



Passive Hydrocarbon Remediation in a Foreshore Marine Environment

**Community Advisory Panel Update
May 15, 2019**

Location – Refinery Area 2 looking west



Phase 1 - Initial Response

- April 2010:
 - NAPL* hydrocarbon seeps observed on the foreshore below the refinery. Refinery notified PEP.
 - Refinery responded immediately with soaker pads and booms to mitigate the effects of the NAPL seeps.



*NAPL = Non-aqueous phase liquid, i.e. liquid petroleum

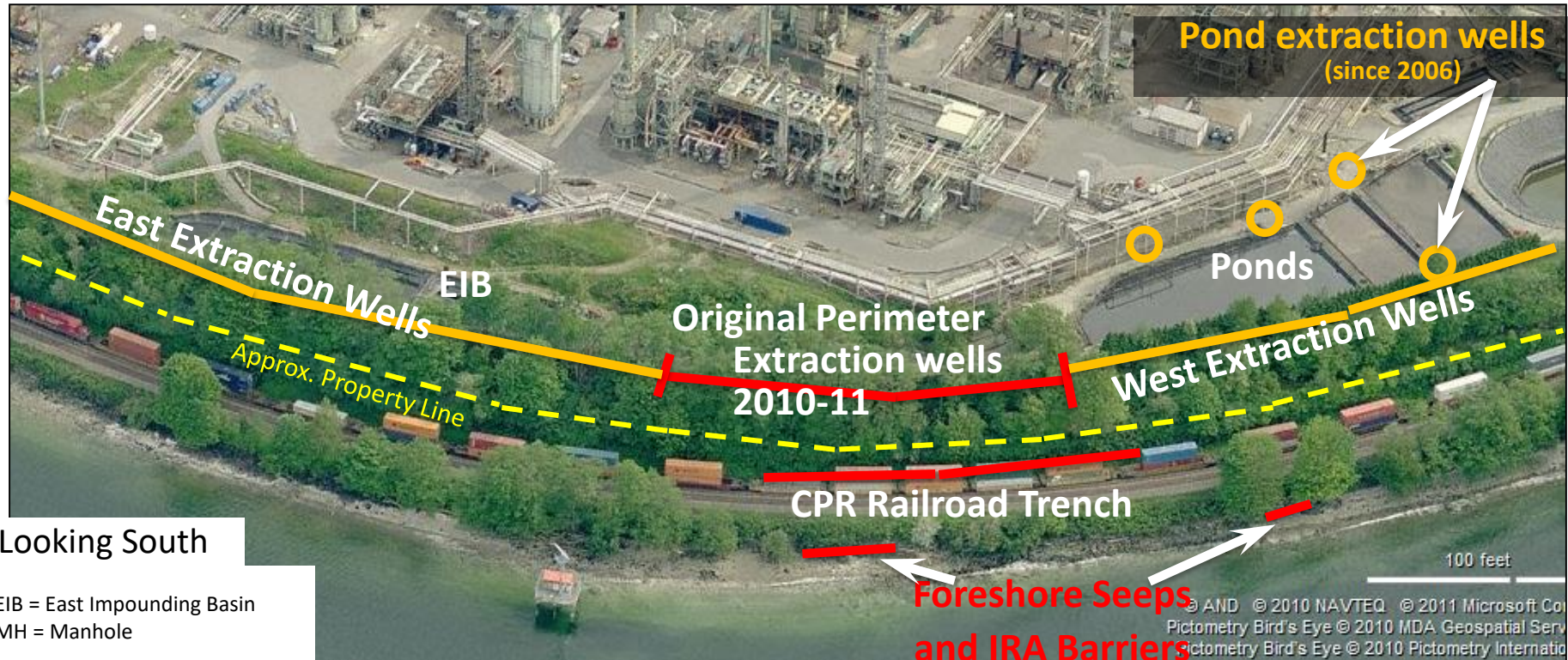
Phase 2 - Upland Perimeter Extraction System (PES)



- Summer 2010:
 - Refinery constructed a perimeter extraction system at the Refinery fence line to prevent further migration of NAPL or impacted groundwater
 - The original extraction system was 100 metres long and consisted of 10 wells with extraction pumps
- Spring 2011:
 - The perimeter extraction system at the Refinery fenceline was expanded to 400 metres length consisting of 40 wells with extraction pumps



Project Area



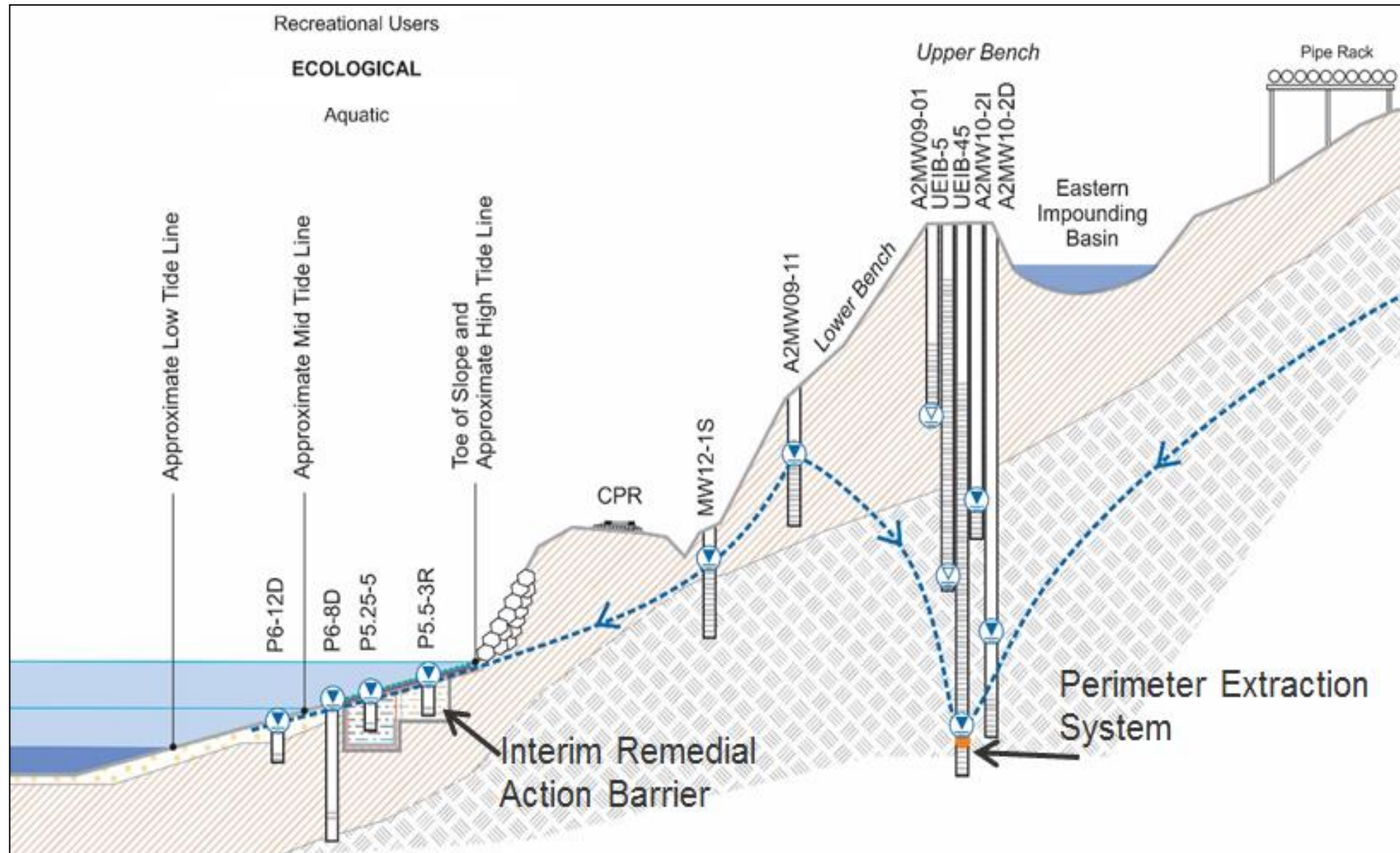
Looking South

EIB = East Impounding Basin
MH = Manhole



Looking North

Cross-Section – showing PES and IRA (vertical exaggeration)

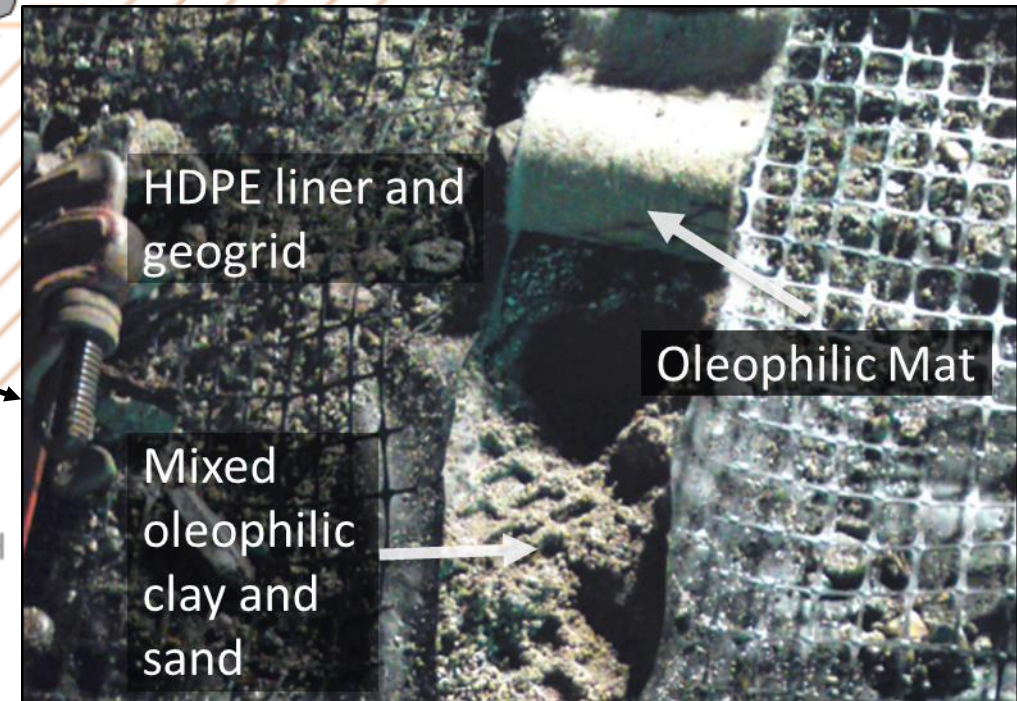
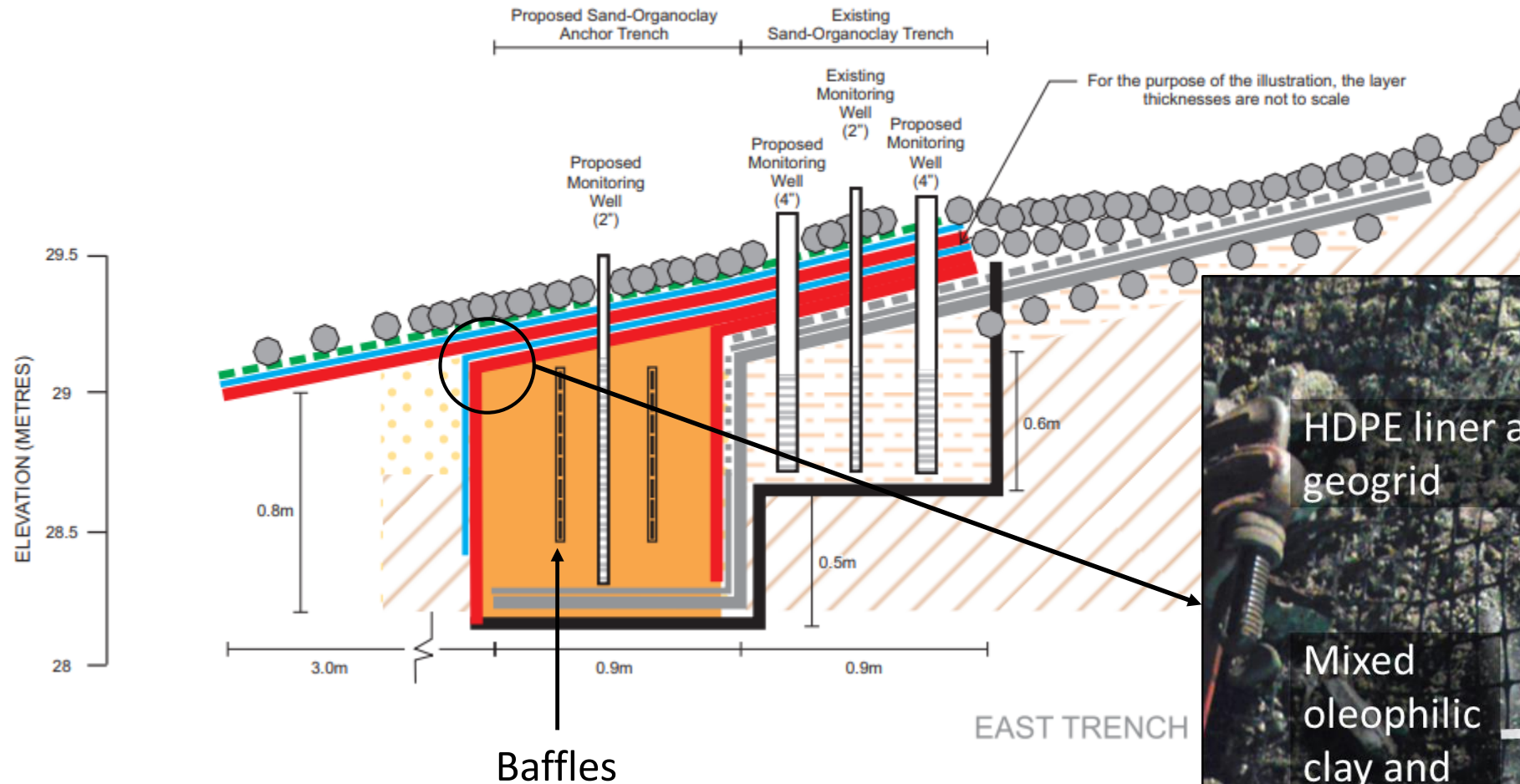


Phase 3 – Interim Remedial Action (IRA) 2011-2017

- Spring 2011:
 - Construction of 10 and 30 metre long Interim Remedial Action (IRA) passive barriers
 - The IRAs consisted of sand and organoclay trenches and organoclay geotextile along the high tide line. Organoclay absorbs NAPL.
- Spring 2012:
 - IRAs were modified and extended to improve effectiveness



Phase 3 - IRA Detailed Cross-Section



Phase 4 - Foreshore Passive Treatment System (FPTS)



Objectives

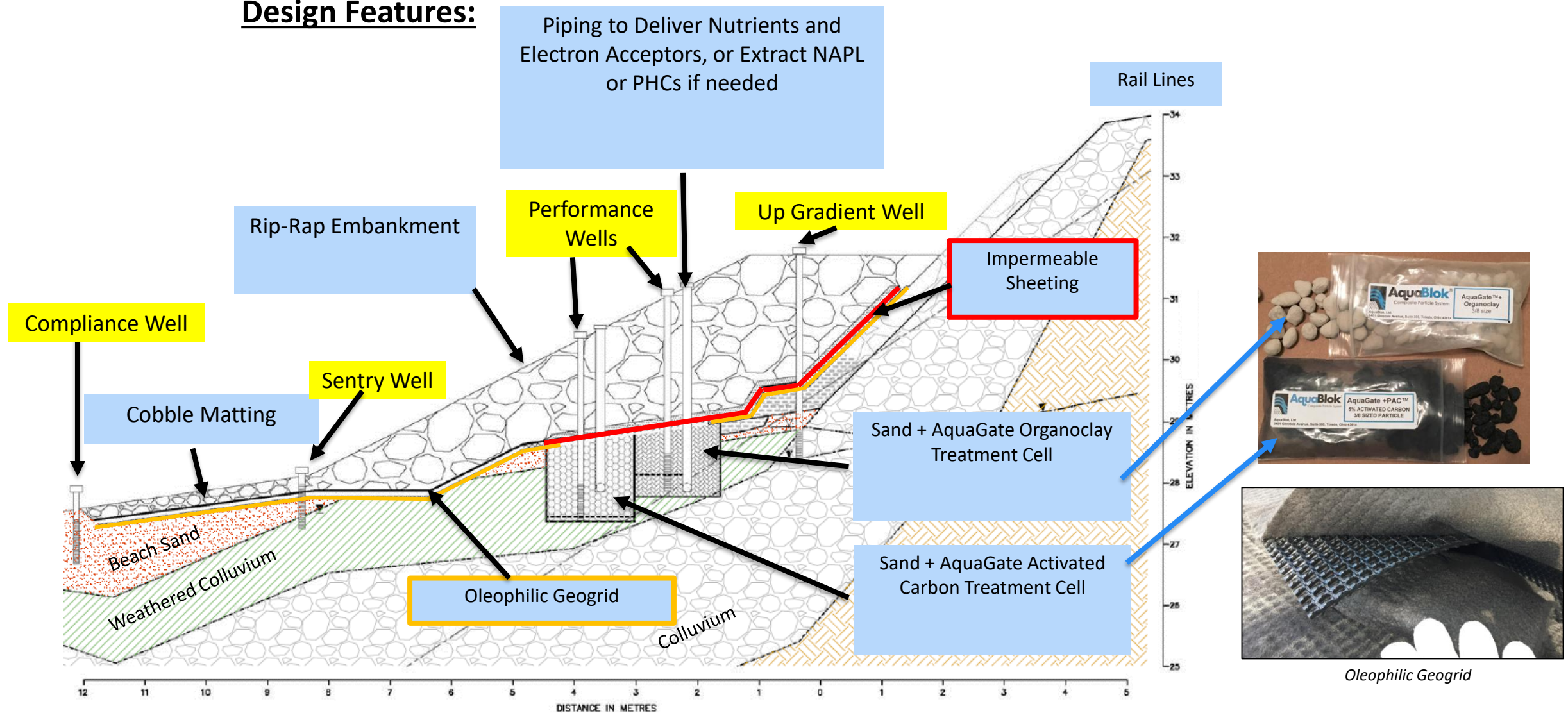
- Last 30 years
- Treat NAPL
- Treat dissolved phase impacts, notably LEPHw
- Treat sheen
- Resist erosion
- Maintain permeability
- Install monitoring wells up slope, cross gradient, within and down slope of the system
- Have flexibility to adjust to higher than expected levels of contamination
- Passive system

- Removal of existing IRA Barriers (and associated impacted sediments)
- Subsurface cells to treat NAPL and dissolved phase petroleum hydrocarbons in the ESA
- Infrastructure to allow addition of Enhanced Bioremediation amendments
- Sheen Prevention (Oleophilic Bio Barrier)
- Embankments to protect subsurface components

FPTS Detailed Cross Section



Design Features:



FPTS Construction



Below ground components – Plywood reinforced baffles can be seen placed within both cells of the Eastern FPTS. The plywood was removed once backfilling was complete.



FPTS Construction – Treatment Cells



FPTS Construction – Well Protection



FPTS Construction – Protective Rip-Rap Boulders



Restored Environment with FPTs



Summary

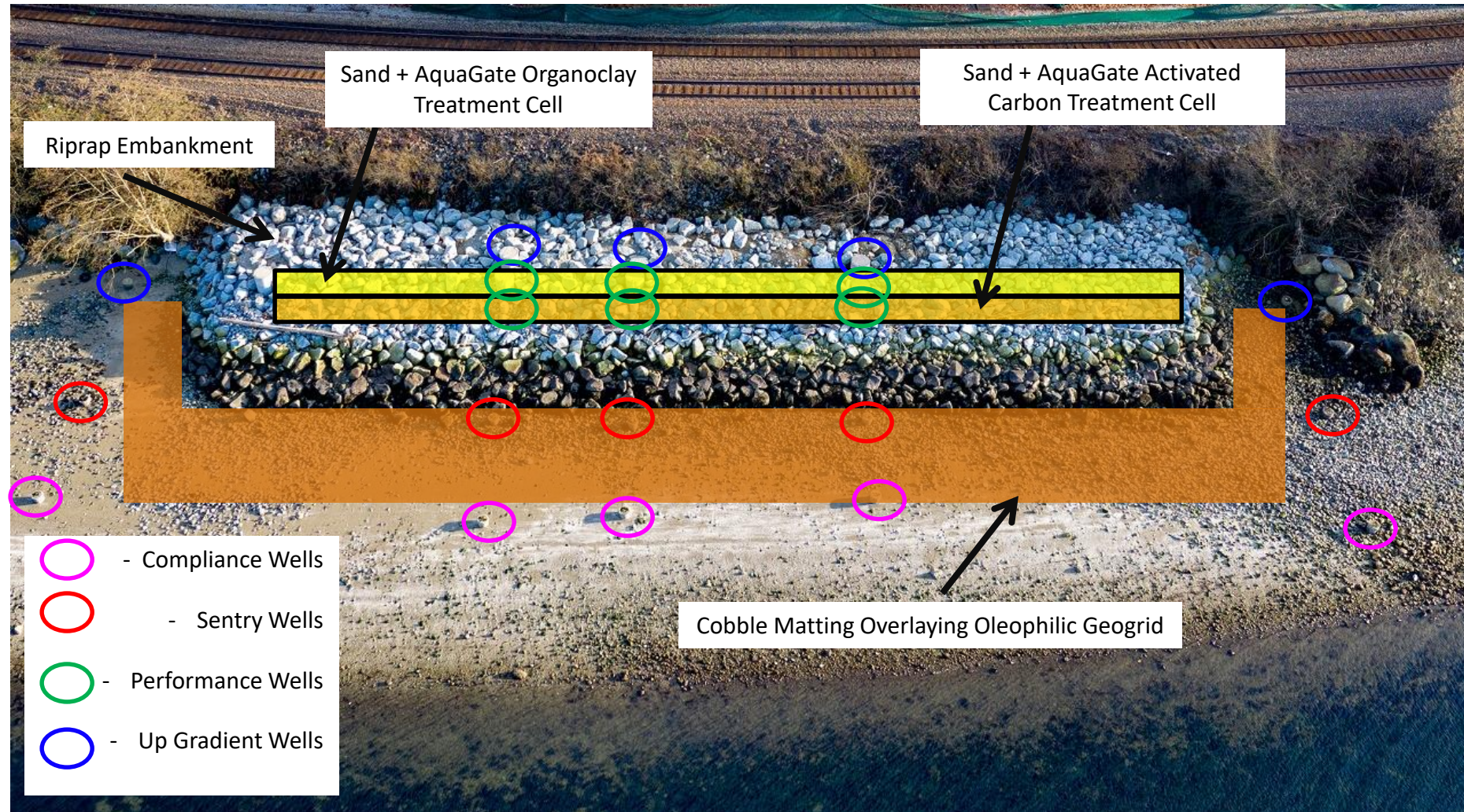
Project Significance

- ▶ Effective - contaminant concentrations consistently below targets in down-gradient wells
- ▶ Transparent – reports posted to www.parklandcap.ca – Resources tab
- ▶ Multi-jurisdictional stakeholders/Agencies involved: BC Ministry of Environment, Vancouver Fraser Port Authority, Environment Canada, Tsleil-Waututh Nation, Squamish Nation, City of Burnaby, Fisheries and Oceans Canada, and CP Rail.
- ▶ Innovative Technical design - a novel combination of several existing and innovative technologies in series to provide a remedy with several layers of environmental protections.

Awards / Recognition

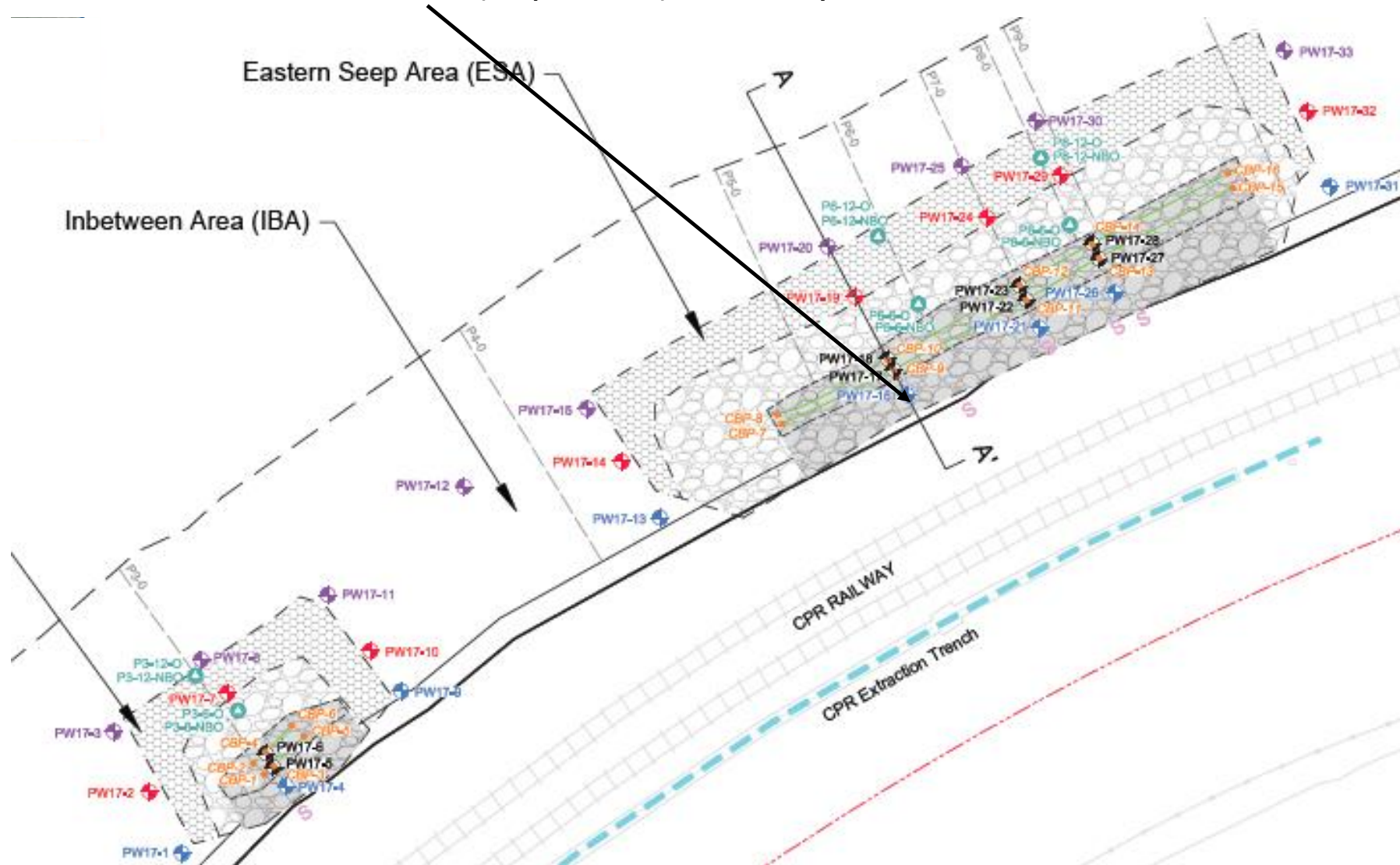
- ▶ IRA featured in Ministry of Environment Land Remediation 2009-2011 Section Report
- ▶ “Innovation Solution” Presentation given at CSAP workshop on Nov 16, 2017.
- ▶ Poster session at Battelle conference April 8-10, 2017.
- ▶ EMA of BC 2017-2018 award for Remediation and Restoration.

Eastern Foreshore Passive Treatment System



2018 Quarterly Monitoring Results

All measured parameters meet Risk Based Monitoring Targets (RBMTs) except LEPH marginally over in Up Gradient well PW17-16 (expected). I.e. Very little contamination remains.



Acknowledgements



9 year collaborative team effort:
Parkland Refinery (Formerly Chevron)
AECOM
SLR Consulting (Canada)

A note on reviewing [CAP website](#) technical reports: start with the Executive Summary and Figures.

