

Practice and Guidance note

River/ Stream Classification

This Practice and Guidance Note (PGN) sets out criteria and processes to classify whether rivers and streams, are permanent, intermittent or ephemeral. Correct classification of rivers and streams is essential to correctly apply the provisions of the National Policy Statement – Freshwater Management 2020 (Freshwater NPS), the Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (NES-F) and the Auckland Unitary Plan (Operative in Part) (AUP(OP)), in particular Chapter E3, Lakes, Rivers, Streams and Wetlands.

1. [Introduction](#)
2. [Key message to resource consent applicants](#)
3. [Application of this Practice and Guidance Note](#)
4. [Terminology and Definitions](#)
5. [River/ Stream Assessment Approach](#)
6. [River/ Stream classification using the AUP\(OP\) criteria](#)

[Appendix 1 Modelled river / stream classification](#)

[Appendix 2 Additional sources of information for classification of rivers/streams](#)

[Appendix 3 Relevant Definitions](#)

Disclaimer

The information in this practice and guidance note is, according to Auckland Council's best efforts, accurate at the time of publication. Auckland Council makes every reasonable effort to keep it current and accurate. However, users of the practice and guidance note are advised that:

- *the information provided does not alter the Auckland Unitary Plan, Auckland Council District Plan - Hauraki Gulf Islands Section, Resource Management Act 1991 or other laws of New Zealand and other official guidelines and requirements*
- *this document sets out general principles which may be used as guidance for matters relating to the interpretation and application of the Auckland Unitary Plan; it is not intended to interfere with, or fetter, the professional views and opinions of council officers when they are performing any function or exercising any power under the RMA. Each consent will be considered on a case-by-case basis and on its own merits*
- *Users should take specific advice from qualified professional people before undertaking any action as a result of information obtained in this practice and guidance note*
- *Auckland Council does not accept any responsibility or liability whatsoever whether in contract, tort, equity or otherwise for any action taken as a result of reading or reliance placed on Auckland Council because of having read any part, or all, of the information in this practice and guidance note or for any error, or inadequacy, deficiency, flaw in or omission from the information provided in this publication.*

1 Introduction

The Resource Management Act 1991 (RMA) defines “river” as being continually or intermittently flowing body of freshwater. The [National Policy Statement – Freshwater Management 2020](#) (Freshwater NPS), the [Resource Management \(National Environmental Standards for Freshwater\) Regulations 2020](#) (NES-F) and the [Auckland Unitary Plan \(Operative in Part\)](#) (AUP(OP)) include provisions for the management of permanent and intermittent rivers and streams. To achieve the outcomes of these statutory documents as they apply to rivers and streams, people must identify whether a river or stream is permanent, intermittent, or ephemeral in order to understand which rules apply.

This Practice and Guidance Note (PGN) sets out processes to identify whether rivers or streams are permanent, intermittent or ephemeral, and importantly to enable persons to determine the point where a river or stream transitions from ephemeral to intermittent.

For further guidance, please refer to the “Essential Freshwater Policies & Regulations” section of the [Auckland Design Manual](#).

2 Key message to resource consent applicants

Auckland is characterised by small rivers and streams. Intermittent rivers and streams can be difficult to identify and locate. This is especially true in modified environments. If works are being proposed and a river or stream may be present, expert advice should be taken to determine the nature of that river or stream and to determine what provisions apply.

3 Application of this Practice and Guidance Note

Identifying whether rivers or streams are permanent, intermittent or ephemeral is a technical matter and persons classifying rivers and streams must be suitably qualified and experienced practitioners (SQEP). The National Environmental

Standard guidelines¹ recommend that such an individual would possess the following qualifications:

- Relevant professional experience relating to freshwater ecology, assessment and the ability to undertake independent ecological evaluations (preliminary investigations)
- At least tertiary level education in ecology, environmental science or a related field, with one or more years of professional experience in freshwater ecological evaluations (detailed investigations)

At council's discretion and on a case by case basis, the council may request that the report produced by the SQEP in support of the classification, is also certified by a senior or principal freshwater ecologist.

4 Terminology and Definitions

This PGN uses the terms 'rivers' and 'streams' interchangeably when referring to permanent and intermittent flowing bodies of freshwater. This reflects the mix of terms on the definitions of the RMA and the AUP(OP).

The RMA defines river as:

A continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse; but does not include any artificial watercourse (including an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal)

The AUP(OP) refers to both rivers and streams. The AUP(OP) in [Chapter J](#) defines rivers and stream types as:

River or stream

A continually or intermittently flowing body of fresh water, excluding ephemeral streams, and includes a stream or modified watercourse; but does not include any artificial watercourse (including an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal except where it is a modified element of a natural drainage system).

¹ MfE. 2012. *Users' Guide National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health*. Wellington: Ministry for the Environment.

Permanent river or stream

The continually flowing reaches of any river or stream.

Intermittent stream

Stream reaches that cease to flow for periods of the year because the bed is periodically above the water table. This category is defined by those stream reaches that do not meet the definition of permanent river or stream and meet at least three of the following criteria:

- a) it has natural pools*
- b) it has a well-defined channel, such that the bed and banks can be distinguished*
- c) it contains surface water more than 48 hours after a rain event which results in stream flow*
- d) rooted terrestrial vegetation is not established across the entire cross-sectional width of the channel*
- e) organic debris resulting from flood can be seen on the floodplain or*
- f) there is evidence of substrate sorting process, including scour and deposition.*

Ephemeral stream

Stream reaches with a bed above the water table at all times, with water only flowing during and shortly after rain events. This category is defined as those stream reaches that do not meet the definition of permanent river or stream or intermittent stream.

Also see [Appendix 3 Relevant national and regional definitions](#).

5 River/ Stream Assessment Approach

5.1 Non-survey / desktop analysis

The first step is a non-survey/desktop analysis. The following should be used (when available) to improve confidence in drainage system classifications:

- Existing GIS data and tools (e.g., GeoMaps, Overland Flow Path layer, Modelled stream layer)
- Existing site data (local, regional and national datasets)

- Modelled data
- Current and historic aerial photography
- Existing literature
- Use local knowledge as much as possible (upstream, downstream, on-site, knowledge of previous years, photographs from the landowner)
- Understand relationships between drainage features and topography on the site and in the catchment

Some of the available information sources are provided in [Appendix 1](#) and [2](#). This information should be included with the assessment.

The SQEP should be aware of any new tools that are developed over time and have the ability to use them.

5.2 Field survey

The second step is a field survey. The first matter to consider when on site is whether the watercourse has evidence of intermittently or permanently flowing water. Clear evidence of extended periods of surface water or base flow in a watercourse include:

- Aquatic macroinvertebrates presence
- Obligate or facultative wetland or aquatic vegetation presence
- Algal growths
- Anaerobic / hydric soil presence
- Presence of a spring (hard to observe in summer)
- Fish species presence
- Historical evidence (e.g., fish records and historical flow data – prolonged flows)

If the watercourse exhibits some or all of the above features, then it is considered to be, at a minimum, an intermittent river.

Whilst it is possible for classification to be carried out at any time of the year, assessment confidence is highest in the wet season, particularly when assessing intermittent rivers and streams. River and stream classification assessments are best undertaken between July and October² when ecological functioning can be most accurately assessed. Assessment in the wet season may increase the uncertainty or difficulty of determining whether the watercourse is permanent or intermittent

² Neale, M W., Storey, R G and Quinn, J L (2016). Stream Ecological Valuation: application to intermittent streams. Prepared by Golder Associates (NZ) Limited for Auckland Council. Auckland Council technical report, TR2016/023.

classification, however, the key requirement for the NES-F and the AUP(OP), is the distinction between ephemeral and intermittent.

If initial assessments cannot be undertaken during the wet season it is possible to classify rivers and streams outside of these months. However, if conclusions cannot be formed with confidence, the watercourse should be considered intermittent until a follow up assessment can be completed in the wet season or an alternative method of classifying the watercourse can be agreed with council.

When undertaking a field-based assessment, the SQEP should apply the following:

- Familiarise itself with the catchment drainage system in the area. Before going to site, note the catchment drainage system in terms of its size and any modelled overland flow path status³ (available on GeoMaps), and use this as a high-level indication of the point of origin of the rivers onsite.
- The modelled overland flow path extent has generally shown a good correlation with survey data in instances where groundwater tables have not been artificially lowered. However, the modelled data should be treated as indicative only. It is recommended the actual extent of watercourses are obtained during the site inspection / field survey.
- Go to the site with the outcomes of the non-survey / desktop outcomes in mind and annotated on maps.
- Walk down from the top of the catchment and walk all tributaries; if the catchment extends beyond the property, assess the drainage system above and below the property in question to better understand the drainage features on the property.
- Walk over remainder of the site to determine if any offline wetlands are present (i.e., those wetlands not immediately associated with a river network).
- The assessment should not be spatially limited to any specific property, as rivers are connected systems and individual reaches cannot be considered in isolation.
- Assess drainage features that are visible at that time of year and that can be assessed with high confidence.
- Where high confidence predictions can be made, include these in the assessment (including assumptions).
- Compensate for levels of land use disturbance / anthropogenic impact.
- Consider factors such as preceding rainfall⁴ in comparison to the long-term rainfall mean and seasonality of the high water table. Local rainfall gauges should be detected to determine the volume and time since the last rainfall. Where flow gauges are available, these will also provide useful information.

³ Storey R and Wadhwa S (2009). *An assessment of the length of permanent, intermittent and ephemeral streams in the Auckland Region*. Prepared by NIWA for Auckland Regional Council. Auckland Regional Council Technical Report 2009/028.

Whilst this study was primarily undertaken to assess the length of different streams classes (permanent, intermittent and ephemeral) within the Auckland region, it is the best currently available tool for predicting the presence or absence of streams.

⁴ Rainfall data can be obtained from Auckland Council GeoMaps (Hydstra data) for the nearest rainfall monitoring station.

- Where livestock have had an impact on the watercourse, assess areas where stock have not had access immediately upstream or downstream of the site if possible, and carry out comparative assessments within less impacted areas as close as possible to the catchment. The assessment must not be made by observing one point, but rather should be made by observing the entire reach and upstream and downstream (where practicable).

6 River/ Stream Classification using AUP (OP) criteria

The third step is to assess the information gathered against the criteria set out in the AUP(OP) definition of permanent, intermittent and ephemeral river and stream. Whilst these do not apply to the NES-F, in the absence of other direction, these would form best practice guidance.

Permanent rivers are distinguished from intermittent and ephemeral streams by having continually flowing water year-round. However, due to the periodic nature of both intermittent and ephemeral streams, the process of distinguishing between these is more complex. Table 1 below sets out the criteria from the AUP (OP) definitions:

Table 1: AUP(OP) criteria for permanent, intermittent rivers and streams and ephemeral streams

Criterion	Definition
Permanent river or stream	
1	Evidence of continuous flow
Intermittent river or stream, or ephemeral stream	
Ceases to flow when bed is above water table. To be intermittent, a river must exhibit at least 3 of the following	
1	Evidence of natural pools
2	Well defined channel. Banks and bed can be distinguished
3	Surface water present (more than 48hrs after a rain event)
4	Rooted terrestrial vegetation not present across the entire cross-sectional width of channel
5	Organic debris present in floodplain
6	Evidence of substrate sorting processes, including scour and deposition
Ephemeral stream	
1	Stream bed above the water table at all times.
2	Water present only during and shortly after rain fall

6.1 Permanent and intermittent rivers and streams

The first matter to consider when on site is whether the watercourse has evidence of intermittently or permanently flowing water. Clear evidence of extended periods of surface water or base flow in a watercourse includes:

- Aquatic macroinvertebrates presence
- Obligate or facultative wetland or aquatic vegetation presence
- Algal growths
- Anaerobic / hydric soil presence
- Presence of a spring (hard to observe in summer)
- Fish species presence
- Historical evidence (e.g., fish records and historical flow data – prolonged flows)

If the watercourse exhibits some or all the above features, then it is considered to be, at a minimum, an intermittent river.

6.2 Intermittent and ephemeral rivers and streams

Determining whether a river or stream is intermittent or ephemeral can be challenging. The defining distinction between intermittent and ephemeral streams is that ephemeral streams always have a bed above the water table and only hold flowing water during and shortly after rain events. In contrast, the prolonged presence of water in the bed is a clear factor for intermittent streams.

The best time to make this determination is winter when the seasonal groundwater table is at its highest and intersects with the bed. If there is significant uncertainty in classification during the dry season, then the assessment should be re-done in winter, with a precautionary approach adopted in the intervening period (being the classification as an intermittent watercourse).

The following process provides a guideline for determining the status of a natural watercourse:

- **Question 1:** Is there flowing water year-round or flowing water present in the height of summer? If yes, then it is a permanent river or stream. Do not consider subsequent questions. If no, then the watercourse is either intermittent or ephemeral.
- **Question 2:** Is the bed below the water table at any time? If yes, then it is an intermittent river or stream. If no, then it is an ephemeral stream. If Question 2 cannot be assessed due to seasonality or uncertainty, then you must consider Question 3.

- **Question 3:** Can at least 3 out of 6 criteria in the intermittent stream definition be assessed with sufficient confidence? If no, then a wet season survey is required. If yes, then consider Question 4.
- **Question 4:** Are at least 3 of the 6 criteria in the intermittent stream definition met? If the answer to Question 3 is yes, then it is an intermittent river or stream. If no, then it is an ephemeral stream.

The definition of intermittent stream in the AUP (OP) includes six criteria used in determining whether a stream is intermittent. A diagrammatic representation of the assessment process is provided in [Section 6.4](#). It is recognised that there are some limitations to the application of these criteria, therefore it is required that the applicant engages a SQEP whom will exercise their experience and professional judgement when undertaking the assessment.

Criterion 1 – Does the river/stream have natural pools?

- Cannot be assessed with confidence when the watercourse has been trampled by livestock or where vegetation has grown across the watercourse during the dry season reducing the visibility of pools. Where stock have had unrestricted access, or where terrestrial vegetation has grown over the bed, pools may not be present.
- Natural pools are easily identifiable during the wet season when filled with water but may be more difficult to identify in the dry season.
- Pools retain water and the bed remains free of terrestrial vegetation for longer periods between wet seasons. A pool does not require the presence of water to be identifiable, and pool features can be assessed in the dry season.
- Pools must be easily distinguishable. Clear evidence it has formed by sustained flows. This includes evidence of deposition in the base of the pool, an absence of terrestrial plants, and connection to the streambed.

Criterion 2 – Is there a well-defined channel, such that the bed and banks can be distinguished?

- Cannot be assessed with confidence when the watercourse has been trampled by livestock or where terrestrial vegetation has grown over the bed in the dry season.
- In impacted area, the bed should be clearly identifiable - a simple test involves the following questions:
 - Can I point to the bed?
 - Can I point to the bank?
 - Can I, with confidence, place one foot in the bed and the other on the bank; and when I look down, can I clearly see the area where the change takes place?
- There is an identifiable transitional area between the stream bed and banks. A permanent river or stream is likely to have a narrow well-defined transitional area

(‘point of inflexion’, where there is clearly a change in the angle of the stream channel). An intermittent river or stream generally has a flat bed (however narrow) that transitions abruptly into sloped banks. There is a clear change in angle between the stream bed and the banks (a trapezoidal channel). An ephemeral stream has an indistinct or wide transitional area. An ephemeral stream generally has a concave or V-shaped channel.

- Sometimes there is no clear point of inflexion on both sides of the channel, such as on the inside bend of a river or stream. A river or stream can, therefore, have one bank–stream bed interface which is well-defined and still meet the test of ‘well-defined’. The presence of an active or relic floodplain is a good indicator of channel processes.

Criterion 3 - It contains surface water more than 48 hours after a rain event which results in stream flow

- This criterion cannot be assessed with confidence in dry conditions (i.e., summer months, outside of July to October).
- This criterion can only be assessed if the watercourse is inspected shortly after a suitable rainfall event that results in stream flow. In the absence of flow monitoring data, a suitable rainfall event is at a magnitude of 12-70 mm and will enable this criterion to be assessed with confidence. An inspection between 48 and 60 hours (2.5 days) after a suitable rainfall event is considered practically acceptable, although the aim must be to visit the stream as close as possible to the 48-hour threshold. The 48 hours is measured from the end of precipitation in rain events shorter than 6 hours, or once 90% of the rain has fallen in rain events longer than 6 hours.
- Surface water may be flowing water or still water in pools. Intermittent streams regularly do not have flowing water, especially in their upper reaches. The depth of the surface water is not important. Low volume and shallow flow are characteristic of intermittent streams.
- Note: An inspection after 60 hours only serves to validate the presence of surface water; it cannot be used to validate the absence of surface water.
- Rainfall data is best obtained from rain radar and the closest Auckland Council rainfall gauges, which are available here: <https://environmentauckland.org.nz/>. Due to the variability of rainfall events, it is recommended that multiple rainfall events are surveyed. Auckland Council’s long-term monitoring data indicates that seasonal base flows have returned in most intermittent streams during the period beginning August to end of November.
- Factors to keep in mind when assessing this criterion:
 - Surface water in intermittent rivers and streams is often disconnected, hidden beneath vegetation, and may comprise very diffuse and shallow water. The assessment must therefore include close-up examination of the bed, looking beneath organic debris or overhanging vegetation where the bed is not visible.
 - Rivers and streams may also go underground for short lengths, and these interceding sections comprise a functional component of the river/stream; to

prevent a false negative, rivers/streams should be walked moving down from the top of the catchment.

- Thin films of surface water may be absent in unshaded rivers/streams, whilst being present in shaded sections of rivers/stream.
- Base flow may at times and at certain locations be under the surface, with patches that have no surface flow.
- It is important to look upstream and downstream of the reach to determine whether there is flowing water which may be absent from the subject reach.

Criterion 4 - Rooted terrestrial vegetation is not established across the entire cross-sectional width of the channel

- Extremely difficult to assess with confidence from the end of October to July in streams that are not forested or where stock impact is evident.
- Terrestrial vegetation is unable to survive prolonged periods of inundation. The thalweg⁵ of intermittent rivers and streams generally remains devoid of terrestrial vegetation over the entire year in natural forested streams. However, at sites where a watercourse is not shaded by forested riparian margins, terrestrial vegetation tends to spread into intermittent river/stream channels as soon as they start drying up. This can make identification of this criterion difficult.
- In the dry season it can be difficult to use the presence or absence of terrestrial vegetation as a distinguishing feature between ephemeral and intermittent watercourses (in rivers/streams without riparian margins).
- When conducting the assessment in the above conditions:
 - Plants should be assessed as to whether they have spread into the stream bed since the end of winter, or whether they are present year-round (i.e. established).
 - Dominance of the bed by annual plants or opportunistic perennial plants (e.g., creeping grasses), is an indication that terrestrial plants are not established.
 - An absence of perennial tufted plants in the bed is an indication that terrestrial vegetation is not established in the bed.
 - Plants in the bed will generally have less fibrous root material than those on the banks; the less fibrous the root mass the more likely the river/stream is intermittent.
 - Terrestrial plants rooted in the bank may spread into the river/stream and obscure the stream thalweg⁵ / flow paths; it is necessary to lift up overhanging vegetation to inspect thalwegs⁵ / flow paths.

⁵ Thalweg definition: The longitudinal alignment of the lowest points along the entire length of a stream bed or valley in its downward slope, defining its deepest channel. Not defined in the RMA or AUP(OP).

- The presence of facultative wetland plant species (as per Clarkson *et al* 2013⁶) adjacent to or within the channel of a watercourse is an indication that the river/stream is likely to be intermittent rather than ephemeral, and a wet season survey is required for verification in such circumstances.

Criterion 5 - Organic debris from flood can be seen on the floodplain

- It is not possible to apply this criterion in situations where there are negligible upstream sources of organic debris, livestock impacts are too great, or streams are too incised to have a floodplain that floods regularly. Where organic debris sources are not available, the presence of non-organic debris (e.g., plastics and sediment) can be an indicator of the presence of an intermittent stream.
- The floodplain is the area outside of the stream bed and banks which is inundated when the stream floods / 'overbanks' (flows are high enough so that water spills out over its stream banks). The floodplain for an intermittent stream is relatively narrow. Organic debris includes twigs, sticks, branches, logs, leaves and other floating materials that have accumulated in the floodplain (up the bank, on flooded areas, and on vegetation). Whilst woody debris persists, herbaceous material degrades relatively quickly.
- The amount of debris accumulated is influenced by upstream catchment characters, land use, sources of debris, and artificial changes to stream morphology. This must be considered during the assessment, and the following questions should be addressed:
 - Is there an upstream source of woody organic debris?
 - Is there an upstream source of herbaceous organic debris?
 - Has there been a rainfall event within the past one or six months which overbanked the channel, respectively in rivers/streams with pasture or tree dominated upstream catchments?
 - Is the floodplain protected from livestock?
 - Is the floodplain protected from other land disturbances?

If the answer to the above questions is generally 'no', then it is unlikely that this criterion can be applied with confidence.

Criterion 6 - There is evidence of substrate sorting processes, including scour and deposition

- Cannot be assessed with confidence when the watercourse has been trampled by livestock, or other land use has significantly transformed the stream.
- Intermittent streams have evidence of substrate⁷ sorting due to prolonged flows in the watercourse. Signs of bed forming processes are:

⁶ Clarkson BR, Champion PD, Rance BD, Johnson PN, Bodmin KA, Forester L, Gerbeaux P and Reeves PN. 2013. *New Zealand wetland indicator status ratings*. Hamilton: Landcare Research.

⁷ The material on the stream bottom, including organic and inorganic material

- Variable sediment size aggregations in the bed and banks.
- Low quantities or the absence of humus in the watercourse.
- Distinct erosion and sedimentation patterns.
- Formation of sinuous channels, depositional bars, benching on the stream bank, accumulated mud, scour pools, under-cuts, head-cuts, side-cuts, riffles, alluvium, braided channels, and cascades.
- Substrate sorting is most visible in geologies that give rise to hard-bottomed streams as opposed to soft-bottomed streams. Most of Auckland's rivers/streams are soft-bottomed and are comprised mostly of mud (fine sand and clay), and substrate sorting processes are much more subtle. Furthermore, substrate sorting is less evident in spring-fed rivers/streams and headwater rivers/streams, and the assessment should be scaled to stream size / power.

Note

It is important to note that once a watercourse or river/stream reach has been determined to be permanent, all downstream reaches from that point are considered to be permanent. Similarly, once a river/stream reach has been determined to be intermittent, all downstream reaches from that point are considered to be, at a minimum, intermittent.

6.3 Factors complicating classification

Land use impacts can significantly affect the appearance and structure of watercourses and wetlands, and subsequently the confidence level at which the assessment can be completed. Land use impacts may make it difficult or impractical to apply all of the criteria as described above all of the time. As such, the criteria must be assessed in the context of the site.

Examples of the factors that may complicate the classification process are described in Table 2 to provide an insight into the complexities of stream classification, especially for differentiation between intermittent and ephemeral streams or wetlands. Some images of intermittent streams are shown below to provide some insight as to the challenges to classification. Potential solutions for overcoming these issues are described in Section 6.2.

Table 2 does not provide a complete set of issues to be considered, but instead provides an insight into the complexities of stream classification, especially for differentiation between intermittent and ephemeral streams or wetlands.

Piped flows (including piped streams, pipes for land drainage and piped stormwater networks) are generally not considered watercourses or wetlands, unless a natural stream or wetland was piped or drained unlawfully. If the latter applies, then the

relevant pipes and piped areas are classified in terms of what they would have been prior to unlawful modification.

Culverts and piped streams (undertaken legally) continue to provide some (albeit a small amount) of ecological function and contribute to maintaining catchment hydrology. Despite not being ‘water’ while contained within the piped reach under the RMA, these piped streams and culverts should be identified for the potential for them to be daylighted.

Table 2: Examples of factors which may complicate classification of intermittent and ephemeral streams and possible solutions for overcoming them.

Disturbance factor	Potential impact	Affected criterion (refer to Section 7)
Livestock trampling / access	Difficulty identifying stream bed / banks	Stream criterion 2
	Removal of flood debris	Stream criterion 5
	Removal of vegetation characteristics	Stream criterion 4
	Removes evidence of natural stream processes (i.e. substrate sourcing)	Stream criterion 6
Agricultural land use	Pastoral species can rapidly invade intermittent streams in summer compromising the ability to identify drainage features	Stream Criteria 1, 2, 3 & 4
	Associated watercourses are often free of sediment and weeds. This may eliminate vegetation and substrate characteristics required for the assessment	Stream criteria 4 & 6
	Agricultural streams will often lack riparian margins, therefore do not have a source of debris and so can result in no flood debris being present.	Stream criterion 5
Urban land use	Increased imperviousness may increase surface runoff and stream flow	Stream criterion 3
	Reduced infiltration may reduce ground and surface water flow, which may lower base flows and shorter periods of intermittent flow	Stream criteria 1 & 3
Disruption to natural watercourse flow	Constructed dams can alter surface water flow, making it difficult to determine natural flow regimes	Stream criteria 1 & 3
	Upstream water takes can impact duration, frequency and severity of stream flow / flooding, the incidence of flood debris	Stream criteria 1, 3 & 5
Watercourse modification	Reduced connection to floodplain can make it difficult to identify flood debris	Stream criterion 5
	Alteration of physical attributes	Stream criteria 1 & 2
Clearance of riparian vegetation	Reduction of potential sources of flood debris	Stream criterion 5
Watercourse size	Smaller / intermittent streams will not always have evidence of flood debris	Stream criterion 5



Examples of intermittent streams where riparian margins are fairly intact and stream criterion can be easily assessed. Photographs taken when flow present, however even in dry season, most of the criterion can be assessed with confidence.

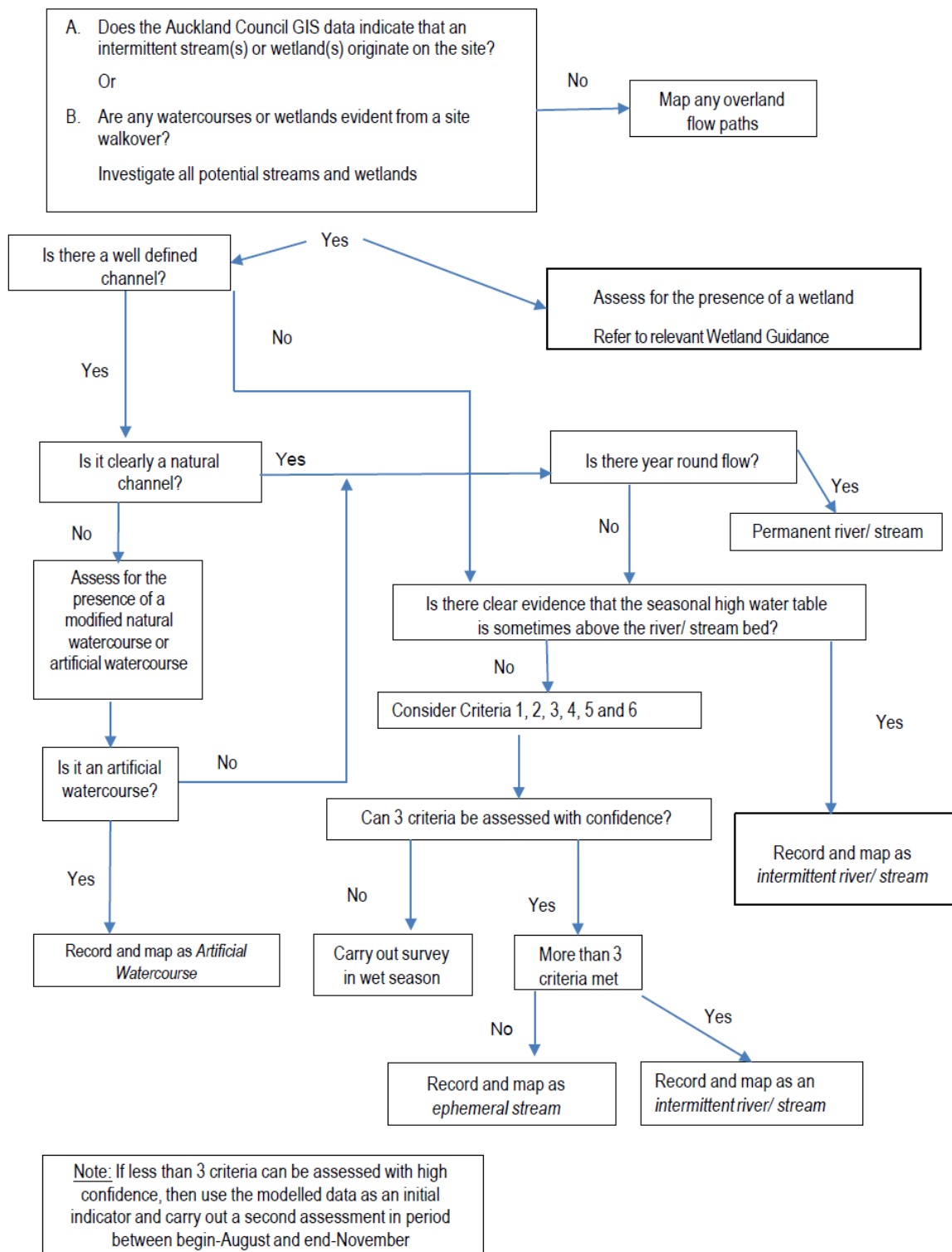


Examples of streams where the bed and bank are not easily distinguishable due to land use and topography. In dry periods, stream channels in both sites become effectively absent and other criterion are difficult to assess with confidence.



Example of streams where agricultural land use has significantly impacted the stream channel and subsequently makes classification of these systems difficult in dry season conditions. Terrestrial vegetation is present across the stream, due to stock damage, there is no upstream contributing organic debris and substrate sorting is absent. Catchment size, contours, evidence of flowing water more than 48 hours after rainfall and aerial imagery contributes to the classification of these streams. In dry season, these streams would not be identified, let alone assessed with confidence, and so a wet season assessment is essential.

6.4 Decision-Making Flow Chart – Stream Type



Appendix 1 Modelled river / stream classification

The findings of Storey and Wadhwa⁸ can be used as a general guide to identify the transition between ephemeral and intermittent river/stream reaches. Whilst this study was primarily undertaken to assess the length of different river/streams classes (permanent, intermittent and ephemeral) within the Auckland region, it is the best available tool for predicting the flow classification. Where land use has significantly affected river/stream morphology, this transition point may be the point at which wetlands have formed.

The Auckland Council overland flow path GIS layers are available for approximate application of the Storey and Wadhwa⁹ catchment figures. These are currently available on Auckland Council's GeoMaps. Although high level, these do provide a reasonable indication of river/stream status based on flow and should be a starting point for all assessments.

Table 2 Average threshold contributing areas (i.e., the size of catchments where stream channels are initiated); all values are in hectares

	Permanent	Permanent + Intermittent	Permanent + Intermittent + Ephemeral
Waitemata sandstone	2.8	1.68	0.84
Franklin volcanics	4.4	2.08	1.52
Mudstone	3.2	1.6	0.64
Sand country	5.8	5.44	3.88

*Note: These figures may vary as modelled maps are updated.

Storey and Wadhwa predict that intermittent rivers/streams are formed when catchments exceed 1.68 hectares in Waitemata sandstone areas; they also suggest that intermittent rivers/streams are likely to originate above the extent of the modelled floodplain. All these factors can be investigated using Auckland Council GeoMaps overlays (overland flow path, floodplains and contributing catchment size) and should be used as an initial step to determine stream status prior to fieldwork (refer to Figures 1 to 3 below).

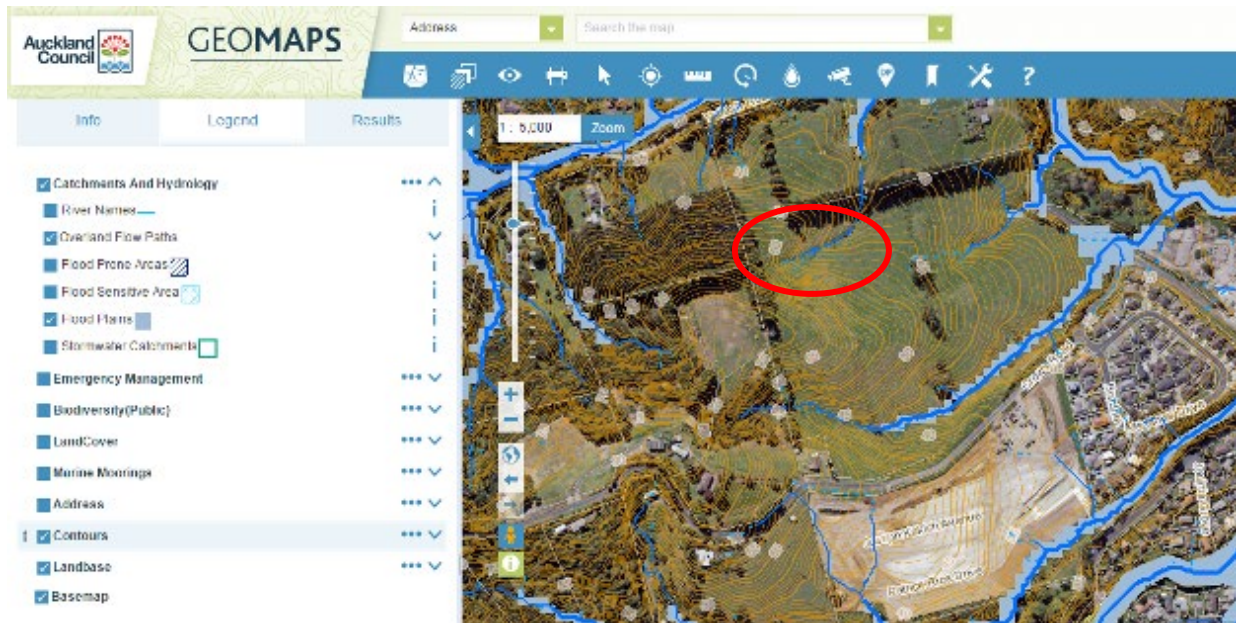
Auckland Council is currently working on an intermittent river/stream overlay that will be made publicly available and incorporated into GIS mapping tools (e.g., GeoMaps) once finalised. As such, it is important that applicants check the availability of this tool prior to undertaking preliminary desktop assessments.

⁸ Above in 3

⁹ *ditto*

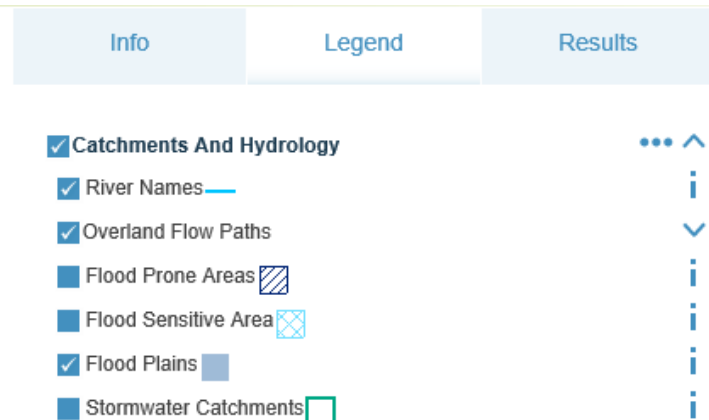
Figures 1 to 3 provide examples of the layers and information available in existing GeoMaps overlays.

Figure 1: Auckland Council Geomaps layers: contours, streams and modelled floodplains (Ranui).



The red circle indicates an intermittent stream that is fed by a degraded wetland

Figure 2: Auckland Council Geomaps layer tabs: catchment area and catchment overlays.

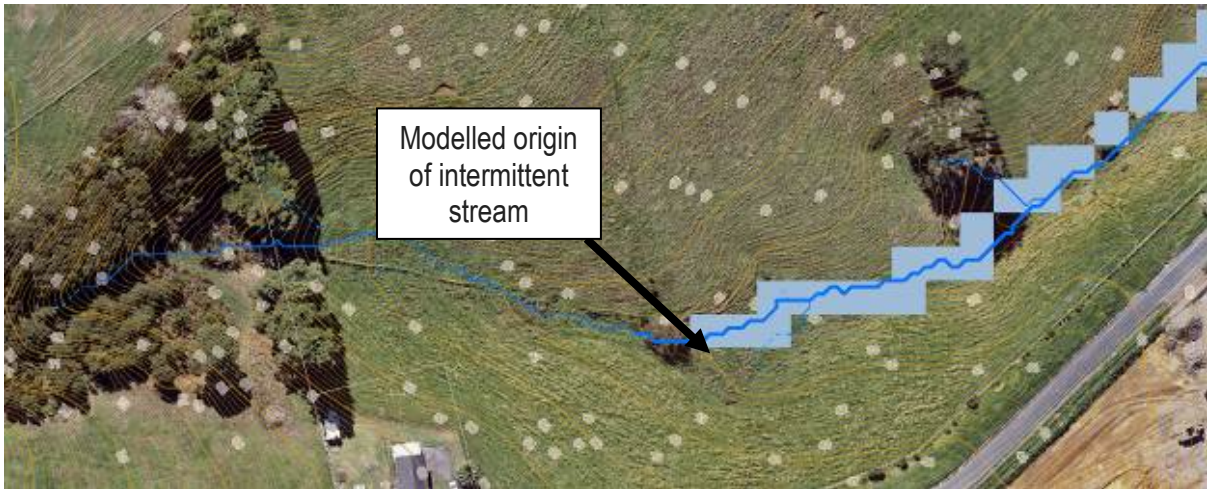


Relevant Geomaps layers

ARCID	GRID CODE	FROM NODE	TO NODE	CATCHMENT AREA
16033895	342368	16048937	16048402	342368
16034428	342248	16049471	16048937	342248
16034951	342136	16049988	16049471	342136

Contributing catchment areas (m²)

Figure 3: Close up of Ranui indicating how Auckland Council Geomaps layers can be used to determine the approximate origin of an intermittent stream.



Appendix 2 Additional sources of information for classification of rivers and streams

The following may be considered (*inter alia*):

- Auckland Council GIS data including:
 - Contours
 - Flood plains
 - Flood sensitive areas
 - Flood prone areas
 - Overland flow paths
 - River names
 - Catchment and Hydrology\ Water course assessment
- Fish surveys databases (e.g., NIWA)
- Auckland Council Watercourse Management Plans and Watercourse Assessment Reports
- Catchment Management Plans and Network Discharge Consents
- River Environment Classification (REC)
- Existing site data (any relevant local, regional and national datasets)
- Historic aerial photography
- Existing literature
- Use local knowledge as much as possible (upstream, downstream, on site, knowledge of previous years)
- A number of streams in the Auckland region have been surveyed; at the start of a project enquire with Auckland Council as to whether any surveys have been done for any specific property or stream, or upstream or downstream of the stream
- Forested streams in adjacent catchments provide opportunities for comparative assessments against degraded rural rivers/streams, improving confidence.

Note: Not all of the above may be accessible to the public, Council to assist where required.

Appendix 3 Relevant definitions

Table 3: RMA NPS Freshwater, NES-F and AUP(OP) definitions relevant to river and stream classification.

Legislation	Freshwater system	Definition
RMA (Part 1, Section 2)	River	A continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse; but does not include any artificial watercourse (including an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal)
	Water body	Fresh water or geothermal water in a river, lake, stream, pond, wetland, or aquifer, or any part thereof, that is not located within the coastal marine area
NPS Freshwater and NES-F	River	Has the same meaning as in section 2 of the RMA
AUP(OP) (Chapter J)	River or Stream	A continually or intermittently flowing body of fresh water; excluding ephemeral streams, and includes a stream or modified watercourse; but does not include any artificial watercourse (including an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal except where it is a modified element of a natural drainage system).
	Permanent river or stream	The continually flowing reaches of any river or stream
	Intermittent stream ¹⁰	Stream reaches that cease to flow for periods of the year because the bed is periodically above the water table. This category is defined by those stream reaches that do not meet the definition of a permanent river or stream and meet at least three of the following criteria (refer to Section 6 for more detail): <ul style="list-style-type: none"> a) it has natural pools b) it has a well-defined channel, such that the bed and banks can be distinguished c) it contains surface water more than 48 hours after a rain event which results in stream flow d) rooted terrestrial vegetation is not established across the entire cross-sectional width of the channel e) organic debris resulting from flood can be seen on the floodplain f) there is evidence of substrate sorting process, including scour and deposition
	Ephemeral stream	Stream reaches with a bed above the water table at all times, with water only flowing during and shortly after rain events. This category is defined as those stream reaches that do not meet the definition of permanent river or stream or intermittent stream.
	Artificial watercourses	Constructed watercourses that contain no natural portions from their confluence with a river or stream to their headwaters. Includes the definitions stated in the RMA (canals that supply water to electricity

¹⁰ Note that the definition of River or Stream takes precedence and if there is 'intermittently flowing' water, then the stream is intermittent. The additional characteristics are aimed to assist in a classification where intermittently flowing water is not present at the time of assessment.

Legislation	Freshwater system	Definition
		power generation plants; farm drainage canals; irrigation canals; and water supply races, but excludes naturally occurring watercourses.
	Surface water	Any freshwater waterbody located above the ground surface, includes lakes, rivers, streams, springs, water impounded by dams and wetlands