PHCC PROJECT CODE: 0210
PROGRAM: Urban Rivers and Catchment Program Round 2

Healing Waangaamaap Bilya

(Lower Serpentine River)

PROJECT UPDATE

Peel MD Swales Off-line Treatment Project

10-July-2025

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We acknowledge the Noongar people as Traditional Custodians of this land and pay our respects to all Elders past and present

Introduction

The original concept of this 'off-line water treatment project' in 2015, was to divert phosphorous-rich waters from the Peel MD into a set of Swales where the clays would adsorb and retain much of the phosphorous in the flow. The current layout is shown in **Figure 1** below. This update is to summaries our learnings from the operation of the system during the 2024 period where operation occurred from June 2024 to January 2025.

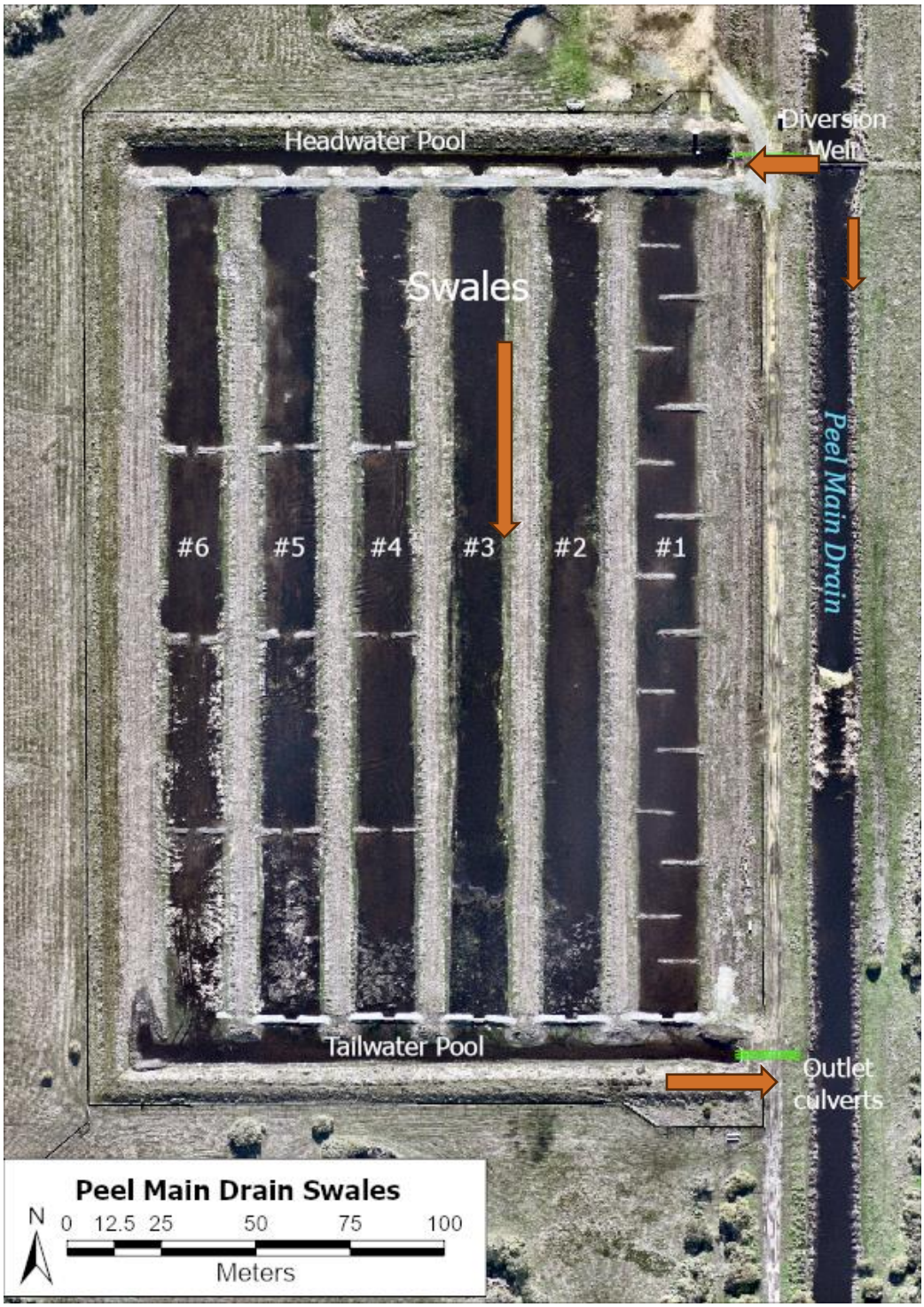


Figure 1 – Clay lines Peel MD Swales (25/06/2025); with two-thirds of flow through Swales

Note: each swale is 220m long and 13m wide. For 2025 operation, Swale#1 has meanders to mimic a natural system, Swales #2 & #3 are flat while Swales #4 to #6 have 'riffles' to slow water treatment. Swales #1 to #5 have tail-end stopboards and Swale #6 is sloping at 1:500 down to the tailwater.

Background

The project was initiated in 2015 with investigation studies to develop the feasibility of the proposed concepts. Construction works began in 2018 and were finally complete in June 2021. Operations were expected to commence soon after, however significant inundation of our site occurring due to high flows in Peel Main Drain (PMD) (**Figure 2**) through a series of clay-lined swales (**Figure 3**):

Figure 2 – Peel MD weir – weir completely drowned out (21/07/2021)

Figure 3 – Inundated Swale #1 – all Swales completely inundated to 0.75m deep (30/07/2021)

Due to this, we decided that operating the Swales during this high-flow/inundation period would be difficult until the complexities of managing high Winter flows were better understood.

Hence, over the first two years of actual operation (2022 & 2023), we only ran the system over the Spring (**Figure 4**) through to when Peel MD flows stopped in early Summer. This allowed us to trial

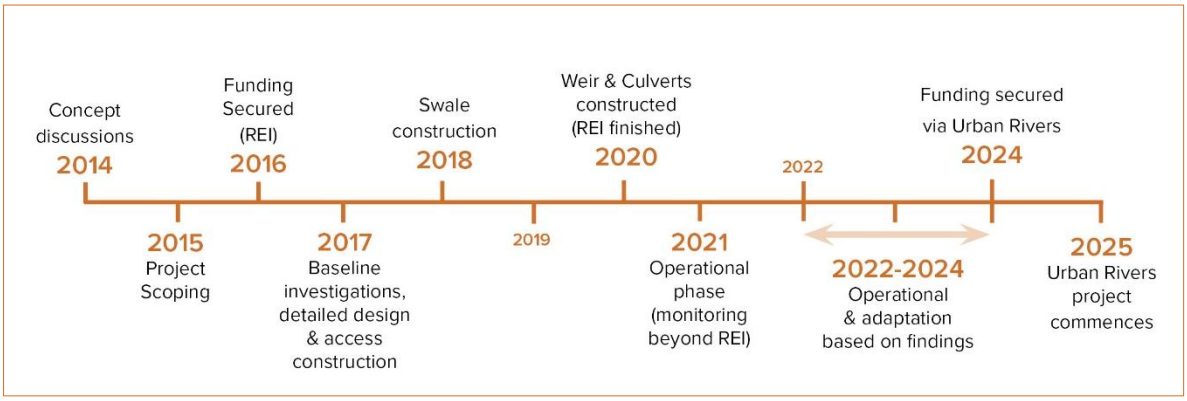
different flow rates and water depths in the Swales; beginning to understand what drove changes in phosphorus although in both years significant reduction of 'P' was achieved in the flows (25–60%). It was also apparent that other parameters changed little.

Figure 4 –Swale #1 in late Spring flows (22/11/2022)

Project Timeline

The broad timeline for the project since its conception is as follows:

2015	Concept discussions and initiation
2016	PHCC and DWER agreement, funding and feasibility investigations commence
2018-2019	Swale construction
2020	Water Corporation agrees to design and fund diversion weir & culverts
2021	All construction complete and operational phase begins
2022-2024	Operational Phase continues with flow and water quality monitoring culminating with an annual review. Each year our 'learnings' initiated modifications of operation to gain more understanding of the behaviour of the system.
2025-2028	DCCEEW funding received to further works and expansion of Project Scope to include Serpentine Wetland restoration and River Restoration of Serpentine River.



2024 Operation

For the 2024 operation, we decided to run the operation throughout the whole flow period from June 2024 to January 2025. In Autumn 2024, the Swales were slashed back to their original clay base (**Figure 5**) and in the sloping Swale#6, three "riffles" were installed to partition the swale to encourage ponding (**Figure 6**). In addition, stopboards were designed to manage the low/medium/high flow conditions and that could be easily changed. So, in April 2024 (well prior to any PMD flows), the inlet Penstock was opened ready to allow the initial flow through the Swales; while still allowing flow over the weir when water level was high enough.

Figure 5 – Slashed & ripped Swale #2 (05/04/2024)

Flow in Peel MD, Headwater Pool and the Swales commenced on 04 June 2024. For the next six weeks, almost all of the Peel MD flow was routed through the Swales with only a few minor events large enough to overtop the weir. During that time, we sampled the amount of phosphorous in the flow three times (11/06, 03/07 & 16/07) and each time the amount of total phosphorous (TP) sampled at the swale outlet equalled the TP concentration that entered the Swales.

Hence, the theory that the clays of the Serpentine Floodplain would retain phosphorous by themselves was disproved!

Figure 6 – Sloping Swale#6 – location of the three 'riffles' to create ponding (13/04/2024)

Figure 7 – Flow in Swale#1 (11/06/2024)

Figure 8 – Vegetation and flow in Swale#2 (04/12/2024)

Monitoring continued, and it became apparent that when each of the Swales began to have visible vegetation growth, the phosphorous reduction again showed itself. During Spring, reductions were 10 – 20%, then from November with more vegetation growth and smaller flows, the reductions were 30 – 50%. The highest reductions throughout the year were found in the sloping Swale#6 which had the shallowest water depth through the entire flow season and hence allowed the most vegetation growth.

Learnings and Future Operations

During the 2024 operations, there have been significant learnings uncovered that have changed our understanding of the behaviour of clays, although there have been many learnings throughout the project in each of the years even prior to operational commencement. And after each year, we have been able to take these learnings and enhance our operations to understand more and more about how to improve treatment options for nutrients as well as with water flow and hydraulics.

For the winter of 2025, we have again modified our swales to enhance the absorption of phosphorous by: slowing down the flow in Swale#1 by adding meanders; by adding an additional sloping swale (#5); adding riffles to Swales #4 & #5; and also by leaving vegetation in place in Swales #2 & #3.

Flow in 2025 commenced on 25 May and for the first month, was only flowing through the Swales although as at early July, mostly flows through the Swales with some flow over the weir.

For next years winter of 2026, the plan is to add different types of vegetation to the swales to determine how well each facilitates phosphorous absorption under various different water conditions.

In the early years of project investigation (2016-2018), many of the 'Serpentine Wetlands' to the west of the Peel MD (called because they are remnants of the original Serpentine River channel) were sampled for nutrients, though not water levels. In 2023, we noted how 'stressed' the wetlands seemed to be and during 2024 we sampled the wetlands again to see how water quality had changed since the original sampling. The sampling also included riverine pools in the current Serpentine River. We also recorded water levels in key wetlands to look at how they varied. In the future, the plan is to improve conditions in the wetlands and in the Serpentine River. In the next Wattle and Quoll [Late 2025], we will report on our initial findings in the Serpentine Wetlands.

This project was initially part of the 'Regional Estuaries Initiative' and was supported by the State Government's Royalties for Regions program. Since February 2025, the project is now part of 'Urban Rivers Program', funded by the Commonwealth Government which is allowing the expansion to looking at improving wetland conditions.

This project is funded by the Australian Government's Natural Heritage Trust under the Urban Rivers and Catchments Program, with the support of PHCC and the Western Australian Department of Water and Environmental Regulation