SPEED WITHOUT WAKE :
ELECTRIC FOILING COMMUTER VESSELS

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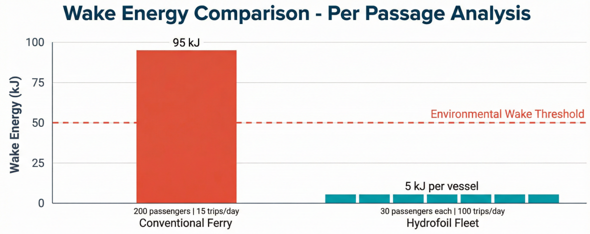
How High-Frequency Foiling Fleets Deliver Greater Capacity with Less Wake for Water Cities Worldwide

EXECUTIVE SUMMARY

Water cities worldwide share a paradox: natural waterways connecting residential areas to employment centres sit underutilised while parallel roads are gridlocked. Sydney, Hong Kong, Istanbul, San Francisco, Dubai—each loses billions annually to congestion while ferry networks carry a fraction of potential demand.

The barrier is wake. Not technology, not finance, not demand. **Wake.**



Metric	Conventional	Hydrofoil Fleet	Reduction
Wake per passage:	95 kJ	5 kJ	95%
Daily passages:	15	100	+567%
Total daily wake:	1,425 kJ	500 kJ	65%
Daily capacity:	3,000 pax	3,000 pax	Equal

Conventional ferries generate waves that erode shorelines, damage seawalls, and destroy habitat. These impacts constrain both speed and frequency. The result: water transit cannot compete with roads, despite obvious geographic advantages. Sydney's $9.5 billion annual congestion cost represents just one city's share of a global problem.

Electric hydrofoils change the equation. By lifting the hull clear of the water, these vessels cut wake energy by 80–95%. They travel faster while producing less impact than slow-moving conventional ferries.

The real insight is counterintuitive: a fleet of small, frequent foiling vessels generates less total wake than fewer large ferries carrying the same passengers. More boats, less damage.

Table 1: Fleet Comparison: Equal Capacity, Different Outcomes

Metric	Conventional	Hydrofoil	Result
Daily capacity	3,000 pax	3,000 pax	Same
Fleet model	15 trips × 200 pax	100 trips × 30 pax	6× frequency
Wake per trip	~95 kJ	~5 kJ	95% less
Daily wake total	~1,425 kJ	~500 kJ	65% less
Wait time	15–30 min	2–5 min	Metro service
Journey time	55–60 min	15–25 min	50%+ faster

SOURCE: KTH ROYAL INSTITUTE OF TECHNOLOGY (2024); STOCKHOLM P-12 OPERATIONAL DATA; WATER ROADS ANALYSIS.

Stockholm proved this works. The Candela P-12 entered public transit service in late 2024, cutting journey times in half while producing wake equivalent to a 4-knot vessel—at 25 knots. Regulators granted speed exemptions based on measured performance, not hull type.

There is no reason why this experience and model cannot be applied to any water city facing the same constraints.

1. WAKE AS THE GOVERNING CONSTRAINT

1.1 The Capacity Problem

Every transport mode has a binding constraint. Roads have axle loads. Airports have noise contours. Waterways have wake.

This reframes the question. The issue isn't 'how do we reduce ferry impacts?' It's 'how do we maximise waterway capacity within wake limits?' Different problem, different solution.

In a wake-constrained system, corridor capacity depends on cumulative wake energy per hour—not vessel size, not trip count, not passenger demand. Any technology that cuts wake per passenger-kilometre expands system capacity.

1.2 Energy, Not Height

Wake discussions typically focus on wave height. But erosion correlates with wake energy, which combines height and wave period.

Long-period waves from displacement vessels penetrate further up shorelines and shift more sediment per cycle. A 0.30m wave with a 3-second period does far more damage than a 0.30m wave with a 1-second period. Cox and Macfarlane's 2019 research at the Australian Maritime College confirmed this relationship.

Hydrofoils cut both height (85–90% reduction) and period. Combined effect: 90–95% less wake energy per passage. Height measurements alone understate the advantage.

1.3 The Wake Budget

To plan around wake constraints, we need a metric. The Wake Budget defines the maximum wake energy a corridor can absorb daily without exceeding erosion thresholds:

Wake Budget = Energy per Passage × Number of Passages

This converts wake from externality to planning parameter. It also reveals why more foiling vessels can mean less wake: the per-passage reduction dominates the frequency increase.

Table 2: Hourly Comparison: Same Passengers, Different Wake

Component	1 × 200-pax Ferry	6 × 30-pax Foils
Passengers/hour	200	180
Wake energy/passage	~95 kJ	~5 kJ
Total wake/hour	~95 kJ	~30 kJ
Budget consumed	100%	32%
Max wait	60 min	10 min

The foiling fleet uses one-third of the wake budget while delivering metro-frequency service.

1.4 Key Terms and Definitions

The following terms are used consistently throughout this document:

Displacement hull ferry: A vessel that operates with its hull in the water at all times, displacing water as it moves. This category includes conventional ferries such as Sydney's Parramatta River-class and RiverCat vessels. Also referred to as "conventional ferry" in this document.

Electric hydrofoil ferry: A vessel equipped with wing-like foils that lift the hull above the water surface at cruise speed, dramatically reducing wetted surface area and wake generation. Powered by electric motors and batteries.

Foiling mode: The operating state when the hydrofoil hull is lifted above the water, supported by submerged foils. Typically achieved at speeds above 16–18 knots.

Displacement mode: The operating state when any vessel's hull is in the water. For hydrofoils, this occurs at low speeds (below approximately 16 knots) and during transition phases.

Speed-restricted zone: Any waterway area subject to speed limits under maritime regulations. Includes "no-wash zones" (typically 4 knots), harbour transit zones (typically 15 knots), and wharf approach areas.

Wake height: The vertical distance from wave trough to crest, measured at a standardised distance (30 metres) from the vessel track. All wake heights in this document use this convention unless otherwise stated.

Wake energy: The kinetic energy delivered to shorelines by vessel-generated waves, measured in kilojoules per vessel passage (kJ/passage). This metric accounts for both wave height and wave period.

2. WHY MORE VESSELS MEAN LESS WAKE

The objection is obvious: won't more boats create more wake? No, and here's why.

2.1 Non-Linear Physics

Wake doesn't scale linearly with vessel count. Three factors matter:

1. Wake energy scales with the cube of speed.
2. Wake energy increases with displacement.
3. Foiling eliminates 95% of wetted surface, cutting wake proportionally.

Result: **a hydrofoil at 25 knots produces wake equivalent to a displacement vessel at 4 knots**—the typical no-wash zone limit. KTH verified this. Stockholm's regulators accepted it.

2.2 Continuous vs Discrete Wake

Displacement vessels generate elevated wake continuously—every metre of travel impacts shorelines.

Hydrofoils produce elevated wake only during transitions: 15–30 seconds at takeoff, 15–30 seconds at landing. During cruise—the bulk of the journey—wake stays below erosion thresholds.

Transitions can be positioned away from sensitive areas. Wake becomes a schedulable event, not an unavoidable impact.

2.3 Fleet-Level Numbers

For 3,000 daily passengers:

Parameter	Displacement	Foiling	Difference
Vessel size	200 pax	30 pax	—
Daily trips	15	100	6.7× more
Wake/trip	~95 kJ	~5 kJ	95% less
Daily wake	~1,425 kJ	~500 kJ	65% less
Wake duration	~7.5 hrs	~50 min	89% less

Despite 6.7× more trips, the foiling fleet delivers 65% less cumulative wake and 89% less time above erosion thresholds.

A Note on Wake Energy Figures

Two figures appear in this paper: ~5 kJ refers to foiling cruise only; ~15 kJ covers the full journey including transitions. Both represent 80–95% reductions versus conventional operations (~80–95 kJ). Fleet calculations use 5 kJ to show the physics. Appendix B uses 15 kJ for conservative route planning.

3. FREQUENCY BEATS SIZE

3.1 Two Models

Conventional planning maximises vessel size to reduce wake-generating trips. This made sense when all hulls were displacement hulls.

Displacement Logic

Capacity = Big Vessel × Few Trips

Large vessels concentrate wake per trip but kill frequency. Long waits suppress demand. Water transit can't compete.

Foiling Logic

Capacity = High Frequency × Low-Wake Vessels

Small foiling vessels stay below wake thresholds. High frequency generates demand. Water transit competes with roads.

3.2 The Service Quality Effect

Wait time uncertainty suppresses transit use more than journey time. A 5-minute-headway service captures different mode share than a 30-minute service—even with identical travel times.

Stockholm saw this: Route 89 ridership jumped 30% after P-12 introduction. Speed mattered. But show-up-and-go frequency mattered more.

Operating Class Comparison

Attribute	Displacement	Foiling
Speed limited by wake?	Yes	No (when foiling)
Wake scales with speed³?	Yes	Weak relationship
Viable frequency	Low	High
Elevated wake pattern	Continuous	Transitions only
Wake positioning	Unavoidable	Schedulable
Operating class	Wake-constrained	Frequency-enabled

Foiling isn't a better ferry. It's a different operating class—one that resolves the wake constraint rather than managing it.

4. HOW FOILING WORKS

4.1 Wake Physics

Displacement ferries push water aside (bow wave) and draw it back (stern wave). Wake energy scales with the cube of speed and increases with vessel weight. At 15 knots, a 200-passenger ferry generates 0.30–0.50m waves at 30 metres—with long periods that maximise erosion.

4.2 The Foiling Difference

Hydrofoils lift the hull clear of the water. Submerged foils generate lift like aircraft wings. Wetted surface drops from 15–20 m^2 to roughly 0.5 m^2—a 95%+ reduction that translates directly to wake reduction.

Component	Displacement	Foiling	Reduction
Wetted surface	15–20 m^2	~0.5 m^2	95–97%
Wake height @ 25 kt	0.40–0.60 m	0.04–0.08 m	85–90%
Wake energy @ 25 kt	~95 kJ	~5 kJ	~95%

SOURCE: KTH ROYAL INSTITUTE OF TECHNOLOGY; CANDELA P-12 DATA.

4.3 Operating Modes

Mode	Speed	Hull	Wake	Duration
Displacement	0–8 kt	In water	0.05–0.15 m	Wharf zones
Takeoff	8–16 kt	Rising	0.20–0.40 m	15–30 sec
Foiling	16–30 kt	Above water	0.03–0.08 m	Most of trip
Landing	16–8 kt	Descending	0.20–0.40 m	15–30 sec

Peak wake occurs during transitions—brief windows that can be placed away from sensitive shorelines. The rest of the journey stays below erosion thresholds.

5. STOCKHOLM: PROOF OF CONCEPT

The Candela P-12 'Nova' entered Stockholm's public transit network in late 2024. It's the first electric hydrofoil integrated into scheduled urban ferry service.

5.1 Route 89

Tappström to Stockholm City Hall: 15 km. Previous journey time by car or bus: 60 minutes. P-12 journey time: 30 minutes. Full fare integration with Stockholm's SL ticketing.

Parameter	Specification
Vessel	Candela P-12 'Nova'
Capacity	30 passengers
Cruise speed	25 knots (46 km/h)
Range	50+ nautical miles

5.2 Measured Performance

Metric	Diesel Ferry	P-12	Change
CO_2/pax-km	439 g	23 g	−95%
Energy use	Baseline	16%	−84%
Journey time	60 min	30 min	−50%
Wake @ cruise	0.30–0.50 m	0.03–0.08 m	−85–90%

Source: KTH lifecycle analysis (2024); Region Stockholm operations.

5.3 The Regulatory Precedent

Stockholm granted speed exemptions based on wake performance. The P-12 operates at **22 knots through zones limited to 12 knots for conventional vessels**—because its wake at 22 knots matches a displacement hull at 4 knots.

This is performance-based regulation in action. Wake outcome matters; hull type doesn't.

5.4 Passenger Response

Route 89 ridership rose 30%. Most departures ran fully booked during the trial. Passengers cited speed and reduced motion (active stabilisation eliminates most pitch and roll).

Region Stockholm expanded from five days to daily service in May 2025. Additional routes across the archipelago are under evaluation.

6. WAKE IMPACTS: A GLOBAL PATTERN

6.1 Documented Damage

Wake damage follows the same pattern across water cities. Research from the Chesapeake Bay, European estuaries, and Australian waterways tells a consistent story: vessel wake erodes shorelines not adapted to ongoing wave action.

Australian research quantifies the problem. The Aboriginal Heritage Office's 2019 Coastal Erosion Strategy reports that boat wake may be the leading cause of erosion in sheltered waterways. One-third of 240+ recorded Aboriginal sites on Sydney's northern harbour foreshores show significant erosion. Wake measurements on Sydney Harbour and the Parramatta River recorded heights of 0.25–0.87m for larger vessels at speed (Watson, 2012).

Similar studies on the Tweed, Clarence, and Murray rivers confirm the pattern—as do equivalent findings from the Chesapeake Bay, the Thames, and waterways across Scandinavia.

6.2 Universal Thresholds

Environmental limits apply regardless of geography:

- Waves as small as 0.10m erode vegetated shorelines (Coops et al., 1996)
- Marsh survival fails when waves exceed 0.30m more than 5% of the time (Schafer et al., 2003)
- Wake scours substrates, reduces clarity, and damages seagrass (Bilkovic et al., 2017)
- Cultural heritage sites—from Aboriginal middens to European canal infrastructure—face accelerated loss

6.3 Economic Scale

Coastal protection costs run to billions across water cities. Australia alone faces an estimated $30 billion in coastal protection spending over 50 years (Insurance Council of Australia). Wake is one contributor—but a controllable one.

Protection Measure	Cost (AUD)
Seawall construction	$500–2,000+/linear metre
Seawall maintenance (5-year cycle)	$50–200/linear metre
Bank stabilisation	$200–800/linear metre
Dredging (wake-induced)	$15–50/cubic metre

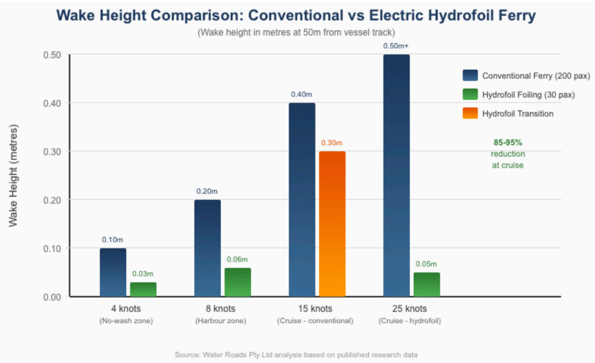
Sources: Insurance Council of Australia (2021); NSW infrastructure estimates.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Key Findings

1. Wake is the binding constraint on waterway capacity—not a secondary concern.
2. Hydrofoils cut wake height 85–90% and wake energy ~95% versus displacement hulls.
3. A high-frequency foiling fleet delivers 65% less cumulative wake than conventional operations at equal capacity.

4. More foiling vessels do not mean more wake. Per-passage reduction dominates.
5. Performance-based regulation can enable speed advantages while protecting shorelines.



7.2 Application Framework

These findings apply to any water city where wake constrains transit development. Implementation requires three elements:

Regulatory engagement: Apply for performance-based speed exemptions based on measured wake equivalence (25-knot hydrofoil = 4-knot displacement). Stockholm's precedent provides the model.

Corridor planning: Implement wake budgets. Position transition zones away from sensitive shorelines. Match fleet frequency to demand.

Fleet model: Deploy high-frequency foiling vessels to achieve metro-level service while cutting cumulative impact below current operations.

Sydney Example

Water Roads is applying this framework to Sydney Harbour and the Parramatta River. The Rhodes–Barangaroo corridor (detailed in Appendix B) demonstrates feasibility: 81% wake reduction, 50%+ journey time improvement, metro-frequency service on a route currently served by infrequent conventional ferries.

7.3 Policy Shift: From Speed Limits to Wake Limits

The findings point to a regulatory shift. If wake governs capacity, then wake—not speed—should be the regulated parameter.

Current rules impose speed limits as a wake proxy. That made sense when all ferries were displacement hulls with similar wake characteristics. It no longer fits available technology.

Performance-based regulation would set corridor wake caps—maximum energy per hour that shorelines can absorb. Operators would demonstrate compliance through measured wake, regardless of speed or hull type. A hydrofoil at 0.05m wake and 25 knots would pass where a displacement ferry at 0.40m wake would not.

Three benefits follow: environmental outcomes improve over speed proxies; superior technology delivers its full value; innovation incentives align with protection goals. Stockholm proved regulators will adopt this approach when shown the data.

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ABOUT WATER ROADS

Water Roads Pty Ltd operates sustainable passenger ferry services, combining CBS Group's infrastructure expertise with electric hydrofoil technology. Founded 2025.

Mission: metro-level waterway transit for water cities worldwide, using zero-emission foiling vessels—84% less energy, 50% faster journeys, protected shorelines.

Sydney serves as the launch market, with the 2026 Rhodes–Barangaroo service demonstrating the model: 15–25 minute journeys with 6-minute headways. Technology partners include Candela and Artemis Technologies. Water Roads holds agreements with Artemis and Candela with expansion pathways across Asia-Pacific and global water cities under development.

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Jeff Dusting brings a unique combination of aerospace engineering expertise and maritime passion to the challenge of sustainable urban water transit. His technical foundation spans aerospace systems, control systems engineering, hydrodynamics, and lightweight structures—disciplines that converge directly in electric hydrofoil vessel technology.

A lifelong sailor and aviator, Jeff's practical understanding of vessel behaviour, wave dynamics, and waterway and commuter operations complements his engineering credentials.

As CTO of Water Roads, Jeff leads the technical strategy for deploying electric hydrofoil ferry services across Sydney's waterways. His career spans over two decades in infrastructure-intensive industries, including leading asset management contracts for road tunnels with Transport for NSW, where his team achieved over $1 billion in validated savings through application of the CAPITAL framework for critical infrastructure.

His approach combines systems thinking with commercial acumen, challenging conventional precedents to unlock hidden value in infrastructure investments. Jeff is based in Sydney, Australia.

APPENDIX A: STOCKHOLM P-12 CASE STUDY

A.1 Background

In autumn 2024, Stockholm became the first city to integrate an electric hydrofoil ferry into its public transit network. The Candela P-12, named "Nova," commenced service on Route 89 connecting Tappström (Ekerö centre) to Stockholm City Hall, operated by Region Stockholm as part of the integrated Storstockholms Lokaltrafik (SL) public transport system.

A.2 Vessel Specifications

Parameter	Specification
Vessel name	Nova (Candela P-12)
Length overall	11.99 metres (39.2 feet)
Beam	4.5 metres (14.7 feet)
Passenger capacity	30 passengers
Cruising speed	25 knots (46 km/h)
Operating range	50+ nautical miles
Propulsion	Electric with hydrofoil lift
Wave handling	HS 1m (foiling), HS 2m (displacement)

A.3 Operational Performance

The Stockholm deployment provides validated operational data across multiple performance dimensions:

A.3.1 Journey Time

Route 89 distance: approximately 15 kilometres. Nova journey time: 30 minutes. Previous journey time (car/bus): approximately 60 minutes. Improvement: 50% journey time reduction.

A.3.2 Environmental Performance

Compared to diesel ferries operating the same route:

- CO_2 emissions: 95% reduction per passenger-kilometre
- Energy consumption: 84% reduction per passenger-kilometre
- Wake signature: Enables higher speeds through restricted zones

A.3.3 Passenger Response

- Most departures fully booked during trial period
- Route 89 ridership increase: 30% compared to prior periods
- High passenger comfort with reduced motion compared to conventional vessels

A.4 Service Expansion

Based on the successful autumn 2024 pilot, Region Stockholm has announced:

- April 2025: Service resumption after winter ice season
- May 2025: Expansion to daily operations (7 days per week)
- August 2025: Full pilot evaluation and assessment of additional routes
- Potential expansion to Stockholm's archipelago routes under consideration

A.5 Regulatory Framework

The Stockholm deployment operates within Region Stockholm's public transit framework, integrated with the existing ticketing system (SL). Notable regulatory aspects include:

- Speed exemptions granted based on demonstrated wake performance
- Vessel operates at higher speeds through zones with speed limits for conventional ferries
- Development funding provided by Swedish Transport Administration

A.6 Lessons for Australian Operations

The Stockholm deployment validates several factors critical to Australian applications:

Technology readiness: The P-12 has demonstrated reliable performance in demanding public transit operations with high passenger satisfaction.

Passenger preference: Strong demand (30% ridership increase) confirms that passengers value speed and comfort advantages over conventional alternatives.

Environmental verification: Real-world data confirms manufacturer specifications for emissions and energy consumption reductions.

Regulatory adaptation: Performance-based speed exemptions enable hydrofoils to deliver their full value proposition without compromising environmental protection objectives.

Integration model: The service integrates with existing public transit systems and ticketing, demonstrating feasibility of incorporation into established transport networks like Sydney's Opal card system.

APPENDIX B: ROUTE WAKE IMPACT ASSESSMENT

Rhodes to Barangaroo Service via Parramatta River and Sydney Harbour

B.1 Research Foundation

This appendix provides a segment-by-segment wake impact assessment for the proposed Water Roads electric hydrofoil ferry services. The analysis draws on research conducted by KTH Royal Institute of Technology in partnership with Candela, which established comprehensive wake measurement protocols.

Key research findings supporting this assessment:

- Hydrofoil vessels produce dramatically lower wake when foiling
- Wake reduction enables higher speeds in sensitive environments
- In Stockholm, P-12 operates at 22 knots while other vessels limited to 12 knots
- Low wake directly correlates with reduced shoreline erosion

B.2 Current Sydney Ferries Context

The F3 Parramatta River service is currently operated by Transdev Sydney Ferries using a mixed fleet:

- Parramatta River-class ferries (7 vessels, 200 passengers each) – delivered 2024–2025
- River-class ferries (10 vessels) – operating various harbour routes
- RiverCat (1 remaining vessel, MV Dawn Fraser) – approaching retirement

These displacement hull vessels generate wake heights of 0.30–0.50 metres at cruise speeds.

B.3 NSW Maritime Speed Regulations

Zone	Speed Limit	Location/Application
Sydney Harbour Bridge Transit Zone	15 knots maximum	Bennelong Point to Millers Point/Blues Point
Wharf approaches	4 knots	Within 100 metres of wharves
Proximity to vessels	6 knots	Within 30 metres of any vessel
Environmental Protection Areas	4 knots	Designated sensitive zones

B.4 Wake Physics Summary

B.4.1 Conventional Displacement Vessels

Speed	Wake Height (at 30m)	Wake Energy	Impact Zone
4 knots	0.05–0.10 m	Low	20–30 m
8 knots	0.15–0.25 m	Moderate	40–60 m
15 knots	0.30–0.50 m	High	80–120 m
20 knots	0.40–0.70 m	Very High	100–150 m

B.4.2 Hydrofoil Vessels (When Foiling)

Speed	Wake Height (at 30m)	Wake Energy	Impact Zone
15 knots	0.02–0.05 m	Very Low	10–15 m
20 knots	0.03–0.06 m	Very Low	15–20 m
25 knots	0.04–0.08 m	Low	20–25 m
30 knots	0.05–0.10 m	Low	25–30 m

Wake Reduction Factor: Hydrofoil vessels achieve 85–90% wake reduction compared to conventional vessels at equivalent speeds.

B.4.3 Operating Modes

Mode	Speed Range	Hull Position	Wake Height	Duration
Displacement	0–8 kt	In water	0.05–0.15 m	Wharf area
Transition (Takeoff)	8–16 kt	Rising	0.20–0.40 m	15–30 sec
Foiling	16–30 kt	Above water	0.03–0.08 m	Journey majority
Transition (Landing)	16–8 kt	Descending	0.20–0.40 m	15–30 sec

B.5 Segment-by-Segment Route Analysis

The Rhodes to Barangaroo route (approximately 12 kilometres) is analysed across six operational segments.

Segment 1: Rhodes Departure Zone (0.5 km)

Parameter	Candela P-12	Artemis EF-12	F3 Ferry
Operating Mode	Displacement	Displacement	Displacement
Speed	4 knots	4 knots	4 knots
Wake Height	0.05–0.08 m	0.05–0.08 m	0.05–0.10 m
Risk Level	LOW	LOW	LOW

Compliance Status: COMPLIANT with 4-knot wharf approach requirements.

Segment 2: Parramatta River West – Transition Zone (2.0 km)

Parameter	Candela P-12	Artemis EF-12	F3 Ferry
Operating Mode	Transition to Foiling	Transition to Foiling	Displacement cruise
Speed	8 to 25 knots	8 to 25 knots	15 knots
Wake Height (Transition)	0.25–0.40 m	0.30–0.45 m	N/A
Wake Height (Foiling/ Cruise)	0.04–0.06 m	0.05–0.08 m	0.35–0.45 m
Transition Duration	20–30 sec	25–35 sec	N/A (continuous)
Risk Level	LOW	LOW	LOW

Compliance Status: Transition wake limited to 20–35 seconds vs continuous for conventional vessels.

Segment 3: Parramatta River Central (2.5 km)

Parameter	Candela P-12	Artemis EF-12	F3 Ferry
Operating Mode	Full Foiling	Full Foiling	Displacement cruise
Speed	25 knots	25 knots	15 knots
Wake Height	0.04–0.06 m	0.05–0.08 m	0.35–0.45 m
Risk Level	LOW	LOW	HIGH

Key Advantage: Hydrofoil wake at 25 knots equals conventional vessel at 4 knots – 85% wake reduction while 67% faster.

Compliance Status: COMPLIANT. Superior environmental performance.

Segment 4: Parramatta River East (2.0 km)

Parameter	Candela P-12	Artemis EF-12	F3 Ferry
Operating Mode	Full Foiling	Full Foiling	Displacement cruise
Speed	25 knots	25 knots	15 knots
Wake Height	0.04–0.06 m	0.05–0.08 m	0.35–0.45 m
Risk Level	LOW	LOW	HIGH

Environmental Sensitivity: Cockatoo Island heritage area. Hydrofoil wake 85% lower than F3 ferry.

Compliance Status: COMPLIANT.

Segment 5: Sydney Harbour Bridge Transit Zone (2.5 km)

Parameter	Candela P-12	Artemis EF-12	F3 Ferry
Operating Mode	Foiling	Foiling	Displacement cruise
Speed	15–25 knots*	15–25 knots*	15 knots
Wake Height	0.03–0.08 m	0.04–0.08 m	0.30–0.40 m
Risk Level	LOW	LOW	MODERATE

* Speed exemption application recommended based on wake equivalence.

Environmental Sensitivity: High traffic, heritage shorelines (The Rocks, Kirribilli), cruise berths.

Compliance Status: Wake compliant; Speed limit subject to exemption.

Segment 6: Barangaroo Approach – Transition Zone (2.5 km)

Parameter	Candela P-12	Artemis EF-12	F3 Ferry
Operating Mode	Landing Transition	Landing Transition	Deceleration
Speed	25 to 4 knots	25 to 4 knots	15 to 4 knots
Wake Height (Transition)	0.25–0.40 m	0.30–0.45 m	0.20–0.30 m
Transition Duration	20–30 sec	25–35 sec	N/A
Risk Level	LOW	LOW	LOW

Mitigation: Begin transition at Dawes Point, complete before Walsh Bay.

Compliance Status: REQUIRES CAREFUL MANAGEMENT.

B.6 Comparative Summary

Total Journey Wake Profile

Vessel	Average Wake Height	Wake Reduction vs F3	Journey Time
Candela P-12	0.07 m (weighted)	81%	15–20 minutes
Artemis EF-12	0.09 m (weighted)	76%	15–20 minutes
F3 Parramatta River-class	0.37 m (weighted)	Baseline	45+ minutes

Wake Energy Per Trip

Vessel	Wake Energy (kJ/passage)	Percentage of F3
Candela P-12	~15 kJ	19%
Artemis EF-12	~22 kJ	28%
F3 Ferry	~80 kJ	100% (baseline)

Note: Wake energy measured as kilojoules per vessel passage, calculated from wake height, wave period, and journey distance.

B.8 Conclusions

The segment-by-segment analysis demonstrates that electric hydrofoil ferries achieve:

- 81% wake reduction (P-12) / 76% reduction (EF-12) vs F3 ferry
- 70–81% less cumulative wake energy per trip
- 67% faster journey times with superior environmental outcomes
- Significantly reduced heritage shoreline impact (Cockatoo Island, Walsh Bay, The Rocks)
- Minimal aquatic vegetation disturbance