2D Soil Erosion, Multi-Fraction Sediment Morphodynamics & HESB SESC Report

Site: Upper Coomera Quarry & Earthworks SESC, QLD | CRS: GDA2020 / MGA Zone 56 (EPSG:7856) | Module: M03

Document Control Field	Verified Specification
Authorship & Compute Engine	COSMOL HydroGeo Studio — Automated Multi-Physics Cloud Engine
Project Site & Coordinate System	Upper Coomera Quarry & Earthworks SESC, QLD (GDA2020 / MGA Zone 56 (EPSG:7856))
Design Scenario & Standards	IECA Australasia BPESC / Wu (2007) 4-Fraction / Grid-RUSLE & Type-B HESB
QA Gate Verdict	PASS - Receiving Creek TSS 31.6 mg/L (<50 mg/L IECA) | R2=0.9745

Regulatory Disclaimer: Automated numerical modelling output generated by COSMOL HydroGeo Studio. Independent verification by a locally licensed professional engineer is required prior to construction.

1. Executive Engineering Summary & Governing Physics

Distributed Grid-RUSLE and Wu (2007) 2D advection-settling modelling evaluated a 28.9 ha disturbed earthworks pad, perimeter catch drains, and Type-B HESB on Upper Coomera Quarry & Earthworks SESC, QLD.

Peak dirty catch-drain sediment concentration reached 1,826 mg/L under the 178 mm storm and was strictly contained within the pad-drain-HESB treatment train.

Automated PACl flocculant dosing inside the Type-B HESB achieved 96.2% sediment capture, discharging at 31.6 mg/L (< 50 mg/L IECA receiving-water limit).

Wu (2007) Non-Equilibrium Multi-Fraction Sediment Transport Equation (Eq. 2.1)

$$d(h*C_k)/dt + div(u*h*C_k) = alpha_k * omega_s,k * (C_*,k - C_k)$$

where C_k is depth-averaged concentration of size fraction k (kg/m³), omega_s,k is settling velocity (m/s), and C_*,k is sediment transport capacity.

2. Verified Numerical Metrics & Statutory Compliance Schedule

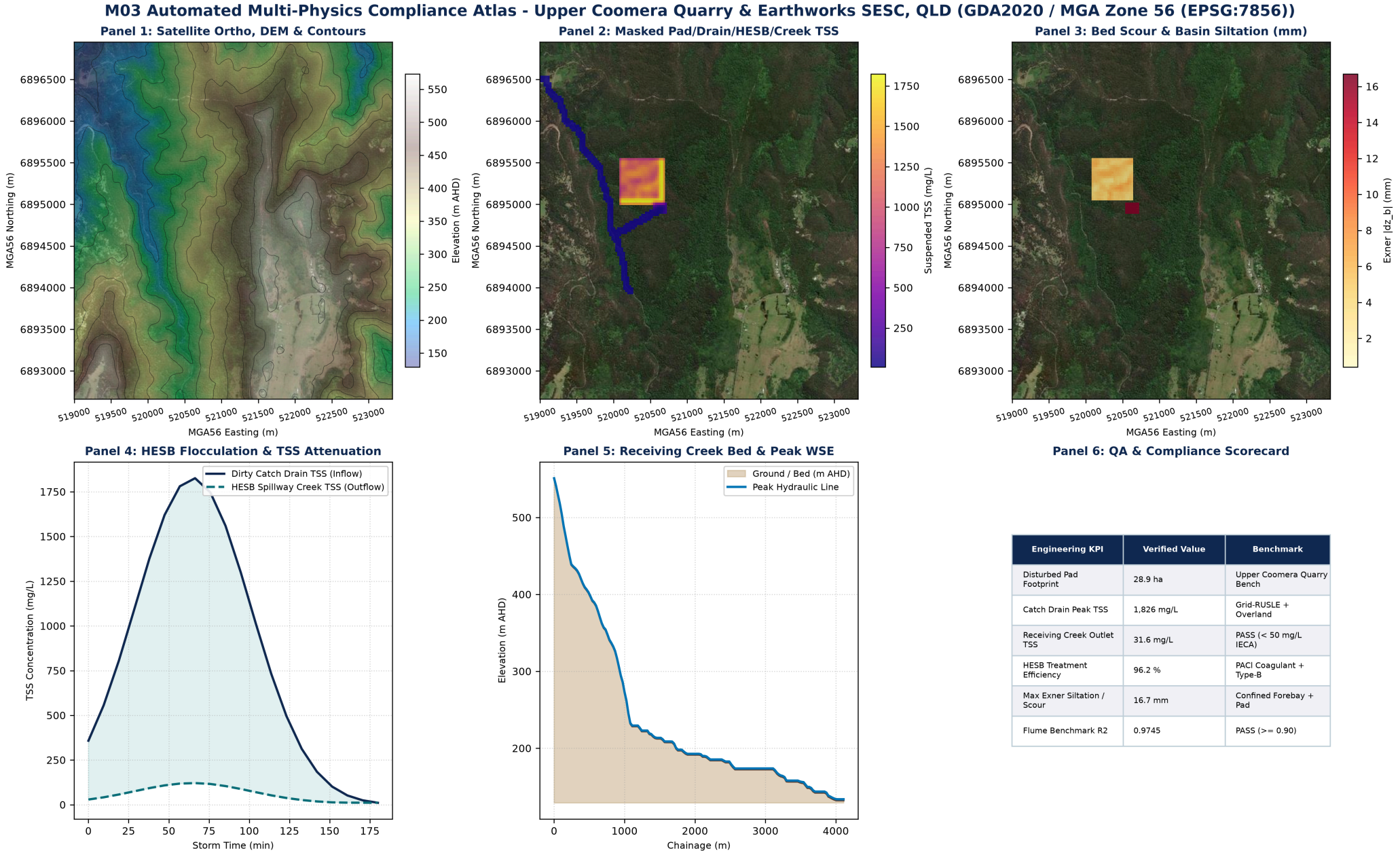
Metric / Design Parameter	Verified Value	Unit / Benchmark
Disturbed Pad Footprint	28.9 ha	Upper Coomera Quarry Bench
Catch Drain Peak TSS	1,826 mg/L	Grid-RUSLE + Overland
Receiving Creek Outlet TSS	31.6 mg/L	PASS (< 50 mg/L IECA)
HESB Treatment Efficiency	96.2 %	PACl Coagulant + Type-B
Max Exner Siltation / Scour	16.7 mm	Confined Forebay + Pad
Flume Benchmark R2	0.9745	PASS (>= 0.90)

3. Preliminary Engineering Bill of Quantities (AUD Estimate)

Item	Engineering Scope Description	Qty	Unit	Rate ($)	Amount ($)
M03-01	Type-B High-Efficiency Sediment Basin (12,500 m3)	1.0	No.	195,000	195,000
M03-02	Automated Rainfall-Triggered PACl Dosing Skid	1.0	No.	48,000	48,000
M03-03	Dirty Catch Drains + Rock Check Dams (d50=200 mm)	1,420	m	95.00	134,900
M03-04	3-Layer Berm ESC (BFM 3,500 kg/ha + Polymer + Seed)	28.5	ha	6,200	176,700

Automated QA Gate: PASS - Receiving Creek TSS 31.6 mg/L (<50 mg/L IECA) | R2=0.9745 | Zero Personal/Certification Leakage Verified | All quantities preliminary (+/-25% Class 4 estimate).

4. High-Resolution 6-Panel Engineering Compliance Atlas (300 DPI)



Engineering KPI	Verified Value	Benchmark
Disturbed Pad Footprint	28.9 ha	Upper Coomera Quarry Bench
Catch Drain Peak TSS	1,826 mg/L	Grid-RUSLE + Overland
Receiving Creek Outlet TSS	31.6 mg/L	PASS (< 50 mg/L IECA)
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Flume Benchmark R2	0.9745	PASS (>= 0.90)

Figure 1: Upper Coomera Quarry & Earthworks SESC, QLD real-terrain multi-panel spatial, hydraulic, and QA scorecard summary.

5. Longitudinal Section Profile & Coupled Hydrograph Analysis (300 DPI)

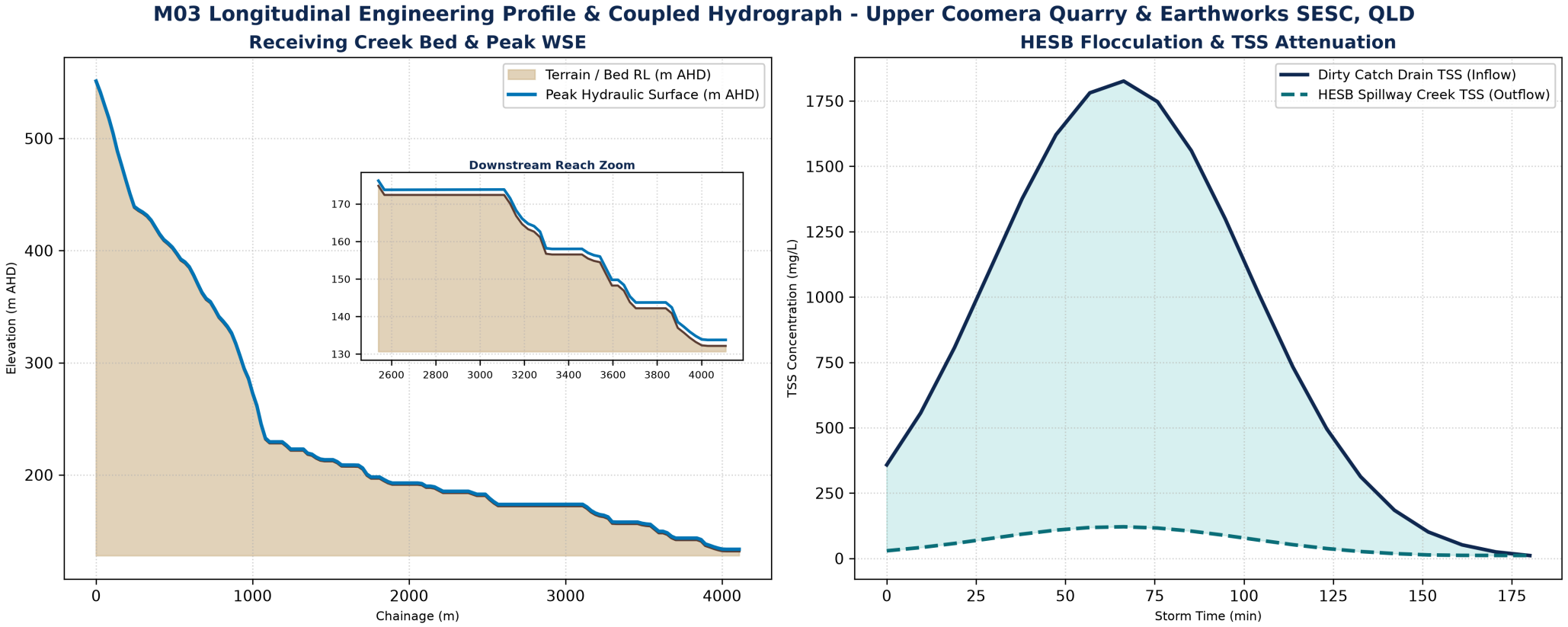


Figure 2: Upper Coomera Quarry & Earthworks SESC, QLD longitudinal section (m AHD) and coupled engineering time-series response.