

Date: **April 19, 2023 (revised from April 11, 2023)**

Project No.: **20985**

To: **Orleans Wastewater Management Advisory Committee (WMAC)**

From: **Mike Giggey**

Subject: **Orleans Wastewater Management Planning
Town-wide Progress toward Nitrogen Removal Goals**

As we are developing a town-wide plan for wastewater and nitrogen management, it is appropriate to consider the progress to date in completed and upcoming projects. This is an important topic for public outreach as well. Accordingly, we have prepared this memo to provide you with our best current estimates.

The attached Table 1 presents our best estimates of the nitrogen removal benefits of the first three phases of the sewer program, as well as the performance of non-traditional approaches (shellfish harvesting and PRB). The first column Table 1 presents the nitrogen removal targets, either as codified in the Pleasant Bay Watershed Permit, or as derived from MEP reports for Nauset Harbor and Rock Harbor. Actual or expected removals are shown in the next set of columns, based on water consumption data provided by AECOM or from separate reporting for the Lonnie's Pond shellfish project and the Middle School PRB study. The last column of Table 1 shows the remaining load removal requirements.

The broad picture is as follows through Phase 3, with nitrogen removal expressed in kg/yr:

	Nauset Harbor	Rock Harbor	Pleasant Bay	Total
Phase 1	1,656	1,173	0	2,829
Phase 2	99	0	1,873	1,972
Phase 3	201	0	274	475
Non-traditional	161	0	67	228
Total	2,117	1,173	2,214	5,504
Goal	5,000	1,500	6,980	13,480
% Complete	42%	60%	32%	41%

Nauset Harbor removals are depicted in the green-shaded part of the attached table. Rock Harbor removals are in the tan portion of the chart. Pleasant Bay removals are shaded in blue. Table 1 also shows the nitrogen removal in the Little Namskaket watershed that is associated with Phase 1; note that no nitrogen removal is required there.

Table 1 should serve as a way to periodically update the town's progress toward its nitrogen removal goals. Also attached is a bar-chart depiction of this same information.

In reviewing this table and bar chart, several points should be considered:

1. Nitrogen removal goals for the Nauset Harbor system are based on the 2012 MEP report. We know that Eastham wishes to modify the watershed loads estimates there to reflect Eastham's new water supply system. New water use data for Eastham may increase Orleans' share of nitrogen removal needs in that watershed. The same may apply to the Rock Harbor system.
2. The 2012 MEP report for the Nauset system includes the recommendation that no nitrogen removal is needed in the Mill Pond sub-watershed. Declining water quality in that embayment may mean that some nitrogen removal is warranted, which is not reflected in the attached table.
3. The 2008 MEP report for Rock Harbor first evaluates Cedar Pond as a freshwater pond and attributes it with 58% attenuation based on 2002-2003 data. Later in the MEP report, Cedar Pond is treated as an estuarine water body with a defined nitrogen loading threshold and suggested TMDL, but with no nitrogen removal needs. Flow controls at the Cedar Pond discharge have been modified over the years, and as currently configured the control boards are set high enough to prevent most brackish water intrusion. Therefore, for the purposes of this memo, the sewerage that has occurred in the Cedar Pond watershed has been treated as a Rock Harbor load reduction after the 58% attenuation in Cedar Pond as a freshwater body. Clarification of the nitrogen dynamics should occur as the Rock Harbor TMDL is established.
4. The attached table and bar chart show that Phase 3 of the sewer program will allow a relatively small reduction in nitrogen load to Lonnie's Pond. One of the primary reasons for Phase 3 is to eliminate phosphorus loading from 69 homes upgradient of Crystal Lake and Pilgrim Lake. Nitrogen attenuation in those freshwater ponds reduces the nitrogen-related benefits of sewerage those upgradient homes; about 40 kg/yr of the 240 kg/yr removal shown in the attached table is associated with sewerage those homes upgradient of the two lakes.

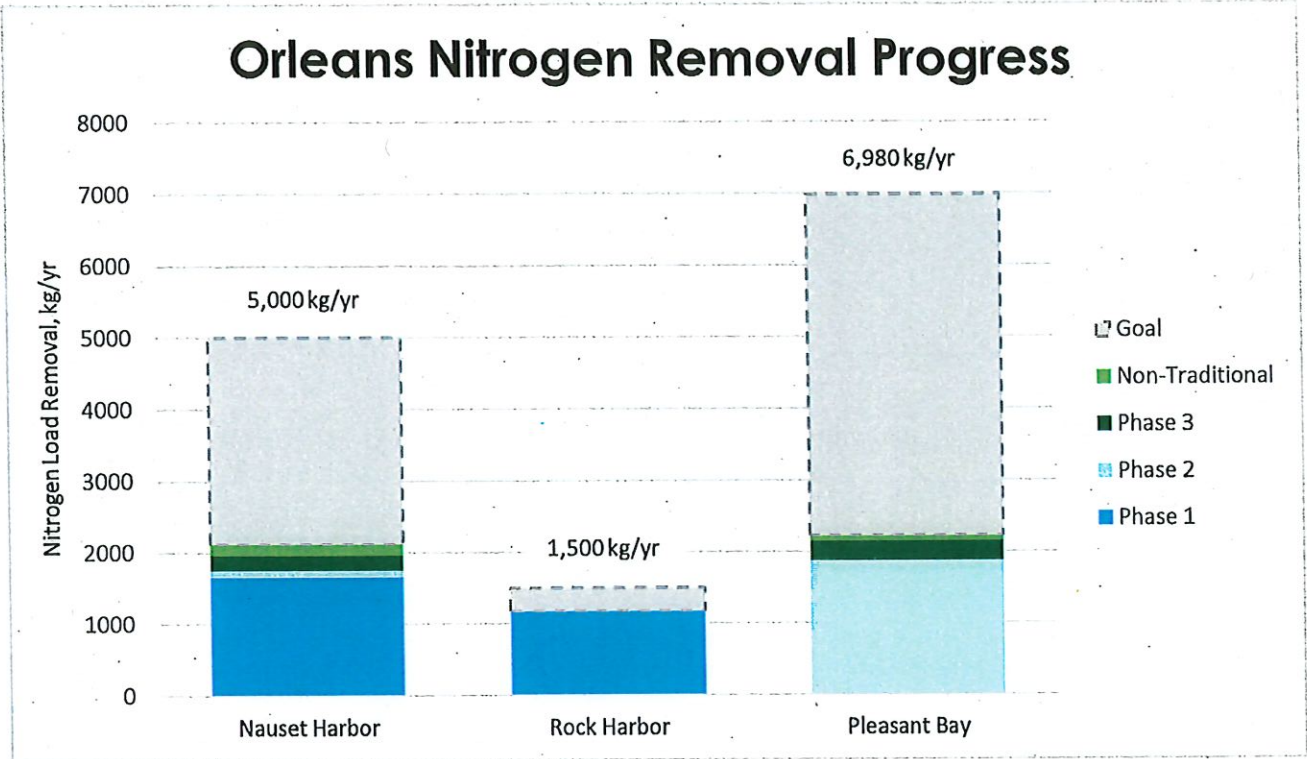
Considering these caveats, these data show that Orleans will have accomplished about 41% of its nitrogen removal goals by the completion of Phases 1, 2 and 3, and the continued performance of the non-traditional measures.

Once Phase 3 is complete, the remaining load removal needs will be:

- Pleasant Bay: 4,766 kg/yr
- Nauset Harbor: 2,883 kg/yr
- Rock Harbor: 327 kg/yr
- Total: 7,976 kg/yr

without considering possible Mill Pond needs or the dynamics of Cedar Pond.

Note that the nitrogen removal accomplishments do not include any credit for reduced residential fertilizer use, and that the nitrogen removal goals do not include any growth since the MEP reports.



ORLEANS WASTEWATER MANAGEMENT PLANNING

Progress Toward Expected Nitrogen Removal Requirements

Loads in kg/yr

19-Apr-23

Table 1

Sub-watershed	Req'd Load Removal	Load Removals by Sewer Phase					Load Removal Remaining
		Phase 1	Non-Trad	Phase 2	Phase 3	Total	
Town Cove	5,000	1,656	161	76	201	2,094	2,906
Mill Pond	-	-	-	23	-	23	(23)
Total--Nauset Harbor	5,000	1,656	161	99	201	2,117	2,883
Rock Harbor	1,500	1,173	-	-	-	1,173	327
Total--Rock Harbor	1,500	1,173	-	-	-	1,173	327
Meetinghouse Pond	1,876	-	-	1,689	34	1,723	153
Lonnie's Pond	284	-	67	-	240	307	(23)
Arey's Pond	113	-	-	-	-	-	113
River--upper	375	-	-	152	-	152	223
River--Lower	518	-	-	2	-	2	516
Namequoit River	348	-	-	-	-	-	348
PahWah Pond	413	-	-	-	-	-	413
Quanset Pond	227	-	-	-	-	-	227
Pochet Neck	1,569	-	-	30	-	30	1,539
Pleasant Bay aggregate	1,257	-	-	-	-	-	1,257
Total--Pleasant Bay	6,980	-	67	1,873	274	2,214	4,766
Little Namskaket	-	{665}	-	-	-	{665}	
TOTAL	13,480	2,829	228	1,972	475	5,504	7,976