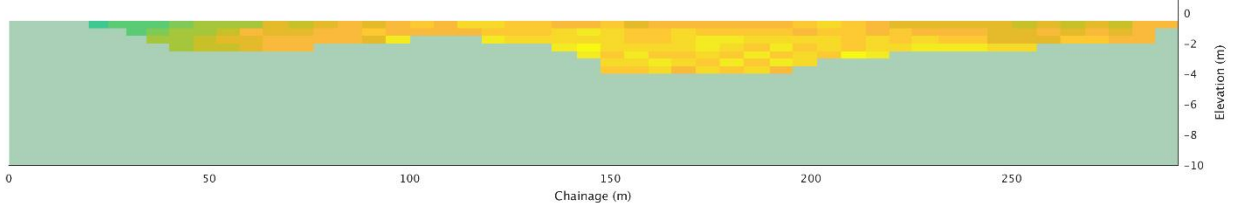
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Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



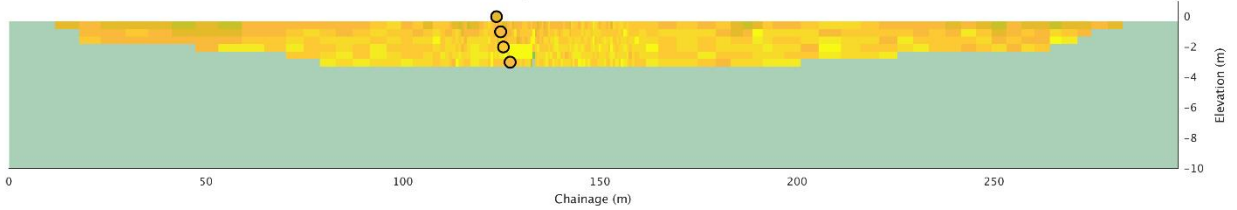
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Transect of Suspended Sediment in Profile



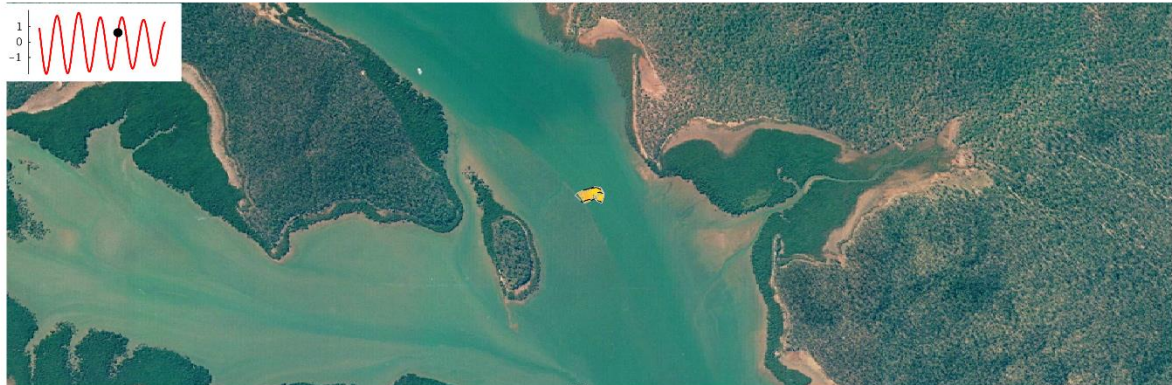
Transect of Dredge Plume in Plan



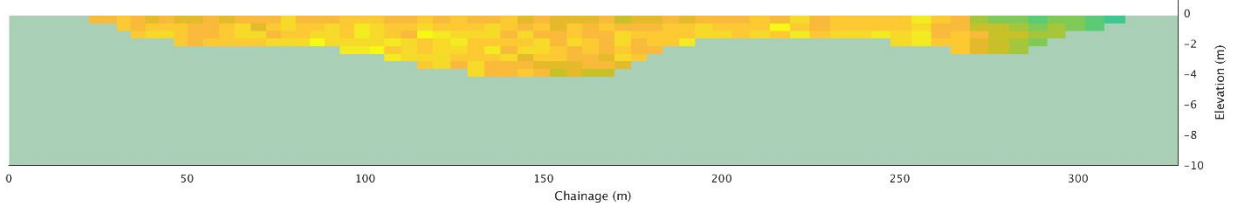
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Transect of Suspended Sediment, OBS Profile Included



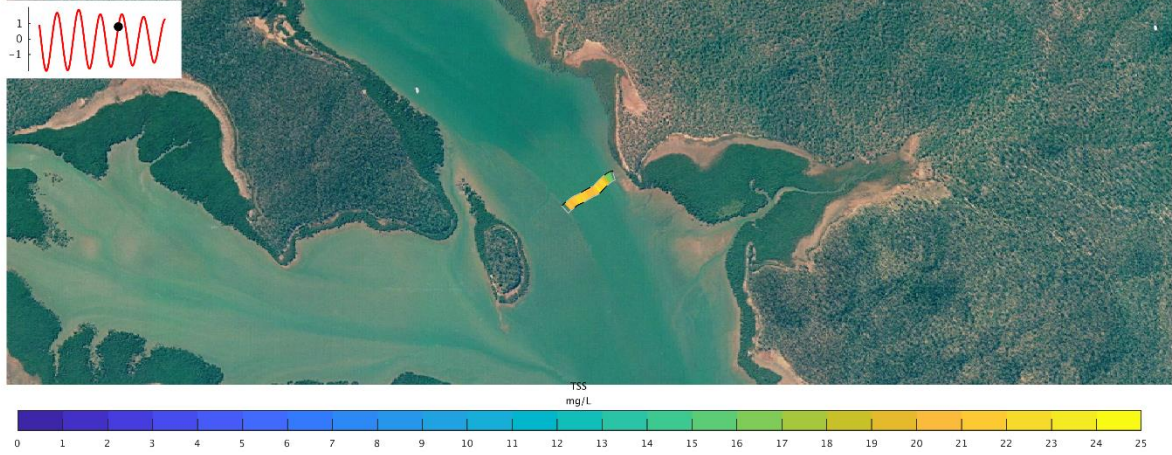
Transect of Dredge Plume in Plan



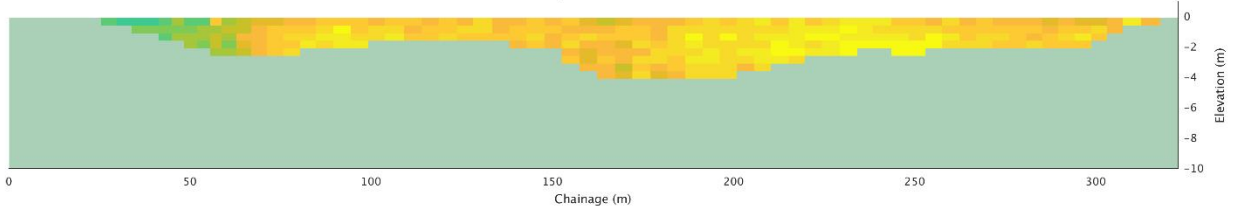
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Transect of Suspended Sediment in Profile



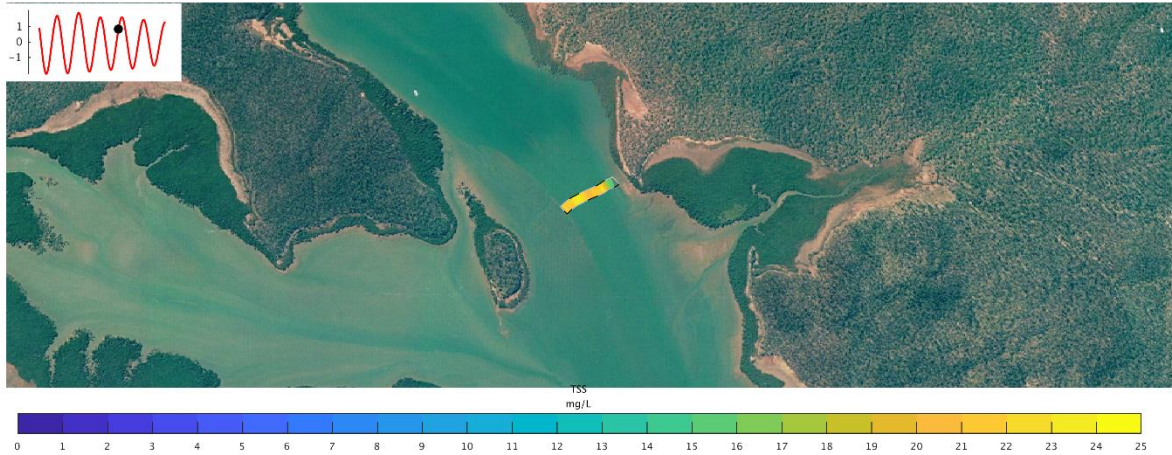
Transect of Dredge Plume in Plan



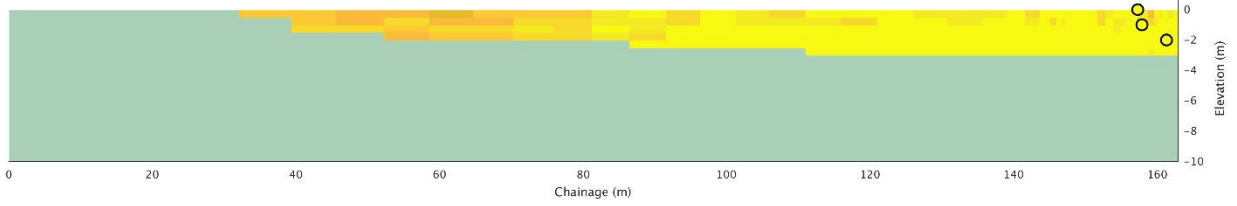
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Transect of Suspended Sediment in Profile



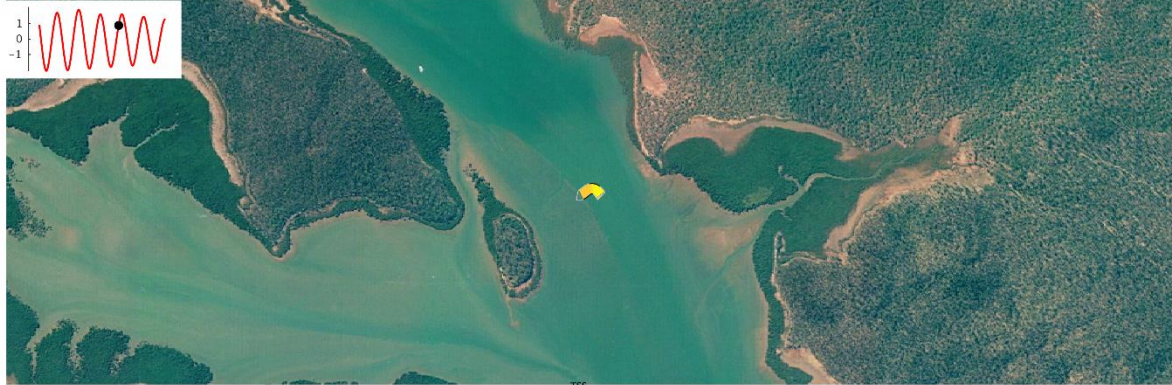
Transect of Dredge Plume in Plan



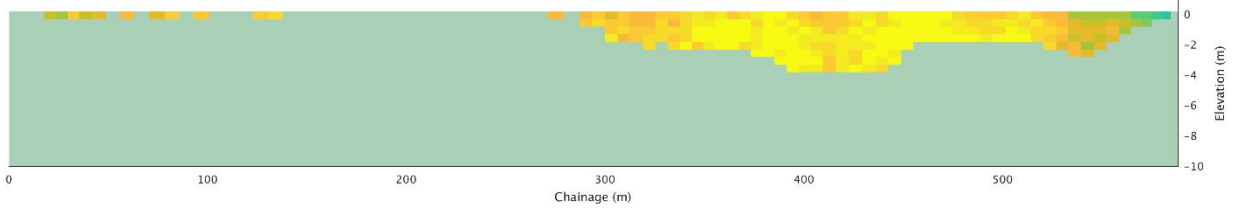
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Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan



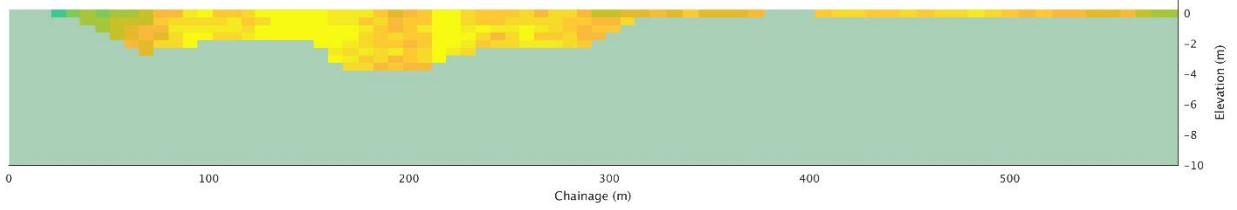
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Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



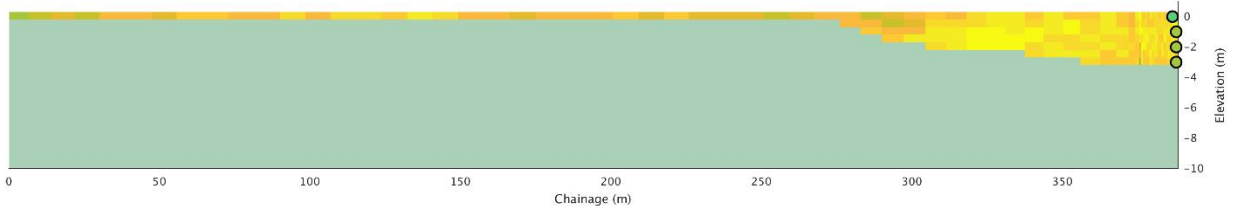
12-Sep-2018 21:43
Transect of Suspended Sediment in Profile



Transect of Dredge Plume in Plan



12-Sep-2018 21:48
Transect of Suspended Sediment, OBS Profile Included



Transect of Dredge Plume in Plan

