Macquarie Harbour Waste Capture System (WCS)

MONTHLY PROGRESS REPORT

Submission date: 1 August 2017
Report closing date: 31 July 2017
Report number: 1
Next report due: 31 August 2017

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Section 1.0: Purpose

The purpose of the Monthly Report is to determine:

1. that Waste Capture Systems (WCS) are in good working order
    - Report by exception. Any problems observed, repairs undertaken, actions needed, issues resolved or requiring resolution. Log of number of times each liner is emptied, volume of liquid captured and mass of solids captured.
2. if WCS are effective in reducing impact to sediments and water quality at the Harbour bottom
    - **a.** monthly progress updates covering issues as per the EMP
    - **b.** when the project is nearing completion, a summary report will be required as per the EPN

Section 2.0: WCS Installations and Standing Biomass

Table 1 summarises all WCS installation dates and current standing biomass for each WCS. Total biomass for the 2016 salmon input year, 150% of total biomass in excess of 13t/ha and total biomass with WCS deployed is also provided in *table 1.*

Reporting Date		31/08/2017
WCS Location	Installation Date	Standing Biomass (kg)
G17A	6/06/2017	85,676
G15A	15/06/2017	93,103
G13A	24/06/2017	95,353
G11A	28/06/2017	87,551
G9A	4/07/2017	90,304
G7A	23/07/2017	92,753
G5A	26/07/2017	81,469
G3A	28/07/2017	89,194
Total Biomass 2016 YC (kg)		4,033,442
Required Waste Capture Biomass (Kg)		590,163
Actual Waste Captured Biomass		715,403

Table 1: WCS installations and Standing Biomass

Section 3.0: Waste extraction quantities and calculations

Table 2 summarises total feed input and waste extracted for all WCS since installation dates, together with theoretical waste volumes which would have been produced by the biomass with WCS deployed. 'Total solid waste removed' is calculated using the median TSS value provided in the waste characterisation section of this report. Total waste produced by biomass in excess of 13t/ha vs total waste removed from all WCS is shown in *table 3. Table 3* also shows the percentage of waste removed from the pens with liners and compares it to the total waste produced by those pens.

NOTE: The calculation of Total Solid Waste Removed for G17A, G15A and G13A includes extraction data where the early versions of the trial were obtaining an average of 3.00% TSS. All extractions starting on July 3 were calculated with a TSS of 4.79% based on the laboratory data obtained as seen in *Table 5*.

WCS Location	Installation Date	Date Of Most Recent Waste Extraction	Total Feed Input From Installation date (kg)	Total Waste Extraction From Installation Date (L)	Total Solid Waste Removed (kg) @ 4.79% of Waste Extraction
G17A	6/06/2017	27/07/2017	12752	27400	1110
G15A	15/06/2017	31/07/2017	16914	31600	1352
G13A	24/06/2017	27/07/2017	13171	27200	1267
G11A	28/06/2017	31/07/2017	9930	26100	1250
G9A	4/07/2017	31/07/2017	9153	17000	814
G7A	23/07/2017	31/07/2017	2664	4000	192
G5A	26/07/2017	No extraction as of reporting date			
G3A	28/07/2017	No extraction as of reporting date			
Totals			64584	133300	5985

Table 2: Waste Capture Analysis

Total waste (kg) produced by fish with WCS	Total waste (kg) produced by fish over 13mt/ha	Total waste (kg) removed from all WCS	% waste removed vs % waste produced by fish with WCS	% waste removed vs % waste produced by fish over 13 mt/ha
8396	3642	5985	71%	164%

Table 3: % Waste Removed

Section 4.0: WCS inspections and issue resolutions

The integrity of all WCS has been regularly inspected by Tassal divers. All records of inspections have been recorded on official Tassal dive sheets, these are legal documents which are archived and kept for seven years. Records of these dive inspections can be provided upon request.

Table 4 summarises any issues which were identified during inspections and subsequent corrective action taken.

WCS Location	Installation Date	Issues Identified/Resolved
G17A	6/06/2017	Nil
G15A	15/06/2017	Nil
G13A	24/06/2017	Nil
G11A	28/06/2017	9/7/17 - During Inspection of the camlock connection between the waste hose and sump, it was found that the camlock joining the hose to the sump had come undone. The camlock arms had been secured with locking pins but it is believed that the pins had come undone through the agitation created during pumping of the waste. The issue was resolved by securing shut with cable ties and this was repeated for all other WCS and is now standard practice for installation.
G9A	4/07/2017	9/7/17 - During Inspection of the camlock connection between the waste hose and sump, it was found that the camlock joining the hose to the sump had come undone. The camlock arms had been secured with locking pins but it is believed that the pins had come undone through the agitation created during pumping of the waste. The issue

		was resolved by securing shut with cable ties and snood, this was repeated for all other WCS and is now standard practice for installation.
G7A	23/07/2017	Nil
G5A	26/07/2017	Nil
G3A	28/07/2017	Nil

Table 4: WCS inspections and issues resolutions

Tassal have procured a larger pump to extract the waste from WCS. Although the current pumping arrangements have allowed all waste to be extracted, there have been times where the current pumping arrangement has taken longer to extract waste than anticipated. Due to the ongoing successful refinements to the sump design, the latest design versions are producing a much thicker waste on extraction than earlier design versions. Extracting a thicker waste (less liquid to treat and dispose) is an ongoing performance variable that Tassal have been working on, as a result of achieving this performance variable a larger capacity pump will be required to meet efficiency requirements. The new pump will be commissioned during the week ending 6 August 2017.

Section 5.0: Environmental monitoring, modelling and testing

Section 5.1: Pelagic Water Quality Monitoring

Preliminary results for physical properties (within the water column) show that waste extraction activities are not detrimentally impacting upon the receiving environment. The initial monitoring was undertaken with only five liners installed at MF 219, so subsequent water quality monitoring will be used to confirm any level of potential impact as waste extraction activities expand across lease areas.

Tassal has commissioned Aquenal and Marine Solutions to environmental monitoring activities to assess any potential impacts of waste capture operations on the receiving environment. The initial water quality sampling was conducted at MF Lease 219 over two days on 5 and 6 July 2017. Ten sampling stations (upstream and downstream of the midwater current flow) were established – three stations upstream and seven stations downstream of the pens with waste capture liners installed. Water quality profiles and nutrient samples were collected at each of the sampling stations prior to, and post feeding, and post extraction of waste from within the liners (see Appendix 1). At the time of reporting, results of nutrient concentrations, turbidity, TSS, carbon in water, COD and BOD analyses had not yet been reported by the laboratory. However, water column profiles of physical properties are shown for each monitoring station in Appendix 1.

Section 5.2: Visual Benthic Characterization and Monitoring

Initial examinations of the benthic environment beneath WCS cages has showed a lower presence of visible faeces and other related farming impacts. This was observed beneath the pen bays that have had WCS fitted to actively stocked fish cages for extended periods (Positions 17a and 15a). Whilst these initial results show a positive impact from installation of WCS technology, a more targeted approach to reporting the effectiveness of the waste capture systems has been developed moving forward to adequately capture any potential environmental impacts as WCS expand across lease areas. The effectiveness of the waste extraction activities will be gauged by the ability of the waste capture systems to prevent faeces and pellets accumulating on the sea floor, with subsequent beneficial effects to sediment condition and biology.

Tassal has conducted targeted WCS Remote Operated Vehicle (ROV) monitoring - starting in June. This work was conducted beneath the first cages at Gordon lease to receive WCS to provide a visual baseline to track benthic health. During July Tassal have also completed targeted work on these same WCS cages, newly installed WCS cages and beneath cages (pen bays) that do not have WCS. This work has been shared and discussed at regular meetings held at the EPA between Tassal and EPA staff and will now be used within a larger project. This project will cover the duration of the WCS and will be used to show if there is a marked observable difference to benthic impacts between treated (WCS fitted) and control (No WCS fitted) cages. This field experiment will also have another layer in its design where the duration that the WCS has been in place will also be assessed. Tassal will continue to conduct routine surveying in and around the lease areas and surrounding locations.

Aquenal has developed an experimental design for selected liner installation cages to track the benthic health in long term, mid and short term cages with liners in comparison with each other, including cages that do not have liners installed (control cages). As previously mentioned, this will aim to show the recovery and or degradation of benthic health within the lease at these selected locations and provide an insight into the use of waste capture liners and the required timeframes for optimal outcomes. This design has been submitted to the EPA for review.

The implementation of the WCS to these cages has allowed the assimilation of organic waste from farming to occur – with a 70%+ reduction in what otherwise would have been the case. This natural process will continue to break down the organics in these pen bay locations and allowing for natural recovery to start to occur earlier than if the pen bay was to continue to receive organic inputs from the actively stocked fish cage above. It is thought that the installation of WCS will allow the pen bay positions to begin their fallow cycle faster but for active farming to still occur on these areas lease. There is also expected to be better assimilation across the sites that have WCS installed as other untreated (without WCS) pen bay positions will not be subject to any shadowing effects of neighbouring cages.

Sediment filming has been, and will continue to be conducted in-line with Schedule 3V of the marine farming licence in relation to footage quality, ROV speed, video lighting and time requirements. All work has been, and will continue to be tracked via differential global positioning system (DGPS) with date and time stamp attributes and state permanent mark (SPM) files for accuracy calibration of these positioning systems. All footage and date

stamp mapping files are stored and will be provided to the EPA upon request for review, allowing for a full audit trail.

Section 5.3: Waste Characterisation

Tassal have conducted five separate analysis of waste from the WCS during the month of July to determine the system effectiveness with regards to solid waste removed vs solid waste produced. Sampling was taken from bulk homogenised samples during waste capture operations.

The variability in Total Suspended Solids (TSS) from bulk samples is a result of different sump designs and timing of the sampling during the extraction process. The refined sump designs have been producing a higher TSS than earlier models due to the restriction of ratholing during extraction. All waste is currently being extracted into 1000 litre IBC containers, depending on the time between extraction from WCS and amount of waste produced by the fish, extraction volumes have been up to 8000 litres. Sub samples were taken from 1000 litre bulk homogenised samples, sub samples taken from the first or last 1000 litre bulk samples during extraction showed a lower TSS than sub samples taken from 1000 litre bulk samples from the middle of the total extraction volume.

From the July analysis results and results from the WCS trial, the median value of 4.79% Total Suspended Solids (TSS) from all samples has been applied to the waste capture extraction volumes in this report.

As stated in our trial report, Tassal will not undertake further TSS sampling unless there is a material change in waste composition, visual appearance or volume.

Table 5 below shows individual tests results, sample locations and dates of sampling.

Sample Date	Sample Location	TSS %
Trial results	Gordon 17A	3.05
4/07/2017	Gordon 11A	1.91
4/07/2017	Gordon 17A	2.16
4/07/2017	Gordon 15A	10.49
4/07/2017	Gordon 13A	6.52
6/07/2017	Gordon 13A	16.62
Median TSS		**4.79**

Table 5: WCS TSS sampling results

Section 5.3.1: Bio-solid Characterization

Tassal has conducted multiple bulk analysis of waste from the WCS. Although the analysis has informed Tassal for treatment techniques, it is not representative of the waste that will be disposed. Tassal has conducted trial at on the WCS waste using the proposed centrifuge separation technique. Samples of both bio-solids and supernatant were taken from the centrifuge and sent for laboratory analysis, results will not be available until the week of August 14, 2017.

Section 5.3.2: Supernatant Characterization

As above, results will be available Thursday August 10, 2017.

Section 6.0: Waste Disposal

To date, all waste from the WCS project has been delivered by truck to George Town Seafoods (GTS). *Table 6* shows the waste quantities and dates of transport for disposal at GTS.

Date of Transport to GTS	Quantity Transported (Litres)
19/06/2017	16,000
20/06/2017	12,000
21/06/2017	10,000
22/06/2017	19,000
23/06/2017	13,000
24/06/2017	5,000
25/06/2017	12,000
26/06/2017	19,000
Total Waste Transported (L)	106,000

Table 6: Waste disposal dates and volumes

Section 7.0: Weekly Reporting

Tassal have reported weekly to the EPA as per the *Weekly biomass reporting* template. This has confirmed that the biomass has at all times been below the biomass limit. The monitoring has presented the progress of installation of the WCS to pens and the rate of growth against the biomass limit.

Section 8.0: Complaints recording, management and resolution reporting

Tassal have not directly received any written or verbal complaints relating to the Waste Capture Operations and specifically, the WCS.

Section 9.0: Consultation

Tassal has conducted various consultation with stakeholders with regards to WCS operations, as outlined in Tassal's WCS EMP and required by the WCS EPN.

On 11 July 2017, Tassal staff met with West Coast Councillors and management for a briefing on WCS operations and disposal operations currently being investigated.

On 14 July 2017, Tassal sent a newsletter to the Strahan community with information on current WCS operations, this newsletter included an invitation to an information session on WCS, and Macquarie Harbour in general, for the Strahan community, including other salmon farming company staff on Thursday evening 27 July (6.30-8pm) at Strahan Village. The community newsletter and invitation can be seen in *appendix 2.*

On Thursday 27 July 2017, Tassal held an information session on WCS, and Macquarie Harbour in general, for the Strahan community at Strahan Village.

Tassal has maintained regular communication with Petuna throughout the duration of the WCS project. Petuna staff visited Tassal's Macquarie Harbour operations on 27 July 2017 to witness the WCS operations. Tassal has also extended an invitation to Huon Aquaculture to be briefed during an upcoming scheduled meeting between the two companies.

Appendix 1 – Initial Environmental Monitoring – July 2017

Data summary – waste capture plume water quality monitoring:

General Notes:

- Turbidity – was measured in the field with a sonde but we are awaiting the AST results so the data can be calibrated.
- Awaiting results from laboratory analyses from AST – expected date 2 August 2017

Survey dates:

5&6 July 2017

Sampling sites:

Sampling sites were aligned with determined in the field following measurements of current flow from the real time ADCP. The indicative location of sites is shown in Figure 1 below. Site 5 was located immediately adjacent to the cage where waste capture activities were undertaken.

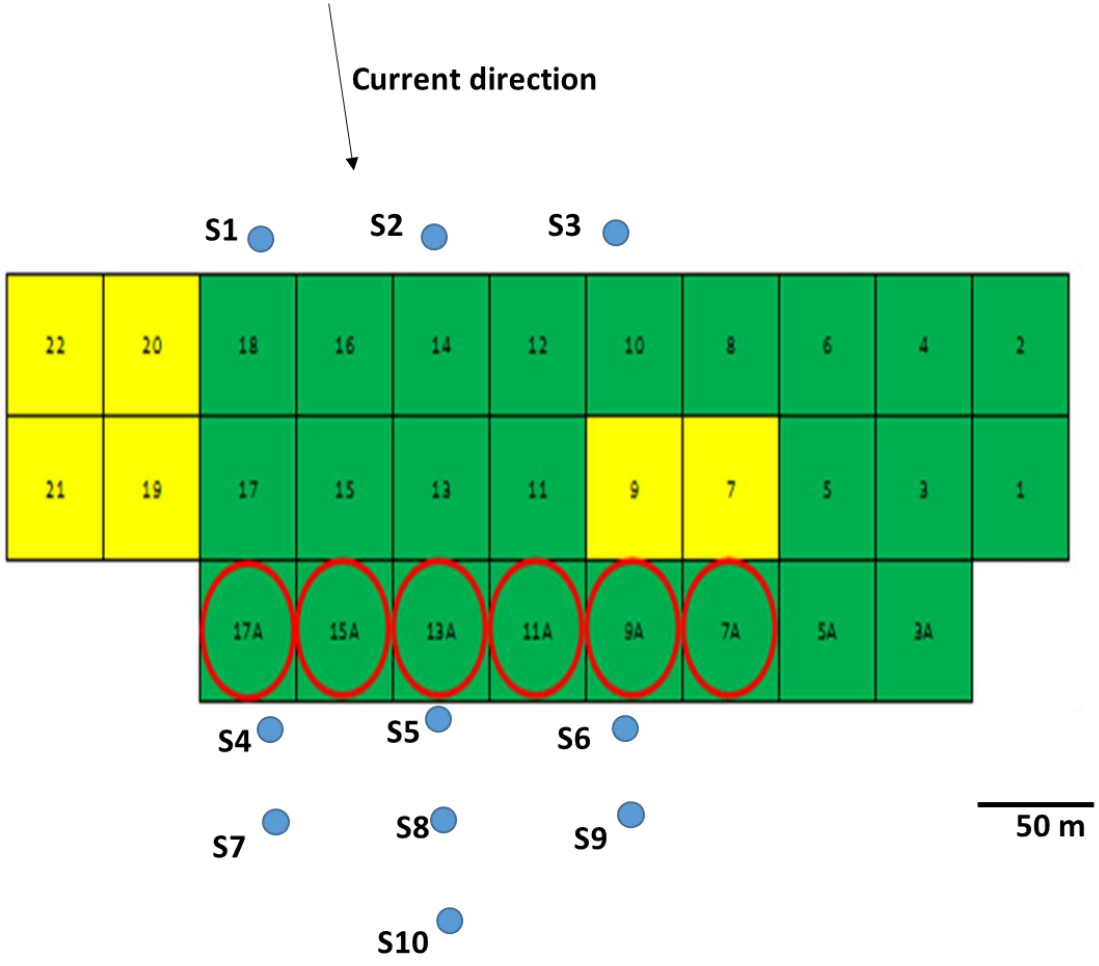


Figure 1. Indicative position of sampling sites. Map not to scale. S1, S2 and S3="up current", S5 = "cage" site, S4, S6, S7, S9, S10 = "down current > 100 m"; S8 = "down current 50 m".

Preliminary Data – Dissolved oxygen profiles:

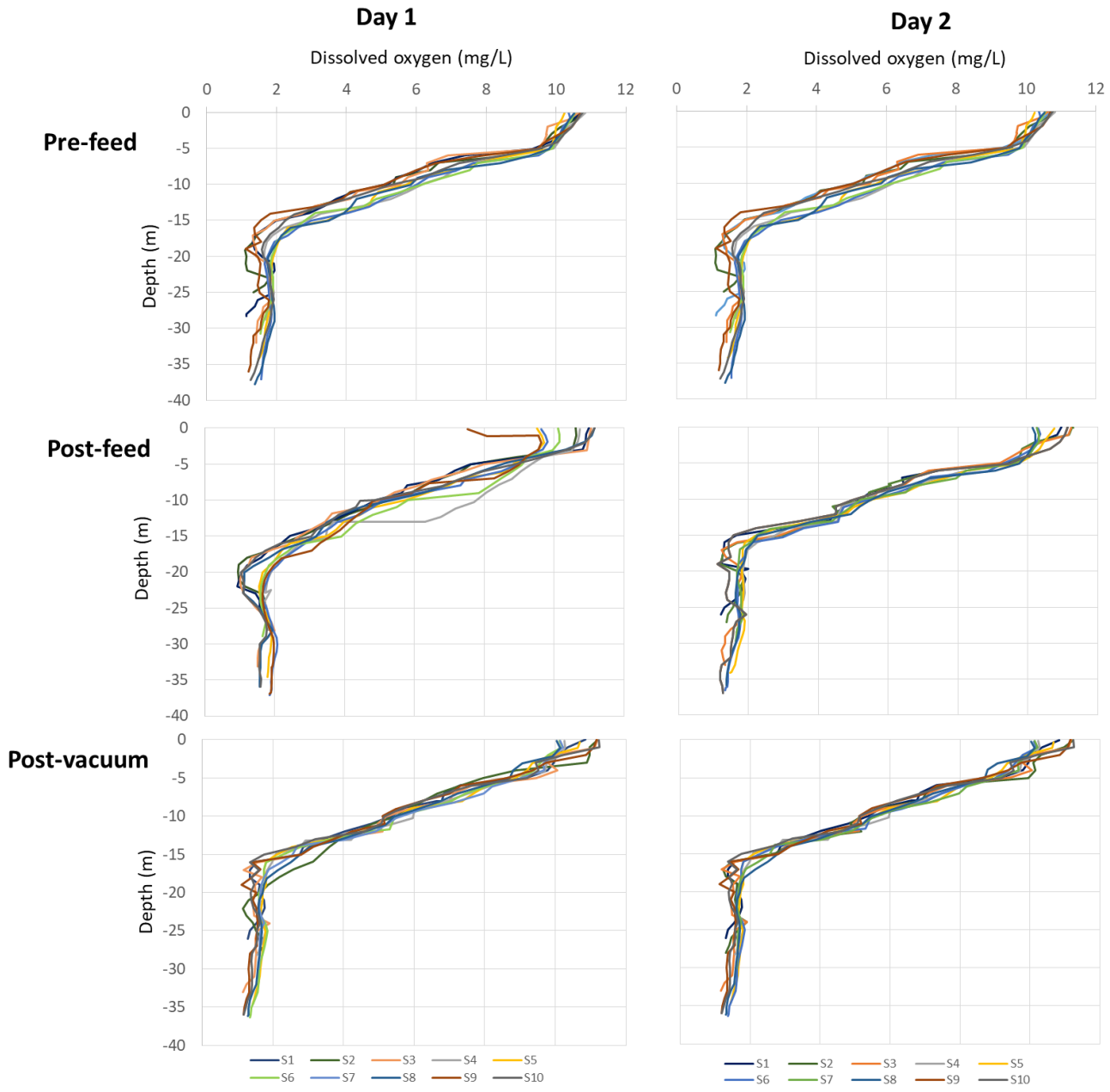


Figure 2. Dissolved oxygen profiles

Water quality parameters – sonde field tabulated data:

Table 1. Temperature. Up = Up current sites = D100 m = down current, > 100 m from waste capture; D50 m = down current, 50 m from waste capture activities

Category	Day	Day 1										Day 2									
	Position	UP	UP	UP	UP	Cage	D100	D100	D50	D100	D100	UP	UP	UP	UP	Cage	D100	D100	D50	D100	D100
	Depth	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Pre-feed	0	8.57	8.66	8.83	8.65	8.77	8.75	9.49	8.83	8.74	9.25	8.65	8.88	8.85	8.76	8.92	9.25	8.84	8.90	8.96	8.96
	5	11.85	11.91	11.79	11.44	11.40	11.28	11.67	11.15	11.66	11.28	10.19	10.52	10.25	10.30	10.16	10.30	10.19	10.38	10.36	10.58
	10	14.04	14.09	14.06	13.72	13.79	13.66	14.05	13.79	13.73	13.95	13.83	13.63	13.46	13.88	13.95	13.73	13.92	13.78	13.77	13.94
	15	15.21	15.12	15.01	14.97	14.95	15.14	14.94	14.91	15.10	15.14	15.16	15.20	15.20	15.18	15.18	15.23	15.18	15.16	15.29	15.26
	20	15.54	15.54	15.50	15.47	15.44	15.46	15.46	15.46	15.44	15.46	15.48	15.46	15.47	15.43	15.46	15.47	15.45	15.47	15.55	15.48
	25		15.54	15.53	15.45	15.46	15.47	15.46	15.45	15.46	15.46	15.55	15.52	15.51	15.46	15.48	15.49	15.48	15.47	15.58	15.46
	30			15.53		15.48	15.46		15.49	15.47	15.49			15.57		15.51	15.51	15.50	15.51	15.58	15.51
	35					15.48	15.46		15.48	15.43	15.48						15.52		15.51	15.58	15.51
Post-feed	0	8.93	8.99	8.96	9.05	9.29	9.08	9.04	9.01	9.08	8.94	8.80	8.84	8.93	8.93	9.00	9.03	9.13	9.13	9.07	9.14
	5	11.56	11.61	11.53	11.49	11.21	11.23	11.46	11.50	10.88	11.42	10.10	10.16	10.41	10.63	10.62	10.65	10.42	10.38	10.38	10.32
	10	13.99	13.99	13.94	13.62	14.02	13.99	14.02	13.91	14.03	14.04	13.62	13.44	13.39	14.02	13.91	13.94	14.10	13.88	13.85	13.79
	15	15.12	15.14	15.10	14.94	15.07	15.17	15.00	15.07	15.09	15.09	15.28	14.83	14.85	15.21	15.30	15.21	15.21	15.18	15.28	15.24
	20	15.50	15.50	15.50	15.45	15.47	15.48	15.43	15.50	15.46	15.49	15.45	15.48	15.49	15.46	15.47	15.47	15.46	15.50	15.54	15.56
	25	15.51	15.50	15.52	15.46	15.48	15.48	15.48	15.52	15.48	15.52	15.55	15.55	15.54	15.47	15.48	15.52	15.46	15.47	15.54	15.56
	30			15.54		15.48	15.44		15.55	15.45	15.55			15.57		15.51	15.51		15.50	15.59	15.57
	35					15.48	15.46		15.54	15.46	15.54						15.51		15.49	15.57	15.57
Post-vacuum	0	8.96	9.04	9.04	9.16	9.09	9.33	9.13	9.17	9.10	9.08	9.16	9.21	9.24	9.29	9.28	9.34	9.34	9.42	9.37	9.57
	5	11.46	11.52	11.97	11.43	11.14	11.46	11.50	12.52	11.50	11.36	10.54	10.01	10.27	10.80	10.42	10.50	10.42	9.99	10.29	10.11
	10	13.89	13.78	13.80	14.03	14.11	13.97	14.03	13.86	13.86	13.85	13.53	13.73	13.72	13.49	13.85	13.92	13.84	13.96	13.72	13.66
	15	15.17	15.05	15.09	15.16	15.16	15.12	15.03	15.18	14.91	14.95	14.88	14.83	14.82	15.22	15.26	15.19	14.72	15.19	14.99	15.21
	20	15.49	15.44	15.47	15.46	15.43	15.45	15.44	15.45	15.49	15.47	15.53	15.56	15.56	15.51	15.49	15.50	15.53	15.51	15.55	15.57
	25	15.51	15.47	15.43	15.46	15.44	15.43	15.46	15.45	15.55	15.53	15.55	15.55	15.56	15.49	15.48	15.48	15.50	15.49	15.56	15.56
	30			15.52		15.48	15.48		15.49	15.48	15.55			15.58		15.50	15.53	15.50	15.50	15.61	15.59
	35						15.45		15.45	15.50	15.51						15.50		15.50	15.57	15.57

Table 2. Dissolved oxygen (mg/L)

Category		Day 1										Day 2									
	Position	UP	UP	UP	UP	Cage	D100	D100	D50	D100	D100	UP	UP	UP	UP	Cage	D100	D100	D50	D100	D100
	Depth	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Pre-feed	0	10.88	11.22	10.97	10.90	10.89	9.81	9.81	9.52	8.32	9.48	10.81	10.72	10.64	10.84	10.25	10.37	10.55	10.52	10.71	10.74
	5	7.37	7.21	7.00	9.55	9.47	8.94	8.92	8.93	8.30	8.88	9.60	9.32	9.48	9.94	9.82	9.82	9.90	9.80	9.44	9.49
	10	4.48	4.39	4.43	7.37	7.43	7.21	6.74	6.99	6.90	6.38	5.33	5.21	5.52	6.22	5.69	6.00	5.94	5.84	5.06	5.25
	15	2.00	2.55	3.15	4.86	5.30	4.64	4.45	4.66	4.36	3.30	1.94	1.99	1.95	2.80	3.43	2.99	2.81	3.48	1.56	2.25
	20	1.05	1.03	1.02	3.02	3.44	2.77	1.53	2.62	2.72	1.58	1.13	1.60	1.42	1.63	1.91	1.73	1.86	1.77	1.45	1.61
	25		1.78	1.54	2.44	2.63	2.33	1.60	2.08	2.23	1.73	1.34	1.87	1.81	1.92	1.89	1.78	1.89	1.86	1.52	1.88
	30			1.85		2.26	2.28		1.93	2.21	1.79			1.44		1.68	1.80	1.56	1.87	1.53	1.74
	35					1.95	2.08		1.86	2.16	1.74						1.59		1.60	1.25	1.43
Post-feed	0	10.62	11.00	11.05	10.74	9.51	9.63	10.11	11.16	7.52	11.16	10.96	11.30	11.23	10.28	10.75	10.29	10.25	10.14	11.14	11.31
	5	7.62	7.60	7.99	9.37	8.85	8.97	9.07	8.63	8.99	8.86	9.36	9.46	9.20	9.42	9.71	9.28	9.58	9.76	9.47	10.03
	10	5.30	4.91	5.05	7.70	5.75	5.08	5.81	5.18	4.81	4.86	5.20	5.42	5.54	5.36	5.55	5.40	5.21	5.46	4.96	5.02
	15	2.77	2.44	2.68	3.46	3.50	3.13	3.91	3.17	3.62	3.04	1.66	3.00	2.90	2.74	2.19	2.98	2.23	2.26	1.58	1.80
	20	0.94	1.07	1.07	1.90	1.66	1.86	1.74	1.12	1.79	1.03	2.00	1.67	1.82	1.84	1.81	1.67	1.67	1.72	1.45	1.39
	25	1.73	1.58	1.48	1.75	1.65	1.77	1.64	1.58	1.69	1.51	1.32	1.55	1.67	1.75	1.82	1.68	1.80	1.70	1.72	1.71
	30			1.59		1.89	2.07		1.63	1.98	1.58			1.33		1.75	1.63		1.64	1.52	1.47
	35					1.79	1.90		1.58	1.92	1.62						1.42		1.37	1.20	1.18
Post-vacuum	0	10.76	11.20	11.04	9.98	10.53	9.17	9.78	9.83	10.95	11.09	10.85	11.24	11.19	10.25	10.69	10.12	10.13	10.04	11.17	11.24
	5	8.07	7.96	7.58	8.87	9.48	8.85	8.84	8.14	8.73	8.99	9.16	9.95	9.46	8.58	8.83	8.98	9.11	8.71	8.63	9.20
	10	5.73	5.47	5.61	5.96	5.82	5.73	6.16	6.47	5.77	6.01	5.37	5.19	5.20	5.96	5.51	5.45	5.48	5.43	5.11	5.14
	15	2.30	3.37	2.94	3.23	3.59	3.35	3.76	3.74	3.35	3.21	2.77	2.73	2.80	2.09	2.10	2.28	2.55	2.50	2.80	1.75
	20	1.08	1.66	1.57	1.89	1.72	1.76	1.82	1.96	1.33	1.31	1.59	1.59	1.51	1.65	1.71	1.62	1.63	1.70	1.53	1.38
	25	1.71	1.54	1.62	1.82	1.85	1.79	1.61	1.82	1.53	1.63	1.35	1.65	1.55	1.80	1.78	1.85	1.65	1.69	1.56	1.56
	30			1.92		1.90	2.05		1.90	2.09	1.66			1.50		1.64	1.62	1.60	1.58	1.32	1.41
	35						1.91		1.88	1.83	1.86						1.40		1.32	1.20	1.24

Table 3. pH

Category		Day 1										Day 2									
	Position	UP	UP	UP	UP	Cage	D100	D100	D50	D100	D100	UP	UP	UP	UP	Cage	D100	D100	D50	D100	D100
	Depth	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Pre-feed	0	7.53	7.63	7.63	7.43	7.45	7.49	7.51	7.52	7.51	7.53	7.62	7.72	7.67	7.49	7.54	7.62	7.61	7.59	7.73	7.60
	5	7.61	7.63	7.62	7.52	7.54	7.57	7.62	7.56	7.61	7.59	7.72	7.72	7.73	7.58	7.60	7.60	7.61	7.61	7.72	7.61
	10	7.53	7.54	7.54	7.56	7.56	7.54	7.56	7.58	7.56	7.58	7.61	7.68	7.68	7.57	7.58	7.60	7.59	7.59	7.63	7.59
	15	7.39	7.44	7.48	7.50	7.50	7.48	7.52	7.52	7.49	7.49	7.43	7.46	7.44	7.43	7.44	7.44	7.45	7.46	7.41	7.44
	20	7.36	7.38	7.37	7.43	7.43	7.43	7.43	7.44	7.44	7.43	7.40	7.47	7.45	7.42	7.44	7.42	7.44	7.44	7.44	7.47
	25		7.46	7.45	7.49	7.50	7.50	7.50	7.51	7.51	7.50	7.46	7.49	7.49	7.47	7.47	7.47	7.47	7.49	7.45	7.51
	30			7.44		7.49	7.51		7.49	7.50	7.49			7.46		7.46	7.47	7.45	7.48	7.46	7.47
	35					7.49	7.50		7.50	7.52	7.49						7.46		7.46	7.44	7.46
Post-feed	0	7.61	7.66	7.68	7.50	7.54	7.54	7.54	7.71	7.57	7.63	7.70	7.74	7.72	7.59	7.56	7.59	7.62	7.60	7.73	7.72
	5	7.69	7.64	7.69	7.59	7.60	7.64	7.64	7.75	7.63	7.73	7.69	7.67	7.66	7.62	7.60	7.61	7.62	7.60	7.72	7.73
	10	7.54	7.55	7.56	7.57	7.56	7.53	7.57	7.58	7.56	7.54	7.63	7.66	7.68	7.60	7.59	7.61	7.59	7.61	7.63	7.64
	15	7.41	7.41	7.44	7.52	7.50	7.48	7.51	7.47	7.49	7.46	7.41	7.55	7.53	7.46	7.43	7.45	7.45	7.46	7.41	7.42
	20	7.34	7.35	7.35	7.42	7.43	7.44	7.42	7.36	7.43	7.35	7.48	7.46	7.47	7.47	7.47	7.44	7.45	7.46	7.43	7.43
	25	7.44	7.45	7.45	7.50	7.49	7.49	7.49	7.44	7.49	7.43	7.43	7.45	7.46	7.47	7.48	7.47	7.51	7.50	7.47	7.45
	30			7.43		7.49	7.52		7.44	7.52	7.43			7.44		7.47	7.47		7.47	7.45	7.44
	35					7.49	7.51		7.44	7.51	7.44						7.46		7.47	7.44	7.43
Post-vacuum	0	7.66	7.71	7.67	7.56	7.53	7.56	7.57	7.55	7.65	7.65	7.68	7.69	7.70	7.61	7.56	7.61	7.58	7.60	7.71	7.70
	5	7.74	7.61	7.61	7.66	7.61	7.65	7.67	7.64	7.72	7.73	7.71	7.73	7.73	7.50	7.42	7.49	7.58	7.42	7.57	7.61
	10	7.57	7.57	7.57	7.57	7.55	7.57	7.57	7.58	7.56	7.57	7.65	7.64	7.64	7.64	7.65	7.65	7.64	7.64	7.64	7.65
	15	7.40	7.45	7.43	7.48	7.47	7.49	7.50	7.47	7.48	7.48	7.52	7.52	7.52	7.45	7.44	7.46	7.54	7.46	7.50	7.42
	20	7.35	7.35	7.35	7.42	7.42	7.42	7.41	7.41	7.37	7.35	7.44	7.44	7.43	7.47	7.47	7.46	7.47	7.47	7.44	7.42
	25	7.44	7.45	7.47	7.49	7.51	7.52	7.50	7.51	7.41	7.43	7.43	7.46	7.44	7.49	7.49	7.50	7.49	7.49	7.44	7.44
	30			7.43		7.49	7.50		7.49	7.46	7.43			7.45		7.47	7.48	7.48	7.48	7.43	7.44
	35						7.50		7.51	7.45	7.45						7.47		7.47	7.43	7.43

Table 4. Salinity (ppt)

Category		Day 1										Day 2									
	Position	UP	UP	UP	UP	Cage	D100	D100	D50	D100	D100	UP	UP	UP	UP	Cage	D100	D100	D50	D100	D100
	Depth	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Pre-feed	0	7.21	7.35	8.08	6.02	6.02	6.25	6.34	6.15	6.27	6.37	8.20	8.91	8.62	6.94	7.67	7.43	7.06	7.14	8.95	7.50
	5	20.25	20.19	19.81	19.45	19.52	19.71	19.52	19.64	19.58	19.38	14.33	15.01	14.09	13.71	13.18	13.17	13.14	13.96	14.35	14.10
	10	26.49	26.72	26.67	26.31	26.74	26.62	26.87	26.58	26.04	26.19	26.71	26.13	25.97	26.59	26.60	26.43	26.98	26.89	26.58	26.80
	15	29.56	29.40	29.35	29.39	29.31	29.61	29.31	29.36	29.56	29.57	29.55	29.57	29.64	29.70	29.65	29.76	29.69	29.67	29.85	29.87
	20	30.31	30.28	30.29	30.34	30.27	30.30	30.27	30.30	30.23	30.27	30.27	30.33	30.29	30.38	30.38	30.35	30.36	30.40	30.38	30.44
	25		30.52	30.51	30.57	30.56	30.56	30.53	30.59	30.55	30.54	30.52	30.49	30.46	30.56	30.58	30.53	30.58	30.59	30.49	30.60
	30			30.59		30.76	30.72		30.72	30.71	30.72			30.58		30.71	30.71	30.69	30.69	30.58	30.70
	35					30.43	30.80		30.77	30.79	30.78						30.74		30.75	30.61	30.76
Post-feed	0	9.10	9.08	9.00	7.76	7.35	7.80	8.11	8.95	7.64	8.62	8.46	8.30	8.62	7.45	7.88	7.70	7.75	7.46	8.77	8.51
	5	19.86	19.46	19.66	19.09	18.82	19.04	18.91	19.56	18.86	19.61	13.77	13.78	14.44	13.74	14.30	14.28	13.45	13.78	14.56	14.04
	10	26.66	26.54	26.58	26.66	26.48	26.20	26.29	26.23	26.43	26.66	25.94	25.79	25.78	26.93	26.63	26.72	27.37	26.66	26.92	26.63
	15	29.45	29.48	29.48	29.37	29.51	29.66	29.49	29.50	29.55	29.55	29.77	29.51	29.54	29.65	29.88	29.69	29.66	29.64	29.78	29.68
	20	30.25	30.23	30.22	30.28	30.34	30.33	30.20	30.23	30.28	30.22	30.34	30.32	30.35	30.42	30.43	30.35	30.39	30.42	30.32	30.40
	25	30.53	30.50	30.49	30.58	30.57	30.54	30.54	30.50	30.54	30.48	30.52	30.51	30.50	30.59	30.60	30.57	30.59	30.55	30.44	30.51
	30			30.61		30.73	30.70		30.61	30.68	30.61			30.57		30.70	30.70		30.69	30.56	30.56
	35					30.73	30.76		30.67	30.78	30.65						30.76		30.78	30.61	30.58
Post-vacuum	0	9.03	8.94	8.98	8.16	8.14	8.19	8.21	8.34	9.19	9.09	8.46	8.37	8.54	7.43	7.67	7.63	7.31	7.32	8.55	8.13
	5	19.68	19.64	20.73	18.92	19.13	19.78	19.23	20.87	19.79	19.60	14.93	13.02	13.75	14.66	13.29	13.74	13.43	11.81	13.92	13.32
	10	26.36	26.37	26.55	26.46	26.65	26.44	26.99	26.50	26.45	26.55	25.86	26.39	26.39	25.80	26.84	27.10	26.94	27.08	26.56	26.27
	15	29.49	29.53	29.47	29.60	29.64	29.61	29.48	29.64	29.41	29.41	29.66	29.58	29.58	29.72	29.76	29.68	29.93	29.78	29.51	29.69
	20	30.22	30.20	30.25	30.26	30.22	30.27	30.22	30.24	30.28	30.22	30.42	30.43	30.39	30.48	30.42	30.44	30.52	30.46	30.36	30.40
	25	30.52	30.54	30.48	30.58	30.60	30.60	30.57	30.57	30.52	30.48	30.51	30.53	30.52	30.63	30.60	30.59	30.63	30.58	30.49	30.47
	30			30.62		30.71	30.72		30.72	30.62	30.61			30.56		30.69	30.68	30.67	30.68	30.57	30.55
	35						30.78		30.77	30.65	30.65						30.77		30.77	30.60	30.56

Table 5. Conductivity (mS/cm)

Category		Day 1										Day 2									
	Position	UP	UP	UP	UP	Cage	D100	D100	D50	D100	D100	UP	UP	UP	UP	Cage	D100	D100	D50	D100	D100
	Depth	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Pre-feed	0	12.59	12.82	14.00	11.01	11.00	11.38	11.52	11.22	11.41	11.57	14.19	15.32	14.86	12.48	13.65	13.25	12.68	12.81	15.38	13.38
	5	32.46	32.37	31.82	31.43	31.53	31.81	31.52	31.72	31.60	31.33	23.69	24.71	23.33	22.96	22.16	22.14	22.09	23.32	23.73	23.54
	10	41.38	41.69	41.63	41.15	41.75	41.60	41.93	41.53	40.77	40.97	41.68	40.86	40.65	41.54	41.55	41.31	42.08	41.97	41.51	41.83
	15	45.66	45.44	45.37	45.40	45.30	45.70	45.28	45.36	45.62	45.64	45.64	45.66	45.77	45.82	45.75	45.90	45.80	45.78	46.06	46.05
	20	46.70	46.66	46.66	46.70	46.59	46.65	46.60	46.65	46.54	46.59	46.64	46.72	46.67	46.75	46.76	46.71	46.72	46.77	46.78	46.83
	25		46.98	46.97	47.01	47.01	47.01	46.96	47.04	46.99	46.97	46.98	46.95	46.89	47.00	47.02	46.95	47.03	47.05	46.94	47.06
	30			47.08		47.27	47.22		47.22	47.21	47.22			47.07		47.20	47.20	47.18	47.18	47.07	47.19
	35					46.82	47.34		47.30	47.32	47.31						47.25		47.26	47.10	47.27
Post-feed	0	15.62	15.58	15.45	13.79	13.13	13.90	14.34	15.38	13.60	14.86	14.61	14.34	14.86	13.30	13.98	13.69	13.78	13.31	15.10	14.68
	5	31.89	31.31	31.59	30.91	30.53	30.83	30.64	31.45	30.59	31.52	22.84	22.85	23.85	23.00	23.83	23.80	22.56	23.06	24.04	23.26
	10	41.61	41.45	41.50	41.64	41.37	40.99	41.11	41.01	41.30	41.61	40.60	40.39	40.37	42.01	41.59	41.72	42.61	41.63	41.98	41.57
	15	45.50	45.54	45.55	45.37	45.56	45.77	45.54	45.58	45.62	45.64	45.95	45.59	45.63	45.75	46.07	45.80	45.77	45.74	45.96	45.82
	20	46.61	46.59	46.57	46.62	46.69	46.67	46.50	46.59	46.61	46.57	46.74	46.70	46.75	46.81	46.83	46.71	46.77	46.81	46.71	46.82
	25	46.99	46.96	46.94	47.03	47.01	46.98	46.97	46.95	46.96	46.93	46.98	46.97	46.96	47.04	47.05	47.01	47.04	46.99	46.88	46.96
	30			47.11		47.23	47.19		47.11	47.17	47.11			47.05		47.20	47.19		47.18	47.04	47.03
	35					47.23	47.28		47.18	47.30	47.16						47.28		47.31	47.11	47.06
Post-vacuum	0	15.50	15.36	15.42	14.41	14.39	14.47	14.50	14.70	15.76	15.61	14.60	14.46	14.73	13.26	13.64	13.58	13.07	13.08	14.74	14.07
	5	31.63	31.57	33.16	30.65	30.98	31.90	31.10	33.45	31.80	31.51	24.60	21.70	22.82	24.37	22.31	23.00	22.53	20.08	23.08	22.15
	10	41.19	41.21	41.46	41.35	41.62	41.32	42.09	41.40	41.31	41.47	40.49	41.24	41.24	40.44	41.88	42.25	42.03	42.23	41.47	41.06
	15	45.56	45.61	45.54	45.68	45.74	45.70	45.52	45.74	45.45	45.45	45.80	45.69	45.69	45.85	45.90	45.80	46.15	45.93	45.59	45.84
	20	46.56	46.54	46.61	46.58	46.53	46.60	46.53	46.56	46.64	46.57	46.85	46.86	46.80	46.88	46.81	46.83	46.94	46.86	46.76	46.82
	25	46.98	47.01	46.92	47.03	47.05	47.05	47.02	47.01	46.98	46.93	46.97	46.99	46.99	47.10	47.05	47.04	47.09	47.03	46.95	46.92
	30			47.12		47.21	47.22		47.22	47.12	47.10			47.04		47.18	47.17	47.16	47.16	47.05	47.02
	35						47.31		47.29	47.16	47.16						47.29		47.29	47.10	47.04

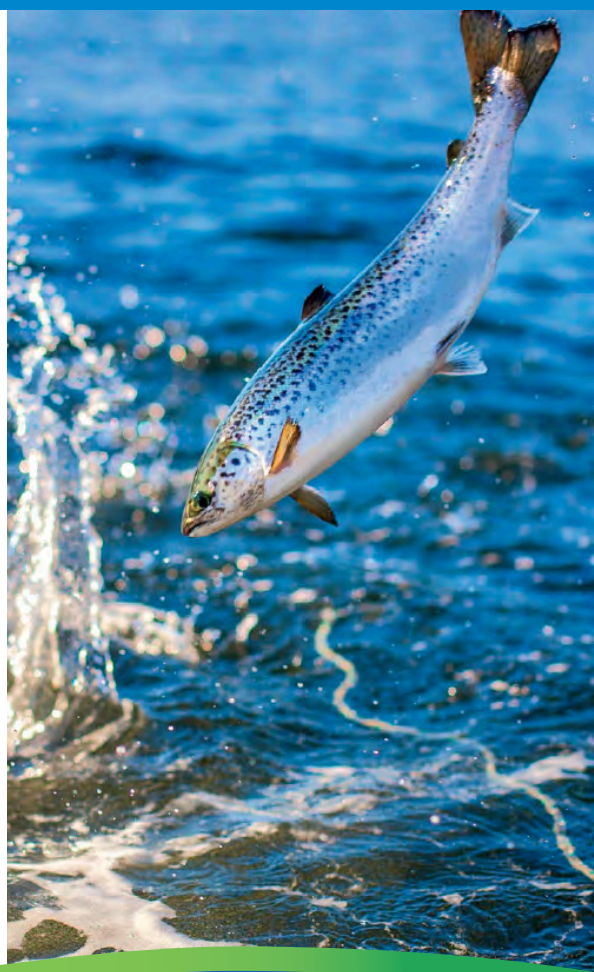
Macquarie Harbour

About Tassal

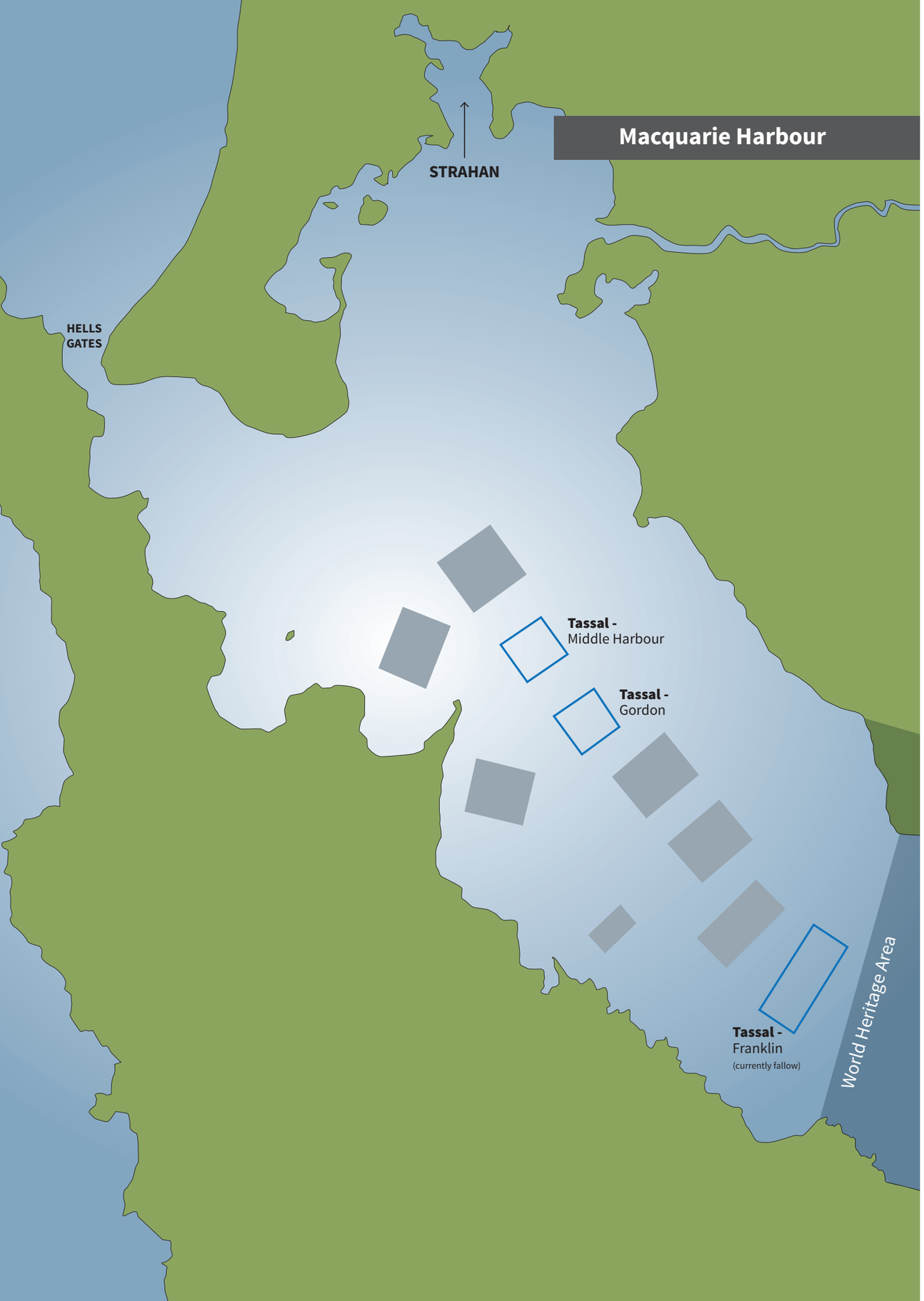
Tassal has been operating in Tasmania for more than 30 years. Underpinned by its people's passion and commitment, it is now Australia's largest producer of Atlantic Salmon and regarded as a global leader and industry pioneer. It was the first company in 2014 to achieve the gold star rating of sustainable salmon farming: ASC certification across all its sites. While we always strive for 100% compliance across our operations, and on average achieve a Tasmanian industry-leading 95%-plus, we have a focus on continuous improvement and are committed to a sustainable future.

We are proud of the aquaculture industry's position in anchoring regional communities, providing considerable opportunities and benefits in sometimes fragile economic areas. Tassal's operations alone stimulate approximately 6,000 jobs, directly and indirectly, and contribute more than $500 million to the State's economy. Tassal is based in Tasmania's south, south-east, east and west coast communities through a variety of operations, processing and value-add activities.

Community engagement is pivotal and Tassal seeks to ensure it has meaningful partnerships, programs and consultation opportunities across all communities where it operates.



tassal®



MACQUARIE HARBOUR:

Tassal has been farming at Macquarie Harbour since 2003, with the zone integral to the company's production cycle, with planning processes more than 30 months in the making. Going forward, Tassal supports a lease by lease approach to salmon farming in Macquarie Harbour, and given the unpredictability of the Harbour's system, believes biomass should be reviewed annually.

What happened in 2016

What happened at Macquarie Harbour in 2016 was unique, unexpected and at odds with Tassal's strong record of sustainable production, science-based processes and careful stewardship. After a number of years of consistently high compliance ratings that were of global leadership standard, this event demonstrated that environmental stewardship must remain a focus; every minute, every day.

While we always strive for 100% compliance across our operations, and on average achieve a Tasmanian industry-leading 95%-plus, recent events remind us that perfect scores are challenging to achieve. Macquarie Harbour is a complex waterway and that is why we are investing substantially in science and innovation.

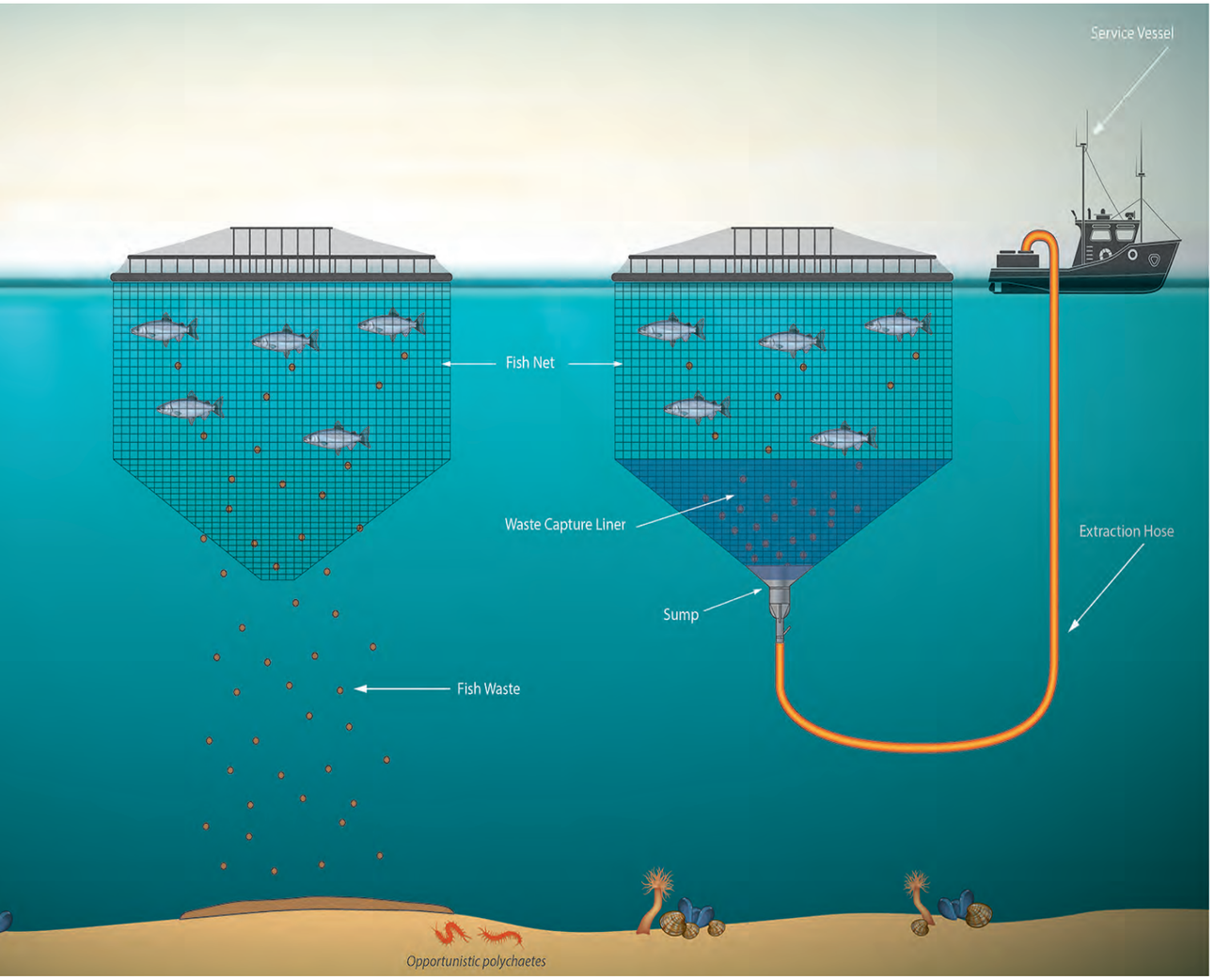
Waste Capture System (WCS)

To support short term biomass goals, Tassal will further minimise the environmental impacts of salmon farming in the Harbour through the deployment of innovative waste capture and recovery technologies. This is a substantial investment for the company, based on careful research, and will be subject to management and monitoring both by Tassal and the independent regulator.

Tassal is committed to establishing an adaptive environmental and operational regime for Macquarie Harbour to underpin sustainable salmon farming for the region, which supports economic vitality for the community and state.

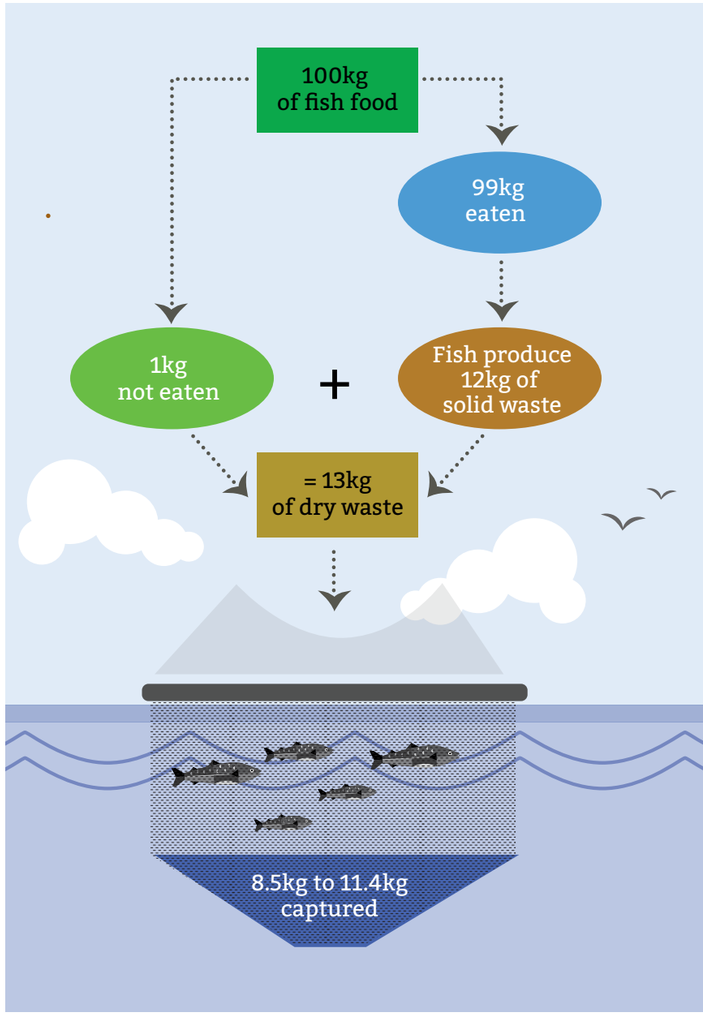
Waste capture systems for salmon farming have been used successfully in other countries, however, conditions for fish farming are substantially different in Tasmania than in the northern hemisphere, so it is important that we use methodologies that are most suitable to operating conditions.

Tassal has a lot of expertise when it comes to capturing and disposing of fish waste – over 30 years in our hatcheries. It is a matter of applying this expertise to sea based operations. Tassal initially trialled a single prototype Waste Capture System (WCS) to test the concept was fit for purpose; several design inadequacies were identified through the testing of prototype I.



Waste capture system concept.

- 13 tonnes per hectare = 12,000 tonne whole of harbour biomass limit. Tassal will be capturing waste from all of the cages that represent biomass in excess of 13 tonnes per hectare, together with capturing waste from a portion of cages below 13 tonnes per hectare. For example, at Tassal's peak stocking levels for the 2016 salmon input year, all cages in excess of 8 tonnes a hectare will have WCSs installed. This effectively demonstrates the equivialent of a significant biomass reduction.
- Design changes were made between prototype I of the WCS and prototype II of the WCS. Design improvements were focused on reducing negative impacts to the structure of the net, improving the sump design for maximum solids extraction and refining pumping design.
- Tassal subsequently installed three trial WCSs to ascertain key information, which has enabled the efficacy of the WCSs to be measured. Existing in-house expertise on liner construction and deployment from fresh water bathing operations, together with Recirculating Aquaculture System (RAS) waste management expertise were utilised and adapted to aid in the development of the WCS.
- Tassal undertook a comparative analysis of captured waste in relation to published salmon faecal characteristics and volumes. This analysis was further informed by Tassal specific diet and feed management information.
- Current literature states that solid dry particle faecal excrement from Atlantic Salmon is on average equivalent to 12% of total feed fed. The literature also identifies uneaten feed wastage is in the range of 1% to 5%, Tassal has conducted measurements of captured feed from the WCS which confirmed an average of 1% uneaten feed.
- The combination of 12% of feed fed becoming dry solid particulate faecal waste and 1% waste feed results in 13% of feed fed becoming dry solid particulate waste.
- A typical commercial salmon diet was initially fed to the salmon in the WCS trial. Although waste was successfully captured using a typical salmon diet, Tassal has found the use of a faecal binder additive to the fish food improved capture rates and extraction efficiency. The food additive is a non-gmo, plant based ingredient. It is no way affects the fish or its welfare but merely changes the density of their faeces. It is a diet type that is used in land based recirculating hatchery systems.
- Tassal is implementing WCSs sufficient to 150% of the biomass in excess of 3640 tonne.
- WCSs have been inspected in adverse weather conditions to ascertain if the system behaves similarly to a sea anchor or causes pluming of fish waste. The adverse surface weather conditions had little to no impact to the WCS integrity.
- All waste removed from the WCSs is currently being disposed of at a temporary approved Waste Water Treatment Plant.
- Tassal is currently investigating several waste disposal options to service the duration of the project. Information of these proposed disposal options will be presented at the Community Engagement Session on 27 July.



Trial results

This huge project was completed with the help and support of Conservation Volunteers Australia, Parks and Wildlife, Wildcare, Active Strahan, Strahan Primary, the local community and the three aquaculture farms - Tassal, Petuna and Huon Aquaculture.

Marine Debris Clean-up
WHAT A FANTASTIC EFFORT!

Volunteers, the aquaculture and tourism industries, stakeholders and the community joined together to collect marine debris from beaches and coves to prevent harm to our wildlife and protect the environment.

Marine debris was collected over 5 days (1-5 April) with over 100 people involved. It took 7 months to coordinate with 12 stakeholder organisations.

The foreshore clean-up aimed to cover 80kms of shoreline in Macquarie Harbour on Tasmania's West Coast. Around 55 cubic metres of marine debris was collected and sorted from remote World Heritage Area beaches in Macquarie Harbour, Ocean Beach and Strahan.

The Community Clean-up Day was well attended by many locals, including children! Rubbish and marine debris was removed from the Meredith St boat ramp and Strahan foreshore, with the majority of rubbish being bottles and cans.

Debris included 5 cubic metres of rope (10% of total rubbish), 724 plastic bottles, 678 cans and 690 glass bottles. The aim was to remove marine debris in the harbour to get it to a baseline level, so we can gauge the type and amount of new debris washed ashore.

This huge project was completed with the help and support of Conservation Volunteers, Parks and Wildlife, the three aquaculture farmers, Tassal, Petuna and Huon Aquaculture and the community. Another clean-up will be coordinated next year, now that the logistics and challenges have been figured out.

Debris ranged from tiny pieces of plastic and glass bottles to polystyrene, tyres, garden chairs, polypipe, buoys and anchors. This was an important project to undertake to ensure one of Tasmania's iconic tourist destinations remains debris free, which assists prevent harm to people and the environment.

The data is being entered into the CSIRO National Marine Debris database which will assist the aquaculture industry in taking a proactive, transparent and measured approach to managing debris.

A meeting of key stakeholders has been held to discuss the results of the clean up. From this new areas of shoreline will be adopted and additional bins provided.

Planning for the next event has begun with the date set for 7-11 April 2018.

MEET TASSAL'S *Steve Thompson ...*

Steve Thompson
Tassal Work, Health and Safety Co-ordinator

"I grew up in Strahan, went to the local primary school and never imagined the opportunities that lay ahead as I prepared for Mountain Heights High School at Queenstown, the closest place at the time to get a high school education if you lived in Strahan. Trust me, one hour each way to and from school every day provided plenty of time to think!

I started out in hospitality in Strahan before working in mining for some years. I was looking for a change and decided to try my hand in the aquaculture industry. When I first started with Tassal as a farm attendant I did just about every job you can imagine, before moving on to become the compliance coordinator at Macquarie Harbour for a number of years. Just to make sure I was doing my part for the community, I also spent the last seven years as a Volunteer Ambulance Officer in Strahan.

The time spent working for Tassal at Macquarie Harbour led me to another career opportunity when Tassal expanded its seafood operations in Sydney and purchased DeCosti Seafoods. Tassal helped me improve my skills and training which has led to a career in workplace health and safety with the company in Sydney. I'm currently based at the Lidcombe processing site.

It's great to have a change after spending most of my life in and around Strahan. I have close ties with the region still, my brother and brother in law both work for Tassal at Macquarie Harbour and my parents still live locally. Watch this space, I could return!

There's been challenges at Macquarie Harbour recently and a lot of controversy about the salmon industry but people need to remember Tassal is a major employer for the West Coast, both directly and indirectly. The community also relies on Tassal to provide financial support to many local events so they can continue to run.

I am confident tourism and aquaculture can co-exist all over Tasmania, just as we have seen at Macquarie Harbour for many years.

I am confident tourism and aquaculture can co-exist all over Tasmania, just as we have seen at Macquarie Harbour for many years. If tourists could be provided with more information on how the operations work, that would be the icing on the cake.

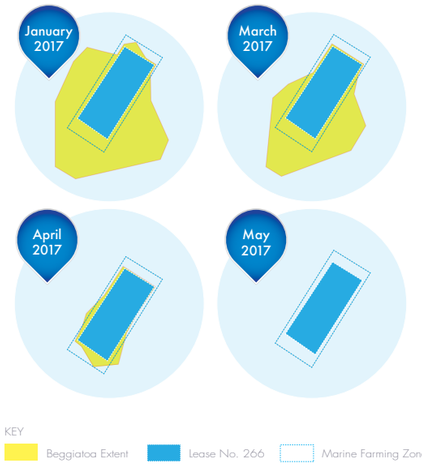
COMPLIANCE

Recent compliance results have reinforced that not every hectare will yield the same environmental performance. In fact, benthic compliance is also dependent on a marine lease's location in the Harbour and external influences.

As you are aware, Tassal has a long history of strong marine compliance, with our 2016 results demonstrating 96% compliance, and 99.9% compliance to date in 2017 across all South-East sites. While we strive for 100% compliance, we remain a recognised global leader when it comes to marine stewardship and transparency.

Tassal's May 2017 surveys at Macquarie Harbour have indicated full compliance across all three leases.

MACQUARIE HARBOUR
Beggiatoa Extent Improvement
Lease No. 266



Your Say!

Trevor Norton

WEST COAST YACHT CHARTERS &
THE CRAYS ACCOMMODATION

"I think tourism and aquaculture can certainly live together provided the aquaculture industry stops trying to appear to be environmentally responsible, but actually achieves it. The Macquarie Harbour clean up in my opinion has been a great success, but more importantly it has given us the data to achieve even better results in the near future."

Anna Wind

COASTAL COORDINATOR AT CRADLE COAST NRM

""A clean-up on the scale of the Macquarie Harbour event has not taken place on the west coast before. The aquaculture farms have adopted sections of shoreline that they regularly clean-up, but this event covered a bigger area and involved not only the aquaculture and tourism industries, but also community members, school students, Conservation Volunteers Australia, Wildcare and Parks and Wildlife staff."

Tim Stephens

TASSAL: SPECIAL PROJECTS -
ENVIRONMENT & SUSTAINABILITY

"It has been a huge task working on Tassal's waste capture system at Macquarie Harbour over the past few months. An incredible team effort has resulted in a successful and innovative solution for capturing fish waste. I'm really proud to have been involved with this project because it will make a big difference at Macquarie Harbour."

Fun Run Cheer Squad

Cancer Council's Slip Slop Slap Seek Slide Ambassador Sid joined forces recently with Tassal's Salmo Salmon to cheer on runners at the Beach to Bay charity fun run.

tassal®

Our 2016 Sustainability Report is now available.
www.tassal.com.au

WE WOULD LOVE TO HEAR FROM YOU: **tassal.news@tassal.com.au**

This publication is proudly designed and printed in Tasmania

Tassal Community Engagement Session

Macquarie Harbour Q & A

When: Thursday 27th July

Time: 6.30pm – 8pm

Where: Henty Room,
Strahan Village,
The Esplanade, Strahan

Refreshments will be provided

tassal®