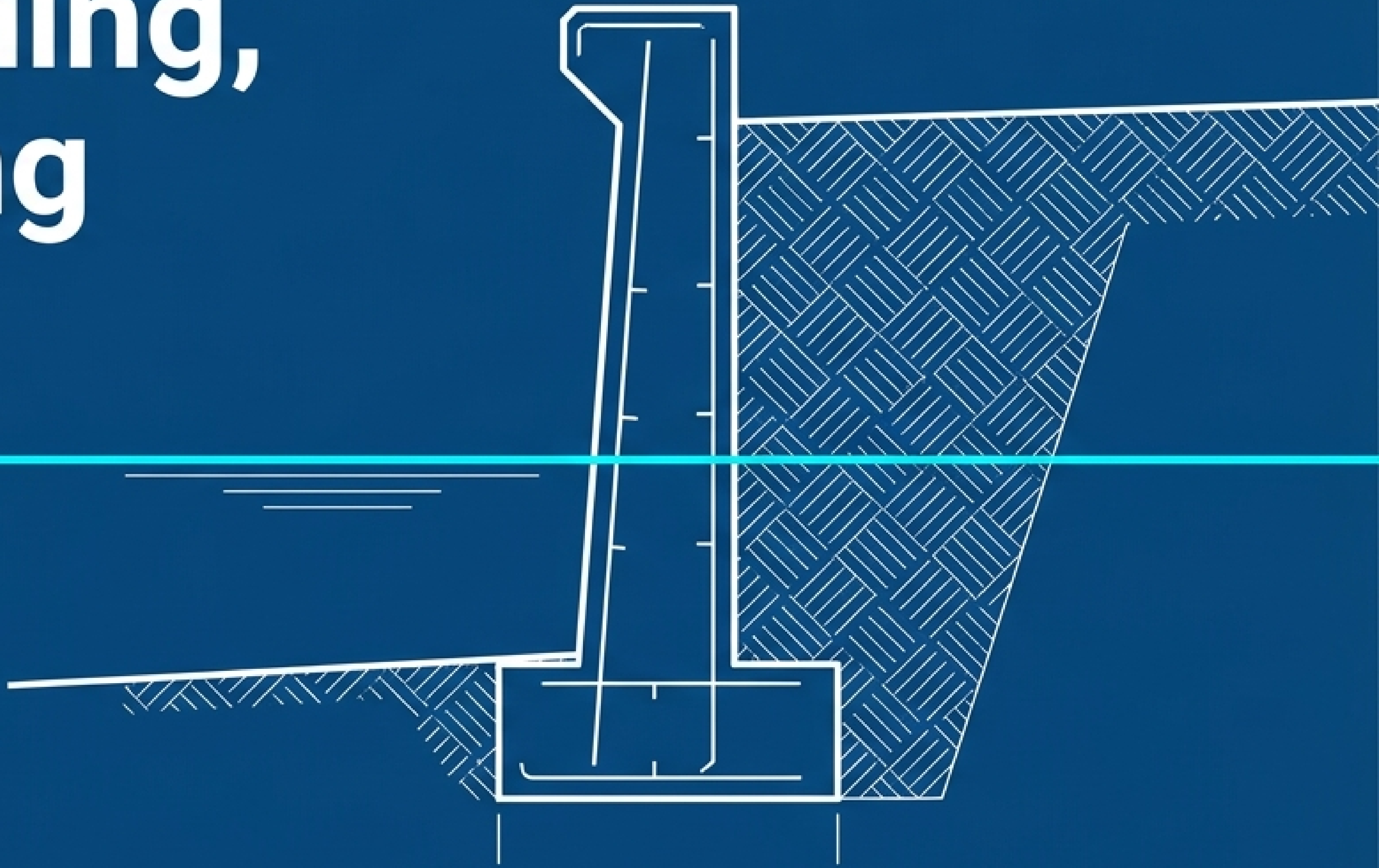
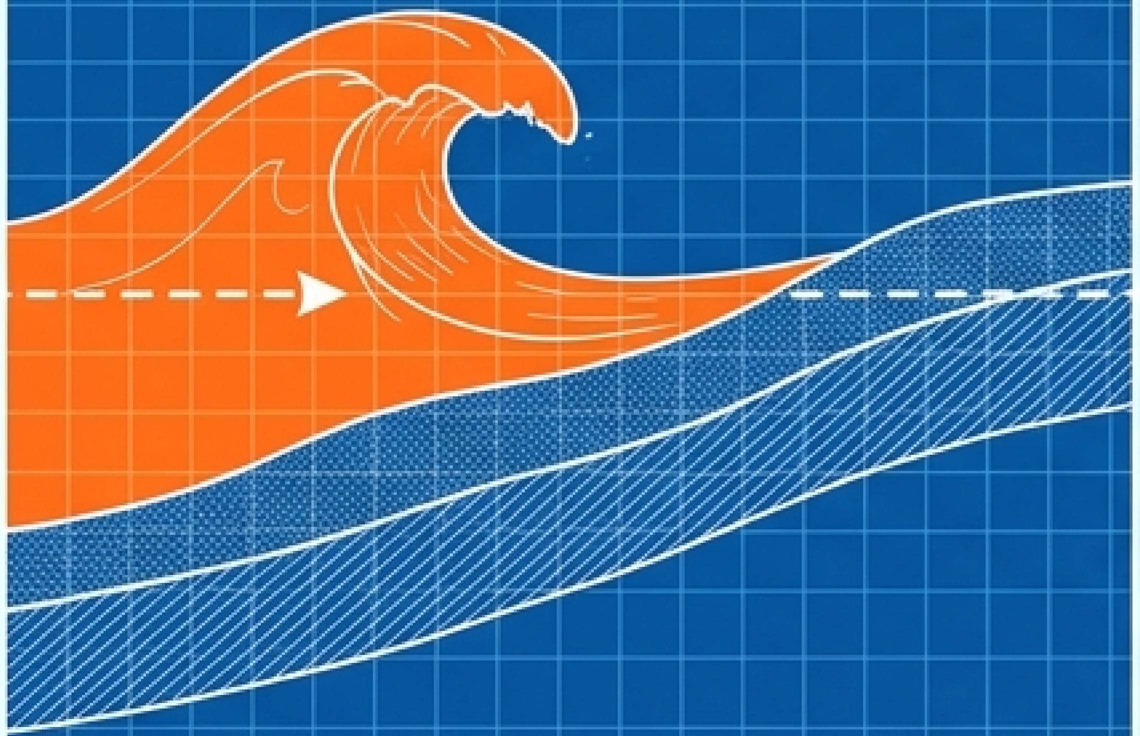
The Seawall Lifecycle: Planning, Building, and Maintaining



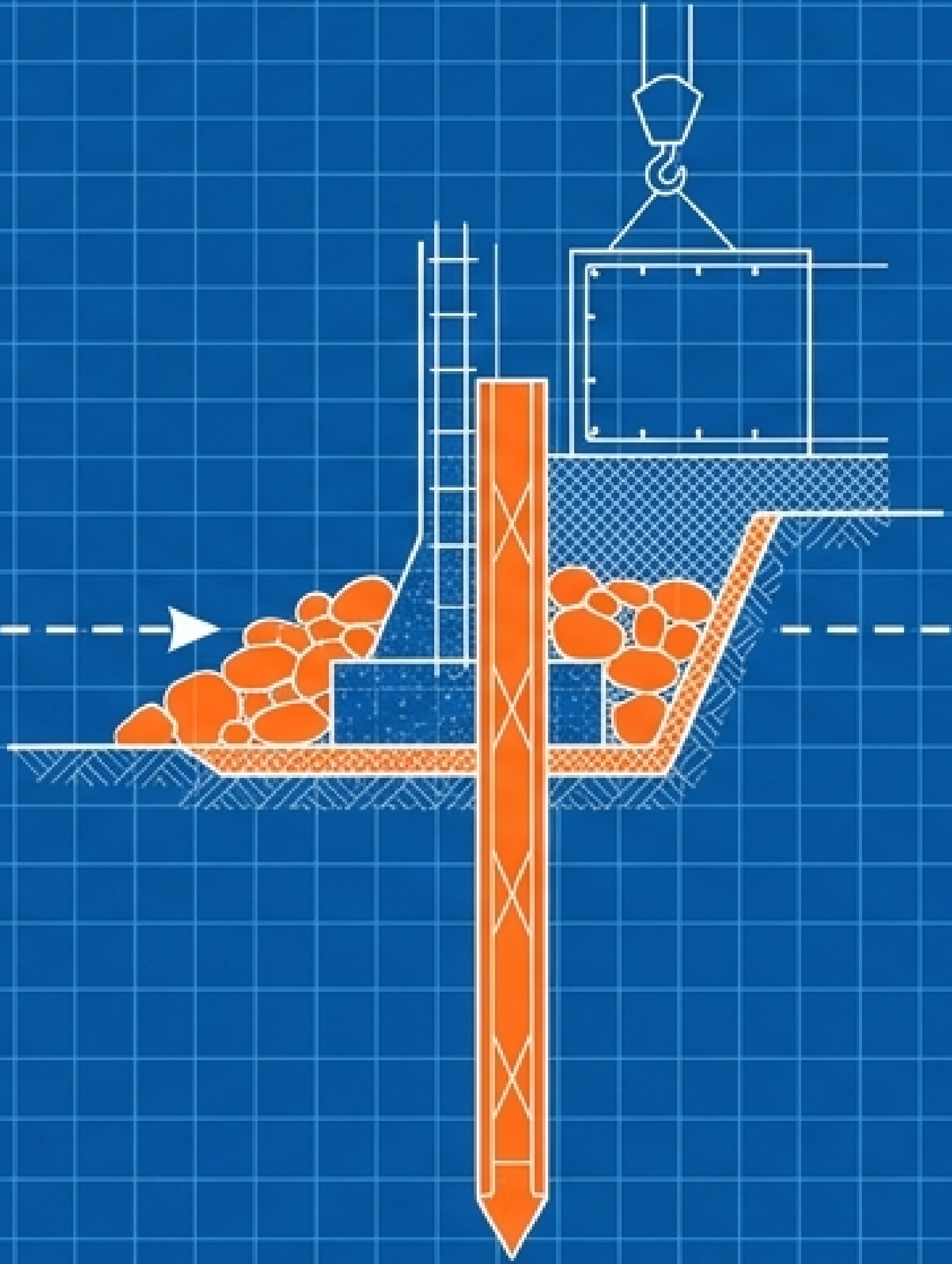
STANDARD COASTAL ENGINEERING OPERATING PROCEDURES // LINEAR PROJECT FRAMEWORK

Phase 1: Planning & Permitting



Focus: Hydrodynamics, wave amplitude, and jurisdictional boundaries.

Phase 2: Design & Construction

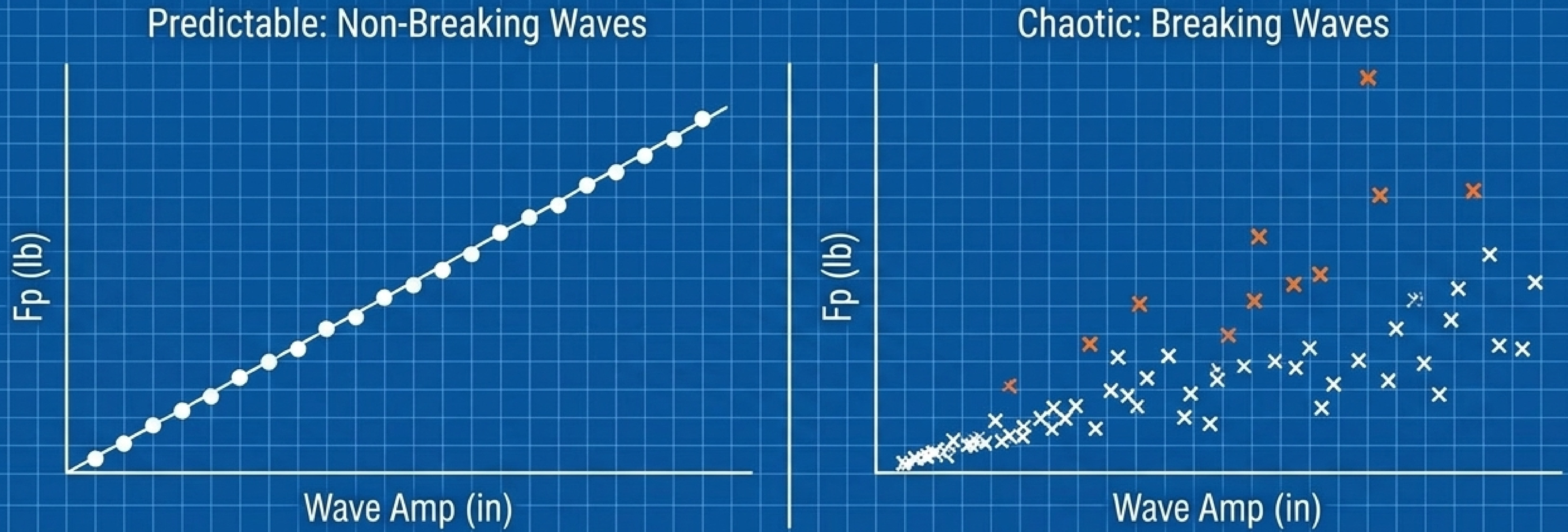


Focus: Physical build sequences, filtration engines, and compaction.

Phase 3: Post-Construction Maintenance

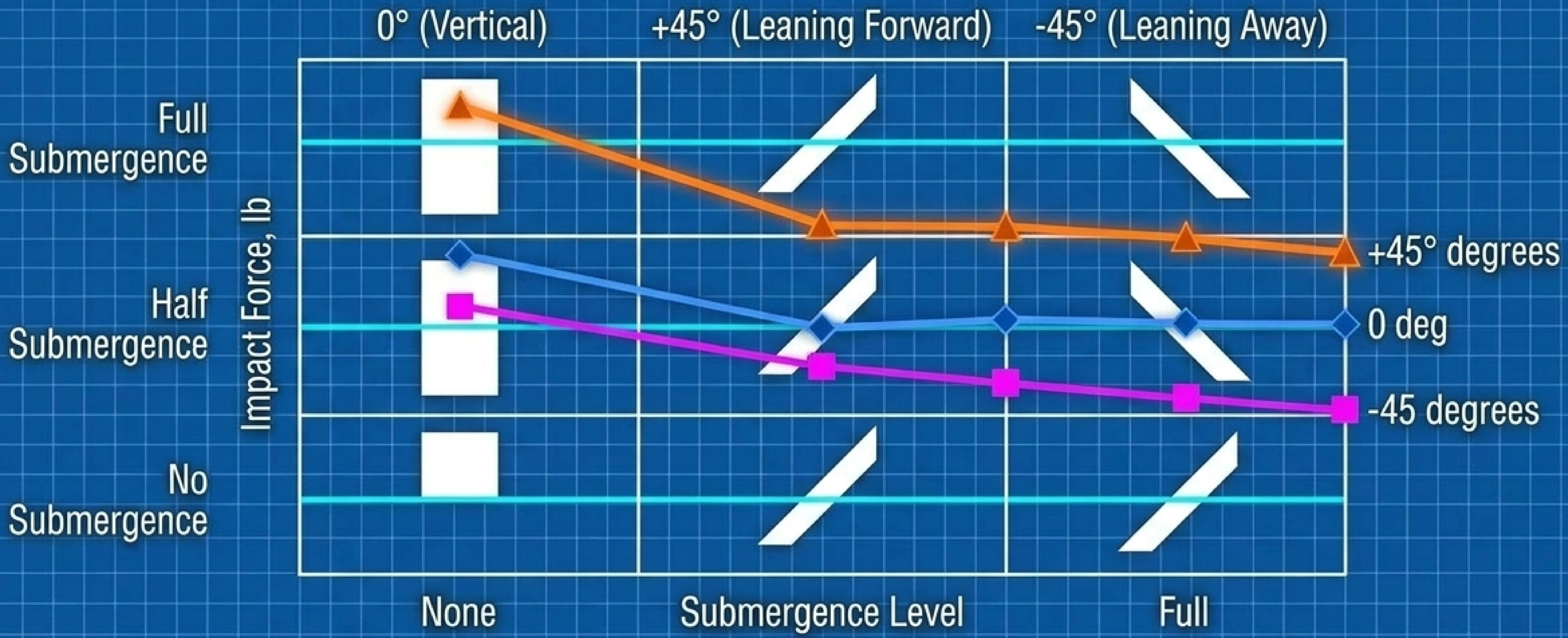
Focus: Material degradation, structural longevity, and repair protocols.

The Breaking Wave Multiplier



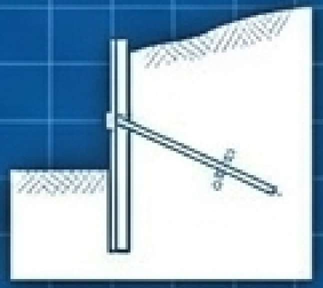
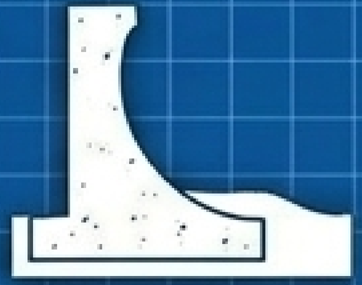
Key Insight: Breaking waves are random and chaotic due to air entrainment and water hammer pressure. Impact forces can vary by up to 70% from the average, producing localized pressure spikes more than twice as high as non-breaking waves of the exact same amplitude. Max pressure can reach $10\rho c^2$.

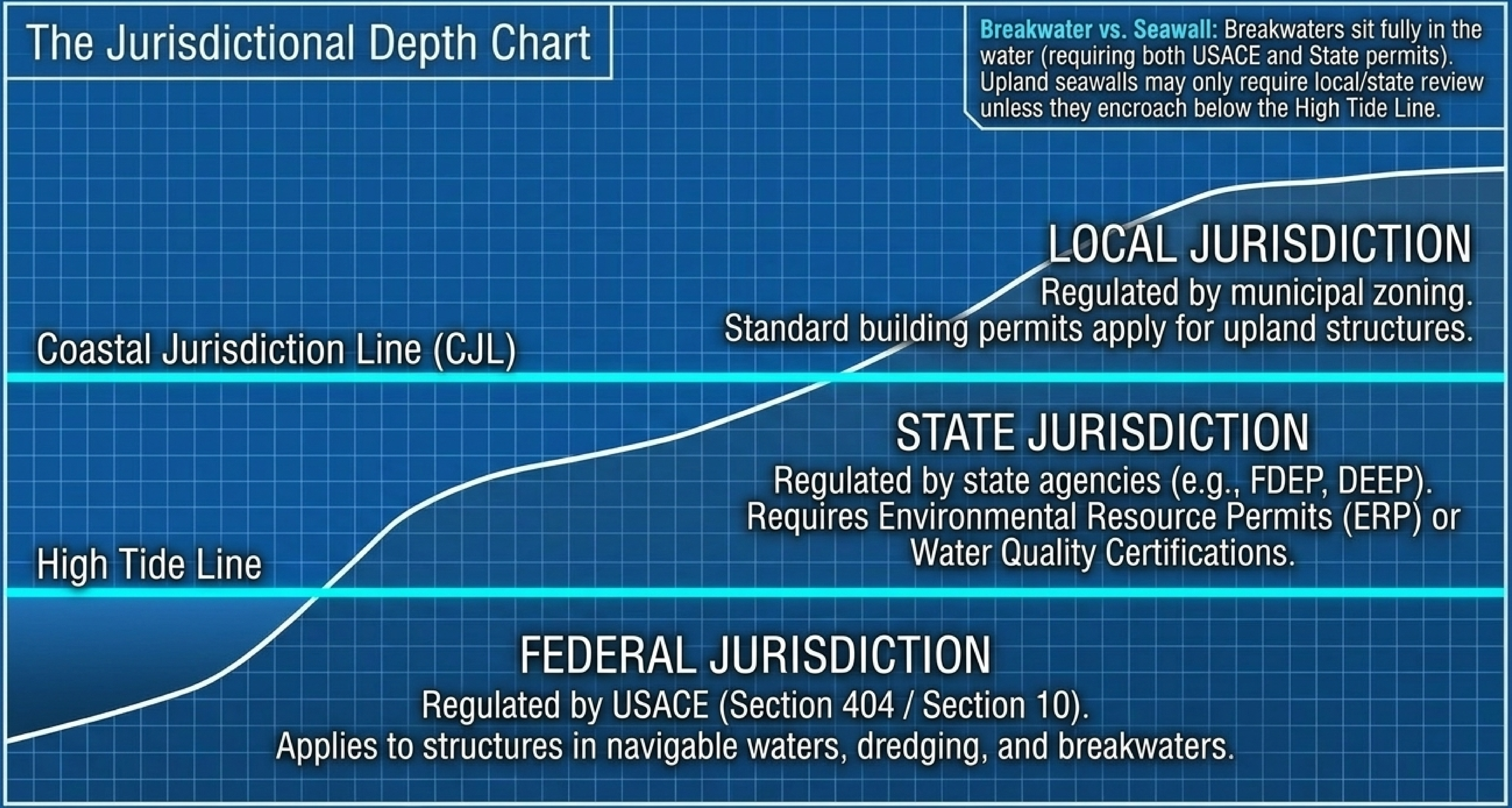
Structural Vulnerability: Submergence and Geometry



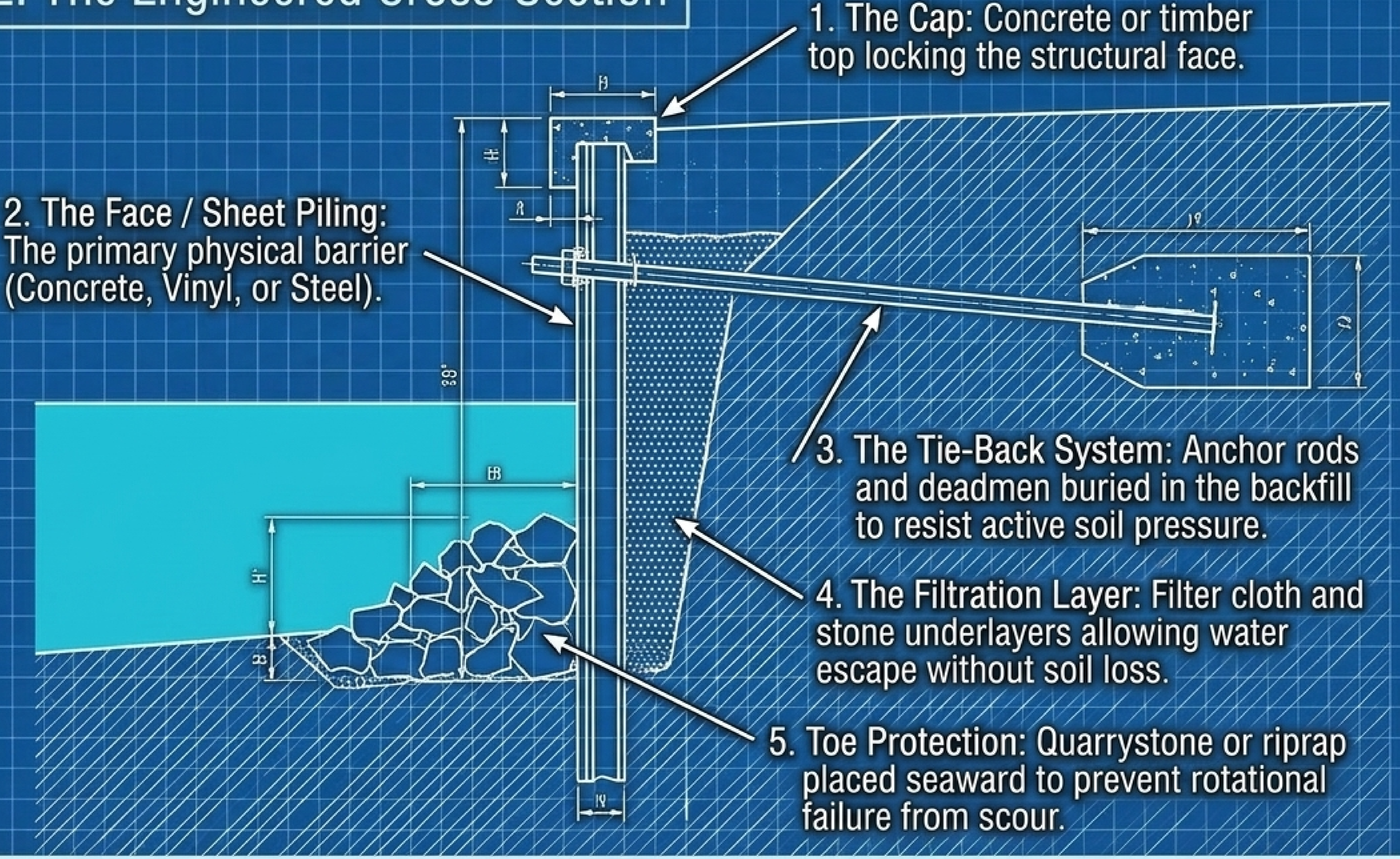
Core Takeaway: The highest impact forces occur at 0° and +45° with NO SUBMERGENCE. The lack of an aquatic buffer means the structure absorbs the full hydrodynamic impulse, demanding massive gravity structures in high-fetch environments.

Structural Typology Matrix

BULKHEADS 	SEAWALLS 
Primary Purpose	
Retain land and prevent soil sliding.	Intercept massive wave action.
Force Resistance	
Relies on embedment, anchored tie-backs, or cantilevered sheet-piling.	Relies on massive weight (gravity walls, heavy concrete profiles).
Ideal Environment	
Marinas, canals, bluffs with toe scour, moderate wave action.	Open ocean fetch, intense breaking wave impact zones.

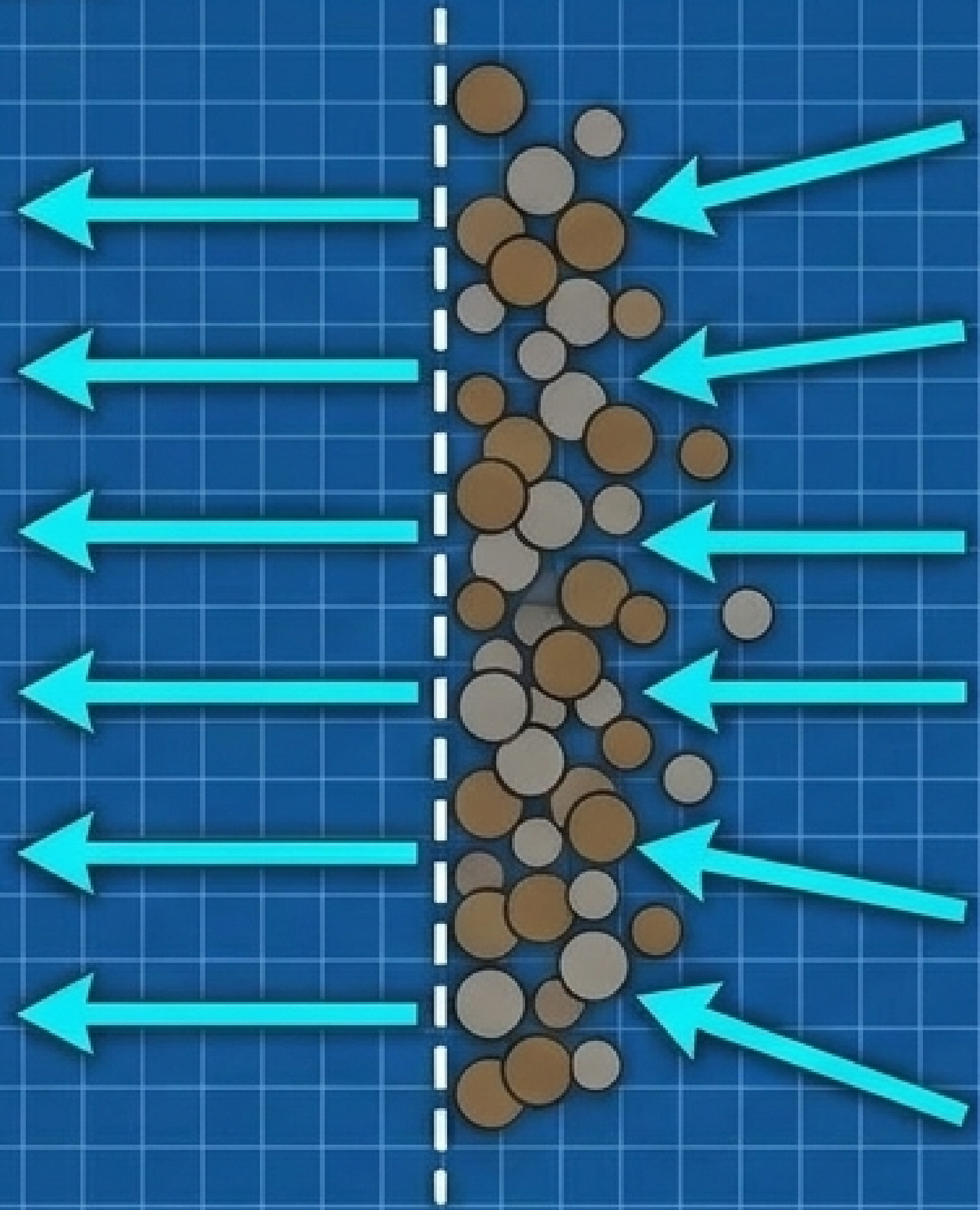

The Jurisdictional Depth Chart
Breakwater vs. Seawall: Breakwaters sit fully in the water (requiring both USACE and State permits). Upland seawalls may only require local/state review unless they encroach below the High Tide Line.
LOCAL JURISDICTION
Regulated by municipal zoning.
Standard building permits apply for upland structures.
Coastal Jurisdiction Line (CJL)
STATE JURISDICTION
Regulated by state agencies (e.g., FDEP, DEEP).
Requires Environmental Resource Permits (ERP) or Water Quality Certifications.
High Tide Line
FEDERAL JURISDICTION
Regulated by USACE (Section 404 / Section 10).
Applies to structures in navigable waters, dredging, and breakwaters.

Phase 2: The Engineered Cross-Section



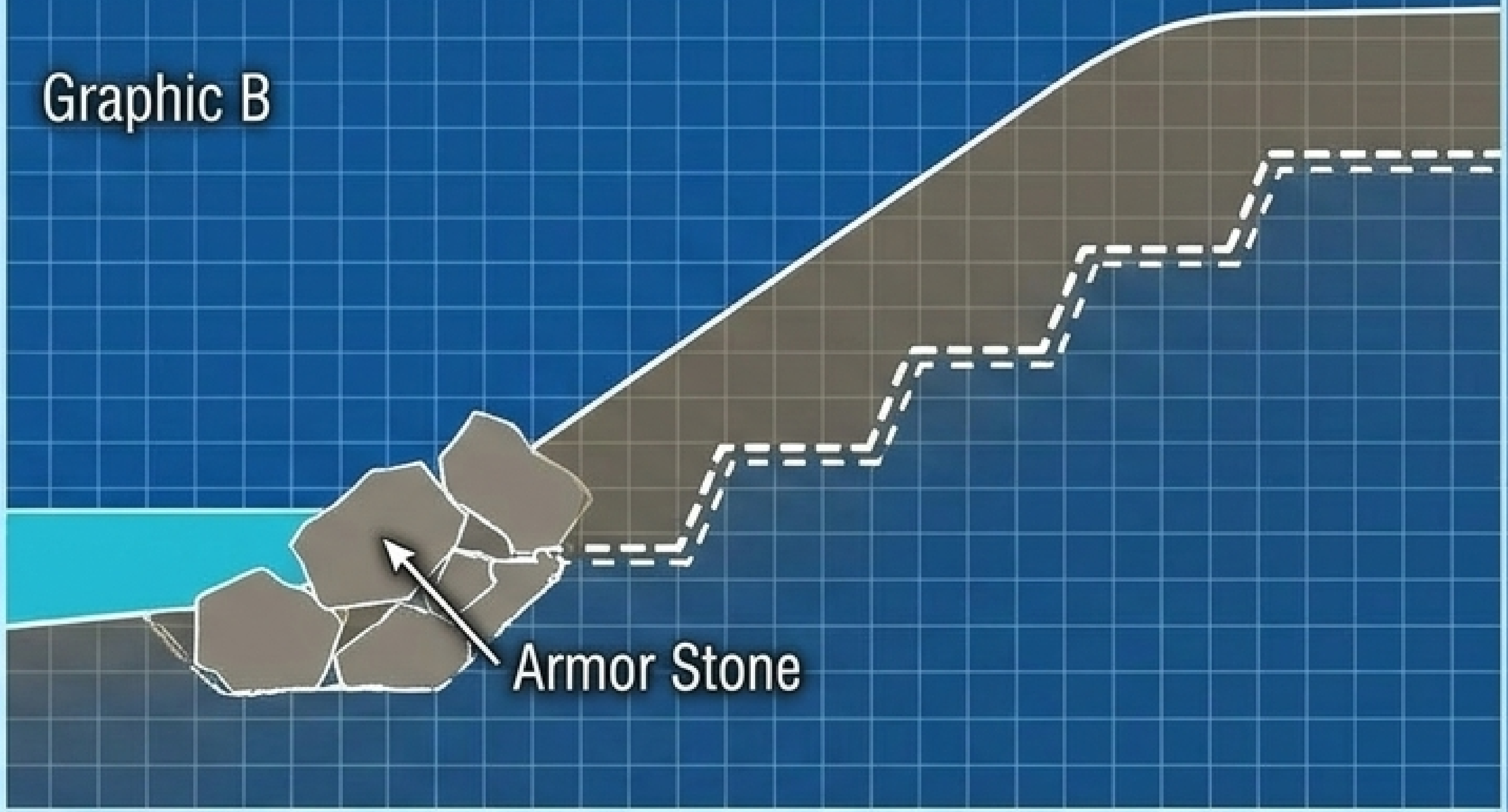
The Filtration Engine

Graphic A



Relieves hydrostatic pressure while retaining fine soils.

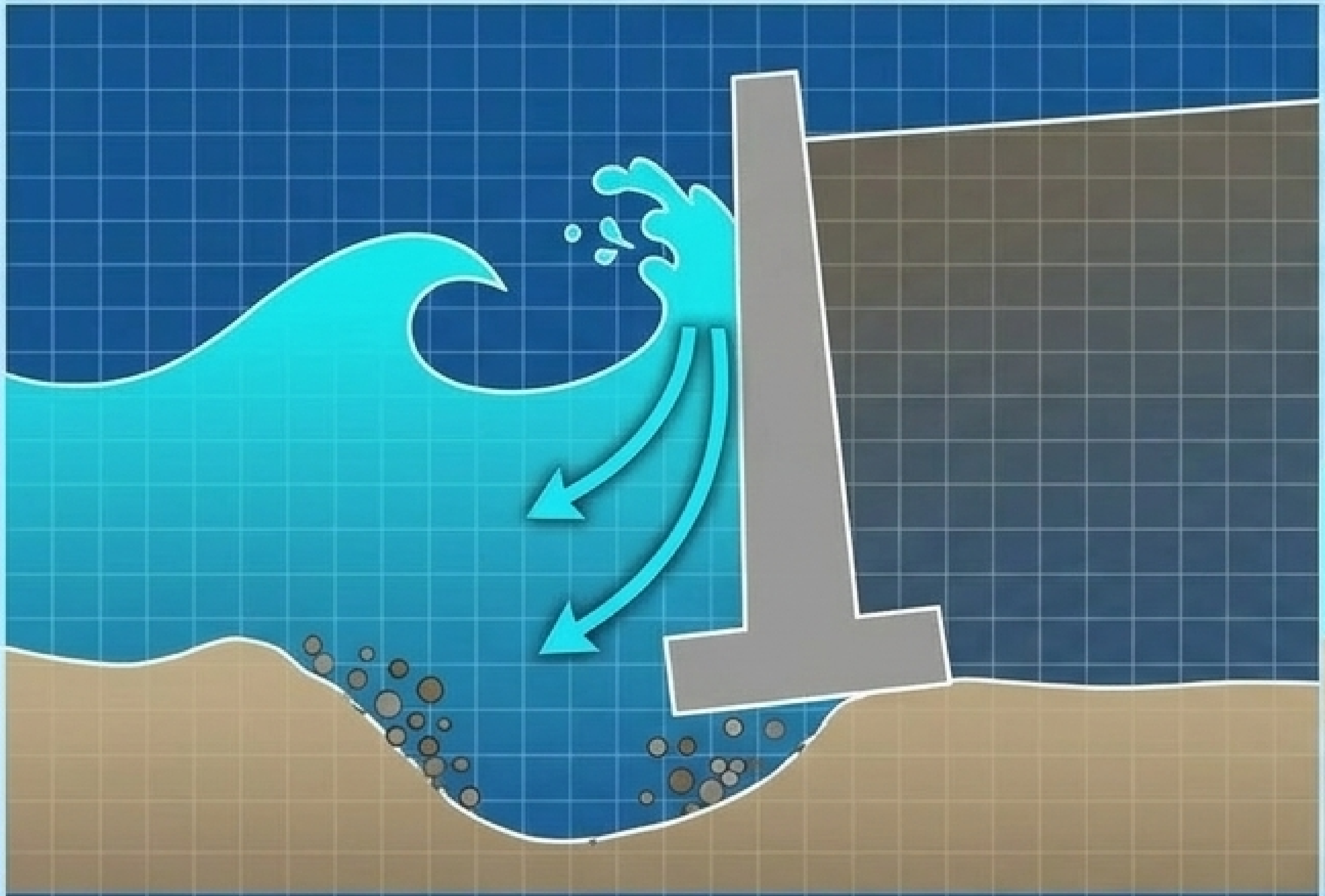
Graphic B



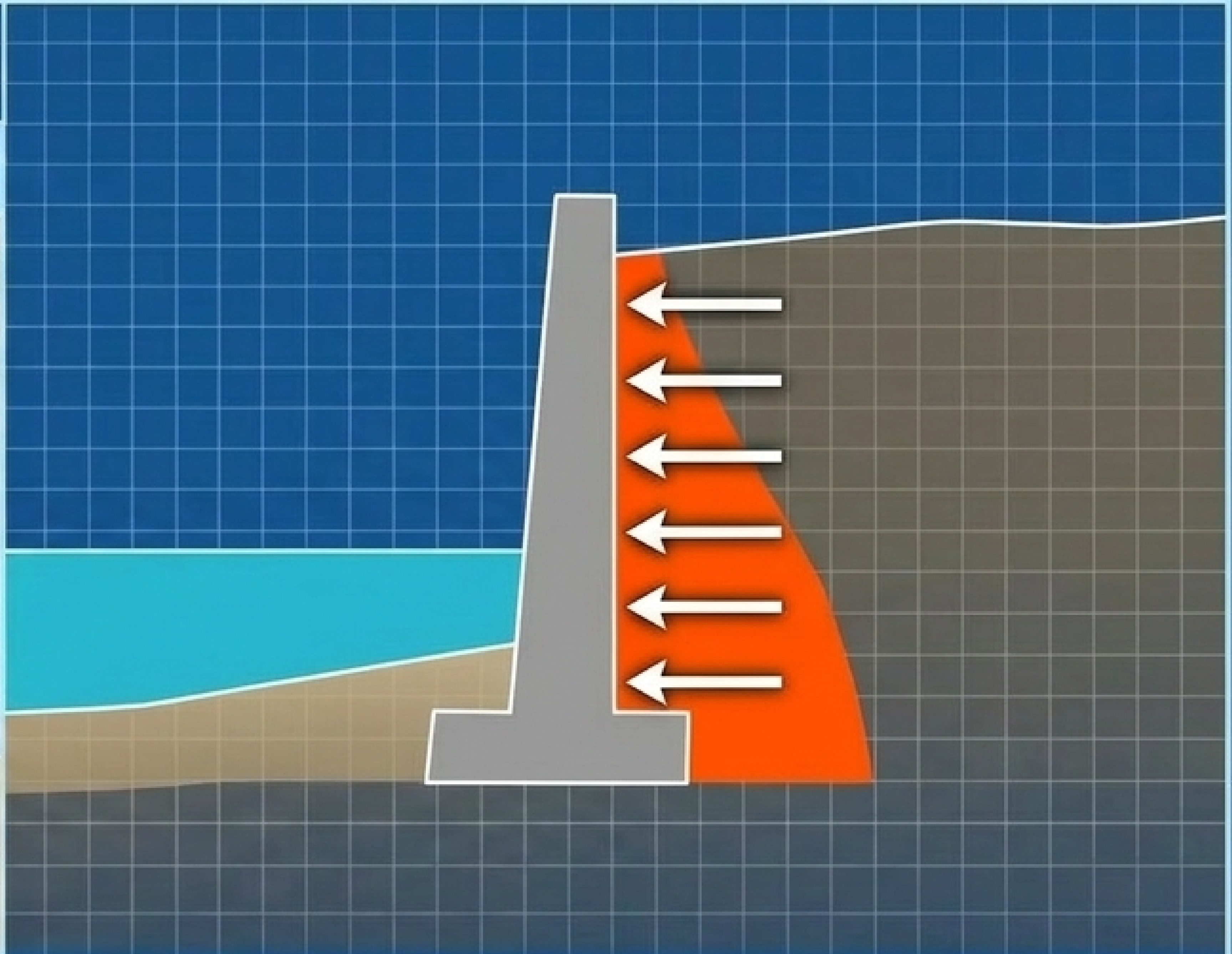
Design Rules

- Use EOS-70 filter cloth.
- Requires 12-inch to 3-foot overlaps between sheets.
- Include deliberate folds to eliminate tension under settlement.
- Secure with pins and washers at 2- to 5-foot intervals.
- Armor units >1 ton require a protective stone bedding layer to prevent fabric bursting.

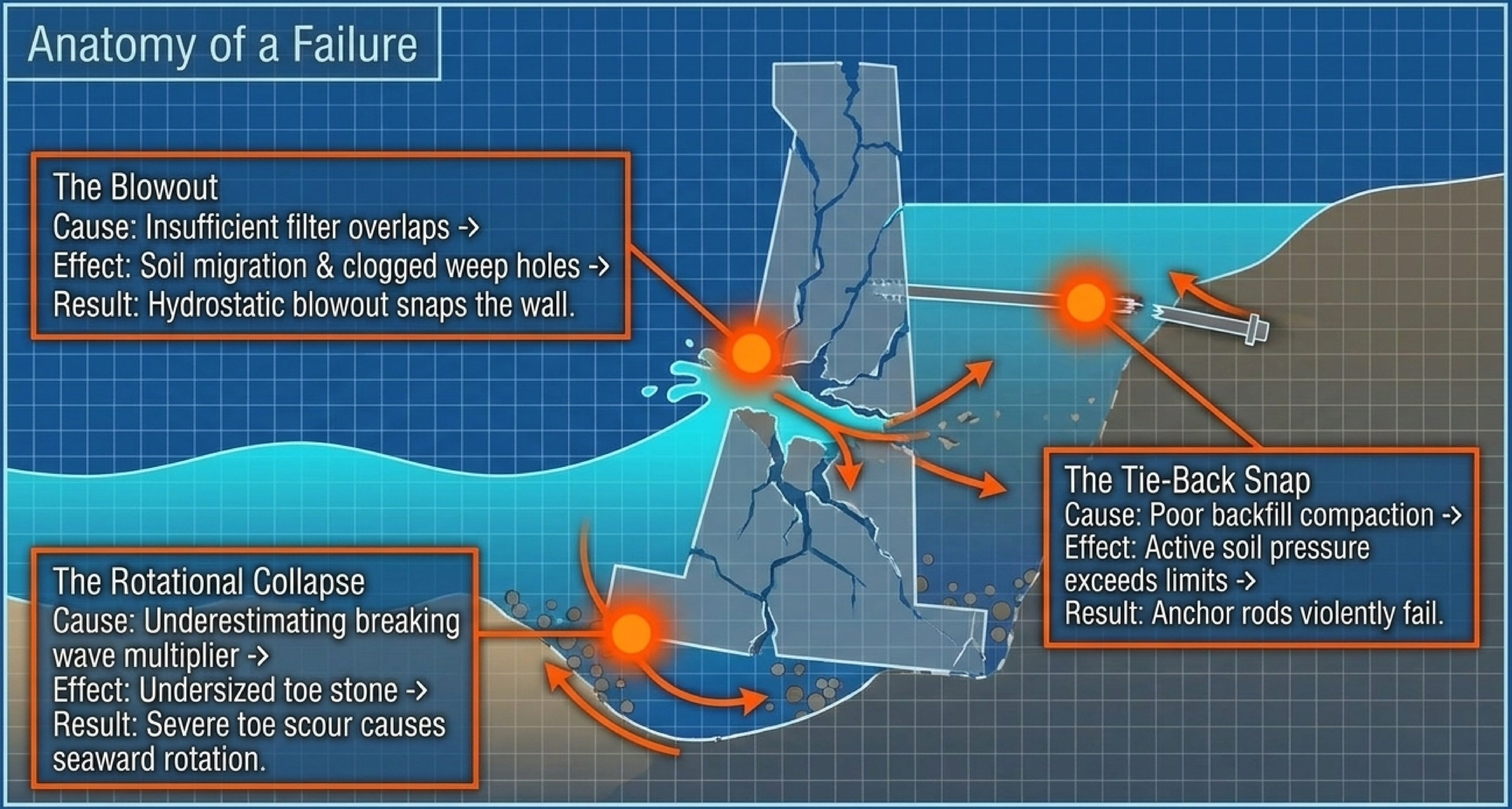
Securing the Base: Scour and Compaction



The Seaward Face: Wave energy deflects downward. Without adequate toe stone (sized to a design wave between H1 and H10), a scour trench forms, causing the wall to slide outward.



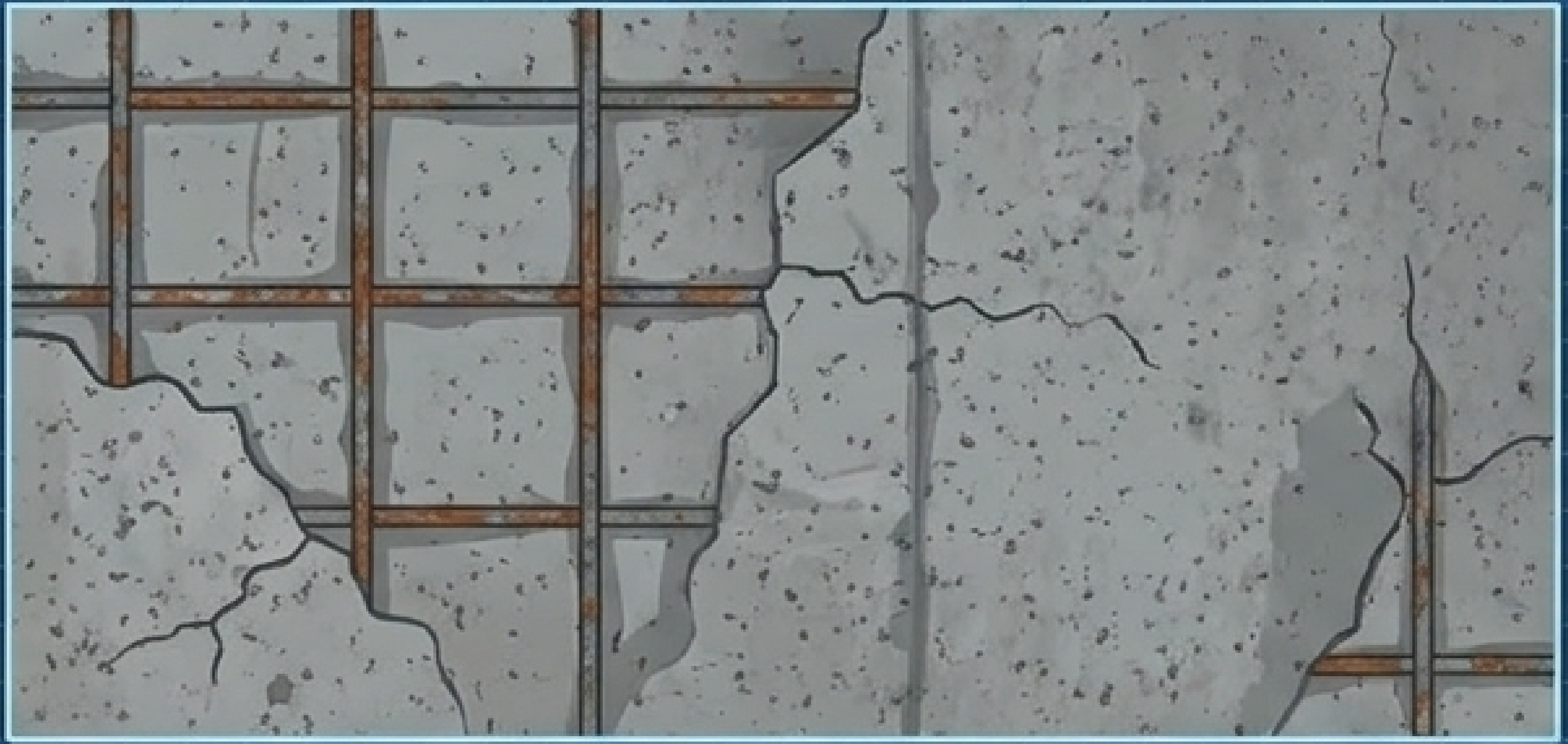
The Landward Face: The wall relies entirely on the passive earth pressure zone for support. Firm compaction of all fill and backfill is an absolute requirement to resist dynamic wave impacts and seepage flow.



Anatomy of a Failure
The Blowout
Cause: Insufficient filter overlaps ->
Effect: Soil migration & clogged weep holes ->
Result: Hydrostatic blowout snaps the wall.
The Tie-Back Snap
Cause: Poor backfill compaction ->
Effect: Active soil pressure exceeds limits ->
Result: Anchor rods violently fail.
The Rotational Collapse
Cause: Underestimating breaking wave multiplier ->
Effect: Undersized toe stone ->
Result: Severe toe scour causes seaward rotation.

Phase 3: Material Reality Check

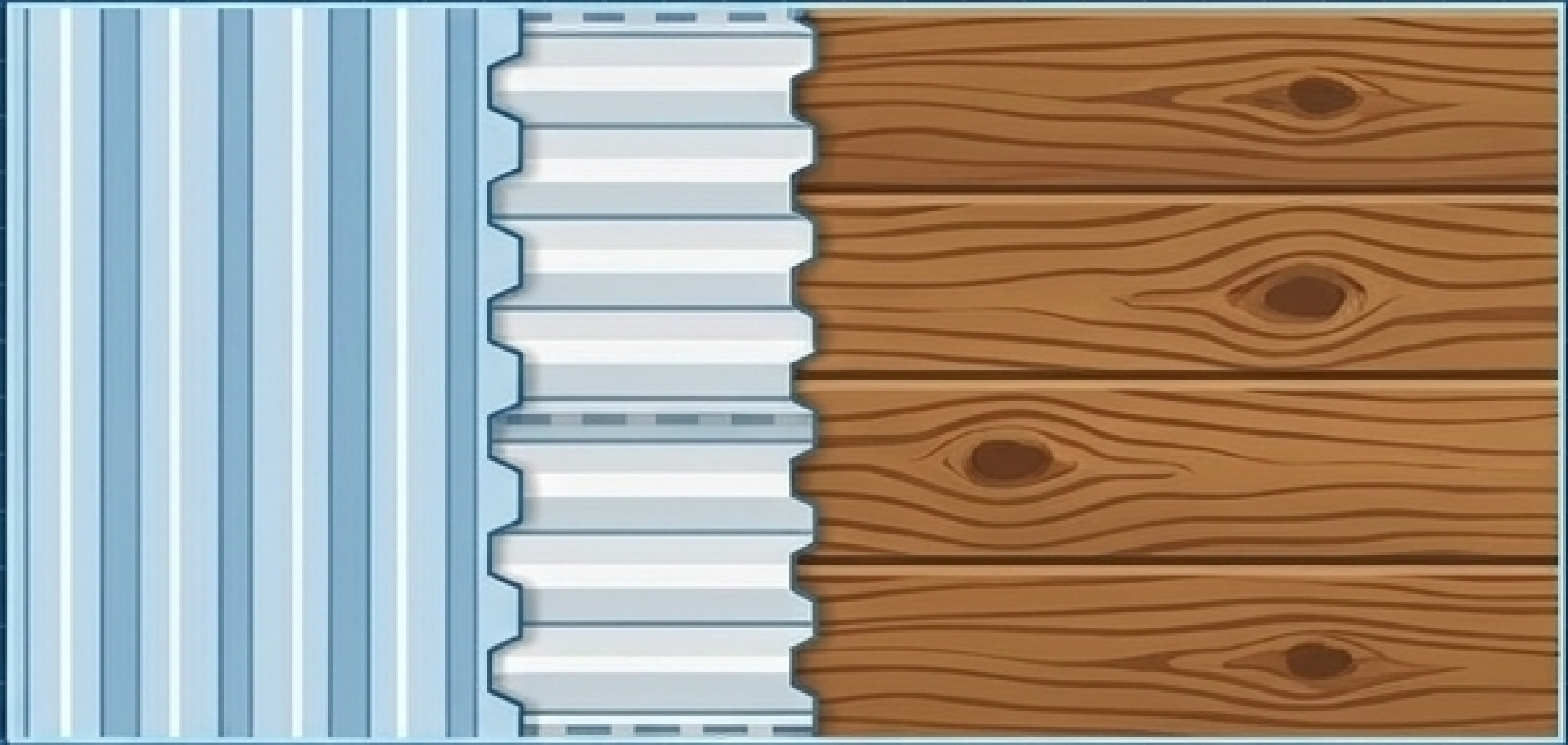
CONCRETE



Strengths: Massive gravity resistance; the only viable option for intense wave action and open fetch.

Vulnerabilities: Saltwater erodes internal steel reinforcement causing rust and structural spalling. Heavy precast panels are prone to joint separation at corners, allowing rapid water intrusion.

VINYL / WOOD

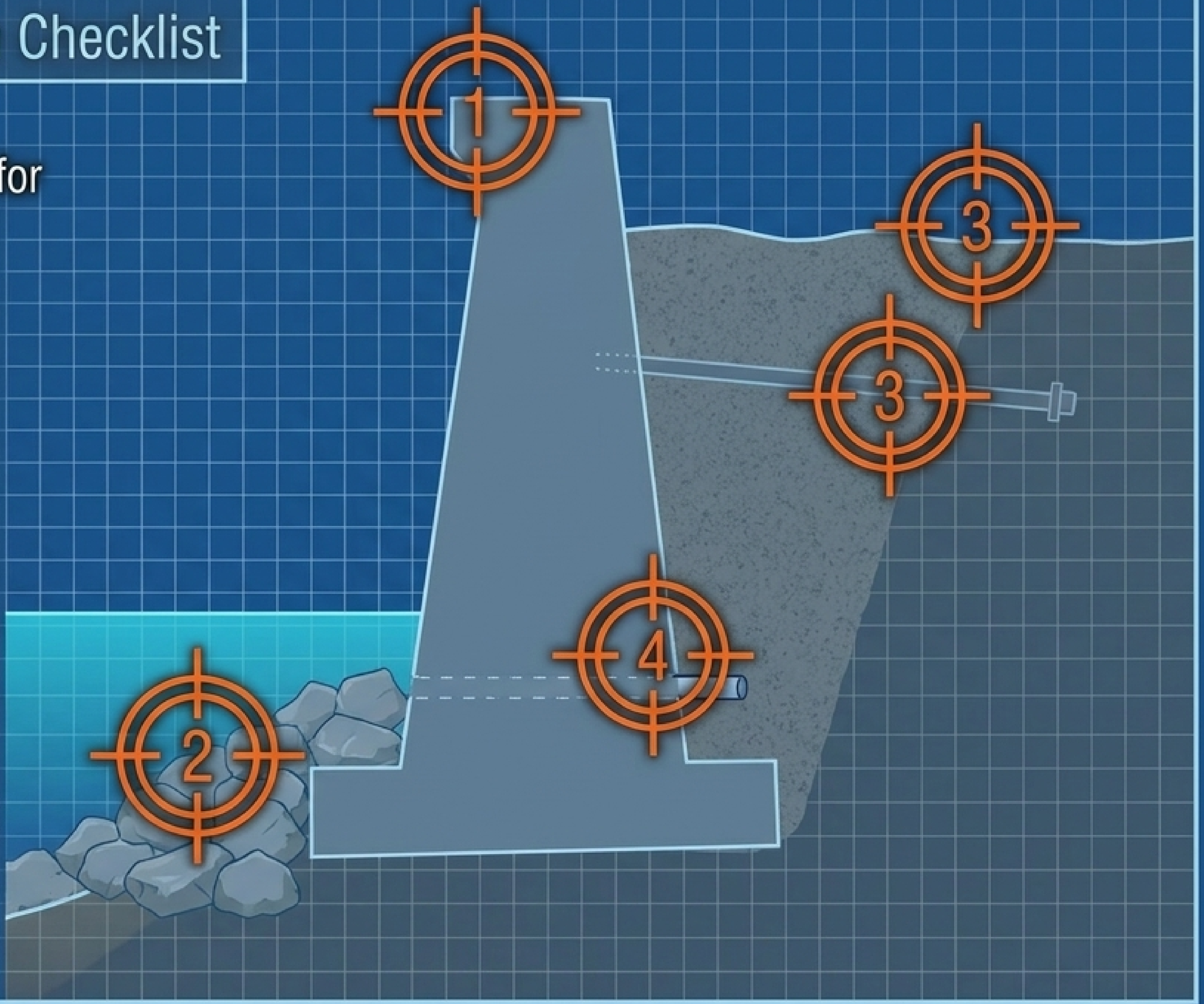


Strengths: Flexible, highly transportable, and immune to saltwater rust (vinyl).

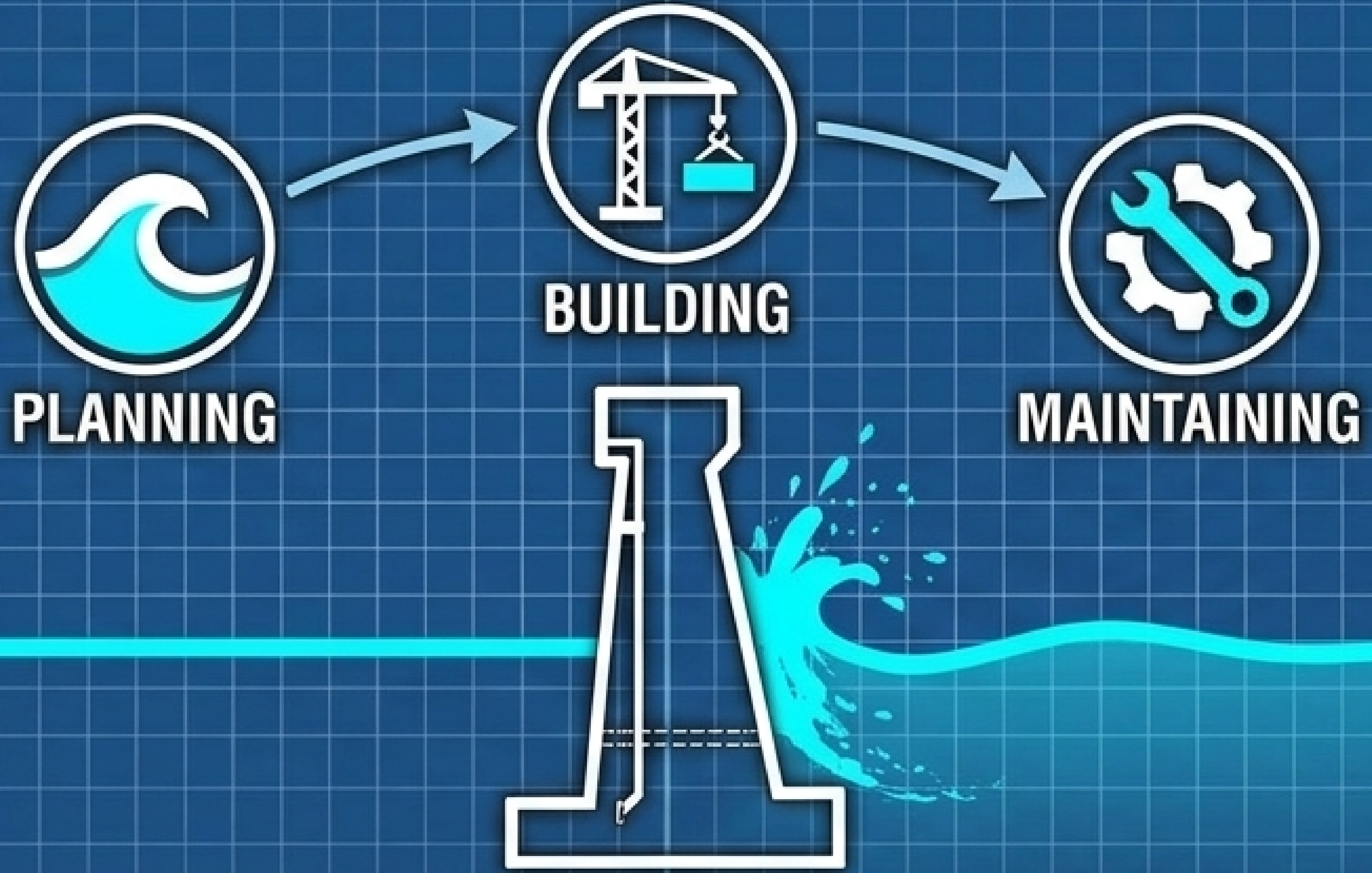
Vulnerabilities: Timber rots quickly in marine environments. Both materials are strictly limited to low-energy shorelines and bulkheads; they cannot survive breaking wave impacts.

The Maintenance & Inspection Checklist

1. **Concrete Caps & Joints:** Inspect for cracks, spalling, and joint separation.
2. **Riprap & Toe Protection:** Map erosion; ensure stone has not migrated seaward or sunk below mudline.
3. **Tie-Backs & Anchors:** Check for landward sinkholes or depressions indicating soil loss.
4. **Weep Holes & Drainage:** Ensure clear drainage to prevent hydrostatic pressure; monitor for bleeding fine soils.



ENGINEERING THE EDGE



A seawall is not a static object; it is an engineered intervention in a dynamic system. Survival requires precise initial hydrodynamics, unrelenting construction tolerances, and a commitment to sustained maintenance.