

Sawdust and sandcastles: A tale of unexpected contamination

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Site History and Project Overview

- Wood waste from Nelson sawmills used in 1960s to reclaim an elevated area for car park
- Eastward movement of Blind Channel gradually eroded site. Sawdust began to appear in 2019, with a large release in 2022
- Contaminant testing in mid 2023 confirmed sawdust was CCAB and PCP treated and estimated 5,900m³ buried material



Project work

- Risk assessment (2023)
- Detailed investigations (2023-2024)
- Remediation (late 2024)



NEW ZEALAND / NELSON REGION

Sawdust with high levels of heavy metals shuts off part of Tāhunanui Beach

3:52 pm on 4 August 2023

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Risk Assessment

- **Purpose:** Assess human and ecological health risks from buried treated timber sawdust
- **Contaminant of concern:** Arsenic
- **Potential receptors:** Beach users (incl. toddlers), dogs, terrestrial & marine ecology
- **Key exposure pathways:**
 - Direct contact
 - Ingestion
 - Marine dispersion
- **Findings:**
 - Overall low risk under managed conditions
 - Highest potential risk limited to toddlers ingesting sawdust near source
 - Minimal risk to adults, dogs, and ecology
- **Critical driver:** On-going erosion, public perception, urgency
- **Conclusion:** Long term risk best addressed by complete source removal

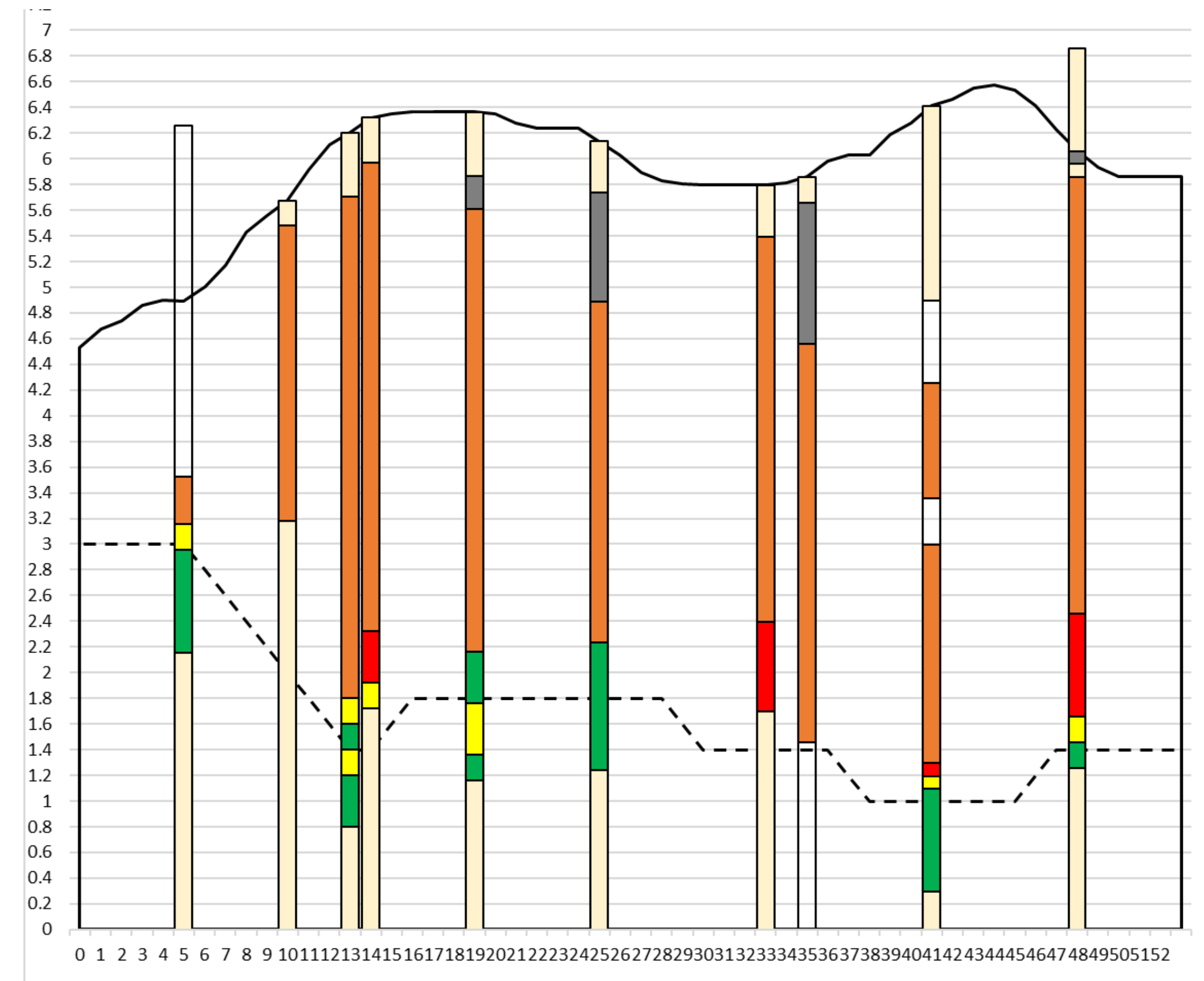


Detailed Site Investigation (2024): 26 boreholes and 179 arsenic tests



Investigation Findings

- High volume of sampling established arsenic had leached into sand underlying the sawdust.
- Arsenic concentration: 2 and 125 mg/kg



Remediation Objectives

- Prevent further erosion (and discharge into the marine environment) of the sawdust and contaminated sand
- Prevent exposure of humans (and pets) to unacceptable levels of contamination
- Prevent adverse ecological effects from residual contamination – e.g. to terrestrial organisms through exposure to contamination, or leaching of residual contamination to the marine environment

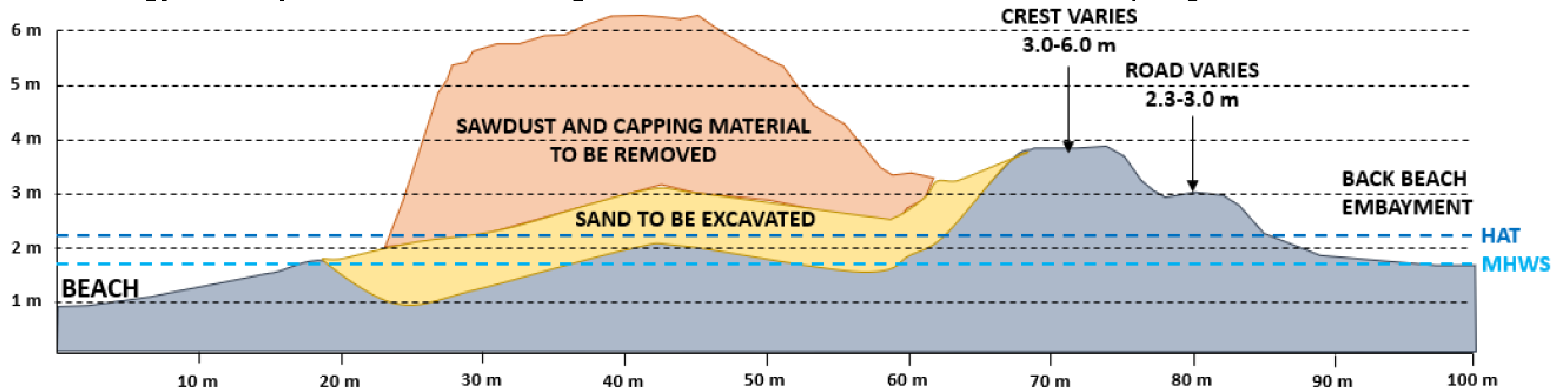


Remediation Approach

- Removal of contamination source (sawdust and contaminated underlying sand).
- Target for underlying sand was a site-wide average of 20 mg/kg arsenic (both ecological soil guideline and marine sediment DGV)

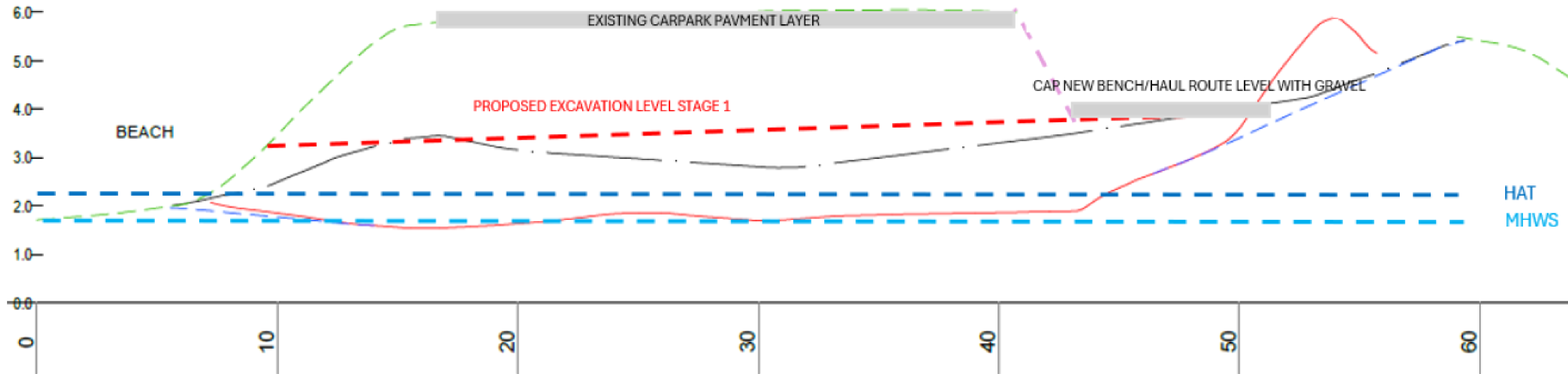
Challenges:

- Uncertainty around depths of remaining contaminated sand due to uneven sawdust placement and leaching
- Dynamic coastal site meant sand needed to be removed rapidly and backfilled.
- Public scrutiny on high profile / high visibility site
- Ecology: Surveys, relocation, fencing and habitat creation for lizards, birds, penguins



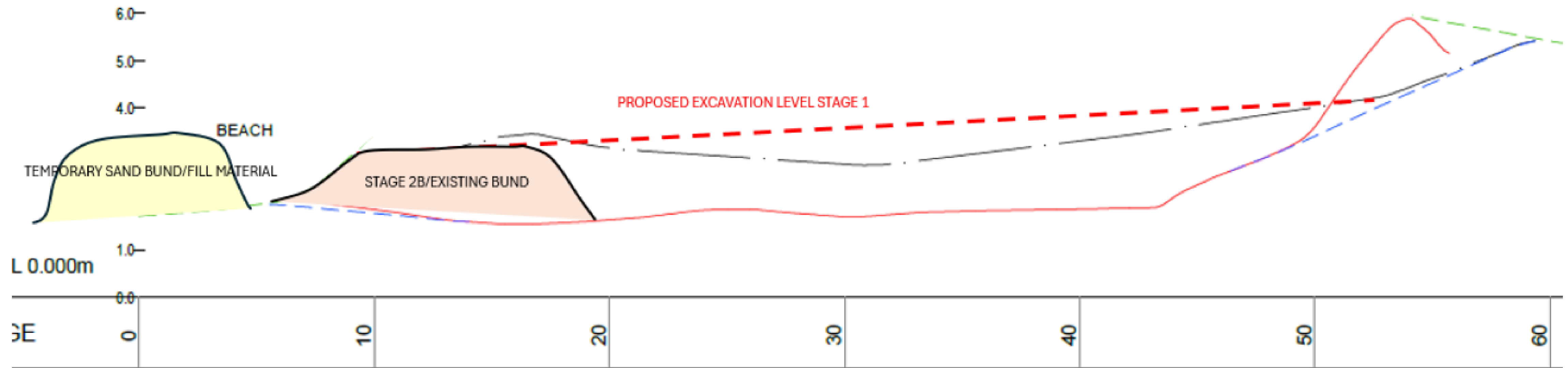
Remediation (Stage 1)

- Removal of vegetation, carpark surface and subgrade/topsoil (cleanfill if no sawdust)
- Complete removal of all sawdust (visual confirmation, potholing as required)
- Removal of underlying sand to above Mean High Water Springs (MHWS)



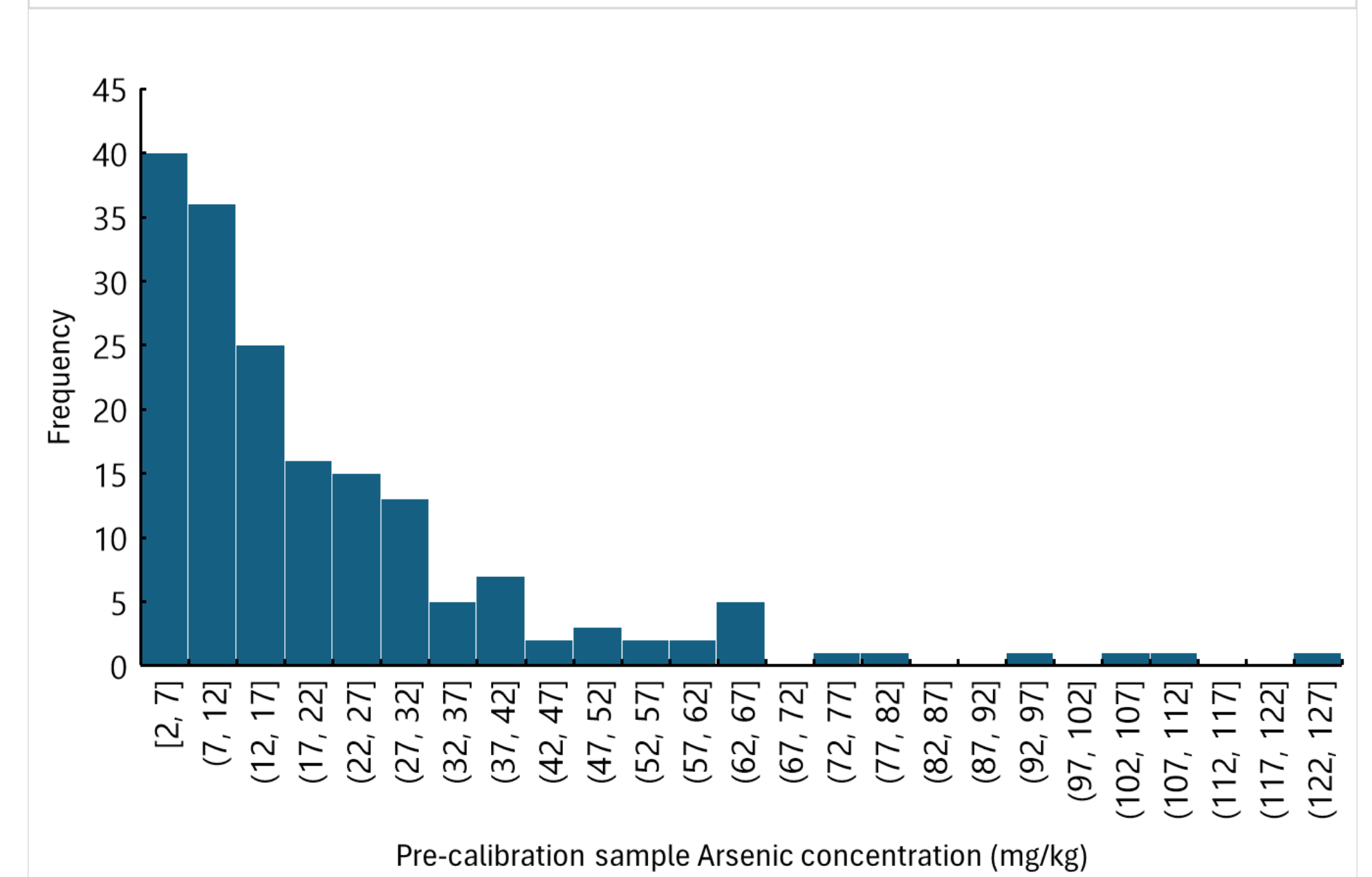
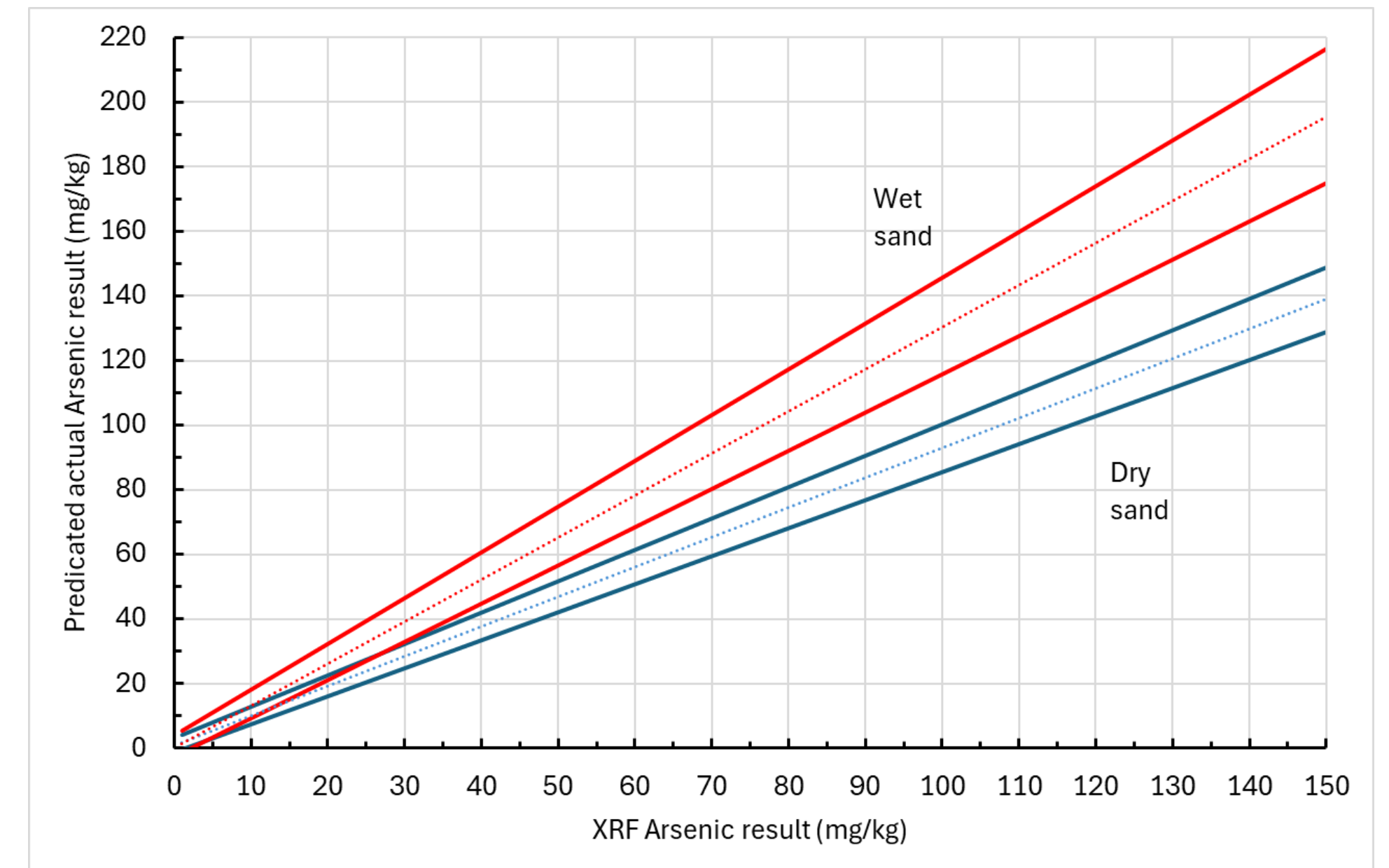
Remediation (Stage 2) and XRF validation

- X-ray fluorescence (XRF) validation chosen to provide real-time data
- Targeted removal of contaminated sand where it extends below MHWS (at low tide)
- Immediate backfilling of areas below MHWS with clean beach sand
- Grading of site for subsequent reinstatement and replanting



XRF Pre-calibration

- MfE guidance flags XRF accuracy issues on sand (damp sand) so pre-calibration designed to quantify/correct for this
- 89 sand samples held from the April 2024 investigation (Arsenic ranged 2–125 mg/kg, 90% results in 2–50 mg/kg range)
- Each sample scanned as-is and after wetting (three 1-minute scans per state, averaged)
- Regression analysis vs lab results:
 $R^2 = 0.937$ (dry), 0.847 (wet)
- Regression + 95% confidence interval converted into a field-calculator giving real-time predicted-lab-equivalent values during site validation
- Two Vanta units (M and S) used in pre-cal and intercomparison showed ~12–13% mean variance — acceptable for combining datasets. Vanta M used on site



Site Validation

- XRF used on sand samples taken at 5 m intervals, 1 minute scans in triplicate
- All samples were able to be scanned relatively dry
- 184 samples analysed. Results maintained as a rolling average and adjusted to 'actual' based on upper 95% confidence interval of the linear regression
- Initial validation showed 3–205 mg/kg, mean 25.8 mg/kg
- High results triggered:
 - Additional higher density lateral delineation sampling
 - 0.1 m depth of elevated sand excavated and area retested. Repeated until achieving acceptable results before backfilling
- Validation following further excavation found:
 - Arsenic reduced to 3-65 mg/kg
 - No samples exceeded NESCS recreational (80mg/kg)
 - Estimated **mean 19.3 mg/kg** (below 20 mg/kg target)



Site Validation



Outcomes & Takeaways

- 10,750 t of contaminated sawdust and sand removed to landfill
- Remediation and validation conducted under constraints. XRF + site-specific pre-calibration enabled real-time decisions where lab turnaround was incompatible with tides
- **Site-wide mean 19.3 mg/kg** arsenic met the 20 mg/kg target for environmental and human health risk
- Legacy timber-treatment contamination buried unseen for 60 years exposed only through coastal erosion — an emerging exposure pathway driven by climate/coastal dynamics that may surface more sites like this



Post Remediation

