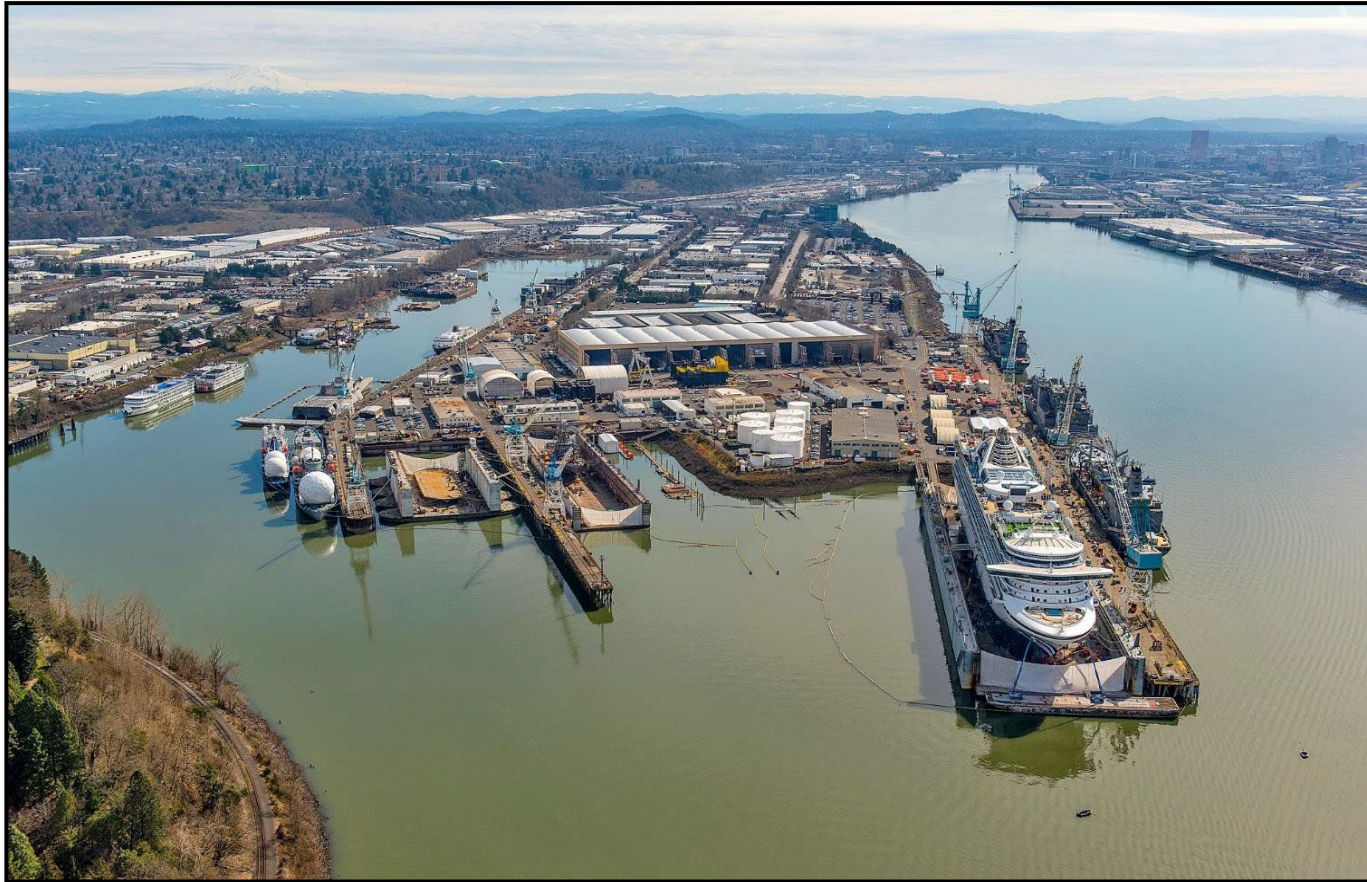


# Two-Phased Approach for Designing an Effective, Cost-Efficient and Area-Specific Remedy



Prepared by:  
**Swan Island Basin Remedial Design Team**



*Restoring the Environment.  
Protecting Our Future.*



**COAST & HARBOR  
ENGINEERING**

PACIFIC groundwater GROUP

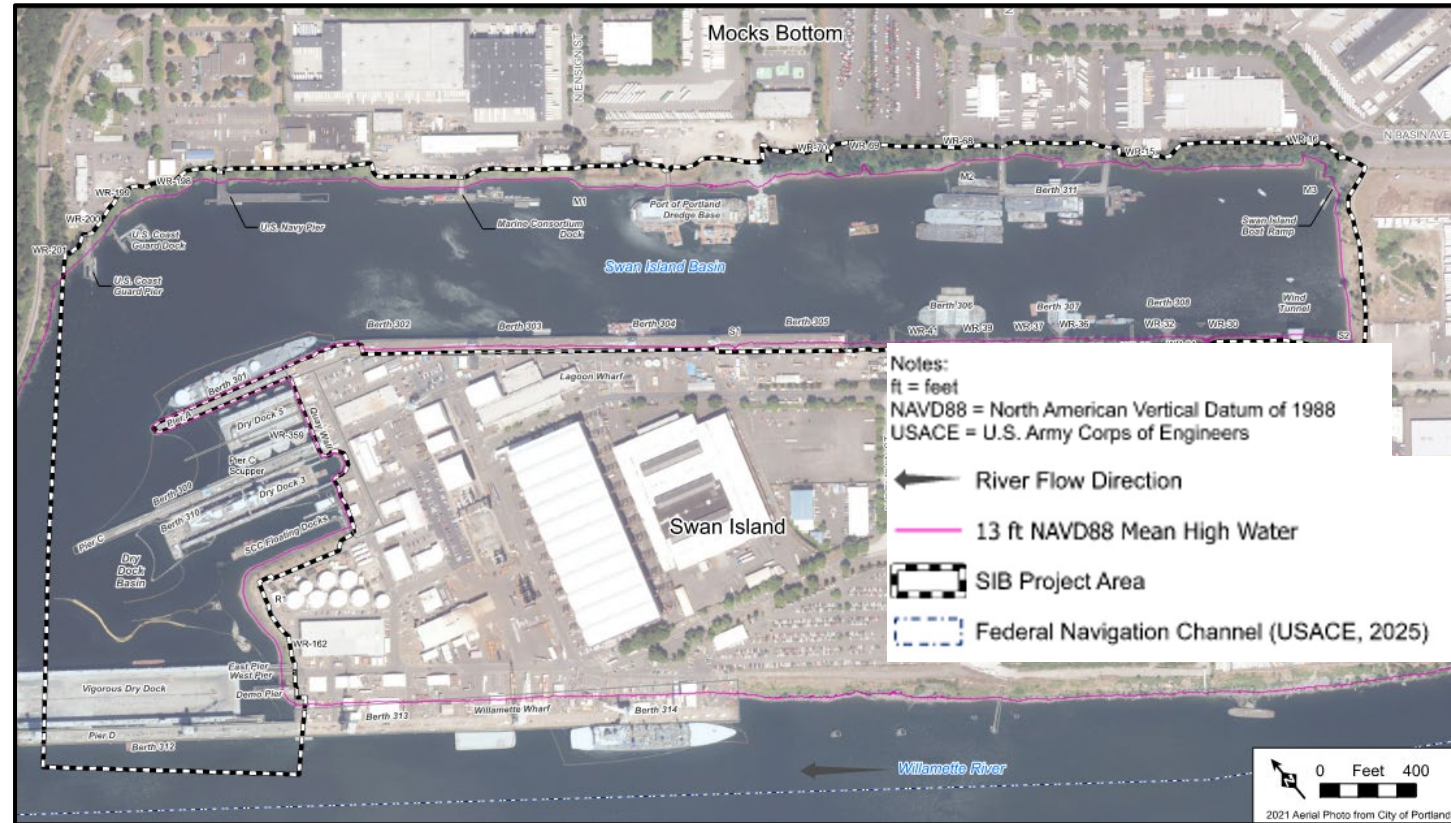
**Presented by: Tea Wood, PhD, P.E.**

January 28, 2026

10:00 am to 11:30 am MT

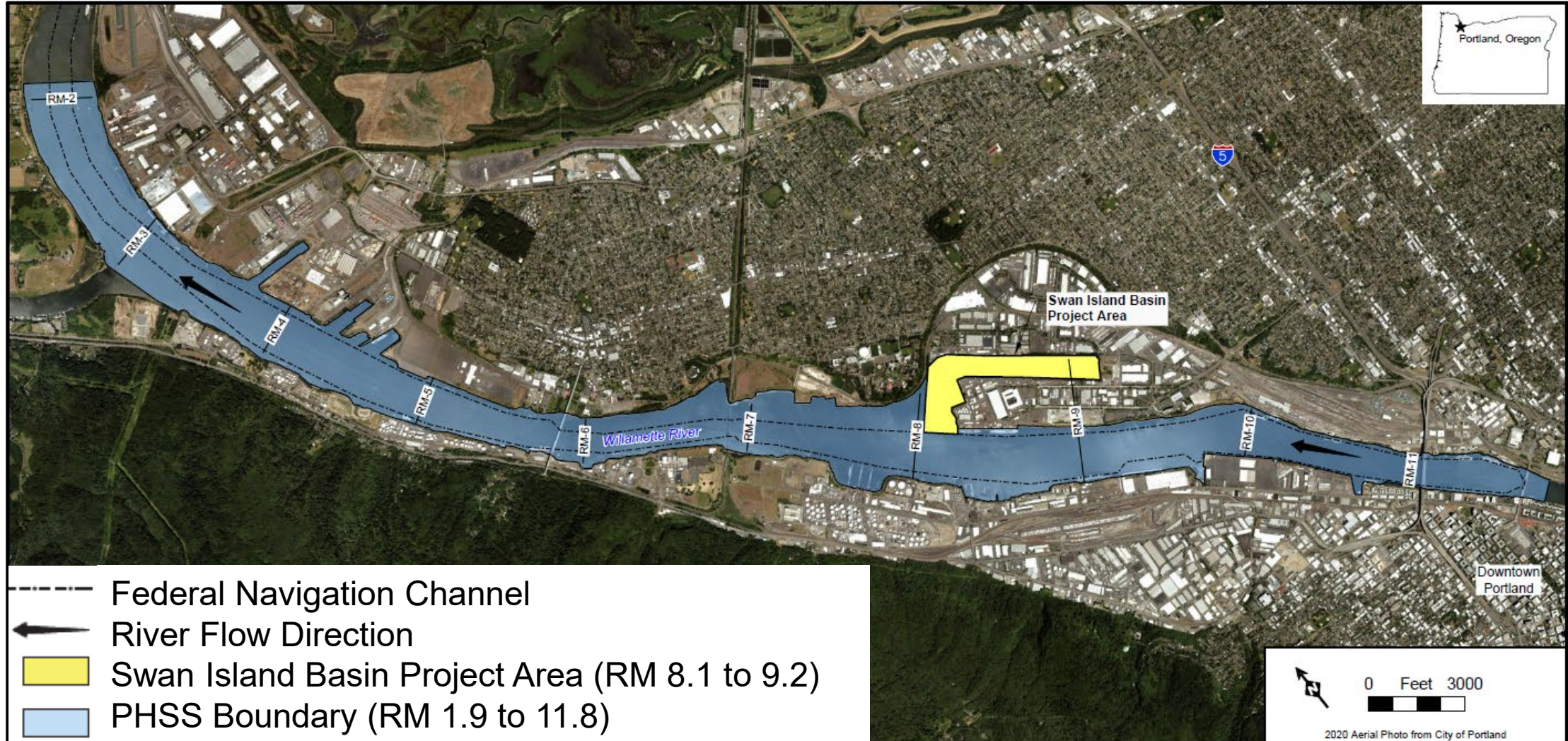
# Agenda

1. Using a two-phased approach to systematically evaluate critical RD factors:
  - effectiveness
  - cost-efficiency
  - constructability
2. Resolving critical design challenges
3. Developing a framework for managing complex RD while balancing multiple competing priorities and guidance updates

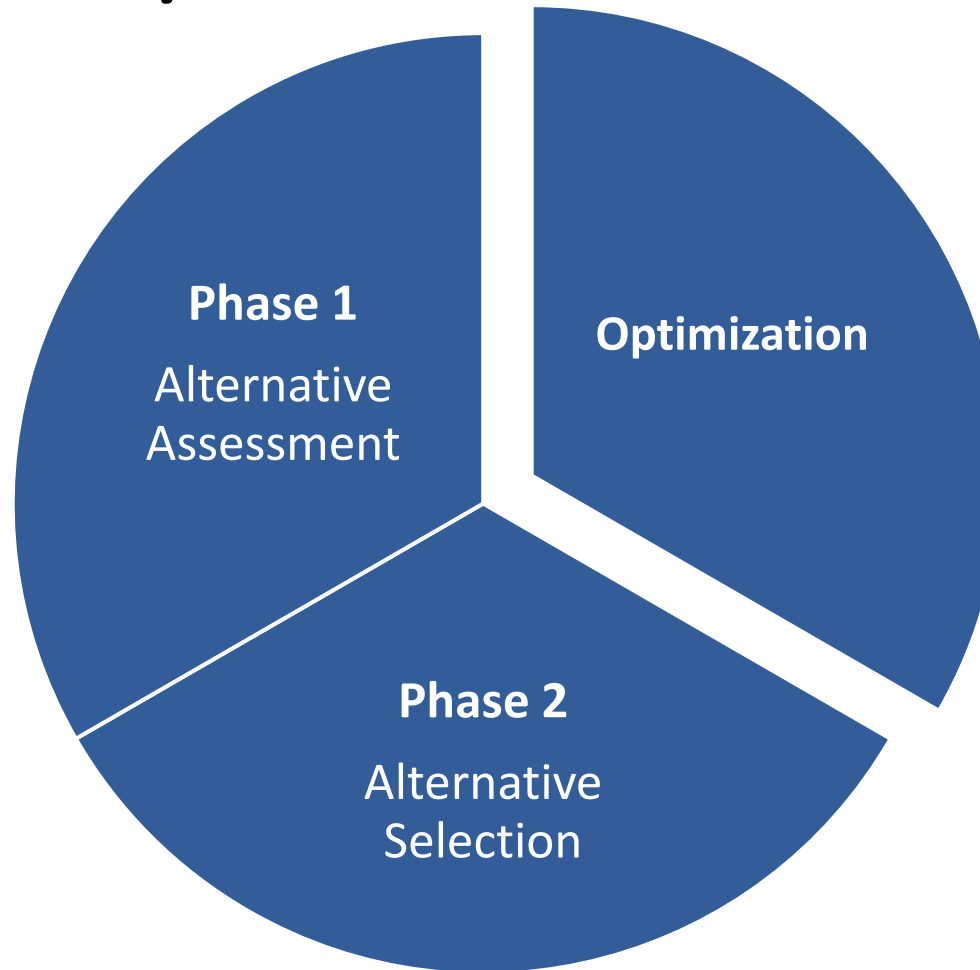




# PHSS Swan Island Basin Project Area



# Selected Remedy



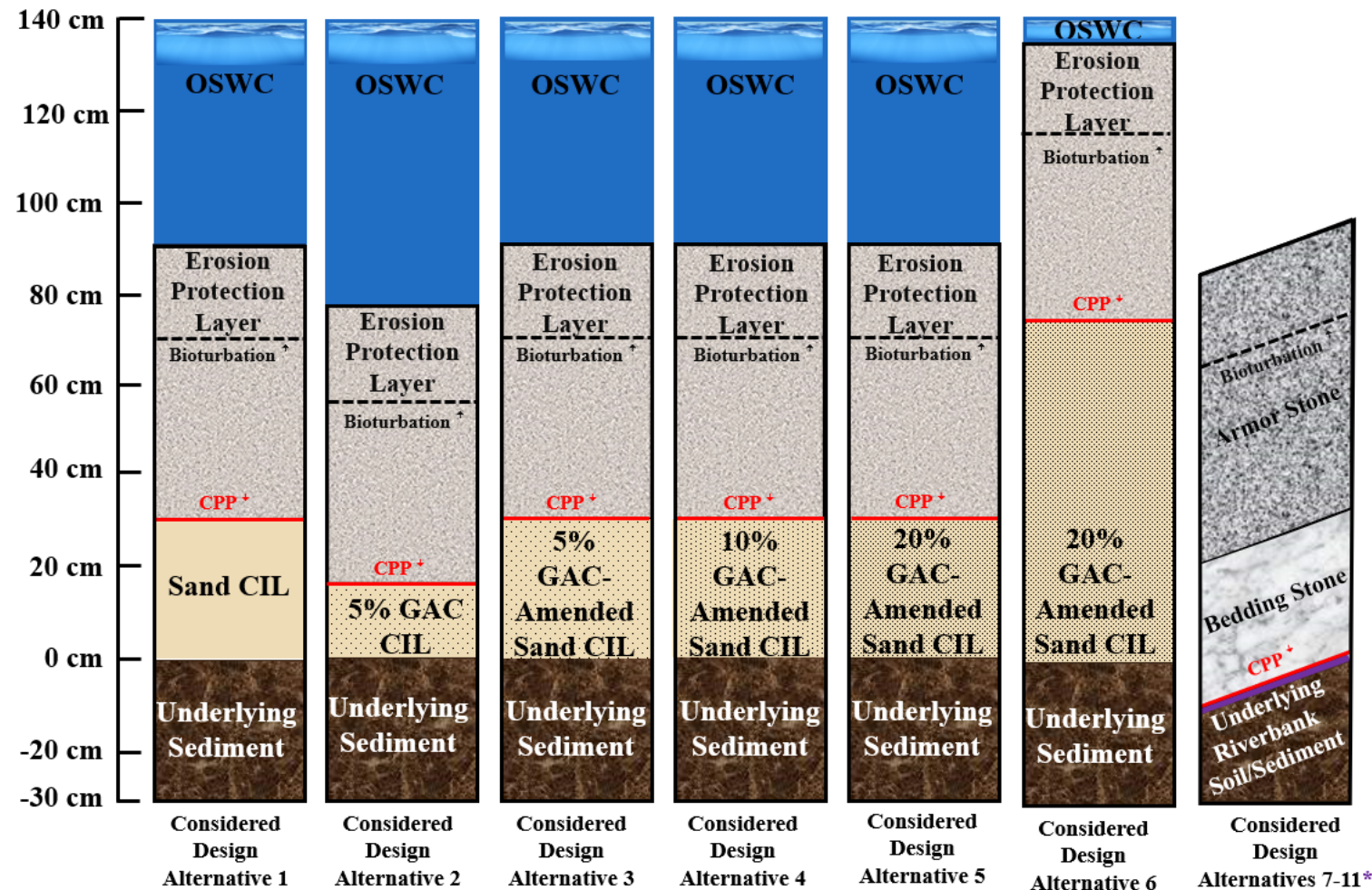


# Phase 1 – Initial Assessment

- Assessment
  - 95th percentile concentrations
  - Area-specific upwelling conditions
  - Constructability
  - Industrial activities
  - Limitations and updated guidance
- Multiple potential remedial alternatives were assessed for selection in Phase 2



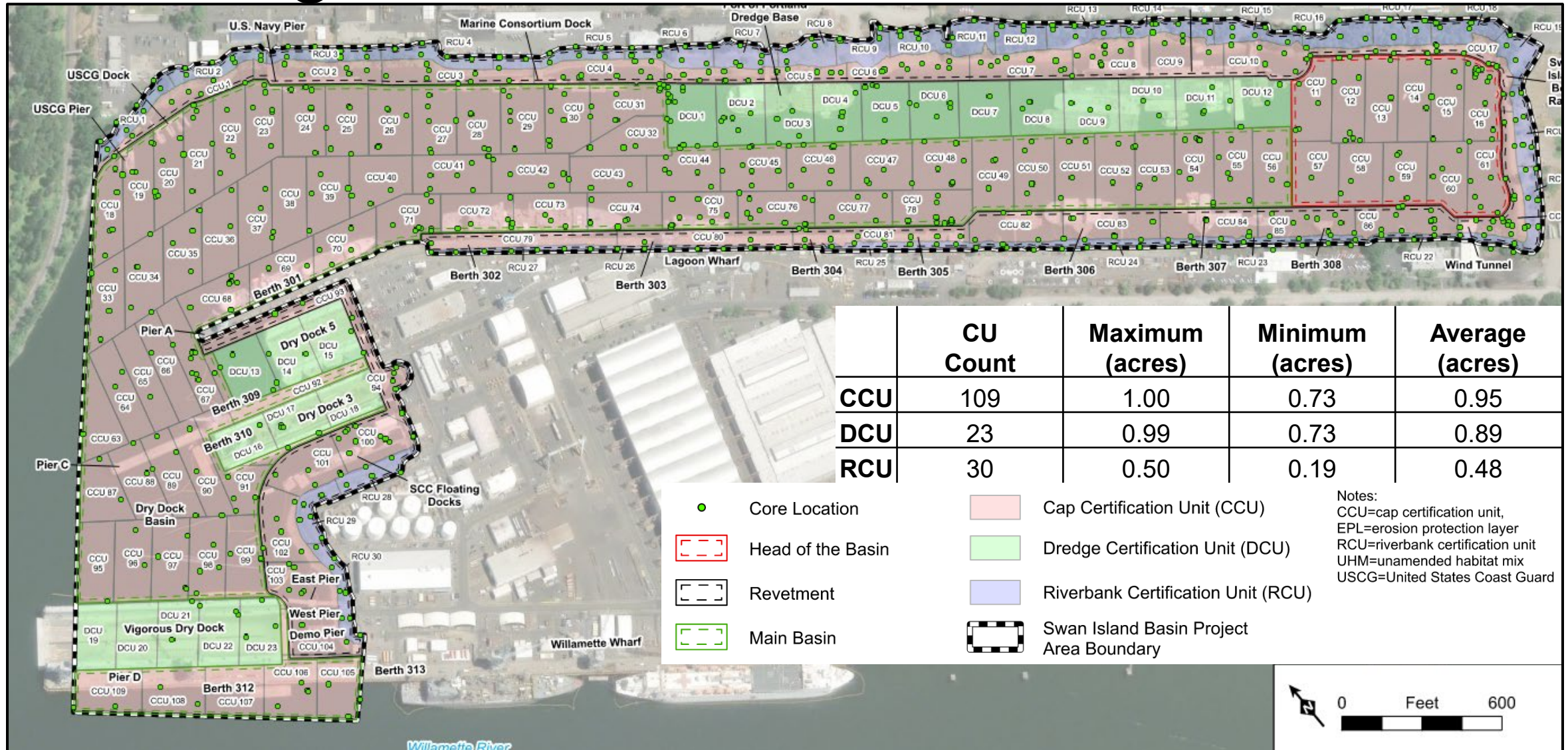
# Considered Design Alternatives (CDAs)



- CDA 7 - 2 cm Tektoseal-AC
- CDA 8 - 2 cm Tektoseal-HM
- CDA 9 - 2 cm Tektoseal-AC + 2 cm Tektoseal-HM
- CDA 10 - 4 cm Tektoseal-AC&HM
- CDA 11 - 4 cm Tektoseal-AC

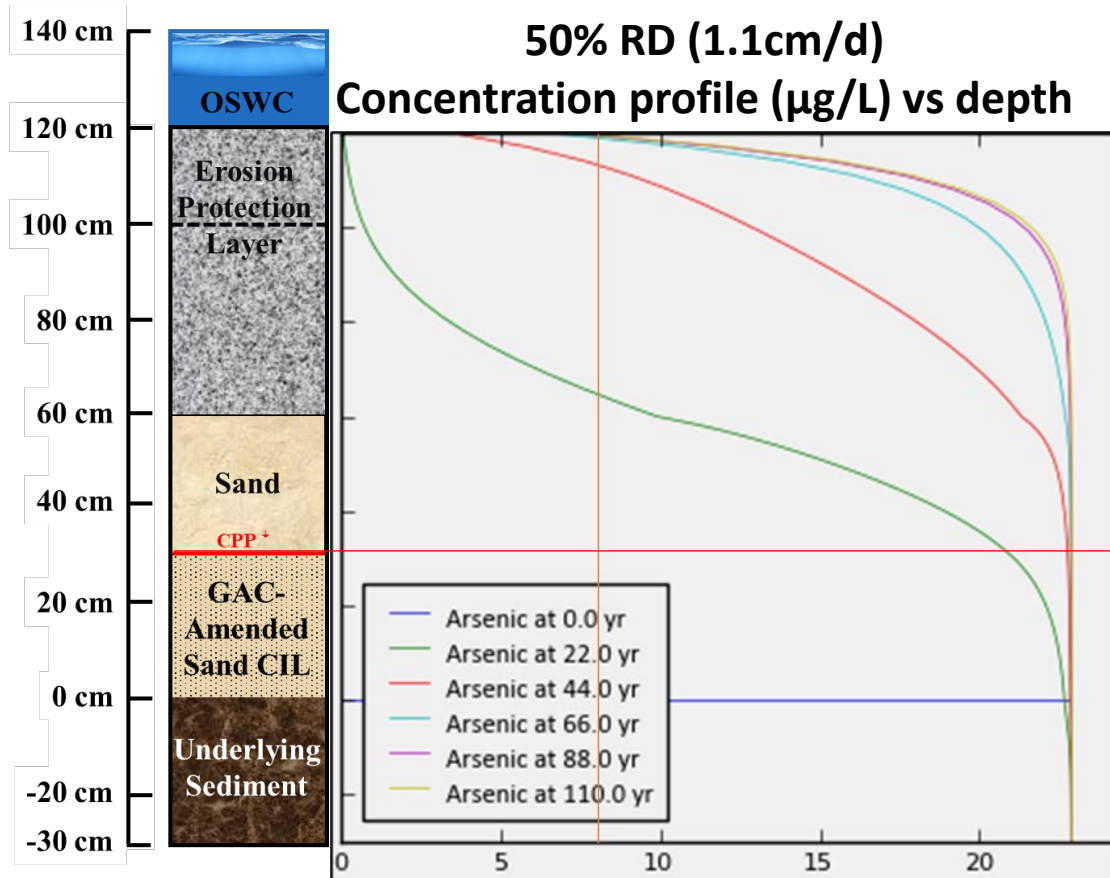


# Challenges – Industrial Activities and CUs



# Challenge – Non-Focused COCs (Arsenic)

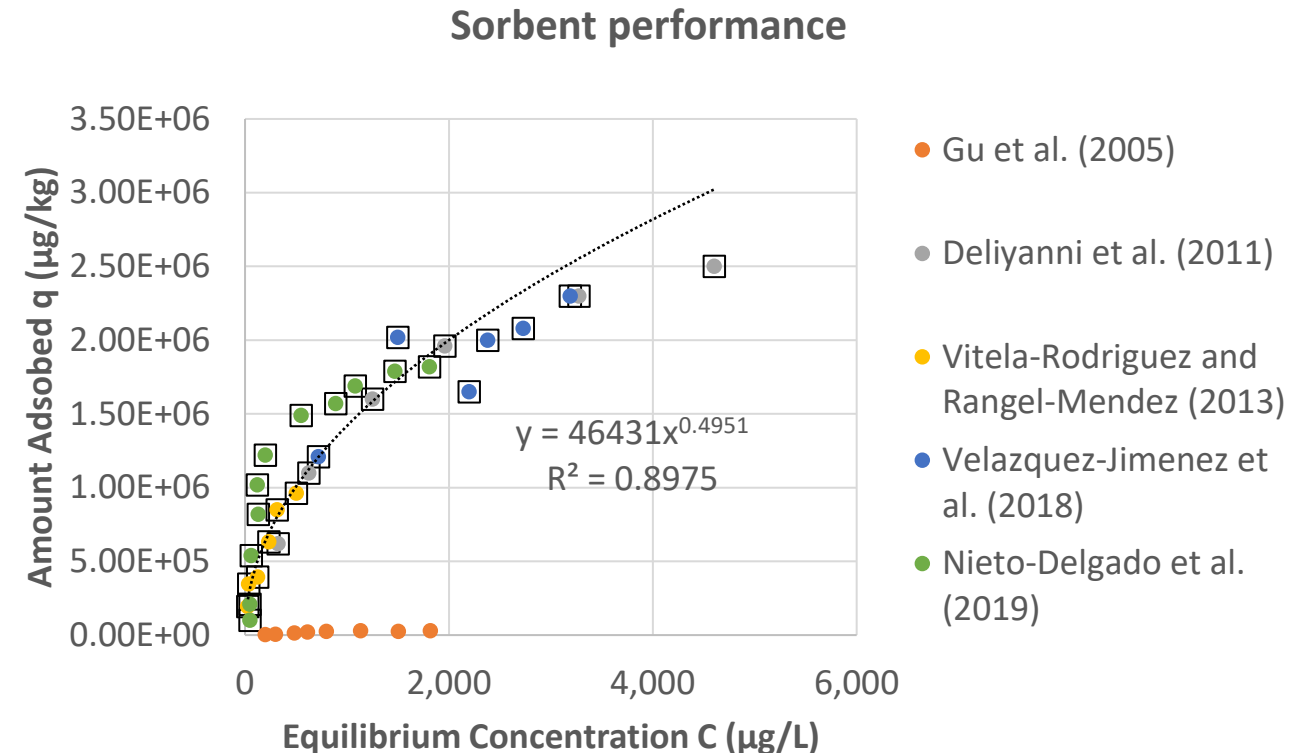
## Driving Engineered Cap Design



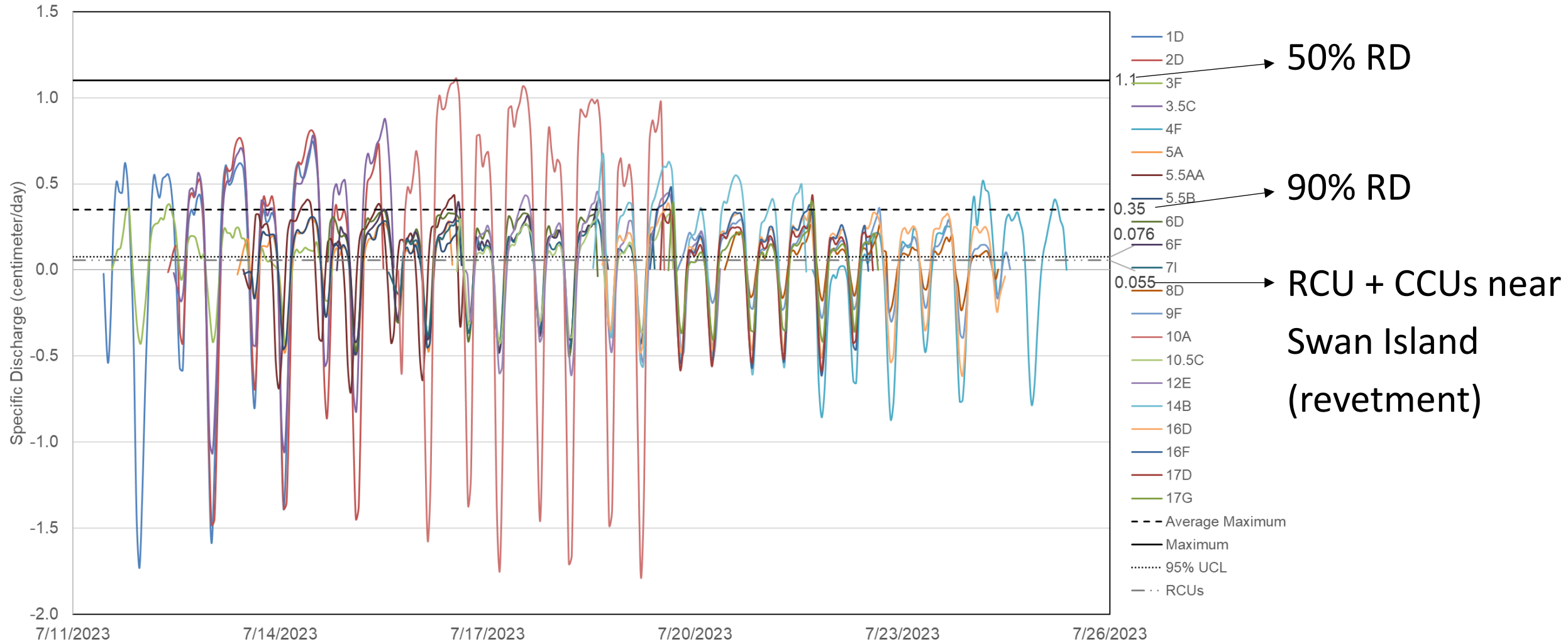


# Updated Assumptions – Arsenic Sorption to Granular Activated Carbon (GAC)

- 50% RD relied on a single study
- Extensive literature review completed
- Combined all literature values to evaluate As sorption to GAC
- 50% RD substantially underestimated GAC performance for sorption of As
- Other GAC literature values in good agreement
- Updated value used in 90% RD



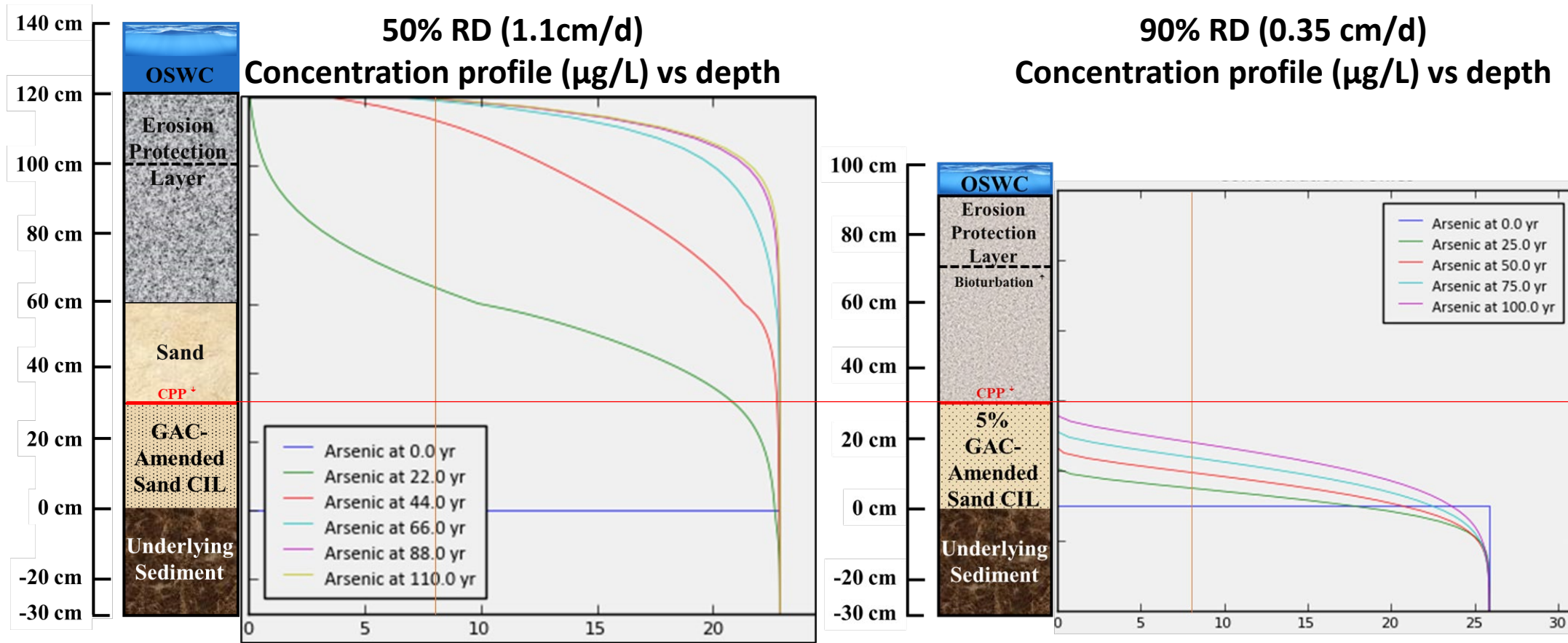
# Porewater Upwelling Velocity





# Challenge – Non-Focused COCs (Arsenic)

## Driving Engineered Cap Design



Cap CIL protective of all RALs, PTW, and CULs driving the cap design.

# Phase 2 – Alternative Selection

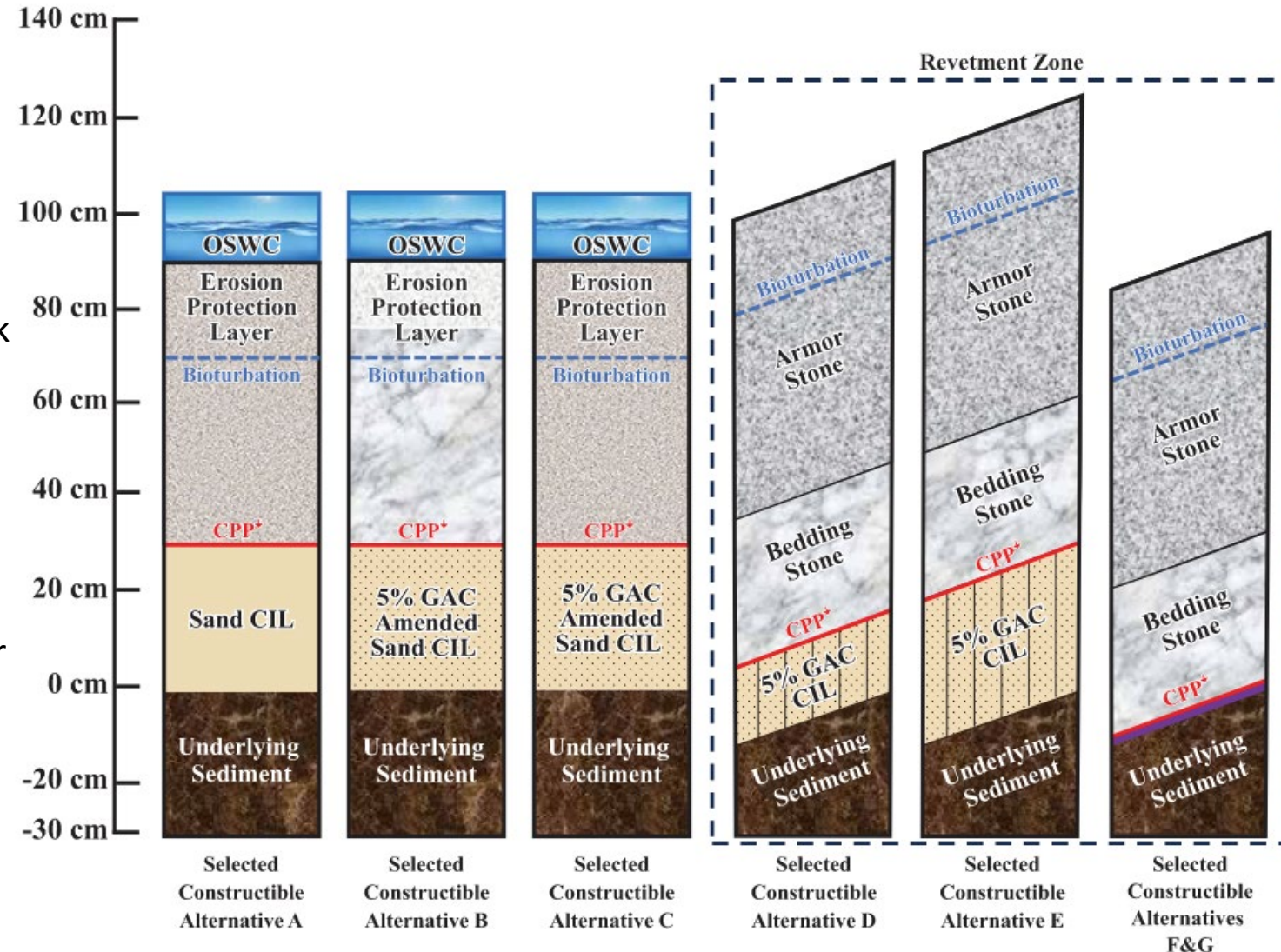
- Selection of the most effective remedial alternative
- Systematic evaluation of performance, cost-effectiveness, and constructability
- Decision matrix developed to assign protective and cost-effective engineered cap alternatives

| Analyte Final                                          | Unit  | CCU 3                            | CCU 30                           |
|--------------------------------------------------------|-------|----------------------------------|----------------------------------|
| ☐ 1,2,3,4,7,8-HEXACHLORODIBENZOFURAN                   | pg/g  | Tektoseal-AC                     | 1 ft (30 cm) of unamended sand   |
| ☐ 1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN                | pg/g  | Tektoseal-AC                     | 1 ft (30 cm) of unamended sand   |
| ☐ 2,3,4,7,8-PENTACHLORODIBENZOFURAN                    | pg/g  | Tektoseal-AC                     | 6 inch (15 cm) 5.0% GAC and Sand |
| ☐ 2,3,7,8-TCDD TOXIC EQUIVALENT (TEQ), (ND=0.5)        | pg/g  | No Cap Needed                    | 6 inch (15 cm) 5.0% GAC and Sand |
| ☐ 2,3,7,8-TETRACHLORODIBENZOFURAN                      | pg/g  | No Cap Needed                    | 6 inch (15 cm) 5.0% GAC and Sand |
| ☐ 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN                  | pg/g  | Tektoseal-AC                     | 6 inch (15 cm) 5.0% GAC and Sand |
| ☐ ALDRIN                                               | ug/kg | No Cap Needed                    | No Cap Needed                    |
| ☐ ARSENIC                                              | mg/kg | 6 inch (15 cm) 5.0% GAC and Sand | 1 ft (30 cm) 5% GAC and Sand     |
| ☐ BIS(2-ETHYLHEXYL) PHTHALATE                          | ug/kg | No Cap Needed                    | 6 inch (15 cm) 5.0% GAC and Sand |
| ☐ CADMIUM                                              | mg/kg | No Cap Needed                    | 6 inch (15 cm) 5.0% GAC and Sand |
| ☐ COPPER                                               | mg/kg | No Cap Needed                    | No Cap Needed                    |
| ☐ DIELDRIN                                             | ug/kg | Tektoseal-AC                     | 6 inch (15 cm) 5.0% GAC and Sand |
| ☐ GAMMA BHC (LINDANE)                                  | ug/kg | No Cap Needed                    | No Cap Needed                    |
| ☐ LEAD                                                 | mg/kg | No Cap Needed                    | No Cap Needed                    |
| ☐ MERCURY                                              | mg/kg | No Cap Needed                    | 6 inch (15 cm) 5.0% GAC and Sand |
| ☐ NAPHTHALENE                                          | ug/kg | No Cap Needed                    | No Cap Needed                    |
| ☐ Residual Range Organics (C25-C36)                    | mg/kg | No Cap Needed                    | 6 inch (15 cm) 5.0% GAC and Sand |
| ☐ Total Chlordane (Calculated U = 1/2)                 | ug/kg | Tektoseal-AC                     | 6 inch (15 cm) 5.0% GAC and Sand |
| ☐ Total cPAH/BaPEq TEQ (EPA 1993) (Calculated U = 1/2) | ug/kg | No Cap Needed                    | 1 ft (30 cm) of unamended sand   |
| ☐ Total DDD (Calculated U = 1/2)                       | ug/kg | No Cap Needed                    | No Cap Needed                    |
| ☐ Total DDE (Calculated U = 1/2)                       | ug/kg | No Cap Needed                    | No Cap Needed                    |
| ☐ Total DDT (Calculated U = 1/2)                       | ug/kg | No Cap Needed                    | No Cap Needed                    |
| ☐ Total DDx (Calculated U = 1/2)                       | ug/kg | Tektoseal-AC                     | 6 inch (15 cm) 5.0% GAC and Sand |
| ☐ Total PAH (Calculated U = 1/2)                       | ug/kg | No Cap Needed                    | No Cap Needed                    |
| ☐ Total PCB Congener (Calculated U = 1/2)              | ug/kg | Tektoseal-AC                     | 6 inch (15 cm) 5.0% GAC and Sand |
| ☐ Tributyltin                                          | ug/kg | No Cap Needed                    | No Cap Needed                    |
| ☐ ZINC                                                 | mg/kg | No Cap Needed                    | No Cap Needed                    |



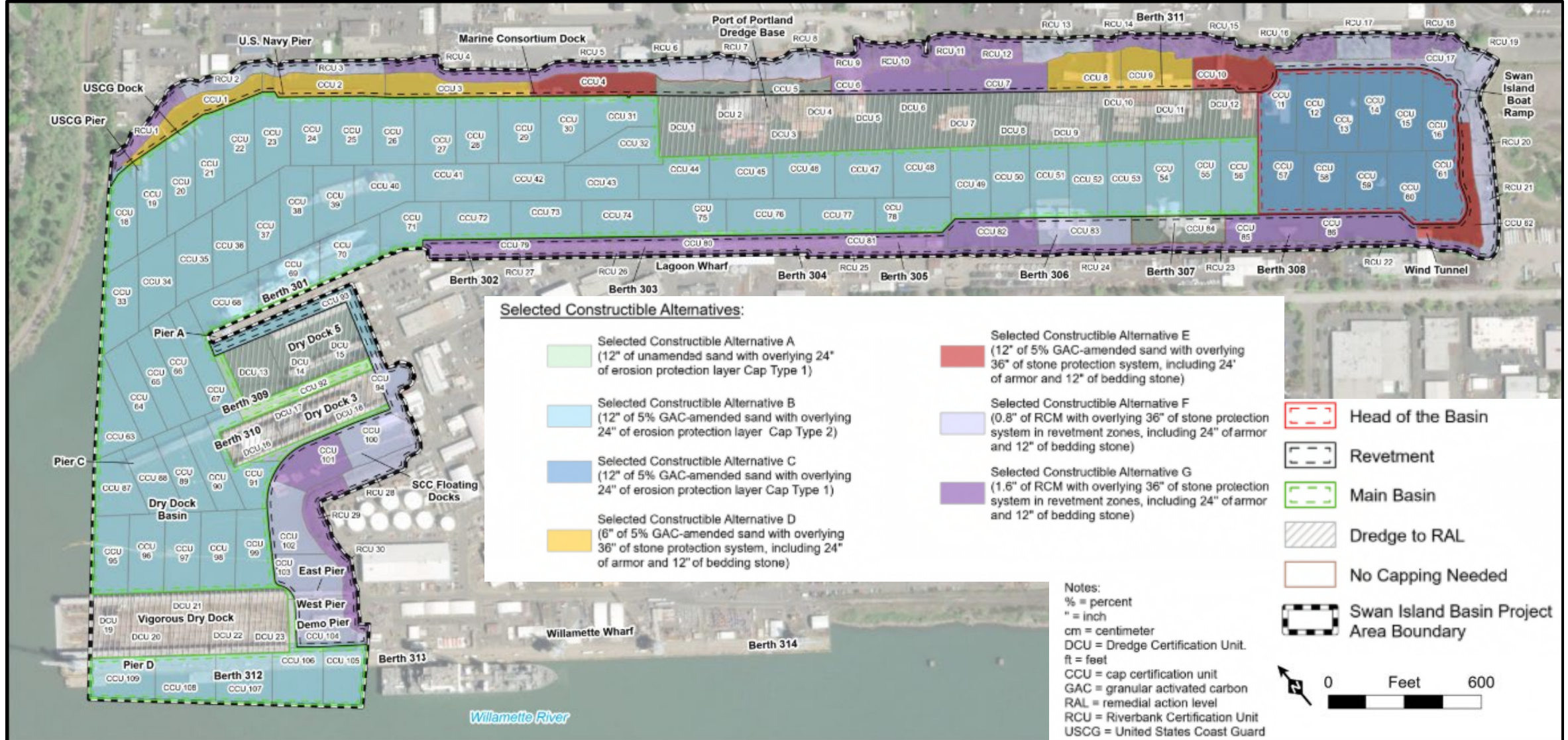
# Selected Constructible Alternatives

- EPL Cap Type 1
  - 2 feet of habitat gravel
- EPL Cap Type 2
  - Erosion Protection
    - 18 inches of 3-inch median diameter rock
  - Habitat Improvement
    - 6 inches of unamended coarse sand
- Revetment Zone
  - Bedding stone
    - 1 foot of 3-inch median diameter angular rock
  - Armor stone
    - 2 feet of 8- or 12-inch median diameter angular rock





# Selected Constructible Alternatives





# Lessons Learned



**Restoring the Environment.  
Protecting Our Future.**

1. The two-phased approach successfully enabled systematic evaluation of key remedial alternative drivers.
2. The approach enabled identification and resolution of critical design challenges while maintaining focus on the most important RD factors.
3. The approach provides a replicable framework for optimization needed to manage complex RDs that balance multiple competing priorities and address major design challenges.

