Out of reach: Catchment-scale geomorphic assessment for urban development in Ipswich: The case for moving beyond the property boundary

Ben Pearson[1], George T. Robotham[1] and Samuel Munger[1]

1 *Hydrobiology, Brisbane, Queensland, 4064.* *Ben.pearson@hydrobiology.com*

Key points

- Ipswich's dispersive sodic soils, high-intensity rainfall and extensive vegetation clearing make it a geomorphically sensitive urban growth area.
- Geomorphic assessments submitted for development applications consistently stop at the property boundary, despite Ipswich City Council's own policies requiring catchment-scale consideration.
- Site-scale assessment is structurally incapable of identifying catchment-driven instability causes or predicting cumulative geomorphic change from sequential development approvals.
- ICC's existing policy architecture already justifies mandatory sub-catchment geomorphic assessment; the missing step is translating that intent into enforceable lodgement requirements.

Abstract

Ipswich City in South-East Queensland is among Australia's fastest-growing urban regions and sits within a catchment characterised by highly dispersive sodic soils, a history of extensive vegetation clearing and degraded waterways. Ipswich City Council (ICC) has developed a progressively sophisticated suite of planning and technical instruments over the past two decades that explicitly recognise catchment-scale geomorphological processes as fundamental to waterway health outcomes. Despite this, geomorphic assessments submitted in support of development applications routinely remain bounded by the property boundary, treating the subject site as a closed system rather than as a node within a catchment network. This paper examines the gap between the catchment-scale intent embedded in ICC's planning framework and the site-scale reality of geomorphic assessment practice. The Ripley Valley Priority Development Area is presented as a case study in which geomorphic regulation is comparatively rigorous, yet the catchment-scale appraisal imperative has been explicitly deferred. The paper argues that meaningful geomorphic assessment in Ipswich requires sub-catchment and catchment-scale characterisation as a prerequisite to site-level analysis and makes recommendations for how this could be formalised within the development assessment process.

Keywords

Catchment-scale geomorphology, urban planning, urban development, south-east Queensland

Introduction

Urban development in the Ipswich City Council (ICC) local government area (LGA) has expanded rapidly since the mid-twentieth century, accelerating from the early 2000s as one of South-East Queensland's designated major growth areas. The LGA now accommodates one of Australia's fastest-growing populations, with projections indicating a transition from approximately 175,000 residents in 2011 to over 435,000 by 2031 (Ipswich City Council, 2015).

The city sits primarily within the Bremer River sub-catchment of the Brisbane River catchment, although smaller portions sit within the Mid-Brisbane, Lower Brisbane, Lockyer and Black Snake sub-catchments. It is characterised by a subtropical climate with high-intensity summer rainfall, extensive historical clearing of native vegetation and a legacy of waterway modification spanning more than 170 years of European settlement, and much of the LGA is underlain by highly erodible and dispersive sodic soils (Ipswich City Council, n.d.-b, n.d.-c, 2014, 2025).

The consequences of failing to account for catchment geomorphology in land use planning are well documented. Elevated sediment loads, bank instability, headcut propagation and sand slug migration are recurring features of Ipswich waterways, documented across multiple Council technical instruments, waterway health monitoring programmes (Healthy Land and Water 2025), and unpublished consultants reports. Yet despite a planning and policy environment that has progressively incorporated catchment-scale thinking into its stated objectives, the geomorphic assessments submitted in support of development applications in Ipswich remain site-focused. They address the behaviour of the stream reach within or immediately adjacent to the development footprint, treating the upstream and downstream catchment as context rather than as the primary determinant of geomorphic condition.

In a catchment with the geomorphic characteristics of the Bremer River system, site-scale assessment is structurally incapable of identifying the principal drivers of geomorphic instability, which operate at sub-catchment to catchment scales and are transmitted downstream through sediment flux, altered flow regimes and progressive channel adjustment. The paper traces the evolution of ICC's planning instruments and demonstrates that the policy framework already provides the basis for requiring catchment-scale appraisal; the problem is one of translation into assessment practice rather than policy intent.

Priority Development Areas (PDAs) are declared under the *Economic Development Act 2012* (Qld) to enable state-coordinated planning and assessment of significant development sites outside the standard local government planning scheme. Several PDAs exist across South-East Queensland, but the Ripley Valley Priority Development Area (RVPDA) provides the most instructive case study. As ICC's most geomorphically regulated development context, the RVPDA represents the outer limit of what site-focused assessment has been able to achieve, and its own internal review documents record the explicit consideration and subsequent deferral of a whole-of-catchment approach. The paper uses this evidence to argue for a recalibration of geomorphic assessment requirements in the Ipswich development approval context.

The Bremer catchment: Landscape setting and geomorphic sensitivity

The Bremer River catchment covers approximately 2,030 km^2 and encompasses the full range of land uses typical of rapidly urbanising South-East Queensland, including agricultural grazing, coal extraction, industrial development and expanding urban residential estates (AECOM, 2010). The catchment drains through six principal tributaries before discharging to the Brisbane River at Ipswich. Deebing Creek and Bundamba Creek are of particular relevance to current development activity, as both drain significant portions of the RV growth area and are the waterways most exposed to the cumulative geomorphic effects of large-scale residential development.

The geomorphic sensitivity of the Bremer River catchment derives from several interacting factors. First, the dominant soil types exhibit a pronounced susceptibility to erosion. Nine soil types occurring across the 174,130 ha covered by the ICC LGA have been formally classified according to their erosion and geomorphic management implications (ICC, 2014; discussed further below). Of these, Vertosols and Sodosols are the most geomorphically significant and are extensively distributed across the catchment. Vertosols are cracking clay soils that frequently exhibit dispersive subsoils, high shrink-swell behaviour and sustained tunnel and gully erosion potential when subsoil horizons are exposed during construction. Sodosols are sodic, alkaline texture-contrast soils with highly dispersive clay subsoils described in the guidelines as vulnerable to sheet, tunnel and gully erosion under even moderate disturbance (ICC, 2014). The *Soils of Ipswich field guide* reinforces this characterisation, presenting an erosion risk matrix in which the combination of concentrated flow and dispersive or slaking soils produces the highest possible erosion risk classification (ICC, n.d.-b).

Second, the Ipswich climate is characterised by a seasonal subtropical rainfall regime. Mean annual precipitation is approximately 850 mm, concentrated in high-intensity summer events, against a mean annual evapotranspiration of approximately 1,300 mm (ICC, 2015).This combination produces extended dry periods during which dispersive soils consolidate and crack, followed by high-intensity rainfall events that drive rapid runoff generation and erosive force well in excess of the threshold required to mobilise fine-grained sodic subsoil materials.

Third, approximately 80% of natural vegetation within Ipswich's catchments has been cleared since European settlement (ICC, 2015). Vegetation clearing reduces infiltration rates, accelerates runoff generation, removes the root systems that bind bank soils and eliminates the riparian canopy that moderates bank exposure and flow velocities. The cumulative consequence is that channels within the catchments are still adjusting to a fundamentally altered hydrological and sediment regime, even where urban development is already well advanced. The ICC *Waterway and Channel Rehabilitation Guidelines* (AECOM, 2010) explicitly characterise this as a dynamic process, distinguishing between catchments in which channel adjustment is still active and those where adjustment has largely occurred and noting that the appropriate management response differs substantially between these conditions. This distinction is inherently a catchment-scale judgment that cannot be made reliably from a site investigation alone.

The *Integrated Water Strategy* (ICC, 2015) identifies erosion, sediment and dispersive soils as one of fifteen key water cycle issues, noting that high levels of construction activity combined with Ipswich's highly erodible soils represent a significant risk to the region's water cycle. The strategy also records that sediment is the major issue affecting waterway health in Southeast Queensland, consistent with findings of the Healthy Land and Water regional monitoring programme (Healthy Land and Water, 2025). The geomorphic sensitivity of the Bremer catchment is not therefore a narrowly technical or localised problem; it is a documented regional environmental concern with consequences extending from individual development sites to the receiving waters of Moreton Bay.

Evolution of the ICC planning and technical framework

It is evident from public documents that the ICC planning and technical framework relating to geomorphology and waterway management has developed substantially over the past two decades, reflecting a progressive if uneven recognition of the catchment-scale character of geomorphic processes. Understanding this evolution is important because it reveals both the sophistication of the current policy environment and the persistence of the gap between policy intent and assessment practice.

Early urban development in Ipswich proceeded with minimal formal consideration of geomorphology. Channel modification, including the conversion of natural waterways to concrete drains, was standard engineering practice throughout the post-war development era and into the 1980s. For example, Small Creek at Raceview was replaced with a concrete drain in the early 1980s following urbanisation of its catchment. The ecological and geomorphic consequences required a subsequent programme of costly remediation to reinstate the channel as a functioning waterway, including the removal of thousands of cubic metres of concrete and the installation of rock riffles, pools and native riparian vegetation (ICC, n.d.-c).

The *Riparian Corridor Revegetation Guideline* (ICC, n.d.-a) established baseline requirements for the reinstatement of riparian vegetation on public land. The guideline's recognition that bank positioning of vegetation must reflect the hydraulic forces acting on different zones of the bank represented an early acknowledgment that channel geomorphology must inform riparian management decisions.

The ICC *Waterway and Channel Rehabilitation Guidelines*, prepared by AECOM (2010) for ICC, represent a substantive step forward. The document establishes a framework for classifying waterways according to their level of modification and positions rehabilitation and remediation responses within the context of catchment condition. The guidelines explicitly instruct users to identify the current stage of development of the catchment before determining the appropriate rehabilitation response, noting that if the catchment is in the process of adjusting to urbanisation, works must address the increased flow regime rather than simply stabilise the existing channel. The guidelines further identify soil type, including dispersive and sodic soils, as a critical site-specific factor requiring assessment prior to any works, and acknowledge that managing dispersive and sodic soils is especially important in Ipswich given the extent of these materials across the city (AECOM, 2010).

The *Ipswich Soil Management Guidelines* (ICC, 2014), formalised the classification of the nine major soil types and their geomorphic management implications. The guidelines provide a practical field-based method for identifying soil type and characterising dispersiveness, slaking and erodibility, and are explicitly directed at informing planning decisions, development assessment and construction management. The guidelines acknowledge that erosion risk is influenced not only by soil type but by landscape position and water flow type, with valley floors and valley heads generating the highest erosion hazard due to concentrated flow accumulation from contributing slopes.

The ICC *Integrated Water Strategy 2015-2031* (ICC, 2015) represents the most comprehensive expression of the Council's catchment-scale water cycle management aspirations. Principle P4.5 of the strategy explicitly commits to considering impacts on the water cycle at multiple scales, being site, sub-catchment and catchment. Principle P3.16 calls for support of whole-of-waterway and catchment management plans and creek master plans. Principle P3.2 commits to managing the impacts of land development on waterways and wetlands. These commitments are embedded within a strategic framework with an identified implementation structure and annual reporting requirements. The strategy also acknowledges that stormwater infrastructure planning in Ipswich has historically operated on a site-by-site basis without a sub-catchment framework (ICC, 2015).The same critique applies with equal force to geomorphic assessment.

The ICC *Waterway Health Strategy* (ICC, 2020) consolidates and extends these commitments into a sub-catchment investment framework. The strategy identifies channel instability and sediment transport, driven by dispersive soils and altered hydrology from urban development, as the primary challenge facing Ipswich waterways, and structures its management actions around sub-catchment condition rather than individual sites. It explicitly calls for sub-catchment waterway and stormwater management plans to inform urban development decisions and identifies investigating the geomorphic impact of altered hydrology from new urban areas as a strategic priority. The Bundamba Creek and Deebing Creek sub-catchments are each assigned targeted actions requiring developers to stabilise channels, manage construction-phase erosion and sediment, and address cumulative stormwater contributions through the development process (ICC, 2020). That these requirements were articulated at a strategic level in 2020 makes the subsequent deferral of whole-of-catchment geomorphic assessment in the *RVPDA Improvement Plan* all the more difficult to reconcile with Council's own policies.

Taken together, these instruments constitute a policy and technical environment that is considerably more sophisticated than is typically reflected in the geomorphic assessment reports submitted as supporting technical documents for development applications in Ipswich. The instruments collectively establish that catchment condition is a prerequisite for sound geomorphic judgment and that site-scale analysis conducted in isolation from the catchment context is methodologically insufficient.

The RVPDA: Geomorphic regulation in practice

The RVPDA, established under the *Economic Development Act 2012* (Qld), represents the most geomorphically regulated development context in the Ipswich LGA. The PDA encompasses a large portion of the Deebing and Bundamba Creek sub-catchments in western Ipswich and has the potential to accommodate approximately 50,000 additional dwellings and a population increase of 120,000 residents (ICC, 2015) (Figure 1). Substantial patchwork urban expansion has already occurred across the area, with an assessment of aerial imagery showing considerable development between 2010 and 2026 (Figure 2).

The PDA development framework incorporates a range of geomorphic and environmental safeguards that are more stringent than those typically encountered in development approvals. The *Standard Conditions for the RVPDA* (ICC 2025b) require a geomorphic assessment by a suitably qualified geomorphologist, geotechnical and earthworks strategies supported by geotechnical reports identifying high-risk areas, compliance with AS3798-2007 for earthworks, specific provisions for managing soil dispersiveness and erosion prevention, and certification from registered professional engineers for all earthworks and related infrastructure. The conditions require strategies that address rehabilitation of waterways and native vegetation, with reporting against targets (ICC, 2025b).

These are not trivial requirements. They represent a materially elevated standard of environmental and geomorphic accountability. Yet they remain fundamentally oriented towards site management rather than catchment appraisal. The geotechnical and earthworks provisions address soil behaviour within and immediately adjacent to the development footprint. The environmental management strategies address rehabilitation of waterways within or directly influenced by the development site. Neither the standard conditions nor the broader PDA development scheme requires a prior assessment of the sub-catchment or catchment geomorphic context within which development is occurring.

The most direct and compelling evidence of this gap is provided by the *RVPDA Project Improvement Plan* (ICC 2024) which underwent a twelve-month review in July 2025 (ICC 2025c). Item 22 of the Improvement Plan identifies as an issue the lack of geomorphology and whole-of-catchment consideration in assessment of applications. The action identified is for ICC to investigate the merit of a whole of catchment approach, classified as medium priority with a long timeframe. However, the twelve-month update records that this item has been considered but will not be actioned as it is considered to be outside the scope of the Improvement Plan (ICC, 2025). The deferral is not attributed to a finding that catchment-scale assessment is unnecessary – it is a scoping judgment that addressing it falls outside a plan; the geomorphic case is implicitly conceded.

The *Integrated Water Strategy*'s Principle P3.16, calling for whole-of-waterway and catchment management plans for precisely the Bundamba and Deebing Creek corridors affected by RV development, highlights the opportunity to align development assessment practice more closely with Council's established strategic direction. The strategy explicitly identifies these waterways as facing development pressures and calls for their protection from inappropriate development (ICC, 2015). The development approval process for the PDA, as documented by the Improvement Plan, proceeds without a catchment-scale geomorphic baseline against which the cumulative effects of individual development approvals can be assessed.

The persistence of site-scale assessment

The RVPDA is not unique in this respect. Across the broader Ipswich development approval context, geomorphic assessments submitted as supporting technical reports for development applications consistently default to the site or property boundary as the assessment extent. This pattern is structural rather than accidental. It reflects the architecture of the development assessment process, which requests site-specific technical reports and provides no explicit mechanism for requiring a prior catchment-scale appraisal as a condition of lodgement.

The consequences of this structural default are predictable and well-documented in the geomorphic literature (Brierley & Fryirs, 2005; Fryirs & Brierley, 2013). A site-scale geomorphic assessment is capable of characterising the morphological condition of the stream reach within and immediately adjacent to the site, identifying visible erosion features, measuring cross-sectional geometry and characterising bank materials. What it cannot do is distinguish between erosion processes that are driven by local disturbances within the site and those driven by catchment-scale changes in flow regime or sediment supply. A bank that is actively eroding on a site assessed as part of a development application may be doing so because of historical vegetation clearing two kilometres upstream, because of a pipe outfall discharging high-velocity stormwater into the channel at a point immediately upstream, or because the entire catchment is in a state of ongoing channel adjustment following decades of progressive urbanisation. Site-scale assessment cannot reliably differentiate between these causes, and the management responses appropriate to each differ fundamentally.

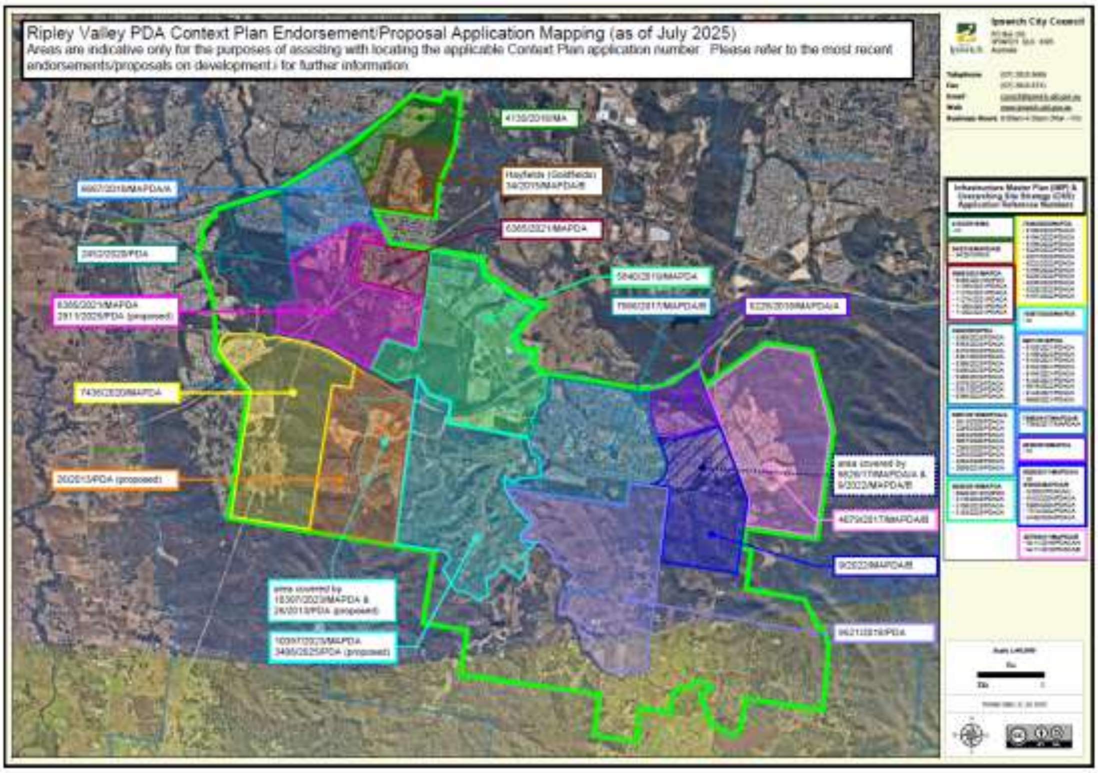

Figure 1 RV Priority Development Area context plan endorsement and proposal application mapping as of July 2025, showing the extent of the PDA across the Deebing Creek and Bundamba Creek sub-catchments(ICC, 2025a)

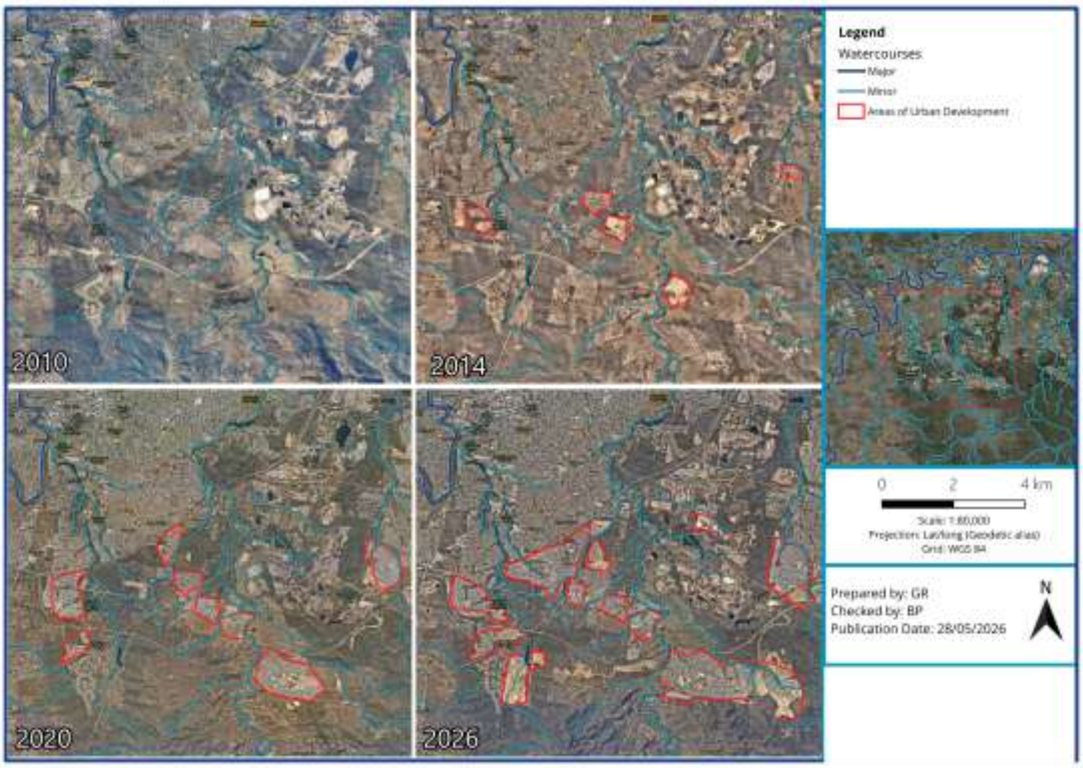

Figure 2 Urban expansion within the RV Priority Development Area between 2010 and 2026

As noted above, the ICC *Waterway and Channel Rehabilitation Guidelines* (AECOM, 2010) require the current stage of catchment development to be established before any rehabilitation response can be designed. The judgment between an actively adjusting catchment and one that has stabilised requires catchment-scale information that a site assessment cannot provide.

The ICC *Waterway Health Fact Sheets* (ICC, n.d.-c) reinforce this point at a conceptual level. Urban development disturbs land and turns natural creeks into modified channels. These changes increase the volume and velocity of stormwater which makes stream beds and banks unstable, with consequences that accumulate across the catchment and manifest downstream (ICC, 2025). The fact sheets also note that erosion and sediment occur in small increments over long timeframes, a description of a fundamentally catchment-scale and temporally integrated process.

The limitation of site-scale assessment is most acute in catchments that are actively developing, where sequential development approvals each generate incremental changes in flow regime and sediment supply that individually appear manageable but cumulatively produce significant channel adjustment. The Deebing Creek and Bundamba Creek sub-catchments within the RVPDA are precisely such catchments. Each approved development generates increased impervious surface area, associated increased runoff volume/velocity and a reduced lag time between rainfall and peak discharge. The cumulative effect of multiple development approvals across a sub-catchment is a progressively accelerated hydrograph that the natural channel network, already under stress from prior clearing and modification, must accommodate. While hydraulic modelling and approvals teams attempt to address these cumulative effects, site-scale geomorphic assessment of any individual development approval in this context is inherently incomplete because the assessment cannot account for the cumulative flow contribution from development already approved elsewhere in the catchment or from development to be approved in future.

The case for catchment-scale geomorphic appraisal

Geomorphic processes in alluvial and semi-alluvial catchments operate as systems. Sediment produced by hillslope erosion is transferred to channels through gully and rill networks, transported through the channel network at rates governed by flow competence and sediment supply, and deposited in zones where stream power falls below the threshold for transport. Changes in any component of this system produce effects that propagate in both upstream and downstream directions over timescales ranging from individual flood events to decades. Erosion observed at a development site may be the local expression of a headcut that originated kilometres upstream following a culvert installation or vegetation clearing event years prior. Bank stabilisation works at a development site may be undermined within a single flood season if the upstream channel is in active headward erosion. Neither scenario can be identified or predicted through site-scale assessment alone.

Catchment-scale geomorphic appraisal, by contrast, establishes the condition of the channel network across the sub-catchment or catchment, identifies the principal sources and sinks of sediment, characterises the stage of channel adjustment relative to historical and current catchment disturbance and provides a basis for predicting the trajectory of geomorphic change under the proposed development scenario. This information is directly applicable to the assessment of development applications: it allows the assessment to distinguish between geomorphic instability that is inherent to the catchment condition and instability specifically attributable to the proposed development, and to identify management measures that address the actual drivers of instability.

The ICC policy framework already provides the basis for this requirement. The *Integrated Water Strategy*'s Principles P3.16 and P4.5 (ICC 2015) commit to catchment-scale water cycle management and the development of whole-of-waterway management plans for the catchments most affected by growth. The *Waterway and Channel Rehabilitation Guidelines* (AECOM, 2010) explicitly require catchment condition assessment as a prerequisite to site-level design. The *RVPDA Standard Conditions* (ICC, 2025b) require Total Water Cycle Management (TWCM) Strategies that must guide future development decisions across the catchment. The policy architecture for requiring catchment-scale appraisal exists; what is missing is the translation of this intent into specific and enforceable assessment requirements within the development application (DA) process.

The mechanism for achieving this is not technically complex. A sub-catchment geomorphic assessment should be required as a supporting technical document for DAs proposing works within or adjacent to waterway corridors or that will generate significant increases in impervious surface area within a defined sub-catchment. This assessment should characterise the current condition of the network, the stage of channel adjustment, the principal erosion sources and sediment pathways and the predicted trajectory of geomorphic change under the proposed development scenario. This assessment could draw on existing catchment scale works that have been undertaken by ICC and other South-East Queensland organisations (e.g. Healthy Land and Water, Resilient Rivers, etc.) and be paid for by ICC with future developers required to pay for access to the assessment to inform site-scale geomorphic assessments.

Site-scale geomorphic assessment of the development footprint should then be conducted within this catchment-scale frame, with site-level recommendations explicitly linked to the broader catchment context. In Ipswich, particular attention to the distribution of dispersive Vertosols and Sodosols in the sub-catchment, the condition and connectivity of the riparian corridor, the degree of catchment development upstream and the proximity of the development to known erosion features such as active headcuts, bank failures and sand slugs.

Conclusions and recommendations

The geomorphic assessment practice currently prevalent in the Ipswich development approval context has not kept pace with ICC's own planning and technical framework. Site-scale assessment cannot reliably identify the drivers of instability or the appropriate management response, without consideration of catchment-scale drivers. ICC's *Integrated Water Strategy*, *Waterway and Channel Rehabilitation Guidelines*, *Soil Management Guidelines* and *RVPDA Standard Conditions* collectively establish an environment in which catchment-scale appraisal is not merely desirable but logically required — and the *RVPDA Improvement Plan*'s explicit identification and deferral of whole-of-catchment geomorphology as an assessment gap confirms that this deficiency is recognised at the operational level within the Council.

The following recommendations are made:

- ICC should formalise the requirement for sub-catchment geomorphic assessment as a condition of lodgement for DAs proposing works within or adjacent to waterway corridors or generating significant increases in impervious surface area. This could take the form of a single assessment undertaken by ICC to be used (and updated) by all future DAs.
- The scope of geomorphic assessment reports accepted as supporting technical documents for DAs should be explicitly defined to require characterisation of catchment condition, stage of channel adjustment and cumulative flow regime change as prerequisite elements. While developers should not be responsible for rehabilitating other parts of the catchment, any site-based development should be undertaken in consideration of the catchment geomorphology.
- The TWCM Strategies required under the *RVPDA Standard Conditions* should be expanded to include a sub-catchment geomorphic baseline that is updated as development proceeds and against an assessment of the cumulative geomorphic effects of sequential development approvals.
- Item 22 of the *RVPDA Improvement Plan*, identifying the lack of whole-of-catchment geomorphological consideration in the assessment of applications, should be reconsidered not as a process improvement matter but as an explicit assessment requirement, with the technical and resourcing implications subject to formal investigation by ICC in consultation with the development industry and technical practitioners.

The fundamental shift required is one of framing. Site-scale geomorphic assessment treats the development footprint as the unit of analysis and the catchment as context. Catchment-scale geomorphic appraisal treats the catchment as the unit of analysis and the development footprint as one of many contributing factors within a system. Only the latter framing is technically adequate to the task.

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