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***Hawke's Bay Regional Council***

***Ruataniwha Water***

***Storage Project***

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**Terrestrial Ecology Study  
Project Inception Report**

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Reviewed by: Prof. John Craig, Patrick Stewart & Dr Stuart Parsons

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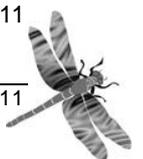
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## 1 Introduction

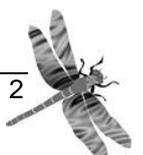
The Terrestrial Ecology Study is part of the wider Technical Feasibility and other Scientific Assessments studies that will provide the information for the resource consenting process for the Ruataniwha Plains Water Storage Project. Kessels & Associates (K&A) have been engaged to conduct an ecological impact assessment (AEE) and make recommendations regarding measures to avoid, mitigate or offset potential adverse effects. The scope of the project is limited to the methodology milestones set out in the Request for Proposal documents and the extent of physical works and flooding associated with the proposed Makaroro River Dam as shown in the site maps of the of MWH baseline ecological report and subsequent revisions by the Hawke's Bay Regional Council (HBRC). As part of the process HBRC requested that a project inception document is prepared. This report fulfils this obligation. The brief for the inception report is as follows:

*The purpose of this project inception document is to report on the review of existing information and discussions with HBRC project team and science team, along with Department of Conservation and Forest & Bird representatives and detail the methodology and work programme proposed along with the allocation of resources and requirements of other service providers and HBRC.*

Subject to the review of this inception report, we are satisfied that our study will ensure that the 10 key components as laid out in section 7 of the Request for Proposal can be met. These are as follows:

- a) Field Investigations to assess whether any rare and/or threatened plants are in the affected areas;
- b) Avifauna surveys to assess whether any rare and/or threatened birds utilise the affected areas;
- c) Field investigations to confirm the level of importance (or otherwise) of affected habitat for long-tailed bats;
- d) Field investigations to confirm the importance (or otherwise) of affected habitat for lizards, in particular to identify the presence or absence of threatened species;
- e) Field investigations to confirm the importance (or otherwise) of affected habitat for invertebrates, in particular to identify the presence or absence of threatened species;
- f) Ground truth and refine preliminary vegetation maps;
- g) Examine the impact of habitat loss on functional landscape ecology values;
- h) Report on the overall terrestrial ecology findings including quantification of key habitats that will be lost or affected for rare or threatened species;
- i) Effect of river morphology on terrestrial linked ecosystem values; and,
- j) Recommend any appropriate measures to avoid, remedy, mitigate, or offset any adverse effects identified under h) above.

This project inception report describes the results of the existing literature review, discussions with the HBRC project and science teams as well as with Department of Conservation and Forest & Bird representatives. It also describes the refined specific methodologies, proposed work programme, with allocation of resources, and the requirements of other service providers and HBRC. In addition, a Project Quality Plan and OSH Plan are attached as proposed in the K&A offer of service (Appendix I and II).



## 2 Review of Existing Literature and Information

A pre-feasibility study by MWH (2011) is the only site specific information available. The MWH study looked specifically at the site, maps the broad vegetation types and provided un-quantified information on native and exotic forest and scrub species as well as suggested lists of birds and lizards. It attempted to compare the distributions with national and regional priorities. The study has a number of inherent biases that may allow perceptions that the area is of considerable ecological significance. The first bias was to exclude the most common vegetation type (pasture) from the analysis. The report fails to quantify the area of indigenous forest lost within the context of what similar habitat remains within the affected ecological district or ecological region. This resulted in an overestimation of the importance of the forests that will be flooded if the proposed dam proceeds. In addition, the report records native 'woodland' as an important habitat whereas viewing of the area shows that these are a temporary habitat only as these old single trees are slowly dying and will not be replaced as they are totally surrounded by grazed pasture.

Three further reports, now out of print and not in electronic form (that we know of) have been supplied to us by the Department of Conservation (DOC). These are:

Fromont, M. 1991. Protected Natural Areas Survey of the Ruahine Lowlands. Department of Conservation, Hawke's Bay Conservancy Office.

Department of Conservation. 1992. Ruahine Forest Park Conservation Management Plan. Hawke's Bay Conservancy Series Number 4, Department of Conservation, Napier.

Lee, A. 1994. Heretaunga Ecological District. Survey report for the Protected natural Areas Programme. Department of Conservation, Napier.

In addition, the species list of the Blowhard Reserve Management Plan and "A checklist of the Arthropoda from Hawkes Bay New Zealand" by T H Davies have been passed to us by the Royal Forest and Bird Protection Society of New Zealand (Forest & Bird).

Review of these documents has led to slight alterations in the survey methods initially proposed and these are outlined in section 4 of this report – Refined Methodologies.

## 3 Preliminary Consultation with Key Stakeholders

### 3.1 Discussions with HBRC

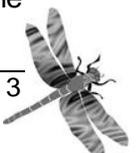
Discussions with HBRC staff included an office based introduction to current plans and a full field introduction to the areas associated with the proposed lake, dam, hydro development and the downstream riverbed. The process being followed along with both the approved changes and the details still being assessed were explained in full. Plans to focus all water storage on the Makaroro River, rather than having two dams along with a corresponding increase in height and larger size of the resulting lake, were outlined.

The introduction and field day included meeting the fresh water ecology contractors, the science coordinator and key staff from the HBRC feasibility team, and project co-ordinator, Stephen Daysh.

### 3.2 Department of Conservation

Neil Grant, a planner in the DOC Napier Area Office, attended the stakeholder meeting and provided comment and answers on a range of related issues. He provided information on past sightings of blue duck which has been incorporated in our field methodology to ensure that the possible presence of this rare species will be checked.

When asked about the availability of PNA and other documentation, Mr Grant suggested a further meeting at the Area Office. Subsequently, a 90 minute meeting did eventuate and considerable documentation relevant to the proposal was obtained. Full support, in terms of providing technical baseline information for the terrestrial ecology investigations was offered on behalf of the Department by Mr Grant.



### 3.3 Forest & Bird Society

Two representatives of the local branch of Forest and Bird attended the stakeholder meeting. They spoke of their interest and familiarity with the wider area. They expressed some concern at the proposed flooding of old trees and habitat. However, they were also interested in the advantages of potential mitigation. Considerable time was spent discussing long-tailed bats and the options for their future if found.

As for the DOC representative, considerable offers of assistance were detailed. Names of potentially helpful scientists and amateurs were offered and some will be followed up. They expressed interest in reviewing this document and the final results and recommendations when available.

Subsequent to this meeting the plant and animal species list contained with Blowhard Reserve Management Plan was forwarded on to K&A from Forest and Bird via HBRC. This list has been reviewed to ensure that the proposed survey methods are adequate for the species lists, which also are likely to be within the proposed dam/lake site.

## 4 Refined Methodologies

### 4.1 Background

The ten objectives of the terrestrial flora and fauna surveys as listed above, will be largely achieved by undertaking robust and comprehensive field surveys and subsequent accurate analysis of the data resulting from the field surveys, including: the mapping of all major vegetation and fauna habitat communities, compiling a list of species and their distribution and key habitats within the dam/lake footprint.

The species list will be used to help identify whether any rare, threatened, or ecologically significant species are present at the sites, to assess the ecological sensitivity of those habitats from a regional and national perspective and to quantify the risk that the proposed habitat disturbance or destruction may pose to them.

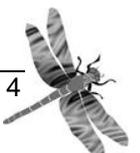
In addition, the information collected from this survey will be used to develop quantitative biodiversity offset mitigation measures aimed at minimising adverse effects on all significant indigenous flora and fauna species and their habitats from development of the proposed water augmentation scheme.

### 4.2 Vegetation Surveys

The first step in the vegetation assessment will be to redefine and map broad vegetation and habitat communities. The proposed dam/lake footprint will be visually rechecked and assessed from high vantage points and up to date aerial photography. The MWH preliminary vegetation type descriptors will be redefined and mapping GIS poly-lines redrawn as required. Importantly, pasture, treeland, exotic forest and shrublands track/road and river gravel bed habitats shall be mapped and areas for each type calculated so that a suitable comparison of indigenous versus exotic (and non-ecologically significant) habitats can be made.

Fieldwork will comprise of semi-quantitative survey plots in major indigenous vegetation community types within the proposed dam/lake footprint in conjunction with opportunistic searches for threatened plant species. Attention will also be given to the margins of the proposed lake edge and tributary streams to assess the potential for wetland habitat to be recreated around the new lake edge.

Specifically, within all major indigenous vegetation community types, one to two 20 m x 20 m RECCE (Reconnaissance) plots will be taken and recorded in accordance with standard protocols as described by Allen – *“RECCE An Inventory Method for Describing NZ Vegetation: A Field Manual.”* In addition, a general survey of all plant species in all tiers shall be assessed within the proposed dam/lake footprint. The number and location of RECCE plots shall be determined at the first site survey.



A vascular plant species list will be compiled from field records. The RECCE results will be run through a software model to assess the relative composition and abundance of each vegetation type within the surveyed sites. The interpretation will be based on an assessment of vegetation diversity and abundance as well as plant and animal pest influences.

Existing and potential weed and browsing animal pests shall be assessed and characterised in terms of potential risk and threat associated with the creation of a lake in the locality and any associated restoration and recreation of lost habitats.

The vegetation mapping and field survey shall be conducted by Britta Deichmann in September, October, November and December 2011.

The presentation and analysis of the data shall also be conducted by Britta Deichmann, with interpretation in terms of ecological significance and sensitivity being carried out by Gerry Kessels in conjunction with Britta Deichmann. Peer review of the results and interpretation shall be undertaken by Professor Bruce Clarkson of the University of Waikato.

### **4.3 Bat Surveys**

Long-tailed bats are the New Zealand bat species expected to be found within the proposed dam/lake footprint.

Acoustic monitoring, via the deployment of Automated Bat Monitoring (ABM) detectors will be conducted along the edge of:

- 1) forested areas to be flooded.
- 2) forested areas that surround those to be flooded.
- 3) connecting landscape features that may be used as movement corridors by bats (tree-lines, hedgerows, etc).

It is important to also survey surrounding forested areas and connecting landscape features as these represent refuge for bats displaced by flooding, and the corridors along which they will move.

At least twelve ABMs shall be deployed throughout the proposed dam/lake footprint site for three 5 day survey events – the first in Late November/December 2011 and again in January 2012 and February 2012, during suitably warm, calm weather (no rain; dusk temperatures above 10°C), when bat activity is expected to be at its highest.

The data from each of the ABMs shall be downloaded to a hard drive in the field at the end of each survey event. All recordings will be inspected visually and acoustically using “Bat Search Software 1.02”. Any detected bats calls will be classified into one of four categories:

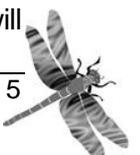
- Search phase calls (calls emitted by bats moving from one location to another);
- Feeding buzzes (calls produced by bats as they attempt to feed or as they approach objects in their path); and
- Social calls (used for intra-specific communication).

From this data, bat utilisation of habitats within the footprint, including any key roost sites and foraging areas, and estimates of local population can be determined.

Gerry Kessels and Patrick Stewart shall conduct the deployment of the ABMs. Dr Stuart Parsons shall assist with the initial on-site placement ABM. Mr Stewart shall compile the data analysis and initial interpretation of data. Review and final interpretation of data shall be undertaken by Dr Parsons.

### **4.4 Herpetofauna Surveys**

A range of passive techniques are proposed for the lizard surveys. This is to avoid seeking permits from DOC for capture of wildlife as well as to reduce labour costs (e.g. pit fall trapping requires daily inspection). Each method and its application to lizard survey is briefly described below. These techniques will be employed in combination with the other surveys being conducted by the field staff in order to further reduce deployment and checking times. The lizard surveys will



be conducted by Gerry Kessels and Patrick Stewart. The lizard survey, data analysis and interpretation shall be peer reviewed internally by Ian Southey (sub-contracted to K&A).

The specific survey procedures are as follows:

**Day & Night Habitat Searches:** This method involves day & night time visual searches of habitat (using the naked eye and binoculars) for basking and/or feeding skinks and geckos, and physical search of day time lizard retreats, e.g. tree bark, rocks, logs, standing dead trees, vegetation, leaf litter, for inactive lizards. Success with this method often depends on the experience of the observers and their familiarity with lizard behaviour and habitats. A minimum of 40 hours of lizard searches are proposed within the dam/lake footprint. Results shall be reported as catch per unit effort (CPUE), number of lizards/person/hour/site.

**Artificial cover objects:** (ACOs) are artificially created retreats designed to attract lizards to use them as shelter and/or a means to assist with thermoregulation. Their primary application to date has been as a method of lizard detection for survey and/or monitoring. ACOs will be placed in each major vegetation community within the proposed dam footprint: They will be installed in early November, to allow time to “weather in”. They will be checked fortnightly from December until the end of February in early morning during warm, dry weather conditions to minimize variation in detection rates. The data will be reported as the proportion of ACOs occupied by species/site.

**Tracking Tunnels:** This is the same technique used for monitoring small mammals, which involves the use of a small plastic tunnel lined with an inked tracking card on which animals leave prints when passing through the tunnel. A set of tracking tunnels shall be installed in December in each major vegetation community. The data will also indicate relative abundance of some animal pest species (such as rats) as well as invertebrates. The data shall be presented as a proportion or percentage of tunnels occupied or ‘tracked’ per site/line.

The exact number and location of ACOs and tracking devices shall be determined on site during the first field visit. Due to the steep terrain, installation will have to be carried out from the bottom of the river up the embankments. A small rubber raft may be the most effective means of carrying the equipment during this task.

#### 4.5 Invertebrate Survey

The invertebrate survey will use both trapping and active searches of suitable habitats. The focus shall be on the ground-dwelling and flying invertebrate fauna located within native forest or shrubland habitats. Sampling shall target two vertical levels, ground level, and up to 1m from ground level.

Collection of insects will be undertaken using at a minimum 4 Malaise traps, 6 pitfall traps, and 2 litter/soil samples for Berlese Funnel Extraction<sup>1</sup>. The traps will be set for one week in the period mid December to early January, depending on weather and temperature.

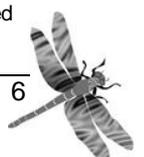
The Malaise traps<sup>2</sup> will be used to target low-flying insects (e.g. flies wasps), and some ground-dwelling, and poor-flying insects (e.g. some beetles, cockroaches). Pitfall traps will be used to target ground-dwelling invertebrates. The Berlese will specifically target small native land snails living in leaf litter.

In addition, 3 nights of active hand searches for snails and other invertebrates will be conducted in December or January. All identification will be undertaken *in-situ* and/or by photography. If this is not possible specimens will be collected and preserved for laboratory identification.

Specimens will be preserved in 70% ethanol. Captured invertebrates will be first sorted on the basis of external morphology to recognised taxonomic units (RTUs) and then, where possible, given generic and species-level identifications by a taxonomic expert (Dr Marc Hasenbank – Kessels & Associates, and audited/peer reviewed by Dr Rudi Schnitzler - MAF/Landcare Research). The identification of specimens to RTUs or generic/species level will allow recognition and thus recording of any taxa on the threatened species list.

<sup>1</sup> a device for extracting soil insects and other micro fauna from leaf litter

<sup>2</sup> a large, tent-like structure used for trapping flying insects. Insects fly into the tent wall and are funnelled into a collecting vessel attached to the highest point.



The deployment of tracking cards (in tunnels) for lizards will also allow for detection of weta species. In this regard all tracking cards shall be assessed for weta and other insects where possible), as well as lizard species.

If identification to genera and species is required for a newly discovered or unusual species, this would be considered an additional service. Specialist taxonomists are required for unusual specimen identification for certain groups because many of New Zealand's invertebrates are so poorly described.

#### **4.6 Avifauna Surveys**

Resident birds will be surveyed in October, December and January within the dam and lake footprint using “reduced diameter 5 minute bird counts” in accordance with Department of Conservation recognised protocols. In the small forest pockets in the valley floor, as well as the terrace flats, and in other suitable habitat including the native woodlands (MWH 2011<sup>3</sup>). Distance estimates will be included in the records to determine any potential bias in sampling. Attention will also be given to the margins of the proposed lake to determine likely habitat formation for birds as a consequence of the flooding and creation of new wetlands and/or lake edge riparian restoration plantings. Location and number of survey stations will be determined during the first visit in October.

Waders will be surveyed in October, December and January. Methods will include opportunistic survey of (i) likely gravel flats and transects within the footprint of the proposed dam, (ii) along the area where river flows would be reduced if the full hydro-development takes place and (iii) at the proposed Waipawa River Intake. These will provide information in the event that reduced water flows and reduced flushing of floods may markedly reduce disturbance of gravel with a resulting increase in flood plain weeds.

Surveys for crakes, kiwi and fernbird will be undertaken using playback of calls in suitable habitats within the footprint. These sites will be determined during the first survey event.

The possible use of the affected portion of the river and its tributaries by blue duck will be assessed by at least once during each of the survey events. Particular attention will be given to the presence of ducklings.

Occupancy surveys will be used to determine the presence/absence of falcon within the study area during each survey event. In this case, specifically within key potential habitats within the dam/lake footprint, and in a radius of some 5 km of the potential dam site areas. Falcon presence will be assessed predominantly through opportunistic surveys. Special attention will be given to looking for dive displays which usually accompany mating. Targeted searches for suitable nesting habitat shall also be conducted within the proposed dam/lake footprint and in the adjacent pine plantation and indigenous forests within the Ruahine Forest Park.

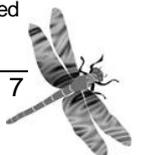
Species richness and abundance will be calculated and divided into native and introduced species for analysis of species diversity. This will enable analysis of relative abundance of the predominate bird species. Combined with data from the Ornithological Society of NZ (OSNZ) this will determine the diversity and relative abundance of key bird species present at the site as well as quantification of habitat usage. Likely loss of useable habitat with the proposed flooding will be evaluated in terms of known territory sizes and known feeding resources.

The site surveys and analysis shall be undertaken by Gerry Kessels and Patrick Stewart. The data interpretation shall be internally peer reviewed and interpreted by Prof. John Craig.

#### **4.7 Threatened Species Risk Assessment**

Any threatened species found will be recorded and assessed in accordance with Hitchmough, R.; Bull, L.; Cromarty, P. (comp.) 2007: “*New Zealand Threat Classification System lists-2005. Science & Technical Publishing, Department of Conservation, Wellington.*” and any subsequent published updates to this document.

<sup>3</sup> Forbes, A. 2011. Preliminary Terrestrial Ecology Assessment of Makaroro & Makaretu Water Augmentation. Prepared for Hawke's bay Regional Council. MWH, Hamilton.



Implications for threatened species as a consequence of the Ruataniwha Water Project will be defined in terms their habitat usage. Habitat usage for any threatened species recorded shall be broadly defined as transitory, home range, territory or breeding. Risk assessment shall be undertaken in terms of habitat usage in relation to the dam/lake footprint and the extent to which habitat removal/modification would affect populations at a local, regional and national level.

#### **4.8 Ecological Sensitivity Analysis**

Following the field surveys an eco-sensitivity analysis will be undertaken. The assessment of the ecological sensitivity (significance) of the areas will be re-assessed using district, regional and national criteria for assessing sites of significant indigenous vegetation and habitats of indigenous fauna. The vegetation types shall also be assessed against nationally threatened vegetation units as defined by Walker et al. (2005)<sup>4</sup>.

The information from the MWH District Wide Ecological Survey report will be incorporated into the comprehensive assessment of ecological effects (AEE) report that includes the survey results, site maps, impact assessment and biodiversity offset recommendations.

Information on the area of forest and other habitat types will be presented in terms of the proportion of these areas in relation to the availability of the same habitats in the same Ecological District as a measure of the relative loss resulting from the proposed dam.

#### **4.9 Monitoring, Remediation Mitigation and Biodiversity Offsetting Requirements**

As part of the overall AEE report, or as a separate “Biodiversity Restoration and Enhancement Strategy” document, detailed recommendations will be made as to possible monitoring, avoidance, remediation and mitigation strategies to minimise any potential adverse ecological effects associated with the water augmentation scheme on each element of the affected terrestrial ecosystems and habitats for terrestrial fauna. The advantages of preparing a separate monitoring and mitigation report is that the broad elements of any package can be worked through with the key stakeholders in tandem with the technical investigations, thus saving time and allowing for early highlighting of issues, early investigation of possible off-site mitigation areas and feedback into the surveys as they proceed.

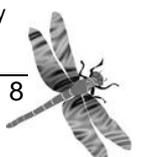
A key part of this programme will involve assessment of the vegetation and contours at the margins of the proposed lake. These will then be used to offer mitigation options most likely to enhance biodiversity. For example, the proposed flooding will produce some small islands which with pest control could act as breeding sanctuaries for local species. Also where contours are relatively wide apart, there will be opportunities to form wetlands that are likely to be far larger than any destroyed by flooding.

##### Biodiversity Condition Offset Modelling

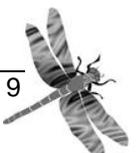
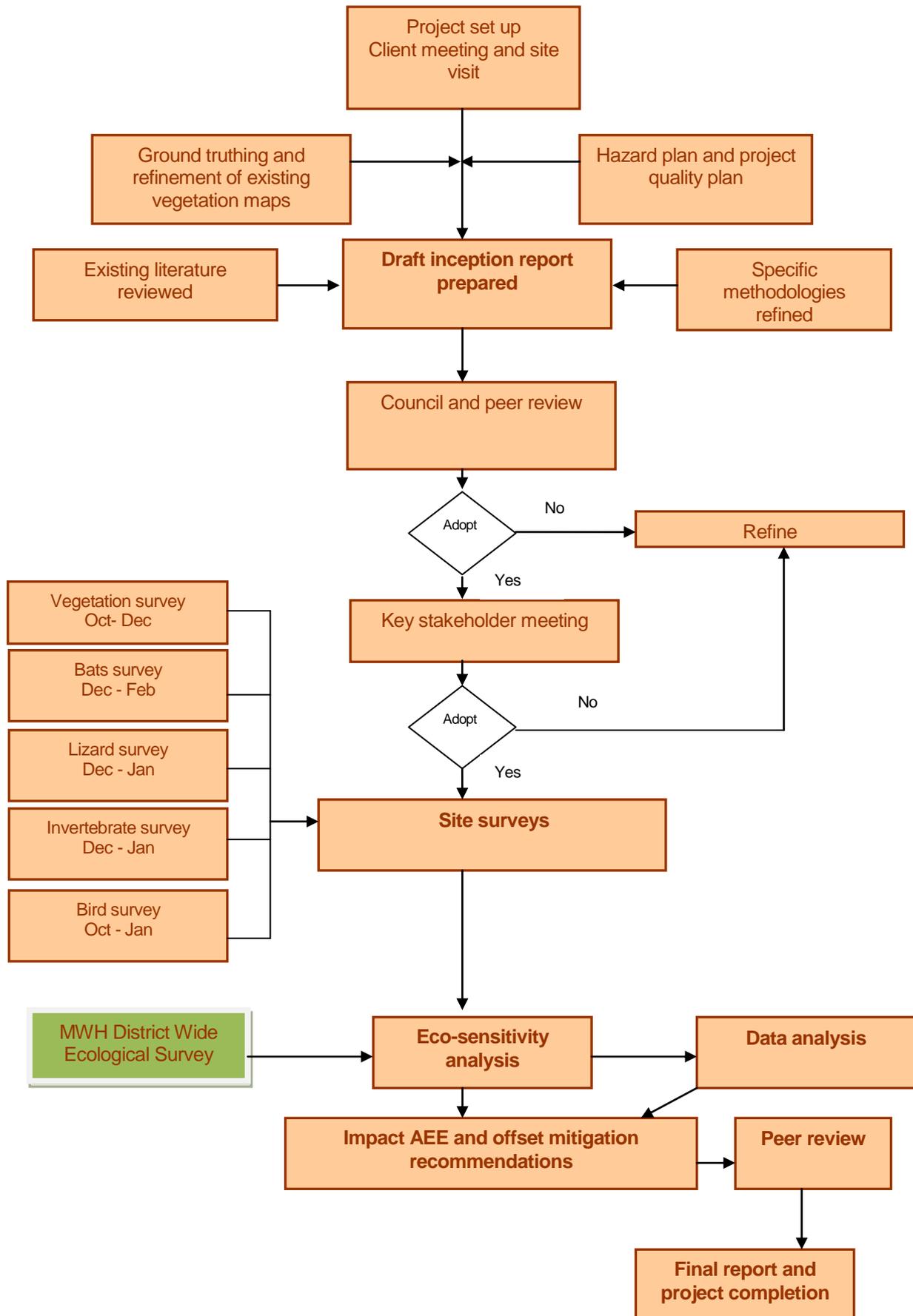
In order to integrate with biodiversity offset mitigation guidelines being undertaken by DOC at present, it is suggested that all surveys and data analysis are captured in such a way that they can be inputted into a biodiversity condition offset model. Bearing this end use in mind, all of the surveys detailed above have been designed to collect data in a format which allows direct input into an off-set model.

The Condition Offset Model is in essence based on accounting models. The idea is to account for the amount of biodiversity lost due to both area and condition effects of development impacts on one side of the ledger, and for positive conservation gains including likely mitigation outcomes on the other side. The goal is then to identify the scale and intensity of conservation or enhancement effort required to fully and clearly ‘compensate’ effects on biodiversity associated with the development. Compensate in this case means to achieve no net loss of biodiversity, and preferably a net gain in its status, ideally within the general vicinity of the development.

<sup>4</sup> Walker, S; Price R; & Rutledge, D. 2005 New Zealand’s remaining indigenous cover: recent changes and biodiversity protection needs Landcare Research, Christchurch



### 4.10 Flowchart of the Methodology



## 5 Work Programme

### 5.1 Proposed Work Programme & Allocation of Resources

STAGE	TASK	KEY STAFF	KEY MILESTONES	KEY EXTERNAL INPUTS
<b>A</b>	<b>REVIEW AND METHODOLOGY DEVELOPMENT</b>			
	Site Visit	G Kessels & J Craig	Completed	
	GIS Database Set up Inception Report	B Deichmann G Kessels	20/09/2011 Completed	HBRC & MWH GIS Data sets PNA Reports & F&B data
<b>B</b>	<b>STAKEHOLDER MEETINGS</b>			
	Forest & Bird/DOC initial meeting Other meetings - yet to be determined	G Kessels & J Craig	Completed	Published and 'grey' literature datasets & reports
<b>C</b>	<b>FIELD SURVEYS</b>			HBRC - Landowner contacts
	Vegetation	B Deichmann	Start Oct 2011. Complete 20/12/11	HBRC staff to assist with field surveys
	Bats	S Parsons, P Stuart, G Kessels	Start Dec 2011. Complete 20/2/2012	
	Herpetofauna	P Stewart, G Kessels	Start Nov. 2011. Complete 20/2/2012	
	Invertebrates	M Hasenbank	Start Dec 2011. Complete 20/2/2012	
	Birds	P Stewart, G Kessels	Start Oct 2011. Complete Jan 2012	OSNZ databases
<b>D</b>	<b>INTERPRETATION &amp; REPORTING</b>			MWH District Wide Eco report
	Data Analysis	S Parsons, P Stewart, J Craig, B Deichmann, G Kessels, B Clarkson, R Schnitzler	Start Dec 2011 Complete 20 Feb 2012	Detailed design parameters from T&T
	Ecological Sensitivity Analysis	G Kessels	29/02/2012	
	Offset Mitigation Modelling	G Kessels & J Craig	29/02/2012	Interaction with HBRC & EMS staff to check mitigation costing & monitoring requirements fit within legal & budget constraints
	Draft Report	G Kessels	29/02/2012	
Final Report	G Kessels	31/03/2012		

### 5.2 Requirements of Other Service Providers and HBRC

The following items are required for the successful completion of the terrestrial ecology surveys:

1. HBRC GIS layers and ortho-corrected aerial photos;
2. MWH baseline report vegetation layers;
3. MWH District-wide ecological report;
4. Tokin & Taylor final technical design aspects; and
5. Landowner contact details.

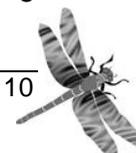
Further requirements are likely to be needed during the course of this project. Close liaison between the K&A and HBRC teams will ensure that additional requirements are identified early and sufficient time is allowed for delivery of them.

## 6 Concluding Comments

There is a large amount of survey work and analysis to be undertaken between now and 31 March 2012 to ensure that a robust understanding and analyses of the terrestrial ecology of the proposed Makaroro River Dam is delivered. The terrain and access to the site is challenging. However, the survey techniques are 'tried and true' and as all methods are in accordance with nationally accepted protocols, the final results will allow valid comparisons of this site with other similar indigenous fauna and flora habitats.

Rather than relying on one or two internal reviewers, we have proposed several internal reviewers, who are highly regarded in their fields of expertise to ensure that each aspect of the terrestrial ecology studies have sufficient integrity to stand up to eventual external reviews by the key stakeholders.

We have already perceived a number of opportunities to create significant biodiversity off-set mitigation gains. For example creation of pest control islands and recreation of wetlands along the lake margin. These ideas will continue to be developed as the project progresses.



**APPENDIX I**  
**PROJECT QUALITY PLAN**



**APPENDIX II**  
**PROJECT HEALTH & SAFETY PLAN**

