

# **WATERCOURSE ASSESSMENT REPORTS: A FRAMEWORK FOR INTEGRATED STREAM MANAGEMENT**

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## **ABSTRACT (300 WORDS MAXIMUM)**

Watercourse Assessment Reports (WARs) are documents developed by Auckland Council to guide watercourse and stormwater network management in the context of a holistic strategic approach for managing stormwater effects on streams. The WARs represent the most recent iteration in a series of program refinements towards developing a management methodology capable of achieving multiple objectives within realistic environmental, economic and social constraints.

WARs provide baseline data on the existing stream state, and are informed by comprehensive field watercourse assessments. The field-based surveys utilise a remote data collection platform and cloud storage services to capture attribute information in real-time, with the survey scope including assessments on the ecological character of stream reaches, stream mouths, and wetlands; the presence and condition of engineering assets; the identification of erosion and fish passage issues, and enhancement opportunities. In conjunction with desktop reviews, the WAR uses the results of field assessments to identify stream state and catchment issues. Grouping and prioritisation of key issues informs management options and zones for the catchment, supporting the delivery of a targeted works programme that seeks to remedy similar issues on a prioritised basis. The approach ultimately ensures that the most meaningful benefits on a catchment-wide prioritised basis are achieved through identification of where multiple issues exist.

WAR outputs offer a catchment specific framework for watercourse and network management which can inform and support a range of stakeholder aims (i.e. local boards, community groups, developers, infrastructure providers) and related stormwater management and development processes. Within the Auckland region this holds particular value where the WAR's will play an important role in informing the development process and delivery of watercourse and water sensitive design outcomes.

The paper will explore the refined WAR approach, and an example of the outputs that can be used by infrastructure providers to deliver prioritised catchment-wide network maintenance.

## **KEYWORDS**

**Stream, management, remote data collection, cloud storage, ecology, engineering, stormwater, conveyance, restoration, field assessment, infrastructure provider.**

## **PRESENTER PROFILE**

Rachel Turner - Rachel is a Senior Ecological Consultant with 4Sight Consulting Ltd.

Rachel is experienced in the management of ecological linkages, and has been involved in several developments in the Auckland region incorporating important

ecosystem services into projects. Rachel has led the development of several WAR's on behalf of the Auckland Council.

## **1 INTRODUCTION**

Stream networks are an integral component of the stormwater system, providing important storage and transportation functions. Effective stormwater conveyance is essential within the urban setting to protect natural and built environments and communities from the effects of flooding. Stormwater discharges and in-stream infrastructure however can place pressure on natural stream systems, which can lead to the occurrence of adverse effects. These include accelerated stream erosion and consequential loss of stream habitat, degraded water and sediment quality as a result of the discharge of contaminants derived from landuse activities, and sedimentation effects such as increased turbidity and sediment deposition (Kelly, 2008; Parshotam et al. 2008; Williamson et al. 2002). Drainage network structures such as culverts, outfalls, erosion protection and dams, are essential for maintaining stream flow and stormwater conveyance, however can also affect the nature and values of stream channels (Male, 2004).

In recognition of the impact of stormwater discharges on watercourses and in line with strategic directions (Auckland Plan 2012; Proposed Auckland Unitary Plan 2013), integrated management of streams is a priority objective for Auckland Council which seeks to balance stormwater conveyance needs whilst maintaining, and where appropriate, improving the ecological, cultural and community values of streams. The effective management of watercourses and the stormwater network seeks to achieve three key management outcomes:

1. Mitigation and remediation of specific stormwater impacts – stormwater discharges and in-stream network structures have the potential to adversely affect the values and physical nature of streams. Management focuses on identifying effects directly caused by stormwater infrastructure, managing and reducing these direct effects on a prioritised basis, and ensuring the legal operation of in-stream network structures.
2. Maintenance and enhancement of existing stream values – management should target areas where meaningful gains to improve ecological and habitat values are possible and particularly where opportunity exists to build on stormwater growth, renewal, or flood mitigation projects, or where Auckland Council can complement stream enhancement work carried out by other departments or organisations.
3. Engagement and working with community and Tangata Whenua groups to enhance stream values – management seeks to identify where targeted meaningful collaborative opportunities to enhance degraded streams exist to provide multiple stream and social benefits.

The WARs are a comprehensive tool developed by Auckland Council to assist in the integrated management of streams and their associated functions and values, and ultimately the achievement of the strategic directions. WARs represent the most recent iteration in a series of program refinements towards developing a management methodology capable of achieving multiple objectives within realistic environmental, economic and social constraints.

## **2 DISCUSSION**

### **2.1 WAR PROCESS**

The purpose of WARs is to collect meaningful data on engineering assets, biological and geomorphological stream state by way of a comprehensive stream survey, and provide a baseline (stream state and issues) assessment of watercourse condition at a point in time. The WAR process is conducted in accordance with a standardised methodology (Watercourse Assessment Methodology Version 2.0; Lowe et al. 2014), and provides a document and supporting database material for a catchment in order to inform effective management of stream ecological health, stormwater infrastructure and stormwater conveyance. A comprehensive description of the WAR methodology is provided by Lowe et al. (2014), however the preparation of a WAR can be generally divided into three distinct stages: a pre-survey desktop review of the catchment, a field-based watercourse assessment and the production of the WAR document and supporting geodatabase.

The pre-survey desktop review component summarises the results of any existing studies conducted within the catchment of interest, as well as reviewing any existing datasets. Available GIS information is examined and relevant data is used to build a geodatabase containing feature classes (GIS layers) and domains (pick lists) required for the field assessment of the streams within the catchment. The geodatabase is designed to be compatible with and integrated into Auckland Council GIS. The field assessment is conducted using data capture devices prepopulated with the geodatabase and a map space. Data is collected remotely with the aid of cloud storage services, allowing for capture of attribute information in real-time and ongoing quality assurance checks during surveys. The field watercourse assessment scope includes survey on the ecological character of stream reaches, stream mouths, and wetlands; the presence and condition of engineering assets; the identification of erosion and fish passage issues, and enhancement opportunities. Data gathered completes the geodatabase, which is able to be interrogated to inform the development of the WAR.

All collection and management of information (including the geodatabase), preparation of data capture devices, data analysis and reporting is conducted as per specific protocols outlined by the standardised methodology. The application of this standardised approach to data collection, storage and analysis provides a powerful baseline information source. A core element of the WAR process is the inclusion of specific protocols for data collection and management, which have been refined through several revisions (Figure 1; Lowe et al. 2014). The resulting datasets provide a robust standard for comparisons between catchments throughout the region and regional prioritisation of issues and works programmes.

The WAR document contains the results of the field assessment, summarising the findings and identifying broader watercourse issues within the catchment. Management zones and enhancement opportunities are also described and grouped to ensure the most meaningful benefits on a catchment-wide, or regional, prioritised basis are achieved.

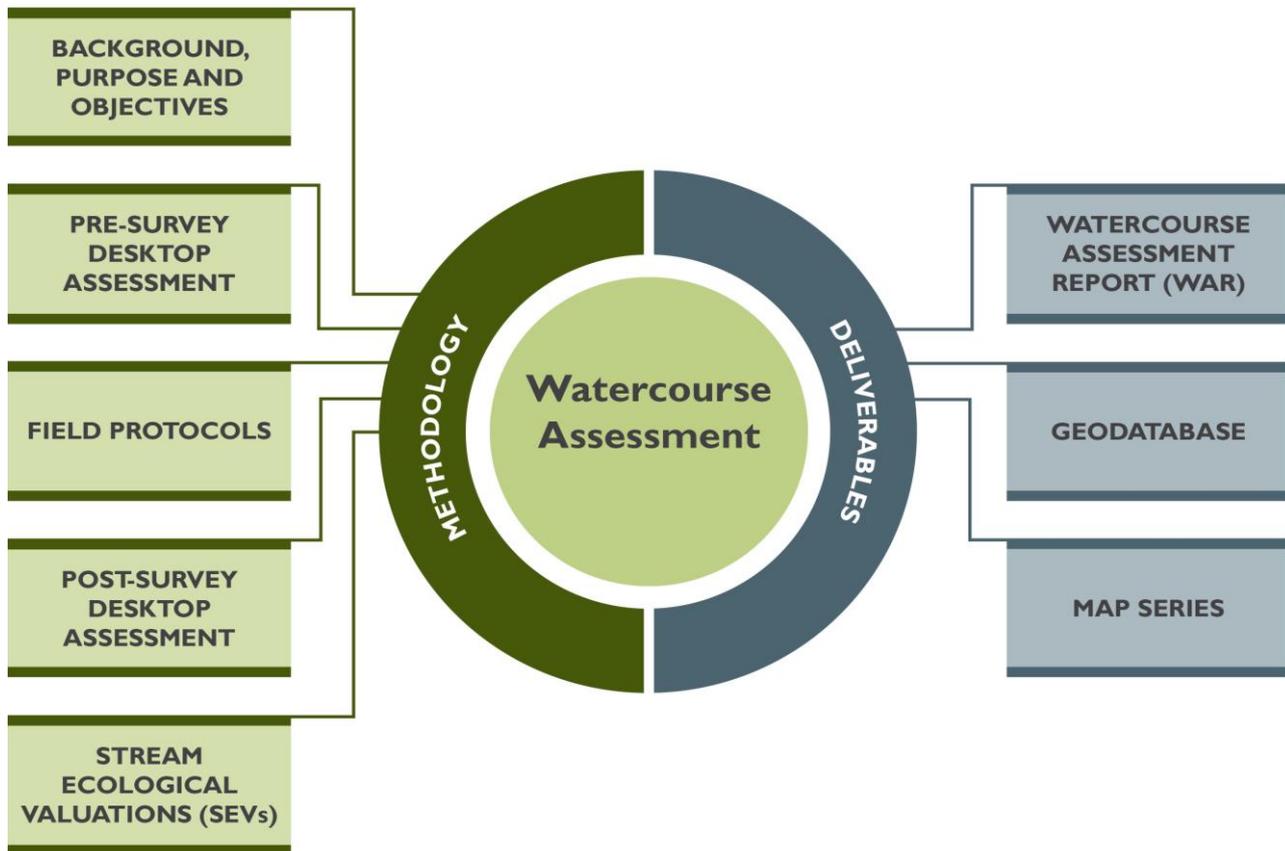


Figure 1: Relationship between data collection and management methodologies and the final WAR document and supporting geodatabase.

## 2.2 OUTPUTS AND APPLICATIONS

A key outcome of the revised WAR process is to direct interventions where the most meaningful multi-factor benefits can be achieved on a catchment-wide prioritised basis through the identification of priorities within the common stream or engineering issues.

Historically, management zones were developed on a high-level stream reach-by-reach basis with all of the issues being presented within that reach. In developing the revised WAR approach, key management priorities (the key issues) are grouped on a catchment wide basis called management "zones", such as where significant structural issues or erosion exists.

Within each of these zones and recognising that there is no "one size fits all" approach to stream or network management, the WARs then provide a tailored "tool-box" of ecological and engineering based solutions. These are based on the catchment and stream-specific management objectives, watercourse and engineering state and function and key issues, anticipated change (occurring within the catchment), and opportunities for accelerated delivery of strategic outcomes.

This revised approach identifies where priority issues exist at a stream/catchment-wide level focusing effort where it will provide the greatest benefit, and with the standardised approach to data collection, further allows for prioritisation of issues on a regional basis. Works programmes in turn deliver the benefits and efficiencies that can be achieved by remedying similar issues "at once" on a prioritised catchment / stream basis (and across the region).

An example of this revised management approach is within the Massey catchment located in West Auckland, where the development of a WAR identified the priority management issue for the Massey streams was related to asset maintenance - with 10% of the engineered assets identified as being severely damaged or at risk of imminent failure, and a further 40% of assets requiring some form of maintenance. Further, to help ensure that multi-factor benefits are achieved through the recommended stream restoration initiatives, specific areas for restoration opportunity are identified where multiple issues (from each of the above management zones) geographically overlap and where the most meaningful benefits on a catchment-wide prioritised basis to improve ecological and habitat values exist.

### **2.2.1 WHANGAPOURI WAR: A CASE STUDY**

The Whangapouri WAR was based on data gathered by a comprehensive stream survey conducted in February-May 2015. The Whangapouri catchment is largely rural with predominantly agricultural landuse, and was assessed due to planned future growth in the catchment. The surveys conducted found watercourses of the catchment reflecting a long history of vegetation clearance and farming, with many having very little channel shading and high loading of fine sediment. Most reaches assessed had bank vegetation comprised of exotic grasses. Fish fauna was dominated by the pest species *Gambusia*, reflective of the generally analogous nature of instream habitats within the catchment. Most of the engineering assets in the Whangapouri catchment are associated with the Pukekohe urban centre, with the majority observed to be in good condition. Maintenance and erosion protection requirements were identified as low, although complete or partial fish passage barriers were present in both urban and rural areas. Fish barriers were most frequently caused when culvert inverts were elevated above the channel causing a 'drop'.

The key management issues for the Whangapouri catchment, directed by Auckland Council stream management objectives, were identified and grouped into the following categories as prioritised below:

1. Lack of diverse riparian vegetation (high number of reaches with low overhead cover);
2. Adverse effects of run-off and sedimentation as a result of surrounding agricultural land use practices and common urban contaminants;
3. Spot "moderate" and "severe" asset erosion;
4. Occasional stormwater assets acting as barriers to climbing native fish and anguilliforms (eels); and
5. Routine (non-urgent) maintenance of stormwater assets.

The Whangapouri catchment is also recognised as an area of future growth for the Auckland region, and contains three Special Housing Areas (SHAs) to accelerate the delivery of residential housing. The approaching "large scale" change for the Whangapouri catchment towards an intensive residential and urban landuse provides an opportunity to develop an integrated management approach specific to the catchment that addresses current and future potential issues, and seeks to enhance the natural environment through low impact design principles and restoration opportunities – a water sensitive city (Ferguson et al. 2014). The "tool" to provide for this integrated development approach (for SHAs) are Stormwater Management Plans (SMPs), as required through statutory processes. The Whangapouri WAR therefore does not seek to replicate this existing process, however provides key baseline data, high level strategies

and priorities which can guide the preparation of SMP documents. In particular, identifying where key issues exist that may be exacerbated through (SHA) development, (e.g. erosion) or where restoration opportunities exist should any off-set mitigation be required.

The WAR will play an important role in both informing the development process and supporting the delivery of stream and water sensitive design outcomes by: (1) providing core baseline data for preparation of ecological reports and SMPs sought from developers as part of structure planning and plan variation/change proposals; and (2) informing any integrated, holistic stormwater/catchment planning by Auckland Council, potentially associated with any Auckland Council led SHA "master planning" process.

The Whangapouri WAR also identified the broader catchment issues (outside of the SHA's) and management priorities that could be implemented depending on regional priorities and drivers.

Overall, the ecological state of the Whangapouri watercourses was considered to be of low-value, with the appropriate prioritised management response focused on targeted management action(s) to maintain and enhance stream values at a meaningful scale within the identified SHAs. Therefore, "management zones" were informed by where overlaps and/or clustering of management priorities and the location of SHAs existed within the catchment, as these large scale landuse changes provided the greatest short-medium term opportunity for the accelerated delivery of strategic stream outcomes (Figure 2; Figure 3). The management priorities were characterised by stream reaches and engineering assets with the following attributes:

- Priority 1: Stream reaches within an SHA;
- Priority 1: Stream reaches with <10% overhead cover;
- Priority 2: Locations of erosion hotspots;
- Priority 3: Stormwater inlets and outlets with "moderate" or "severe" erosion;
- Priority 4: Assets acting as "partial" or "complete" fish passage barriers; and
- Priority 5: Assets assessed as requiring some form of maintenance.

The Whangapouri WAR provides a robust model for the use of the WAR process to not only provide management recommendations for the current state, but capture important baseline data able to inform ongoing management in an area earmarked for significant development and increased conveyance demands.

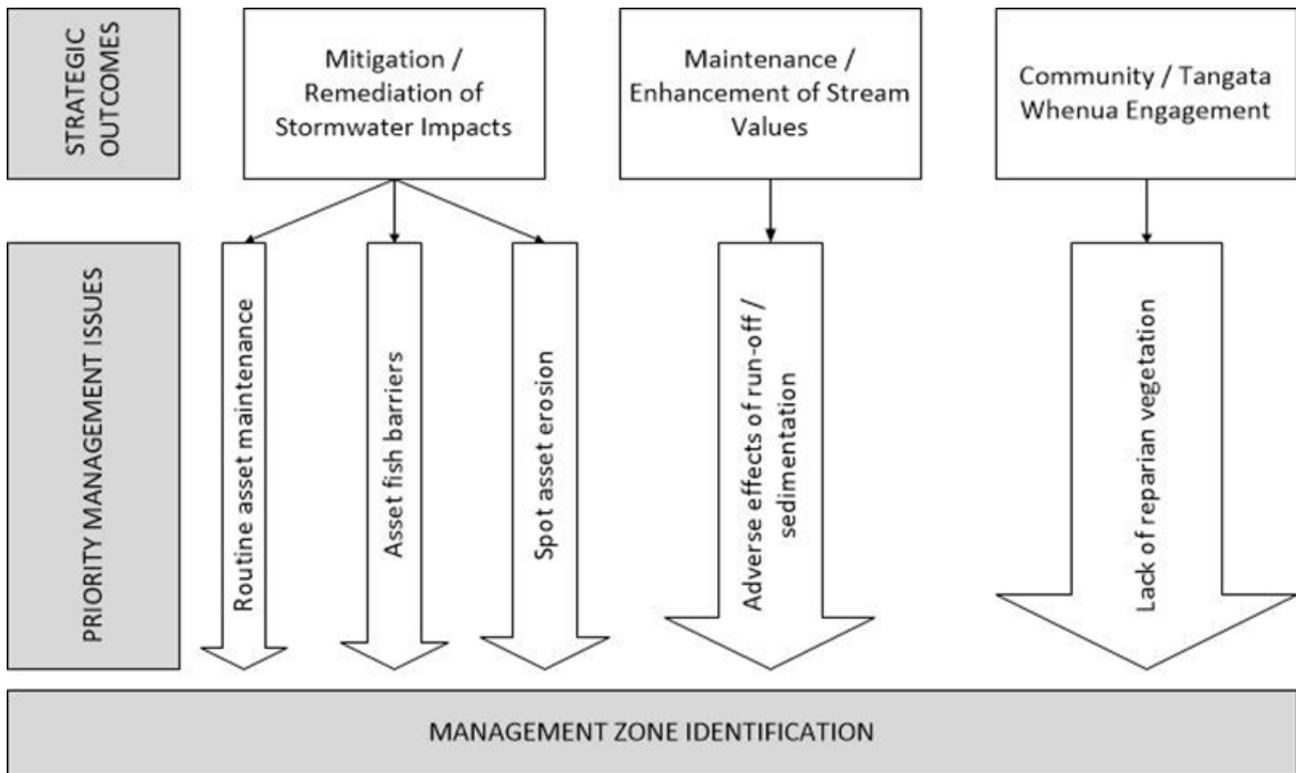


Figure 2: Relationship between strategic outcomes, priority catchment issues and management zones for the Whangapouri catchment. Size of the arrow indicates approximate priority weighting for management issues.

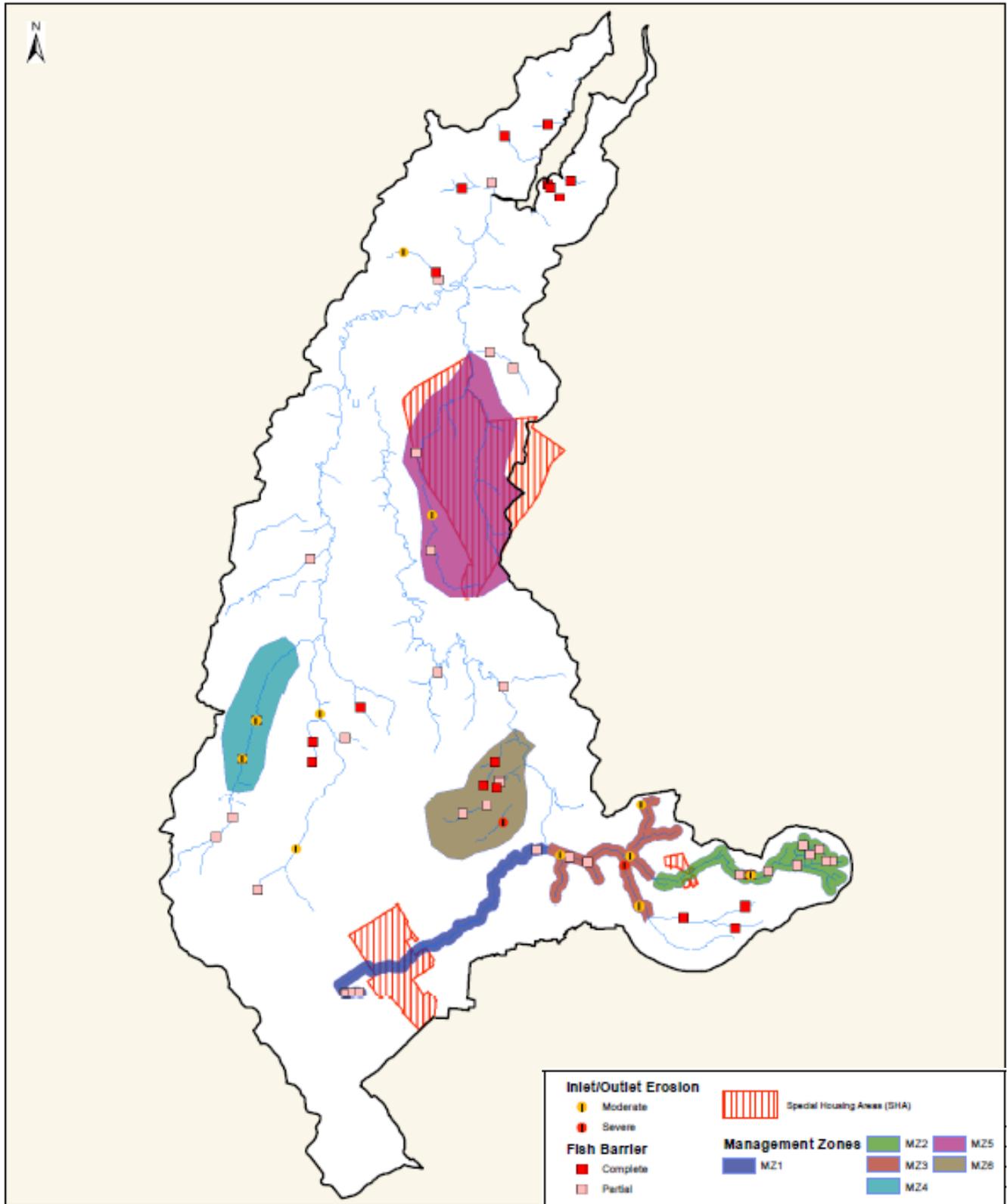


Figure 3: Locations of management zones within the Whangapouri catchment as identified by the Whangapouri WAR.

### **3 CONCLUSIONS**

The revised WAR approach builds on the development of almost 10 years of Watercourse Management Plans and the learnings that have arisen.

The current approach provides a more rapid and streamlined assessment and management framework that directs management focus where the greatest benefits can be achieved on a prioritised catchment and regional basis. The revised approach to management zones further promotes a more integrated approach to stream and network management with the opportunity to develop prioritised catchment-wide works programmes.

With the rapid growth and development of the Auckland region WARs will play an increasing role in both informing the development process and supporting the delivery of stream and water sensitive urban design outcomes.

As part of a holistic approach to stream management by the Auckland Council and key stakeholders, the WAR provide an integrated blueprint that can be used to inform management and restoration interventions and a stream and network management methodology that balances stormwater conveyance whilst maintaining, and where appropriate, improving ecological, cultural and community stream values.

### **REFERENCES**

Auckland Council. (2012). 'Auckland Plan 2012'.

Auckland Council. (2013). 'Proposed Auckland Unitary Plan 2013'.

Ferguson, B.C., Brown, R.R. and Werbeloff, L. (2014). Benchmarking Auckland's stormwater management practice against the Water Sensitive Cities framework. Prepared by the Cooperative Research Centre for Water Sensitive Cities for Auckland Council. Auckland Council technical report, TR2014/007.

Kelly, S. (2008). Environmental condition and values of Manukau Harbour. Prepared by Coast and Catchment Ltd. for Auckland Regional Council. Auckland Regional Council Technical Report 2009/112.

Lowe, M., Ingle, R., Young, D. (2014). Watercourse Assessment Methodology: Infrastructure and Ecology. [Prepared by Morphum Environmental] for Auckland Council. Auckland Council [technical report, TR2015/xxx]

Male, J. (2004). Pukekohe North Catchment Management Plan. Prepared for Franklin District Council. Dated August 2004.

Parshotam, A., Wadhwa, S., Semadeni-Davis, A. and Moores, J. (2008). South eastern Manukau Harbour contaminant study: Landuse analysis. NIWA Client Report HAM2008-162, NIWA, Hamilton.

Williamson, R.B., Blom, A., Hume, T.M., Glasby, G.P. and Larcombe, M. (1992). Heavy metals in Manukau Harbour sediments. Water Quality Centre, Hamilton, New Zealand.