

## Gladstone Healthy Harbour Partnership 2023 Report Card Summary, ISP011: Seagrass

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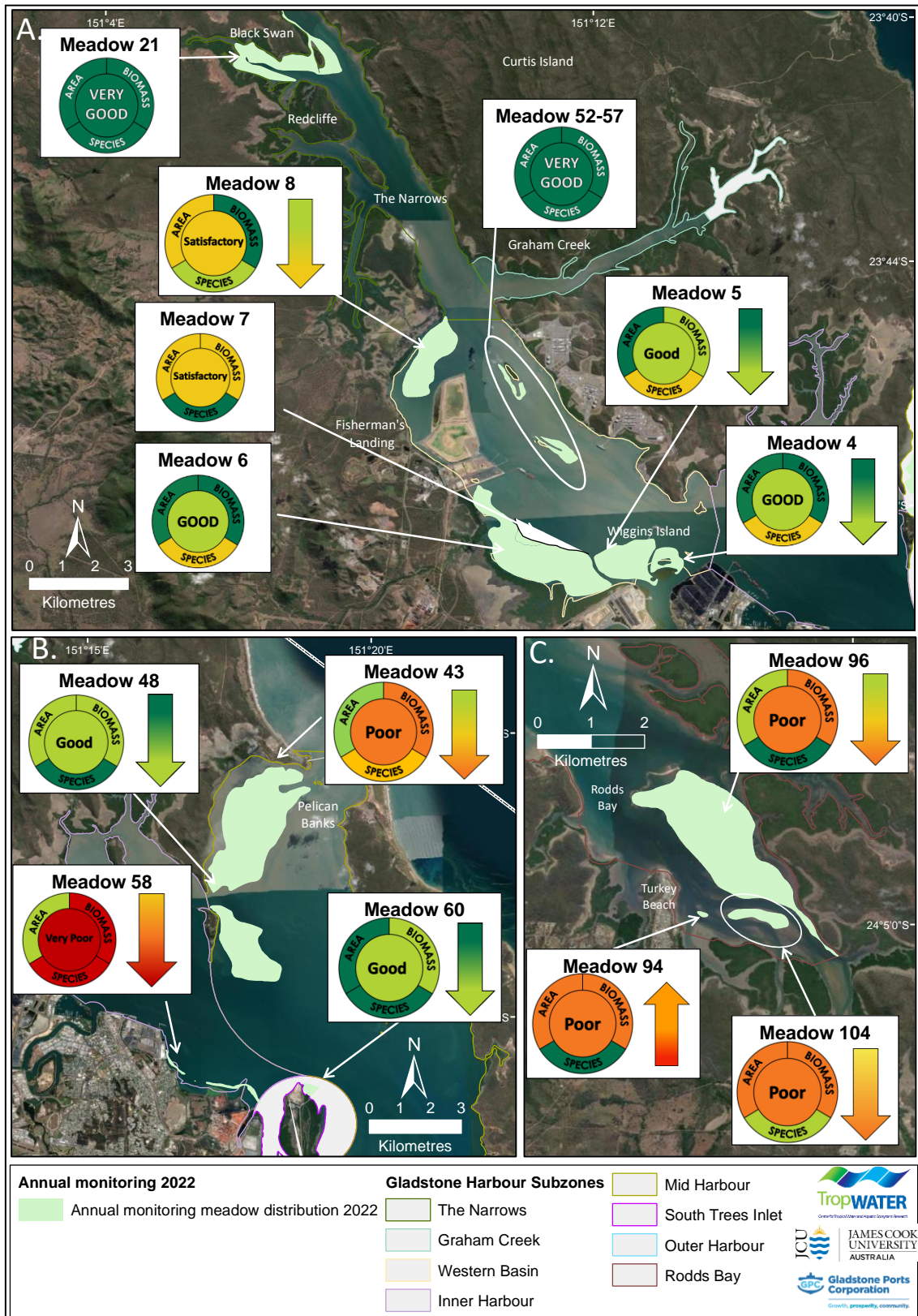
Gladstone Harbour seagrass meadows were in satisfactory overall condition in 2022 after being in good condition for the previous three years. Monitoring was conducted in November 2022, for the 2023 Gladstone Harbour Report Card. Seagrass in the Western Basin and The Narrows continued to be in good condition but there were declines in seagrass biomass, area and species composition in Rodds Bay, Inner Harbour and Mid Harbour.

Seven of the fourteen individual monitoring meadows were rated as being in good or very good condition in 2022 (Table 1). In the Western Basin and north to The Narrows, seagrass remained in good condition with five of the seven monitoring meadows in these zones in good or very good condition. This is the first time seagrass in The Narrows has been in very good condition for consecutive years. Outside the Western Basin, only the meadows at Quoin Island (Meadow 48) and at South Trees Inlet (Meadow 60) were in good condition. Seagrass at Pelican Banks (Meadow 43) returned to poor condition after reaching satisfactory condition in 2021 after 6 years of poor condition. All three monitoring meadows in the out of port reference area at Rodds Bay were in poor condition as a result of decreases in biomass. The seagrass meadow at the Inner Harbour (Meadow 58) was in very poor condition due to a large decrease in biomass and the absence of persistent seagrass *Zostera muelleri* ssp. *capricorni* in the meadow.

**Table 1.** Grades and scores for seagrass sub-indicators (biomass, area and species composition), overall meadow, zone, and Gladstone Harbour scores for the GHHP 2022-23 reporting year. Scores are on 0 – 1 scale; cells are coloured according to grade, where dark green = very good, light green = good, yellow = satisfactory, orange = poor, red = very poor. Note, 2022 scores may differ slightly to those reported by Smith et al. (2023) due to bootstrapping used to calculate GHHP report card and scores. Methods are available in the 2023 Gladstone Harbour Technical Report.

Zone	Meadow	Biomass	Area	Species composition	Overall meadow	2022
1. The Narrows	21	0.93	0.96	0.96	0.93	0.93
3. Western Basin	4	1	1	0.56	0.78	0.72
	5	0.81	1	0.64	0.73	
	6	0.96	0.87	0.50	0.69	
	7	0.58	0.57	1	0.57	
	8	0.86	0.58	0.76	0.58	
	52-57	0.88	0.90	1	0.88	
5. Inner Harbour	58	0.21	0.74	0	0.11	0.10
8. Mid Harbour	43	0.44	0.82	0.63	0.44	0.57
	48	0.71	0.79	0.94	0.71	
9. South Trees Inlet	60	0.81	1	1	0.81	0.81
13. Rodds Bay	94	0.37	0.30	1	0.30	0.38
	96	0.46	0.84	0.90	0.46	
	104	0.42	0.38	0.82	0.38	
<b>Harbour score</b>						0.58

\*Meadow 52-57 consists of a number of small meadows surrounding the Passage Islands in the Western Basin Zone (see Figure 1). These meadows are grouped for reporting purposes.



**Figure 1.** Seagrass distribution and meadow condition in the The Narrows and Western Basin Zones (a), Inner Harbour, Mid Harbour, and South Trees Inlet Zones (b) in Gladstone Harbour, and in Rodds Bay (c) in November 2022 (this report card). Arrows indicate an overall grade change from the previous year.

Decreases in seagrass biomass and meadow condition in 2022 can be attributed to above average rainfall and increased river flow in 2022 relative to the previous four years. Local environmental conditions are a key factor in determining seagrass distribution, biomass and health. Long-term trends in seagrass condition over the past 20 years of annual monitoring reveal a strong relationship with river flow and rainfall in the region. Flow from the Calliope River over the 12 months prior to the survey was higher than any of the previous four years and annual rainfall the highest in eight years. Seagrass has specific light requirements for photosynthesis and growth (Chartrand et al. 2016; 2018). Turbidity associated with rainfall and river outflow reduces benthic light conditions inhibiting seagrass growth and can ultimately lead to plant death. Greater rainfall and river flow in the 12 months preceding the 2022 survey may have led to a reduction in benthic light, poor seagrass growing conditions and ultimately lower seagrass biomass. The low river flow and rainfall conditions between 2018 and 2021 likely led to higher benthic light levels allowing seagrass growth and recovery observed over those years. Increases in seagrass biomass, area and species composition in the Western Basin and The Narrows during this period provided these meadows with some resilience to the unfavourable growing conditions in 2022. If above average rainfall and river flow conditions continue, seagrass biomass and condition may continue to decrease.

The largest seagrass meadow in Port Curtis, Pelican Banks (Meadow 43) is in poor condition after being rated satisfactory in 2021. Pelican Banks is historically the largest, high-biomass seagrass meadow in Port Curtis, but had been in poor condition for the six years prior to 2021. Changes in species composition from the foundation species *Z. muelleri* to small, less persistent *H. uninervis* and *H. ovalis* during this period contributed to lower meadow biomass and poor meadow condition. An increase in *Z. muelleri* in 2021 led to improvements in biomass but in 2022 the meadow returned to poor condition as *Z. muelleri* decreased across the meadow having a direct impact on meadow biomass. The Pelican Banks meadow is subject to high levels of herbivory from dugong and turtle that may be altering the species composition and restricting recovery at Meadow 43. Recent research using herbivore exclusion cages has found the impact of herbivores on both seagrass biomass and canopy height were greater at Pelican Banks than other meadows within Port Curtis and Rodds Bay (Scott et al. 2021). It has been suggested that megaherbivores target areas of high biomass which may explain high levels of herbivory in the past (Smith et al. 2023, Rasheed et al. 2017) and major meadow losses have occurred in other locations around the world as a direct result of turtle herbivory (Christianen et al. 2014).

The declines in seagrass seen at some meadows within the port were also reflected at the out of port reference area in Rodds Bay, with declines occurring in two of the three monitoring meadows there and all three rated as being in poor condition in 2022. Biomass and area in the Rodds Bay meadows peaked in 2019-2020 and were considered very good after nine to ten years of being in satisfactory to poor condition. The last two surveys however have seen a general decline in seagrass biomass and area across Rodds Bay. The fact that declines occurred both within and outside of the port point to broader climate related drivers of seagrass change rather than anything specifically related to port activities in 2022.

Prior to the latest results, the good overall seagrass condition across Gladstone Harbour and Rodds Bay in the 2022 reporting year likely provided seagrasses a level of resilience to pressures including the large rainfall events recorded in March and May of 2022. The reductions in condition of meadows means they are likely to have a reduced level of resilience to future impacts should these conditions return in 2023.

## References

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