BEFORE THE ENVIRONMENT COURT
AT CHRISTCHURCH

ENV-2010-CHC-115, 123, 124 AND 135

IN THE MATTER	**of Appeals pursuant to Section 120 of the Resource Management Act 1991**
BETWEEN	**WEST COAST ENT INC** **Appellant**
AND	**ROYAL FOREST AND BIRD PROTECTION SOCIETY OF NEW ZEALAND INC** **Appellant**
AND	**WHITE WATER NEW ZEALAND INC** **Appellant**
AND	**DIRECTOR GENERAL OF CONSERVATION** **Appellant**
AND	**WEST COAST REGIONAL COUNCIL AND BULLER DISTRICT COUNCIL** **Respondents**

....Continued over leaf

STATEMENT OF EVIDENCE OF
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FOR DIRECTOR GENERAL OF CONSERVATION
Dated: 10 May 2012

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AND	**MERIDIAN ENERGY LIMITED** **Applicant**
AND	**FRIDA INTA** **Section 274 Party**
AND	**WHANAU PIHAWAI WEST – RICHARD WAYNE BARBER AND IRI MAY BARBER MILNER** **Section 274 Party**
AND	**J MacTAGGART** **Section 274 Party**
AND	**ORION ENERGY NZ LTD, ALPINE ENERGY LTD, MAIN POWER NZ LTD AND ELECTRICITY ASHBURTON LTD** **Section 274 Party**
AND	**NZ RAFTING INC** **Section 274 Party**
AND	**ANN SHERIDAN** **Section 274 Party**
AND	**BULLER ELECTRICITY** **Section 274 Party**

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1. QUALIFICATIONS AND EXPERIENCE

1.1. My full name is Timothy (Tim) Shaw

1.2. I have worked for the Department of Conservation (the Department), since 1989 in a number of roles involving the conservation of New Zealand's native flora and fauna. I am currently employed by the Department as a terrestrial fauna conservation technical advisor, for the West Coast Conservancy. I have held this role since February 2005. My qualifications include a Bachelor of Science in Botany and Zoology from the University of Canterbury and a Post Graduate Diploma in Wildlife Management with Distinction from the University of Otago.

1.3. My experience relevant to this proposal includes the following:

- In the seven years between 1989 and 1996 extensive field experience in the conservation management of New Zealand's terrestrial and aquatic flora and fauna. This included managing a range of plant and animal pests, management of threatened species, survey and assessment of conservation values and population monitoring of pest and non pest species.

- Nine years between 1996 and 2005 managing species conservation programmes in the Nelson Region. A significant part of this role was committed to conservation management of whio (blue duck) within Kahurangi National Park. This work included completion of whio population monitoring at a national monitoring site in Flora Stream in the headwaters of the Takaka River; planning, establishment and maintenance of a 'security site' and two 'recovery sites' for whio conservation in respectively the Wangapeka River, Flora Stream and Pearse River; design and management of a whio population survey of Kahurangi National Park completed in the summers of 1998/1999 and 1999/2000; and involvement in the early stages of developing whio management techniques such as stoat trapping to protect riverine habitat and captive raising of wild sourced whio eggs.

- Ten years between 1997 and 2007 as a member of the national Whio Recovery Group and as the leader of this group for the five years between November 1998 and September 2003. Recovery Groups are committees of technical experts and practitioners from within and outside the Department that are formed by the Department to provide national advice on the recovery strategy for a particular species.

- Throughout my 22 years with the Department, but in especially the past ten years, I have provided advice regarding appropriate actions for conservation values being affected by development. Some relevant examples of this include: Whilst leader of the Whio Recovery Group, involvement with the establishment of the Central North Island Blue Duck Trust as compensation for the renewal of consents for the Tongariro Power Development; and more recently involvement with management of great spotted kiwi, whio and *Powelliphanta augustus* being affected by coal and gold mining through several developments in the Westport and Greymouth areas.

- In my current role I provide regional strategic advice for whio conservation and advised on the establishment of, and continue to provide advice on the management of, the Oparara / Ugly and Styx / Arahura Security Sites and Landsborough and Moonlight Recovery Sites for whio conservation management

1.4. I am familiar with the Westland and North West Nelson regions, the Mokihinui River and the habitats in and around the Stockton Plateau to which these proceedings relate. My roles in Nelson and Westland over the past 15years have respectively had a Kahurangi and Buller Coal Plateau focus. In preparing this evidence I visited the Mokihinui River twice in 2008 (for one day on the 22nd of July and for the three days 18th to 20th of August) and once in 2011 (for one day on the 11th of November). In my first visit the river was in high flood flow. I walked upstream from where the proposed dam will be situated to Andersons Flat and viewed from the road the river downstream of the proposed dam to the coast. On my second visit the river was at a lower but still high flow. On this occasion I was flown low over the river channel from the proposed dam site to the Granite Creek / South Branch confluence before being dropped at the Owen Creek / South Branch confluence and walking out over three days to the proposed dam site. During my last visit I was flown over the major tributaries of the South Branch catchment, spent some time on the ground in the South Branch river terrace forests and in riverine habitat in Rough and Tumble Creek, Maori Creek and Hemphill River. As part of this November 2011 visit I also spent a day viewing habitats in and adjacent to the transmission line route across the Stockton Plateau including a flight over the entire route and stops in the Ngakawau, Mangatini and Waimangaroa.

1.5. I have a good familiarity with other areas of whio habitat both within and beyond the West Coast based on field work over the last 22 years.

1.6. I have read the Environment Court's Code of Conduct for Expert Witnesses, and I agree to comply with it. I confirm that the issues addressed in this brief of evidence are within my area of expertise

1.7. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed. I have specified where my opinion is based on limited or partial information and identified any assumptions I have made in forming my opinions

1.8. In writing this evidence I have considered the evidence of Terry Farrell, Bill Langford, John Leathwick, Kelvin Lloyd and Colin O'Donnell, for the Department of Conservation.

1.9. I have also considered the evidence of Brian Lloyd[1], David Norton, John Parkes, Ralph Powlesland and Graham Ussher for the Applicant.

2. SCOPE OF EVIDENCE

2.1. My evidence will deal with the following:

- Background ecological information about whio relevant to the consideration of the Mokihinui Hydro Proposal (MHP).

[1] Unless otherwise stated, all references to 'Lloyd' in the remainder of this document are to Brian rather than Kelvin Lloyd.

- The size and distribution of the whio sub-population that will be affected by the MHP.

- The significance of the whio habitat and whio sub-population that will be affected by the MHP.

- The effects of the MHP on whio habitat and the whio sub-population within the inundation footprint and its minor tributaries.

- Mitigation of effects on whio and the value to whio of the offset proposed to compensate for the effects of the MHP.

3. KEY FACTS AND OPINIONS

3.1. The 22.9km km of river channel directly impacted by the inundation footprint of the MHP and the minor tributary river channel that feeds this inundation footprint that is indirectly impacted by the MHP, has a minimum resident whio sub-population of four to five pairs.

3.2. The importance of the whio habitat and whio sub-population in the inundation footprint and it’s minor tributaries can be clearly demonstrated in a regional and national context and against significance criteria; such that the area is significant for whio under Section 6(c) of the Resource Management Act 1991.

3.3. The MHP would permanently destroy significant whio habitat and force the dispersal of a core part of the local Mokihinui whio sub-population that is part of a region nationally recognised and managed for the security of whio; such that the effects on whio are significant.

3.4. The risk of direct physical harm to whio from construction are low but could be mitigated further by avoiding vegetation clearance in the breeding season and having resident birds monitored with transmitters to inform sensitive construction behaviours.

3.5. It is possible to compensate for the loss of the whio sub-population in the inundation footprint and minor tributaries by a predator control programme of the scale suggested in the ‘Biodiversity Enhancement Strategy’ (BES) and for whio, the South Branch is an appropriate site. I am less confident that the BES compensates for the loss of 22.9km of whio habitat.

3.6. The value of the BES as compensation for the significant biodiversity impacts of the MHP must be considered in the context of considerable uncertainty as to the overall long term outcome for whio in the BEA (Biodiversity Enhancement Area), the failure of the model to pass the additionality gateway test and the fact that speculation about the value of the BES for whio by the applicant is not conservative. I suggest that whilst an effectively delivered BES would provide considerable compensation for adverse effects on whio, the potential improvements for whio and therefore biodiversity from the BES are not as ‘overwhelming’ as suggested.

4. BACKGROUND

4.1. Key concepts for the consideration of the MHP in regards to whio include aspects of the ecology of the species, distribution and abundance, causes of ongoing population decline, threat status and the landscape scale of whio meta-populations. These matters have not been specifically addressed in Meridians evidence; accordingly I set them out here.

4.2. Ecology. Whio is a species endemic to New Zealand. They are river specialists. Their preferred riverine habitat is of high water quality with low suspended sediment, stable river substrates, fully forested catchments and intact riparian vegetation (Adams et al. 1997). Although customarily associated with steep gradient cascading headwaters, it is likely that the mid reaches of rivers with gentler gradient provide the most productive whio habitat (Collier et al. 1993, Godfrey et al. 2003). Whio are known to utilise channels of all sizes right down to creeks no more than half a metre wide (pers.obs.). Although individuals have been recorded from lakes and estuaries, these records are unusual and invariably of dispersing birds that stay for short periods, rather than of resident territory holding individuals.

4.3. The diet of whio is principally the freshwater larvae of caddis fly, may fly and stone fly. Other freshwater invertebrates are also eaten with most feeding occurring in riffles and shallow margins by birds dipping their head, upending or diving to dabble or glean insect larvae from the substrates on the stream bed (Collier, 1991). Whio are also known to take fruit from streamside plants (Harding, 1990). Observations of whio wandering on the ground a long way from water are common and I have observed whio in a forested saddle between rivers fosicking amongst forest floor leaf litter, presumably for other invertebrate food. Fossil evidence also suggests that whio do forage well away from flowing water (Worthy and Holdaway, 2002).

4.4. Whio are strongly territorial year round with pairs defending territories that average 1 to 2 km of river channel. The average life span of individuals is 7-8 years although some live longer than 10 years. In the South Island nesting starts in September with late nests occurring through to December. Most late nests are replacement clutches for failed first attempts and pairs will only raise one clutch per year. Up to six eggs are laid in each attempt, rarely more. Flooding is a major natural cause of nest and chick failure. Juvenile whio are strongly encouraged by their parents to leave the natal territory in late summer autumn and spend up to the first year of their life ‘wandering’, on the equivalent of whio OE, to find a mate and establish a territory (Glaser et al. 2008; Heather and Robertson 1996; and Williams, 1991). Most juveniles settle within their natal catchment close to their natal territory (Williams, 1991), however, many disperse into neighbouring catchments and beyond (Whitehead et al. 2007). Dispersal distances of greater than 20km are not uncommon, with especially male birds recorded as travelling over 65km (Whitehead et al. 2007., Harding, 1994., Udy, 2008., unpublished work from North Eastern Ruahines and work underway in the Ureweras).

4.5. **Distribution and abundance**: Historically, whio were widely distributed and abundant in the middle to upper reaches of most riverine habitats in both the North and South Island. Today, whio are far less abundant and restricted almost exclusively to the upper reaches of the main forested catchments in the central North and the western side of the South Island (Adams et al. 1997 and Cunningham, D.M. 1991).

4.6. On the West Coast, whio occur in discrete regions from Kahurangi to South of Jacksons Bay. Working south from the moderate numbers in Kahurangi, whio reduce to very few in most of the Buller River Catchment and are largely absent or at very low numbers through the Paparoas, Victoria Range and on the Western side of Lewis and Arthurs Pass. Moderate whio populations are present again between the southern tributaries of the Taramakau River through to the northern tributaries of the Haast River and are then again less common heading south into Northern Fiordland.

4.7. The most recent estimate of the total whio population size was completed for the 1997 Whio Recovery Plan (Appendices 1 -3 of Adams et al. 1997). Based on a national sightings database it estimated that 1200 pairs remained split roughly evenly between the North and South Island. Including non paired birds the total population size was estimated at that time to be between 2500 and 3000.

4.8. **Cause of decline:** The main two causes of the decline in the distribution and abundance of whio since European settlement has been predation by introduced mammalian predators, especially stoats (Glaser et al. 2010 and Adams et al. 1997) and habitat loss through land and river development.

4.9. The key research proving a link between stoat predation and whio population decline has been underway since 2000 in the Clinton and Arthur rivers in Fiordland. This work found female whio, nests and chicks to be particularly vulnerable (Whitehead et al. 2007). More recent work in the Urewera has identified the annual post breeding moult of whio to be a time of increased vulnerability of all whio (Glaser pers. Comm.). Other evidence of the impact of stoats on whio include research undertaken on whio translocations to Mt Taranaki [Caskey and Peet, 2006]), anecdotal and documented declines in whio populations (e.g., Flora Stream, [Shaw, 1997]) and the common observation of fragmented and strongly male biased whio populations (Studholme, 2000)).

4.10. The current 2009 – 2019 Whio Recovery Plan (Glaser et al. 2010) acknowledges that habitat loss has become less of a concern for whio recovery over the past 20 years due to a 'curtailing of large scale forest clearance' and 'lower rates of river diversion'. In this context the plan identifies stoat predation as the primary ongoing cause of whio population decline and the key thing that can be managed to affect a recovery in whio populations.

4.11. Despite this current focus on predators, the loss of habitat remains a key concern for whio conservation. The 1997 - 2007 Whio Recovery Plan (Adams et al. 1997) identified the middle and lower reaches of rivers occupied by whio (such as the Mokihinui Gorge), as of the highest importance (section 5.2) and Action 1, Objective 3 identifies the need for 'continued advocacy' and 'legal protection'. Although these Actions are not included in the 2009 to 2019 plan, the importance of these habitats to whio and the need for their protection has not changed. Indeed, in the 2009 to 2019 plan table 1 'threats to whio', Glaser et al. score habitat loss through hydro development at 7, second behind predator control at 10, and this is assuming a 'current risk' score of nil.

4.12. The assumption that the vast majority of remaining whio habitat is within Public Conservation Land and therefore protected from development has allowed the focus of whio conservation to shift to management of predators.

4.13. **Threat status.** Whio are classified as ‘nationally vulnerable’ to extinction (Miskelly et al. 2008); the third highest threat ranking under the Departments eight main threat classifications (Townsend et al. 2008). Whio were classified against this ranking under the criteria of a total population size of 1000 to 5000 mature individuals with a trend of predicted decline of 10 to 50% over 3 generations (‘C 1/1’), and with the qualifiers of being dependant on conservation management (‘CD’ [predominantly predator control]) and being sparsely distributed (‘Sp’ [occurring as small scattered populations]).

4.14. **Meta-populations.** Remaining whio populations generally consist of a patchwork of sub-populations of varying size interspersed by thinly or unoccupied areas of apparently suitable habitat. This distribution pattern combined with the observed dispersal behaviour of whio is ecologically best described as a meta-population; defined as ‘a number of sub-populations at a network of sites that are linked and rely for their continued viability on immigration and emigration’….’where sub-populations collectively contribute to the overall survival of the meta-population’ [Gibbs, 2000 and Hanski, 1999]).

4.15. Such a pattern of whio sub-populations occurs in the Northwest Nelson / Kahurangi region (hereafter referred to as Kahurangi). The whio sub-population affected by MHP that will be the focus of this evidence is one sub-population of the Kahurangi meta-population.

4.16. The meta-population concept and associated importance of immigration for the long term maintenance of individual whio sub-populations scattered over many catchments, is strongly supported by repeated observations from many banding studies of the regular seasonal arrival of unbanded birds that were not produced in the study population (e.g. Styx River, [Tilson 2006] and Oparara River, [Geritzlehner and Quinn 2007], Flora Stream, [Shaw 1997]); Juvenile dispersal studies that document young birds ranging widely (e.g. Udy, 2008., Abel, 2005., Harding, 1994 and Whitehead et al. 2007); and the importance of immigration implied by population modelling completed by Henderson (1994) and at a Whio Recovery Group meeting in 2005 (pers.obs.).

5. WHIO SUB-POPULATION ASSOCIATED WITH THE MHP

Whio sub-population within the inundation footprint and its minor tributaries

5.1. Appendix one shows my estimated distribution and abundance of whio within and immediately adjacent to the inundation footprint.

5.2. A minimum sub-population of seven to nine whio has been shown to occupy the inundation footprint of the MHP; comprised of three to four pairs and a single. At least one additional pair and a single is resident upstream of the inundation footprint in Rough and Tumble Creek and although no sign was recorded in the remaining upstream tributary habitats, the presence of pairs close to their confluences with the Mokihinui means that at least the lower reaches of these waterways will be used by whio.

5.3. The whio sub-population shown to be present occurs throughout the length of riverine habitat within the inundation footprint and into minor tributary habitat beyond[2]. The entire inundation footprint should be regarded as being occupied by a resident moderate density whio sub-population.

5.4. The only recorded systematic whio survey of any part of the Mokihinui River is that commissioned by the applicant for consideration of the MHP (Overmars 2007 inundation footprint and minor tributaries and Overmars 2008 South Branch; summarised in Baseline Terrestrial Ecology Surveys). Incidental records of whio observed in the area reported to the Department's whio sightings database and anecdotally to the applicant, are also useful and have been referenced as part of the applicant's estimate of whio populations.

5.5. The whio survey of the inundation footprint undertaken by Overmars used standard best practice survey methods (Blue Duck Recovery Group, 2004) including walk through with and without a dog, observations from a raft and observations from a helicopter. The survey covered 18.95km of the 22.9km[3] inundation footprint and 13.9km

[2] Minor tributary habitat adjacent to but not directly lost as a result of inundation is included because any whio present in these areas and its value as whio habitat, will be indirectly affected by the MHP.

[3] The applicant does not adequately define the total length of stream and river channel that would be inundated. Overmars 2007 suggests 18.95km as the 'total inundation length' but his analysis is area surveyed and does not represent all affected stream channels. The

of unaffected upstream parts of three main gorge tributaries.

5.6. The key limitation of the specific MHP whio survey work that was undertaken (Overmars 2007) is that it was done only once. A further limitation is that it surveyed only the three main gorge tributaries (Rough and Tumble, Maori and Specimen creeks) missing six smaller named and many unnamed tributaries. These are typical limitations of whio surveys. A further general limitation to quantifying whio abundance is that whio are difficult to detect due to their crepuscular (and often nocturnal) activity patterns, cryptic and often secretive behaviour and the complex and difficult terrain they occupy. It is known from whio populations that have been closely monitored that four to seven repeat walkthrough surveys without a dog are necessary to provide accurate abundance estimates (Adams et al. 1998) and although the number of repeats required is reduced by the use of a dog, it is still in the region of two to four (pers. obs.).

5.7. Whio population estimates based on surveys such as that completed for the AEE therefore provide coarse estimates of minimum population size. This is acknowledged by Overmars (2007) who estimates that the minimum whio population within the inundation footprint and minor tributary habitat surveyed is in the region of five individuals, being a pair and a single bird around the confluence of Rough and Tumble Creek and a pair around the confluence of Specimen Creek. The Terrestrial Ecology Assessment of the AEE quotes a minimum population of

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22.9km figure used here is taken from Dr Leathwicks evidence and was calculated using 100m contour and the NZ river and stream database.

seven individuals (3 pairs and a single), adding a pair regularly seen by rafting guides at the confluence of Maori Creek (pp28).

5.8. My interpretation of the observations presented in the Baseline Terrestrial Ecology Survey document is that a further pair could be added to the original inundation footprint minimum estimate, bringing the sub-population to nine individuals, 4 pairs and a single. The West Coast Regional Council review of the AEE arrived at the same conclusion (Hale, 2008). This discrepancy of one pair is due to interpretation of the incidental observation by Marion Boatwrite of a pair downstream of the Johnny Cake Creek confluence (Table 3.8 of Baseline Terrestrial Ecology Surveys). In my opinion, the fact that this pair was recorded around 2.5km from the next upstream pair around the confluence with Rough and Tumble Creek means that it should be considered as additional rather than the same pair.

5.9. At least one further pair and a single male were recorded by Kath Walker (pers. comm.)[4] in March 2011 approximately 2km upstream of the inundation footprint in Rough and Tumble Creek; bringing my estimated minimum in the combined inundation footprint and minor tributaries to 4 to 5 pairs and two singles (10 to 12 individuals).

5.10. In the AEEs acknowledgement that its population estimate of seven individuals would be a minimum it states that the actual population size is unlikely to be significantly more. I

[4] Several observations of whio in a stretch of Rough and Tumble Creek between L 28/2433400, 5965680 and L28/2433933, 5966290 over the 20&21 of March 2011 that included a minimum of a pair and 1 male (3 birds).

agree that although one off whio surveys invariably underestimate abundance there is enough anecdotal and repeat observations from rafting guides to suggest that the information provided by the AEE is not underestimating by an order of magnitude. Given my higher minimum estimate of 4 to 5 pairs and two singles, I would expect that the actual sub-population of the surveyed area could in reality be 4 to 8 pairs but it is unlikely to be more.

Whio sub-population upstream of the inundation footprint

5.11. Despite the fact that no pairs of whio were found in the parts of the South Branch surveyed by the applicant, it is my view that a low number of pairs (3 to 5) and some single birds are present. The main stem upstream of and including Mountain Creek seem likely to hold the most individuals although birds are probably thinly and patchily scattered throughout.

5.12. There is very little information to inform an estimate of what size whio sub- population exists in the North Branch. No specific whio survey of the area has been completed. There are a handful of recent records for the main stem and the Johnson River tributary. Based on the distribution of whio elsewhere in the Mokihinui and in the neighbouring Karamea and Wangapeka catchments, I would speculate that the North Branch has at least an equivalent whio sub-population to that described for the South Branch – i.e. a scattering of 3 to 5 pairs and some single birds.

5.13. The AEE survey of 40 to 50km of main-stem and tributary habitat in the South Branch (Overmars, 2008) found there to be a ‘low density population’ (AEE Draft terrestrial ecology management plan). Six single birds were encountered concentrated in the head of the main stem and in Mountain Creek with sign indicating whio presence found in two other tributaries (Owen and Goat Creek).

5.14. No pairs were found in the South Branch survey but it is unlikely that none occur as both male (4) and female (2) adult birds were recorded and pairs are recorded on the whio database for both the main stem and tributary rivers. At least one of the whio encountered on the South Branch survey was moulting which may explain the difficulty of locating pairs[5].

5.15. There are many more incidental records of whio from the South Branch and it's tributaries than for the inundation footprint and the North Branch. This cannot be interpreted as a greater relative density of whio in the South Branch. Instead, like most incidental recording systems, it reflects a strong reporting bias to those areas (in this case the South Branch) with greater visitation, accessibility and visibility.

Whio sub-population downstream of the inundation footprint and along the transmission corridor

5.16. Whio will move through these areas as part of juvenile dispersal from adjacent sub-populations and it is possible that a small number of birds may be present in the less developed or less acidity affected catchments of minor tributaries. However, because few to no whio will be resident, whio habitat value of these areas is low and in the case of the transmission corridor, there will be little to no

[5] If there had been an early finish to the breeding season then the January timing of the South Branch survey may have coincided with post nuptial moult. Whio are un-flighted when moulting and become very secretive (i.e. they may have been hiding up small side streams). The inundation area survey was conducted post moult (April).

effect on riverine habitat, I do not include these areas in consideration of whio in the balance of this evidence.

5.17. The wide open and sometimes braided channel, incomplete riparian cover and developed pastoral landscape that is typical of the main Mokihinui riverine channel downstream of the proposed dam is not high quality whio habitat. No whio were recorded in the AEE survey of downstream habitats. There is one record (1983) of a juvenile whio seen at Chasm Creek, a tributary of the Mokihinui downstream of the inundation footprint.

5.18. The Ngakawau River, Charming Creek and upper Waimangaroa Rivers traversed by the transmission corridor of the MHP do not hold whio. There are no records from these rivers that I am aware of. The naturally high and in some cases unnaturally elevated (from coal mining activities) acidity of significant parts of these waterways will be a large part of the reason that whio are not present.

6. SIGNIFICANCE OF THE WHIO SUB-POPULATION AND WHIO HABITAT THAT WILL BE AFFECTED BY THE MHP

6.1. In my view the importance of the whio habitat and whio sub-population within the MHP inundation footprint and it's minor tributaries can be clearly demonstrated; the area is significant for whio in terms of Section 6(c) of the Resource Management Act 1991; and the loss of the whio sub-population and whio habitat within the inundation footprint would have a significant effect.

6.2. The value of the MHP for whio triggers or contributes to all relevant significance criteria outlined by the West Coast Regional Policy Statement (WCRPS). Policy 9.1 of that statement allows that any one of these criteria may determine an area to be significant. The WCRPS criteria triggered by the whio habitat and whio sub-population present in MHP include; (a) protection status, (c) representativeness (part of as described by Dr O'Donnell), (d) long term viability, (e) the presence of nationally threatened species, (g) natural state, (h) connectivity and (o) migratory species

6.3. Likewise, the value of the MHP to whio triggers or contributes to four of the nine significance criteria of the Buller District Plan (BDP), being Connectivity, Threat, Migratory habitat [important …for feeding] and Representativeness (again,, see evidence of Dr O'Donnell).

6.4. Similarly, the value of the MHP to whio triggers three of the four Norton Roper Lindsay (2004) criteria used by the AEE to assess significance ('Rarity and distinctiveness', 'Ecological Context' and 'Sustainability').

6.5. In addition to significance criteria, I reach the view that the whio habitat and whio sub-population within the MHP inundation footprint and it's minor tributaries is significant because;

- The whio meta-population[6] in the Kahurangi region is nationally significant for the conservation of whio.

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[6] Meta-population definition - a collective population made up of a number of sub-populations at a network of sites that are linked and rely for their continued viability on immigration and emigration. The sub-populations collectively contribute to the overall survival of the metapopulation [Gibbs, 2000 and Hanski, 1999]).

- The Mokihinui catchment is strategically important to the long term conservation of this nationally significant meta-population because of its location relative to key remaining and protected whio sub-populations.

- Survey information provided in the AEE shows that the whio sub-population within the inundation footprint and minor tributaries represents a significant part of the remaining whio sub-population in the Mokihinui both in terms of overall abundance and potential productivity.

Consideration by the applicant of the significance of the whio sub-population and whio habitat that will be affected by the MHP

6.6. The AEE does not provide an individual statement regarding the significance of the affected whio habitat and whio sub-population. Overall the AEE concludes that 'the gorge has high ecological values as it supports... threatened fauna... however it is not considered to be core habitat of these species.' And, 'on the basis of its vegetation and fauna characteristics... the Mokihinui Gorge is not considered significant in relation to section 6(c) of the RMA.' (pp 40 of Terrestrial Ecology Assessment).

6.7. The AEE implies low value to and of whio through the following statements.

- "The blue duck population inside the Gorge area … very small'… 'possible that it is currently sustained by immigration of juveniles from other areas of more favourable blue duck habitat such as the South Branch'.

- "Blue duck habitat in the gorge is probably less than optimal because of flooding risk and mobile sediments from landslides…that affect roosting sites and invertebrate food".

- The whio population within the MHP footprint is "in decline due to predation" and with "current level of management is not sustainable" and likely to continue to "decline and disappear", and that this local extinction is "imminent".

6.8. Although the scope of the latest evidence for the applicant on bird communities by Dr Powesland, suggests that significance will be discussed, there is infact no reference to or statements on significance in his evidence. In terms of the value of the inundation footprint to whio, Dr Powesland repeats some of the sentiments of the AEE listed at point 6.4 above including that the inundation footprint contains a 'low whio population' that will be 'declining due to predation, or maintained by immigration' in habitat that 'may be less than optimal'.

6.9. I disagree with the majority of the above statements by the applicant and certainly the sentiment of low value and implied lack of significance of the Mokihinui Gorge to whio.

6.10. The AEE's minimisation of the significance of whio habitat and whio sub-population within the inundation footprint was disputed in the initial round of MHP hearings by the Councils Section 42 report (Hale 2008), a review of the AEE commissioned by the Department (Lloyd 2008) and in my own evidence (Shaw 2008). On behalf of the applicant, Bartlett (2008) stated that there was 'no intention to downplay' and that 'the whio population is significant'.

6.11. In the remainder of section six I will address the questions raised in the AEE of the value of the whio sub-population and whio habitat within the inundation footprint and its minor tributaries. Where relevant I will link these back to significance criteria.

National context of the whio meta-population and whio habitat in Kahurangi

6.12. The Kahurangi region, of which the area affected by the MHP is part, is recognised as nationally significant for the conservation of whio, both as a remaining stronghold for the species and as an area where priority management, key to securing whio from extinction, is underway. The location of two of eight national whio Security Sites and three of 14 whio national Recovery Sites in the Kahurangi Region reflects the importance of the region nationally for whio conservation[7].

6.13. It has been generally accepted since the mid 1990’s that the control of introduced predators (particular stoats) is required to prevent the extinction of whio (Glaser et al. 2010). It has been necessary to determine where this predator control should occur.

6.14. The Departments main internal processes for the planning of conservation management for threatened species include ‘Recovery Planning’ and ‘Species Optimisation’. Recovery planning typically involves the preparation and support of a

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[7] ‘Security sites’ are the top priority sites selected nationally for the conservation management of whio required to achieve security of the species from extinction. ‘Recovery sites’ include all other sites where conservation management allows recovery of the species beyond security from extinction (see 6.11). Stoat control is the primary management tool used at all sites.

strategic conservation plan for a particular species by a group of technical experts (Recovery Group). A Recovery Group and Recovery Plan have been in place for whio since 1988 (Williams, 1988). Species Optimisation is a planning tool that has been developed and introduced by the Department over the past three years to capture and prioritise all conservation actions for all threatened species. This approach is based on 'Recovery Prescriptions' that state the minimum priority actions required to guarantee persistence of each threatened species for the next 50 years. These prescriptions tend to be less aspirational / more minimalistic than Recovery Plans.

6.15. The Recovery Planning and the Species Optimisation processes agree on eight top priority 'Security Sites' for the conservation of whio (Glaser et al. 2010); four in the North and four in the South Island. The selection of these Security Sites was based on recognised remaining strongholds for the species (Shaw, 2003). Three of these Security Sites occur on the West Coast; the Styx / Arahura Security Site is based on the whio stronghold in Central Westland and the Wangapeka / Fyfe and Oparara / Ugly Security Sites are based on the whio stronghold in Kahurangi.

6.16. The Recovery Plan also identifies "Recovery Sites" that whilst not the top priority for securing whio from extinction are necessary to retain a viable total number of whio pairs and prevent the restriction of whio to minimal locations. Fourteen of these Recovery Sites are currently being managed; including within Kahurangi the Pearse River, Flora Stream and Gouland Downs.

6.17. Appendix two attached to this evidence provides a Map that illustrates the location of the Kahurangi Security and

Recovery sites and notable catchments as discussed above and below.

Regional context of the whio sub-population and whio habitat of the Mokihinui

6.18. In terms of size and location of available habitat, remaining whio and proximity to existing management, the Mokihinui should be regarded as an important and strategic part of the nationally significant Kahurangi whio meta-population.

6.19. The systematic survey of 540km of river channel in Kahurangi in 1998/1999 and 1999/2000 (Studholme 1999 and 2000) found the whio meta-population to be roughly centred on the Karamea and Wangapeka Rivers with small pockets of birds extending into the Takaka and Aorere catchments that drain to the north, and in the Heaphy, Kohaihai and Oparara rivers draining to the west. The extent of the Kahurangi whio meta-population beyond the National Park to the south (i.e. between the Mokihinui and Buller) was not surveyed. However, based on the survey work conducted for this AEE, incidental sighting reports on Departmental databases and surveys such as that reported in the AEE by Buckingham of the Orikaka in 1998/1999, it is my opinion that, with the exception of scattered birds likely to occur south towards the Buller, the Mokihinui currently represents the Southern most catchment of the Kahurangi whio meta-population (i.e. effectively the range limit in terms of moderate numbers of pairs).

6.20. The functioning of whio as meta-populations distributed over many catchments, and the need therefore to manage units that span greater than one catchment, was recognised by the Whio Recovery Group in their selection of Security

Sites. Because the scale at which these meta-populations operate and the importance of immigration is unknown, Security Sites were also selected on the criteria of being surrounded by neighbouring catchments that contained quality whio habitat (and preferably whio); to allow immigration processes to proceed without being restricted by habitat availability and to allow management to extend if this proved necessary (Shaw 2003 and O'Connor et al. 2004). From this viewpoint and for the following reasons, the Mokihinui catchment is strategically important to efforts to secure whio in the nationally important Kahurangi whio meta-population.

- The Mokihinui catchment provides an extensive area of quality habitat that supports in the region of 10 to 15 pairs of whio[8], which is roughly equivalent to a fifth of the birds found in the balance of Kahurangi

- The Mokihinui is an immediately adjacent catchment to the Karamea River which retains the best numbers of whio in Kahurangi. The Upper Karamea and Taipo Rivers are a short flight of around 1km from main headwater tributaries of the North Branch of the Mokihinui.

- The Mokihinui is an immediately adjacent catchment to the Wangapeka / Fyfe Security Site. It is a short flight of around 1km from tributaries of the South Branch of the Wangapeka into headwater tributaries of the North Branch of the Mokihinui.

[8] I base this estimation on there being up to 5 pairs in each of the respective thirds of the Mokihinui, being the North, South and Gorge sections of the catchment. See discussion under Section 5 of this evidence.

- The Mokihinui is well within the dispersal range of whio from the Oparara / Ugly Security Site (Whitehead et al. 2007, Harding, 1994, unpublished work from North Eastern Ruahines and work underway in the Ureweras). In a straight line the Oparara tributaries are less than 25km from tributaries of the Mokihinui Gorge such as Rough and Tumble Creek. And the linkage between this security site and the Mokihinui is strengthened by the fact that it is the Karamea Catchment that separates them. Already this scale of dispersal is being seen from Kahurangi Security Sites, with two juveniles banded in the Oparara being found 25km to the North in Wekakura Creek (Abel, 2005) and many dispersal distances greater than 20km (including one bird that travelled 65km) being observed from the Wangapeka Fyfe Security site (Udy, 2008).

Local and regional context of the whio sub-population and whio habitat of the inundation footprint and minor tributaries of the MHP

6.21. The whio sub-population identified within the inundation footprint and its minor tributaries is part of the wider Kahurangi whio meta-population and represents a significant and ‘core’ part of the Mokihinui catchment whio sub-population in terms of total numbers and potentially productive pairs. At the very least it constitutes a third of the whio that remain in the Mokihinui Catchment and should be considered as an at least moderate density whio sub-population that is regionally significant within the Kahurangi whio meta-population.

6.22. **Sub-population size**. Although the 4 to 5 pairs of whio recorded in the inundation footprint and minor tributaries appears as a small absolute number (a point critical in Dr

Norton's consideration that effects to whio are not significant), it compares favourably as part of a limited total regional meta-population of approximately 58 pairs comprised of many such small sub-populations.

6.23. The systematic Kahurangi whio survey in 1998/1999 and 1999/2000 (Studholme 1999 and 2000) is the key reference to appreciate the size and relative importance of the whio sub-population affected by the MHP. A total minimum meta-population size of 58 pairs[9] was recorded from 540km of river channel surveyed in 56 named river channels. Small sub-populations such as that found in the MHP were found to be the norm not the exception. Whio distribution and abundance was found to be clumped with the greatest densities found in catchments adjacent to the Mokihinui in the central part of Kahurangi. Some of the strongest sub-populations include 26 adult whio (incl. seven pairs) in 26km of the Roaring Lion River; nine adult whio (incl. four pairs) in 17.5 of the Beautiful River; and 19 adult whio in 16.5km of the South Branch of the Wangapeka. Many rivers retained smaller sub-populations such as the Crow River at 16 adults (incl. five pairs) in 36.5km and the Kakapo River at seven adults (incl. two pairs) in 25.5km. No whio were found in 17 of the rivers surveyed.

6.24. The AEE found nine whio (incl. four pairs) over a total of 32.85km (18.95km of the 22.9km inundation length and 13.9km of area adjoining the MHP footprint), or 0.12 pairs per km searched. When this result is compared to the pairs per km of river searched in the Kahurangi survey (Table

[9] The size of whio sub-populations is typically expressed as the number of pairs. This is because pairs reflect the viable productive part of the population.

one below) it is clear that the Mokihinui Gorge would be amongst the top 20 of 53 rivers in terms of abundance. Table 1: Pairs per km searched in 53 Kahurangi Rivers (Studholme 1999 & 2000). (Note; three rivers are left out of this analysis because no km searched figure is recorded)

Pairs Per km searched	**Number of rivers**
>0.3	6
0.2 – 0.29	6
0.1 - 0.19	8
0.01 – 0.09	3
0	30
Total	53

6.25. ‘**Core’ habitat.** The whio sub-population found in the inundation footprint and minor tributaries is core to the persistence of whio in the Mokihinui River.

6.26. Core habitat is not explicitly part of WCRPS or BDP criteria but is part of one of three definitions within the Norton Roper-Lindsay (2004) Ecological Context significance criteria used by the AEE. The AEE concludes (pp.37) that the MHP footprint does not provide core habitat for any threatened fauna.

6.27. Norton Roper-Lindsay (2004) do not define ‘core’ habitat. The AEE defines core habitat as ‘those areas with suitable habitat in which the species is at high densities and from which dispersal is most likely.’ On behalf of the applicant Bartlett (2008) explains (pt 4.54) that the MHP habitat is not core for whio (and kiwi) ‘…because pops are at low density meaning juveniles would first replenish local populations before dispersing’.

6.28. Under this definition of core habitat it is my view that it is impossible to define any whio sub-population that includes any number of breeding pairs as anything but core. This is because emigration and dispersal is an element of whio ecology regardless of population size. Yes higher density sub-populations are likely to result in more dispersal than lower density ones, but low density sub-populations still result in dispersing juveniles; this is simply how whio work.

6.29. My view is that the definition of core habitat should be wider than that interpreted by the AEE and that the whio sub-population found in the MHP footprint is currently core to the persistence of whio in the Mokihinui River. This is because the inundation footprint and minor tributaries of the MHP support a whio sub-population that represents the majority of pairs and therefore productive whio encountered in the total AEE survey coverage of over 80km of whio habitat within the Mokihinui and probably represents about a third of the catchments total whio sub-population. Those birds that are present in the MHP footprint are a vital part of the whio sub-population in the Mokihinui catchment.

6.30. **Connectivity and migratory habitat.** The whio habitat and population found in the footprint and minor tributaries provides connectivity of both habitat and occupied territories between whio sub-populations and provides for the seasonal requirements of both dispersing and territorial whio. In so doing the footprint is significant against the connectivity and migratory habitat criteria of both the WCRPS and BDP and the Norton Roper-Lindsay Ecological Context definition ‘enhancing connectivity between patches’.

6.31. The MHP whio sub-population is one of many sub-populations making up and driving the landscape scale Kahurangi whio meta-population. Continuous habitat connecting the maximum number of sub-populations allows for the best performing meta-populations. Connectivity includes not only habitat but also the behavioral influence of the presence of other birds; i.e. dispersing birds are more likely to find a mate and settle in quality habitat with an existing population. The MHP footprint provides one of these strong connections.

6.32. Mixed channel size and topography is recognised as a preferred habitat trait in whio territories because it provides varied feeding opportunities to whio in a range of flow conditions / seasons (Collier et al. 1993 and Collier and Wakelin 1996). All pairs in the Gorge were recorded within 1km of the confluence's of the Mokihinui's main stem and respectively Johnny Cake, Rough and Tumble, Maori and Specimen Creek. It is highly likely that these pairs have a seasonal pattern of use of this varied channel with the main stem likely to be an important and rich source of food during low flow periods.

6.33. **Habitat quality.** The main channel of the Mokihinui Gorge affected by the MHP, whilst not representative of all qualities associated with highly preferred whio habitat, does provide a substantial area of high quality whio habitat. Minor tributary habitat contiguous with this channel is also of high quality. There is no evidence that habitat quality within the MHP footprint is negatively limiting for whio. The best judges of whio habitat quality are whio and the area supports territorial pairs at an above average density relative to other rivers in the region.

6.34. The AEE describes the whio habitat in the gorge as 'probably less than optimal because of flooding risk and mobile sediments from landslides…that affect roosting sites and invertebrate food'. However, Overmars (2007) states that 'the Mokihinui Gorge and its tributaries generally have 'river gradients and other characteristics of currently preferred blue duck habitat' and 'large numbers of larval aquatic invertebrates were observed where searched'.

6.35. 'Optimal' whio habitat has never been defined. What has been identified by several studies are habitat qualities preferred by whio. Physical qualities of preferred habitat include high channel bank and bed stability, narrower stream / river widths, low transport of fine or suspended sediment and coarse bed substrata (Collier et al. 1993) along with abundant shallow margins and riffles relative to deep and cascading habitat that allow whio to obtain food and survive with the least amount of effort (Godfrey et al. 2003 and Collier and Wakelin 1996). Biotic qualities of high water quality, forested riparian habitat and a diversity and abundance of aquatic invertebrates are also suggested (Collier et al. 1993 and Veltman et al. 1995).

6.36. I agree with the AEE that the main channel of the Mokihinui Gorge does not have all the physical qualities associated with highly preferred whio habitat. Less preferred qualities which are present include mobile sediments apparent in eddies which restrict periphyton and invertebrate growth and the physical shape of the channel that often involves long deep runs, deep pools and sheer rock walls plunging directly into deep water which require ducks to dive (work harder) to reach food sources on the river bed.

6.37. However, in my observation the main channel of the Mokihinui also has an abundance of desirable whio habitat qualities. Stable cobbles and large substrates occur along the shallow margins of significant sections of the channel and because the gorge channel is large this equates to a substantial length of habitat. Despite the mobile sediment present in eddies and the high flows of my visits, the vast majority of the riverbed was free of these sediments, periphyton was evident and an abundance of invertebrate fauna was present amongst substrates in the shallow margins. Photographs taken of the gorge in autumn show feeding areas as more extensive and accessible to whio suggesting seasonal variability in the habitat quality of the gorge and perhaps therefore seasonal importance to whio.

6.38. I do not share the AEE concern about flood flows or lack of roosting habitat. Although flood flows do disturb feeding and breeding ecology, this is a hazard typical of whio habitat and one for which they have developed strategies to cope. Although roosting habitat is not continuous, neither, in my opinion is it limiting for whio as there is any amount of dense riparian cover and occasional log piles, flood debris and large boulder jumbles.

6.39. Although the AEE suggests that tributary creeks are likely to be part of the territories of the pairs observed, the AEE only describes the overall habitat qualities of the main Mokihinui Gorge channel. This emphasis provides a misleading impression of habitat quality constraints. As noted in 6.32 above, all pairs in the Gorge were recorded associated with the confluence's of the main tributary streams. It is highly likely based on this observation, documented whio territory patterns (Williams 1991 and Studholme 2000) and those I have observed; that the territories of each pair include a significant proportion of tributary habitat. The preference of whio for such territories is likely to be linked to the varied feeding opportunities that mixed channel size and topography provide to resident pairs in a range of flow conditions / seasons (Collier et al. 1993 and Collier and Wakelin 1996).

6.40. I walked short sections of Rough and Tumble, Welcome, Specimen and Johnny Cake Creek and viewed the lower sections of Pakihi and Maori Creek from the air. These limited observations suggest that these creeks provide many of the features associated with high quality whio habitat. These include abundant aquatic invertebrates and periphyton growth, extensive areas of consistently large sized and stable substrates free of mobile sediment, extensive channel edge and submerged moss growth suggesting a stable bed and low suspended sediment, excellent riparian cover and abundant roost sites.

6.41. **Sustainability of the whio sub-population within the MHP footprint**. In my view the MHP footprint (and Mokihinui as a whole) is more likely than most remaining habitat occupied by whio to retain its whio population under both current and probable future management, and therefore scores highly on whio population sustainability. I hold this view because of the recognition of Kahurangi as one of eight key locations in the national strategy for whio conservation, the existing management of whio at four sites within the dispersal range of whio, the existing large scale use of aerial 1080 within and adjacent to the MHP footprint, the natural qualities of the site which have allowed whio to survive relatively well and the likelihood of more and improved animal pest management in the area in the future.

6.42. Sustainability is considered under one of the WCRPS significance criteria ((d) 'likelihood of the area retaining viability, quality and integrity of processes over a long period of time') and is one of the four Norton Roper Lindsay criteria. It relates to a sites ability to retain ecological values in the future. Sustainability is not one of the BDC significance criteria.

6.43. It is argued by the AEE that (amongst other species) whio populations within the MHP are not sustainable at the current level of management and are infact in 'imminent' (pp 45 of AEE) risk of extinction. In support of this argument the AEE states that:

- The whio population within the MHP footprint is 'probably supported by immigration from better quality habitat and a larger population upstream'.

- Given 'the known impact of stoats on whio populations and the current lack of direct management of stoats within the MHP footprint, that the gorge whio population is likely to continue to decline and disappear and is therefore not sustainable.'

6.44. The evidences of Dr Norton, Dr Powlesland and Dr Brian Lloyd essentially repeat these AEE sentiments. Dr Powlesland states in point 7.22 that the long term viability of the whio population within the MHP footprint is likely to be 'either declining or being maintained by immigration.' Dr Norton predicts eventual extinction for all predator vulnerable species in the Mokihinui because in his view management of predators is unlikely. Depending on the value entered for annual rate of population change, Dr Lloyd's whio population model predicts functional extinction of the MHP footprint whio sub-population in 10 to 50 years.

6.45. First on the point of immigration. As discussed in the background section, emigration and immigration are important elements of the ecology of all whio sub-populations. There is no evidence to suggest that the whio sub- population within the inundation footprint is any more reliant on immigration, and therefore any less sustainable because of this, than any other part of the Kahurangi whio meta-population. Overmars (2007) concedes that the prediction of a population supported by (and implied to be more 'dependant on') immigration from 'better quality habitat and a larger population upstream' was 'speculative' and indeed, results from Overmars (2008) that showed there not to be a larger whio population in the South Branch, undermine that speculation.

6.46. It is recognised that for species where dispersal within meta-populations is important for the survival of the constituent parts, that the relative fitness of the parts is not the same. This is captured by the source / sink concept, where good quality 'source' habitat produces enough individuals to support itself plus emigration, whilst poor quality 'sink' habitat cannot support itself plus emigration and depends on net immigration for it's population to be sustained (Godfrey 2003).

6.47. Whilst sources and sinks are a simple concept and useful in considerations of the relative contribution of the parts of a meta-population, they are in practice very difficult to define

(Watkinson & Sutherland 1995). The source / sink concept has been discussed in recovery planning for whio and in my view its primary use has been in supporting the recommendation that high quality habitats should be the priority for management and to predict that protected sub-populations should act as sources to retain whio over the wider landscape.

6.48. On the point of predation. I agree with the evidence presented on behalf of the applicant that whio sub-populations will continue to decline and ultimately disappear where the population parameters of reduced female survival and recruitment of young whio resulting from stoat predation are not addressed.

6.49. Understanding of the finer details of this assumption is limited insofar as it is not known how long it would take for such sub-populations to disappear, how much female survival and juvenile recruitment needs to be increased to slow or reverse this decline and importantly, how this is best achieved.

6.50. In my view the conclusion of the applicants witnesses (particularly Dr Norton but also Dr's Powlesland and Ussher) that the current lack of direct control of stoats' in the MHP footprint means that the whio sub-population is therefore unsustainable, is an unjustifiably pessimistic and narrow view of how and what conservation management will contribute to the long term sustainability of the MHP footprint whio sub-population. I consider that there is a relatively high probability in the long term of a sustainable whio sub-population in the MHP inundation area due to the contribution of current and future indirect management and the possibility in the future of direct management in the Mokihinui Gorge.

6.51. Increased recruitment of juvenile whio into any whio sub-population can be achieved directly through onsite predator control or indirectly through increased immigration from neighboring managed catchments. Accordingly, although there is no effective stoat control currently underway within the MHP footprint, there is enough management going on in adjacent habitats to be confident that there will be increased immigration of whio into the area[10]. Also, the WCRPS and Norton Roper Lindsay Sustainability criterion are not dependant on 'current' management and therefore allows consideration of what is possible / likely in the future. The medium to long term probability that stoat control will increase in neighboring or upstream catchments is high and it is also likely that some form of stoat control will occur within the MHP footprint itself.

6.52. Relevant current indirect conservation management that reduces the likelihood of imminent extinction of whio in the inundation footprint and combined with any future direct management would increase the probability of a sustainable whio sub-population includes:

- The long term commitment to secure and recover the whio meta-population in Kahurangi including the current management of two security and three recovery sites. These sites should start to act as strong 'sources' to support proximate non managed whio sub-populations.

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[10] It is entirely feasible that whio sub-populations in areas such as the MHP footprint could be maintained without any direct / onsite control of stoats.

- Existing investment by both the Department of Conservation and the Animal Health Board (AHB) in aerial 1080 periodically reducing stoat predation on whio in a number of sub-population parts of the Kahurangi meta–population. Recent research has shown that the use of Aerial 1080 to control possums can also provide enough control of stoats to affect a positive response in populations of species, including whio, threatened by stoat predation (Murphy, et al. 1999 and Tongariro report to the Blue Duck Recovery Group, 2008). Across Kahurangi there are a number of aerial 1080 operational areas managed which collectively provide significant periodic relief from stoats.[11]

6.53. There are several reasons to be confident that this indirect management is and will make a meaningful difference to the sustainability of the Mokihinui Gorge whio sub-population.

- Whio are relatively long lived and have a high annual reproductive potential of up to six ducklings per pair, meaning that even pairs that receive only periodic protection have the potential to substantially increase emigration to nearby sites.

- All managed whio and many of the periodical aerial 1080 sites in Kahurangi are variously but easily within the dispersal range of whio to and from the Mokihinui. The Wangapeka/Fyfe Security site, is in a catchment immediately adjacent to the Mokihinui; whilst one of the security sites, the Oparara/Ugly; and two of the recovery sites, the Flora and

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[11] Although periodic aerial 1080 does not represent the most 'desirable' pest control scenario of a combination of trapping and toxin techniques as described by Dr O'Donnell, evidence suggests that it can be very effective for whio.

Pearse, are only separated from the Mokihinui by the Karamea Catchment; which itself holds the best remaining sub-populations of whio in Kahurangi.

- Whio have some natural resilience to stoats. Stoats have been part of whio population ecology since their release in the 1880's (King, 1995), whilst stoat management on the mainland is recent and limited, meaning that the continued persistence of whio in Kahurangi and other unmanaged parts of their range for over 100 years in the presence of stoats is down to some resilience. This suggests that increased regular immigration may well be enough to sustain whio sub-populations in neighbouring sites that are not directly managed, such as the area within the inundation footprint.

- The Mokihinui Gorge is a site in which whio have persisted at greater densities than other equivalent river channels in the region suggesting that it favours survival[12]. One possible explanation for this is that the area supports fewer predators relative to other areas allowing predator vulnerable species to better persist[13]. It is well documented that introduced mammalian predator population ecology in New Zealand varies with forest type and altitude (King, 1995 & O'Donnell, 1996) and in 2008 I suggested that the forest type and topography of the Gorge may be acting to keep stoat numbers down. Powesland (2011) disagrees and suggests instead that any difference in stoat density would be more likely to be driven by prey abundance. I am happy to accept that prey abundance may be the key driver but this itself is driven by

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[12] See Table 1 which compares pairs per km of river searched and finds the density recorded in the Mokihinui Gorge to be in the range of the top 20 rivers out of 53 surveyed in Kahurangi (Studholme, 1999 & 2000).

[13] The other most likely explanation for the Gorge retaining higher whio numbers than other places would be because of high habitat quality.

forest type and does not affect the overall argument re. the possibility of a more favourable predator environment for whio to persist in.

6.54. A large flaw in the applicants reasoning that the whio sub-population in the MHP footprint is unsustainable due to stoat predation is that it considers only what is currently being done. The following points demonstrate that such a narrow view is clearly inappropriate[14]

- The Mokihinui has been identified by the Department of Conservation as a high priority site for biodiversity and as such would be likely to be part of any expansion in threat management in the region. The Mokihinui Forks Ecological area is identified in the draft Conservation Management Strategy (DOC, 2010) as a priority site for biodiversity conservation and the Departments recently adopted ‘Optimisation’ tool for prioritising ecosystem conservation work has also identified two sites within the catchment. Dr Leathwick provides a full explanation of ‘Ecosystem Optimisation’ which I will not repeat here. The salient points are that the upper Mokihinui / Matiri[15] and the Mokihinui Gorge[16] both within the Mokihinui catchment and several other catchments within the dispersal range of whio (including the Wangapeka, Orikaka, Oparara and further afield, the Heaphy and Big Rivers) are part of the list of ecosystems that the Department of Conservation considers to be priority sites for management..

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[14] These arguments are also important for consideration of additionality in the offset model.

[15] Which includes a substantial part of the Biodiversity Enhancement Area (BEA) promoted as compensation by the applicant.

[16] Which includes the MHP footprint.

- There is likely to be a continued refinement and improvement of threat management techniques that will allow for more efficient and effective threatened species management over larger areas meaning that an expansion of efforts is likely. For example in the early 1990's when possum control began in the northern Kahurangi management units of Wekakura, Mackay Downs, Ryan Creek and Heaphy, work was small scale and single focused on possums using ground control techniques. Today these units are combined into a contiguous 25000ha aerial 1080 treatment area that will whenever possible be treated as one unit and timed to best benefit predator vulnerable species (see evidence of Terry Farrell). Similarly, management aimed at sustaining whio populations around the country is limited to the past ten to 15years (and within Kahurangi has only been on a reasonable scale for the last five to eight years). This was all in the realm of wishful thinking 20 years ago, and there is every reason to consider that as techniques are refined and knowledge and practices improve, that a similar quantum of change is possible.

- Investment and interest in conservation management in whio and in the Mokihinui has increased considerably over the past five to ten years both within and from outside of the Department of Conservation. Notably, in 2011 Genesis Energy provided an additional 2.5million dollars over 5 years to allow whio security sites to be fully developed; in 2008 Solid Energy commenced a trial carbon offset programme involving the control of ungulate pests in the Mokihinui North Branch; and the amount of area treated by aerial 1080 to protect *P. unicolorata* in the South Branch of the Mokihinui by the Department of Conservation grew from 300ha treated in 2008 to 1865ha treated in 2010.

7. ASSESSMENT OF THE EFFECTS OF THE MHP ON WHIO

7.1. The direct effects of the MHP on whio include the permanent loss of 22.9km of stream channel / whio habitat and the displacement of a whio sub-population of a minimum of three to four pairs from within the inundation footprint. The indirect effects of the MHP on whio include a reduction in continuity and habitat diversity for those whio resident in the minor tributaries of the inundation footprint (at least one pair and a single) and a loss to the overall fitness / viability of the Kahurangi whio meta-population. These effects are significant.

7.2. The AEE acknowledges that the inundation footprint will result in a total of 18.95 km of river channel habitat being lost (14.6km of gorge and 4.35km of tributary) and rendered 'largely unsuitable' for whio and that the territories of 'about seven resident whio' would be lost. The AEE predicts that whio currently resident in the inundation footprint will be displaced to unoccupied habitat elsewhere. Powesland (2011) identifies that there is a risk of resident birds being crushed during the construction phase of forest clearance along the river edge.

7.3. Although the number of individuals affected is probably greater than seven, the length of stream channel that will be lost is 4.05km greater than 18.95km (see Dr Leathwicks analysis that identifies 22.9km) and the habitat inundated by the MHP will be completely (not 'largely') unsuitable as whio habitat[17] , I agree that these points generally capture the direct effects on whio of the MHP.

[17] Lakes although occasionally used by whio are not whio habitat. The proposed hydro reservoir would have even less habitat value to whio than a lake because of the high daily

7.4. The AEE does not acknowledge the following indirect effects of the loss of whio habitat and displacement of a whio sub-population from the inundation footprint.

- Reduced whio habitat quality in adjoining tributaries. Currently all whio pairs identified within the inundation footprint occur around tributary confluences with the main Mokihinui. This reflects the preference of whio to have territories with a diversity of channel topography and volume to provide for feeding in all river flows and seasons. The reservoir would remove the main gorge channel from all these confluence territories such that whio remaining in and around those tributary confluences would have reduced habitat diversity and therefore habitat quality.

- Increased isolation of tributary habitats from the Kahurangi meta-population and reduced connectivity between sub-populations. Existing immigration pathways between the Mokihinui Gorge tributaries and upstream parts of the Mokihinui is via continuous high quality riverine habitat that is occupied by a moderate density whio sub-population. The MHP would replace this immigration pathway with a hydro reservoir of no whio habitat value that will have no resident whio. It is not known what effect this change will have on migration to and from the remaining gorge tributary habitats. My view is that the reservoir would amount to a loss of connectivity / increased isolation, will change whio immigration in the area and most likely result in fewer whio finding their way into those tributary habitats reducing the viability of any remaining whio sub-populations.

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fluctuation in water level and the negative effects that this will have on periphyton and invertebrate densities on reservoir margins.

- The loss of the inundation footprint whio sub-population would reduce the overall fitness of the wider Kahurangi meta-population because ‘sub-populations collectively contribute to the overall survival of the meta-population’ (Gibbs, 2000 and Hanski, 1999). Although the contribution of the whio sub-population within the inundation footprint and minor tributaries to the Kahurangi meta-population is unknown and the effect of its removal can not be quantified, any reduction in the size and range of the overall meta-population can only be negative.

7.5. The AEE states that effects on whio are ‘less than minor’ (pp 103 of AEE) because (of the already discussed assertions) the effected whio population ‘is very small, appears to be declining and is in ‘imminent’ risk of local extinction due to introduced predators’; the inundation footprint is ‘not considered ‘core’ habitat for whio’; habitat is ‘less than optimal’; and ‘large areas of whio habitat exists in adjacent areas’.

7.6. Dr Norton reaches the conclusion that although the MHP footprint is significant habitat, the impacts on whio are not significant because, as with other threatened species of birds, ‘the actual number of birds that are likely to be affected is thought to be very small’

7.7. In my opinion the effects of the MHP on whio are more than minor and are significant because (as previously discussed) it would result in the permanent loss of a core part of the local Mokihinui whio sub-population that is a significant part of a region nationally recognised and managed for the security of whio.

8. MITIGATION OR COMPENSATION FOR THE ADVERSE EFFECTS OF THE MHP ON WHIO

Mitigating effects on whio resident within the MHP inundation footprint

8.1. The options for mitigating the effects on whio displaced by habitat loss include reducing direct risk of harm during construction and maximising survival and productivity of forced dispersal. Whilst these actions could mitigate some effects on individuals they make no contribution to mitigating for the permanent loss of 22.9km of habitat.

8.2. In terms of minimising risk of harm from construction, Powlesland has suggested that all tree felling should avoid the whio (and kiwi) breeding season and that all whio should be monitored through radio transmitters, presumably so their whereabouts can be determined relative to construction activities and appropriate actions taken to avoid harm. I agree that these actions would reduce the risk of direct harm and that they represent all that can be feasibly done.

8.3. In terms of forced dispersal, whio can either move themselves (emigration) or be captured and moved (translocation). It is my opinion that because the relative survival chances for whio from either emigration or translocation are the same and because it would be highly advantageous for these birds to preferentially settle in the proposed predator managed area in the South Branch, that translocation (along the lines suggested by Powlesland), although far from guaranteed to establish birds where released, is worth attempting.

8.4. The AEE concludes that the ‘survival prospects’ for the individual birds within the inundation footprint are likely to be higher if they are left to move themselves (pp 53), i.e. emigrate. Hale (2008) supported this view concluding ‘translocation is not a feasible option’. Powlesland takes the contrary view suggesting that although it is likely that some birds may return (‘home’) to the gorge, translocation is worthwhile and that all whio in the inundation footprint should be monitored by radio tagging and moved to the South Branch prior to inundation and once predator control is in place for at least one month.

8.5. The translocation of adult whio is dismissed by the AEE on the experience of the only documented translocation of adult whio that involved five individuals translocated 100s of km to catchments draining Mt Taranaki, which resulted in two settling successfully at the release location, two failing to settle because they homed to their source site whilst the outcome for one is unknown (Hutchinson, 1998). Of the four known fate birds this represents a 50% successful translocation and 100% survival. The only study I am aware of where the response of territorial whio to their habitat being destroyed has been measured was in tributaries of the Tongariro River following the eruption of Ruapehu in 1995 that resulted in severe river sedimentation due to lahars. This work found that resident whio persisted in their territories until extreme deterioration of habitat quality, emigrating as a last resort to unaffected side streams (Collier, 2004). Not surprisingly, whio chose to move as a final resort rather than perish. No measure of survival was provided from this report.

8.6. Therefore, if resident whio are left to emigrate from the MHP footprint the most likely outcome is that they will reconfigure what remains of their territories around tributaries of the gorge or move to quality, vacant habitat elsewhere. The risks to their survival are the same as for translocation, being; territorial conflict with other whio, inability to find suitable habitat and splitting of pairs[18] .

8.7. The mitigation value of displaced whio settling in local habitats where predators are controlled is higher than for non managed sites. If as proposed, the South Branch is managed for whio conservation as a form of partial compensation for the MHP, then unoccupied habitat within that managed site would be the best place for the displaced birds, both in terms of their own survival and their potential contribution to the Kahurangi meta-population.

8.8. Because the chances of affected whio survival are not reduced by translocation and limited experience suggests that there is a chance that they would settle in the release area, then I consider that attempting translocation would be worthwhile and not attempting it would represent a lost opportunity. It must however be acknowledged that any such translocation would be highly experimental and represent the first attempted small scale translocation of territorial whio. The Taranaki study (Hutchinson, 1998) moved birds 100’s of kilometres into new catchments that were almost certainly beyond their natural dispersal experience. Movements from the Mokihinui Gorge to the South Branch would be a maximum of 20km, within catchment and probably within natural dispersal experience. Given the unknown elements of translocation,

[18] Risk from capture and handling during translocation is low, whio are robust if handled appropriately and only very rarely have incidents of harm been encountered.

transmitters should be used (as proposed by Powlesland) to monitor the birds to determine response and survival.

Compensating for the loss of whio habitat and sub-population within the MHP footprint through predator management in the South Branch of the Mokihinui

8.9. I will now discuss whio related aspects of the South Branch animal pest control offset suggested in the AEE and outlined in detail for the Applicant in the evidence of Parkes, Ussher and Norton .. In regards to the Offset Model I have focused on the parameter inputs used in the whio population model provided by Dr Lloyd as appendix H to Dr Usshers evidence.

8.10. I agree that it is possible to compensate for the loss of the whio sub-population in the inundation footprint and minor tributaries by a predator control programme of the scale suggested in the 'Biodiversity Enhancement Strategy' (BES) and that for whio at least, the South Branch is an appropriate site.

8.11. However, compensation for the permanent loss of 22.9km of whio habitat is more difficult to define and achieve. To achieve this without replacing 22.9km of habitat elsewhere requires a disproportionally large contribution to whio conservation elsewhere. The Applicant through the evidence of Dr Ussher (and also Dr D Norton) suggests that the BES achieves this with 'overwhelming' improvements to biodiversity. In terms of whio I am not convinced. In my view there is considerable uncertainty in quantifying the overall outcome of the BES for whio; I consider that the magnitude of benefit to whio has been overstated and am not confident that it represents a no-net-loss in perpetuity scenario for whio and; contrary to evidence of Drs Ussher and Norton, I do not believe that the model strictly pass's the additionality gateway test or is conservative in it's assessment of the value of the BES for whio. Overall I suggest that the potential improvements for whio and therefore biodiversity from the BES are not as 'overwhelming' as suggested

8.12. **Feasibility**. I agree that it is feasible to compensate for the loss of the MHP footprint whio sub-population through the 35,000ha BES proposed by the applicant in the South Branch of the Mokihinui .

8.13. The 2007 AEE (pp.54) concluded that a 'predator-control programme in adjoining waterways with blue duck populations….. would provide a suitable environmental offset for the effects of the MHP on whio'. It proposed that this programme be established in the South Branch of the Mokihinui within the Mokihinui Forks Ecological Area and that the objective of this work in terms of whio should be to at least balance the loss of the population and progeny from within the MHP.

8.14. Bartlett (2008) provided a draft 'Habitat Enhancement and Predator Control Plan' for this work in the South Branch. The key elements of this plan for whio were predator control along 36km of whio habitat in the upper reaches of the South Branch, augmentation of whio population through harvest of wild eggs, captive raising of ducklings and release of juveniles into control area and a target of six new pairs within five to ten years.

8.15. A revised plan is presented by Parkes (2011) as the 'Biodiversity Enhancement Strategy' (BES). Key changes from Bartlett (2008) are an increase in the scale and scope of the terrestrial animal pest control to include most animal pests over the entire South Branch Catchment, around the margins of the proposed reservoir and Pakahi Creek (a total area of 35,000ha). The total stream channel within this area is reported as 114.5km by Lloyd; Parkes suggests that around 40km of this is good whio habitat with some further habitat likely in the headwaters of Granite Stream. Periodic aerial 1080 is the main method of stoat control specified. Trapping of stoats at a rate of 10 traps per km is suggested for at least the early stages of the project but this is not quantified. Supplementing the South Branch whio sub-population through nest harvest and captive raising is not part of the Parkes BES.

8.16. The BES strategy to benefit whio through predator control is in line with the Department of Conservations current preferred option for the security and recovery of whio populations, being ‘to manage whio at selected sites by controlling introduced predators, particularly stoats and by supplementing population growth by releasing captive reared whio’ (Glaser et al. 2010). In general terms the BES suggests an approach that the Department of Conservation would recommend as best practice for a managed site for whio. There are many elements of the proposal that warrant discussion and need defining, such as the amount and duration of trapping, frequency of trap checks, whether population supplementation through nest harvest should be included and importantly, the BEA lacks whio (and infact any) goals and objectives; however within the scale of cost being accepted by the BES it is my opinion that these are details that could be resolved in any operational plan[19] and that the BES could secure and recover whio in the South Branch to a scale sufficient to compensate for effects on whio in the gorge.

8.17. **Operational Area**. The South Branch catchment is a good choice of sites for work to compensate for the effects to the Mokihinui Gorge whio sub-population from the MHP.

8.18. Within the stated operational area there is a significant amount of riverine habitat (according to Lloyd, 114.5km), a diversity of channel width, volume and topography and habitat quality appears to be good (ref. Invertebrate assessments made by Overmars 2008). Strategically the South Branch of the Mokihinui is important for the same reasons as outlined in Section 6 of this evidence for the MHP footprint, namely; that it is part of the Nationally important Kahurangi stronghold for whio and is adjacent or proximal (as the whio flies) to several sites already being managed for the security and recovery of the species. A thriving whio sub-population in the South Branch would be a worthwhile and valuable contribution to efforts to secure whio both regionally and nationally.

8.19. There may be areas other than the South Branch which would be a better choice and give a greater return for whio compensation work; such as the North Branch or parts of the Karamea Catchment. However, without better

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[19] Suggested condition 38 of the Section 42a report reads that many of the details of a habitat enhancement programme can be determined through an 'agreed plan prior to the commencement of construction', i.e. following any decision to construct. In my experience this approach weakens the standard and investment in any compensation delivered. The fundamental elements of objectives, scale, intensity, site and even investment, <u>must be</u> defined as part of, and prior to, any decision.

knowledge about remaining sub-populations and further analysis of habitat quality, such an assessment is not able to be made.

8.20. **Uncertainty.** Beyond feasibility and operational area I have major difficulties with the assessment of the compensatory value of the BES for whio as presented by Dr Ussher's offset model. My following points support the analysis of Dr Ussher's model by Dr Langford.

8.21. There are many aspects of uncertainty in the whio assumptions and data used by Dr Ussher. In my view these uncertainties are not adequately acknowledged. Consequently the model reaches conclusions in regards to whio which are unrealistic in terms of scale and/or confidence.

8.22. One aspect of uncertainty is the type and intensity of stoat control required to achieve security and/or recovery of whio in the BES. Parkes is clear on this in his suggested 'adaptive approach', however this is not acknowledged as an element of uncertainty in the model.

8.23. Stoat control required for whio recovery has not been fully tested and the need for research to confirm the role of stoats at more sites needs to be repeated (Glaser et al. 2008). My view is that stoat control will in the long term be proven to be the key mechanism to secure and recover whio populations over the vast majority of landscapes. However, uncertainty critical for consideration of the offset value of the BES lies in exactly how to achieve this and estimating in a meaningful way (as implied by the Ussher Offset model) what the scale of outcome will be for whio and over what timeframe.

8.24. A study running in Fiordland since 2000 (Whitehead et al. 2007 and 2010) has provided the best evidence to date of the impact of stoats on nesting whio (through video monitoring) and of a positive response of whio populations to stoat trapping (through population productivity and trend monitoring). Whio populations at other sites have also shown a convincing positive response since the implementation of stoat control such as those monitored within Te Urewera in the central North Island and at Flora Stream in Kahurangi (both Glaser et al. 2010).

8.25. Results at other sites have been less dramatic and the value added by management at those sites has yet to be proven. Also, the threats and threat management at each of these sites has been different, as has topography, habitat, predator ecology and subtly, whio behaviour. Accordingly, we do not have a proven model of whio recovery that can be applied universally. I would list amongst unproven sites the Wangapeka / Fyfe, Oparara/Ugly and Styx Arahura Security sites. Yes stoats are probably the main cause of decline, and yes there has been an observed increase in the number of pairs occupying these sites since stoat control and this is probably down to management; but the links between cause and effect have not been proven. [20]

8.26. Another aspect of uncertainty is the population parameter values used by Dr Lloyd in his whio population model which is part (Appendix H) of Dr Usshers Offset Model analysis.

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[20] Although there is uncertainty about the type and intensity of stoat control required to generate a whio recovery response at these sites, I am confident that stoat control will be the answer at these sites, would also be the answer in the South Branch and is to a large degree manageable through the adaptive approach suggested by Parkes (2011); i.e. just keep increasing the intensity and effectiveness of stoat control until whio respond

8.27. Lloyd acknowledges that the population parameter estimates at his disposal from the literature to input into a model were limited and in some cases not available. The lack of reliable parameter data immediately undermines this population model .

8.28. In the absence of real data on population growth rates with and without predator control, Lloyd uses a range of values that give a wide range of possible outcomes in terms of speed of recovery Estimates include the whio sub-population in an unmanaged gorge and minor tributary habitat being extinct between 5 to 50 years (Lloyd figure 2) and a managed South Branch sub-population reaching a carrying capacity of 121 pairs by year 30 or about year 60 (Lloyd figure 4). Without real data this range of estimated values is the best that can be done, but which value and therefore which outcome do we choose and why? Whichever is chosen is educated guess work that introduces a high level of uncertainty as to when net biodiversity gain is provided for whio. This uncertainty is not adequately acknowledged in the Offset Model.

8.29. **Conservatism**. Ussher (2011, pt 5.23) claims that his offset model represents a conservative assessment, such that when there was a choice between estimated values, the higher values were chosen for the impact area and lower values for the offset. I found the Offset Model to be anything but conservative.

8.30. The starting point chosen to model the whio sub-population currently within the inundation area and minor tributaries is two pairs, when a conservative approach would have been to start at three to four pair's minimum and infact, more realistically given the likely underestimation of a single survey, five to eight. Conversely, the starting point for the South Branch offset area is five pairs when infact the survey encountered no pairs in this area. I am not suggesting that 5 pairs do not occur in the South Branch, but it is an optimistic not a conservative estimate.

8.31. Table 3 of Usshers evidence states that 14km of riverine habitat will be lost. Elsewhere in the application the length of the main Mokihinui channel that will be lost is stated at 14.5km and it is acknowledged that the MHP footprint including major tributaries brings the total to 18.95km. When all stream channels are included Dr Leathwick's analysis concludes that 22.9m will be lost. If a balanced approach was being taken then at the very least the 14.5km figure of main channel would not have been rounded down to 14km and we should have expected a figure of at least 18.95km. If a conservative approach was being taken then a more comprehensive analysis of directly affected channel would have arrived at the figure of 22.9km and there would have been some acknowledgement of indirectly affected tributary channel.

8.32. The parameter value arrived at in the whio population model by Dr Lloyd for the Carrying Capacity of the BEA is also not conservative and significantly overstates the likely magnitude of benefit of the BEA at 121 pairs in 114.5km of habitat. In my view a more realistic estimated carrying capacity for this length of habitat is in the region of 76 pairs and a conservative estimate that took into account stochastic events and habitat heterogeneity, would, in the 50 year timeframe of the Offset Model, be in the region of 60 to 70 pairs

8.33. Dr Lloyd calculates carrying capacity citing Godfrey et al. (2003) and their equation ‘log (territory length) = 1.48 + 0.602 x log (Altitude)’.[21] Lloyds use of the Godfrey et al. (2003) equation is done without any comment on it’s likely accuracy (i.e. no acknowledgement of uncertainty) or discussion of other approaches used to calculate territory length. There are many limitations to the work reported in Godfrey et al. (2003) and the discussion section of the paper is cautious in it’s conclusions about altitude. The paper relies on information on territory length from a limited number of existing studies which did not provide for a large sample size or representativeness across altitude.

8.34. I agree that the mid and lower altitude reaches of streams do appear to be more productive and therefore likely to accommodate more whio (i.e. shorter territories), however I do not believe that we understand this enough to be able to confidently predict territory lengths in the South Branch for altitudes at 100m intervals as shown by table 3 of Dr Lloyds model.

8.35. The calculations using the Godfrey et al. equation as presented by Lloyd (and subsequently Ussher) suggest homogeneity in the river channel such that all habitat at a certain altitude will provide for the same carrying capacity (as expressed in territory length). This is clearly not the case as altitude is but one of the variables of whio habitat quality. As a simple example, a 650masl stretch of river channel that is of steep gradient draining highly active

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[21] Dr Lloyd miss quotes the equation values as 1.42 and 0.62 rather than 1.48 and 0.602 (pp4). When his Table 3 results are fitted against the Godfrey regression line they fit within the range suggesting that he either used the correct values in his calculation or the difference they make are not significant.

geologies will have significantly different habitat qualities to a river channel at 650masl over easy gradient and stable geologies.

8.36. When calculating the number of pairs that any given length of river can hold the generally accepted average territory length for whio is taken to be 'about 1.5km of river' (Glaser et al. 2010). For example, to achieve the target of 50pairs protected at each of the two security sites on the West Coast the Department of Conservation aims to protect a minimum of 75km at each site. If we apply this simple logic to the 114.5km of channel in the BEA we get a figure of 76pairs[22].

8.37. **Magnitude.** Although I agree with the Applicant that it is feasible to compensate for the effects on whio from the MHP through the BES I argue that the magnitude of this compensation for whio is less than suggested.

8.38. This is an important point because although Dr Ussher states that the offset model does not rely on 'trading up' or 'in kind' trading, the discussion in his evidence is such that it encourages the reader to accept that the BES results in 'overwhelmingly improvements' to all vegetation and species included in the model, such that there is an overall net gain in biodiversity values.

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[22] I note that if I am wrong about carrying capacity and the figures presented by Lloyd are correct, then the current and future work that is and will be underway in catchments adjacent to the Mokihinui will produce a much greater number of emigrating juveniles than I assumed in my discussion under sustainability (Section 6). I.E. Where I assumed a trickle of birds there will be a flood and retaining as much habitat as possible in the Mokihinui to receive these birds will be important.

8.39. A population of 121 pairs of whio within 40 to 50 years is part of this overwhelming biodiversity gain equation. As stated above, my view is that this is an unrealistic estimate that is effectively double what I would regard as a conservative estimate, and that the magnitude of the 'overwhelming improvement' should be accordingly adjusted.

8.40. **Additionality.** Only parts of the additionality gateway test for the Offset model proposed by Dr Ussher have been met.

8.41. Additionality is one of the gateway tests that Dr Ussher considers has been 'clearly demonstrated' for his offset model. I agree that Dr Ussher has demonstrated that the BES would meet additionality as he has defined it, as it will deliver conservation value for whio and that this would be additional to that currently being undertaken.

8.42. However, I am more inclined to the definition put forward by Dr Norton which is that additionality has been demonstrated when an offset action is 'additional to actions that already occur or are likely to occur at the target site', with the inclusion of the likelihood of future scenarios being the critical difference. My discussion points under sustainability (Section 6) demonstrate that there is a high likelihood that current and future work in adjacent catchments within the distributional range of whio is and will provide benefits to whio in the Mokihinui catchment, and therefore additionality as defined by Norton has not been fully demonstrated.

9. CONCLUSIONS

9.1. The whio habitat and whio sub-population in the inundation footprint and it's minor tributaries are significant for whio under Section 6(c) of the Resource Management Act. The development of the MHP would adversely effect whio at a regionally significant level that has more than minor implications for national efforts to conserve the species.

9.2. Although it would be feasible to compensate for the loss of the MHP whio sub–population through the implementation of the BES, there is significant uncertainty about the outcome for whio as modeled by the Applicant and the magnitude of positive effect for whio from the BES is highly unlikey to achieve the level suggested by the Applicants Offset Model. Consequently, the BES does not provide the 'Overwhelming' gains necessary to be confident that it compensates for the permanent loss of 22.9km of whio habitat.

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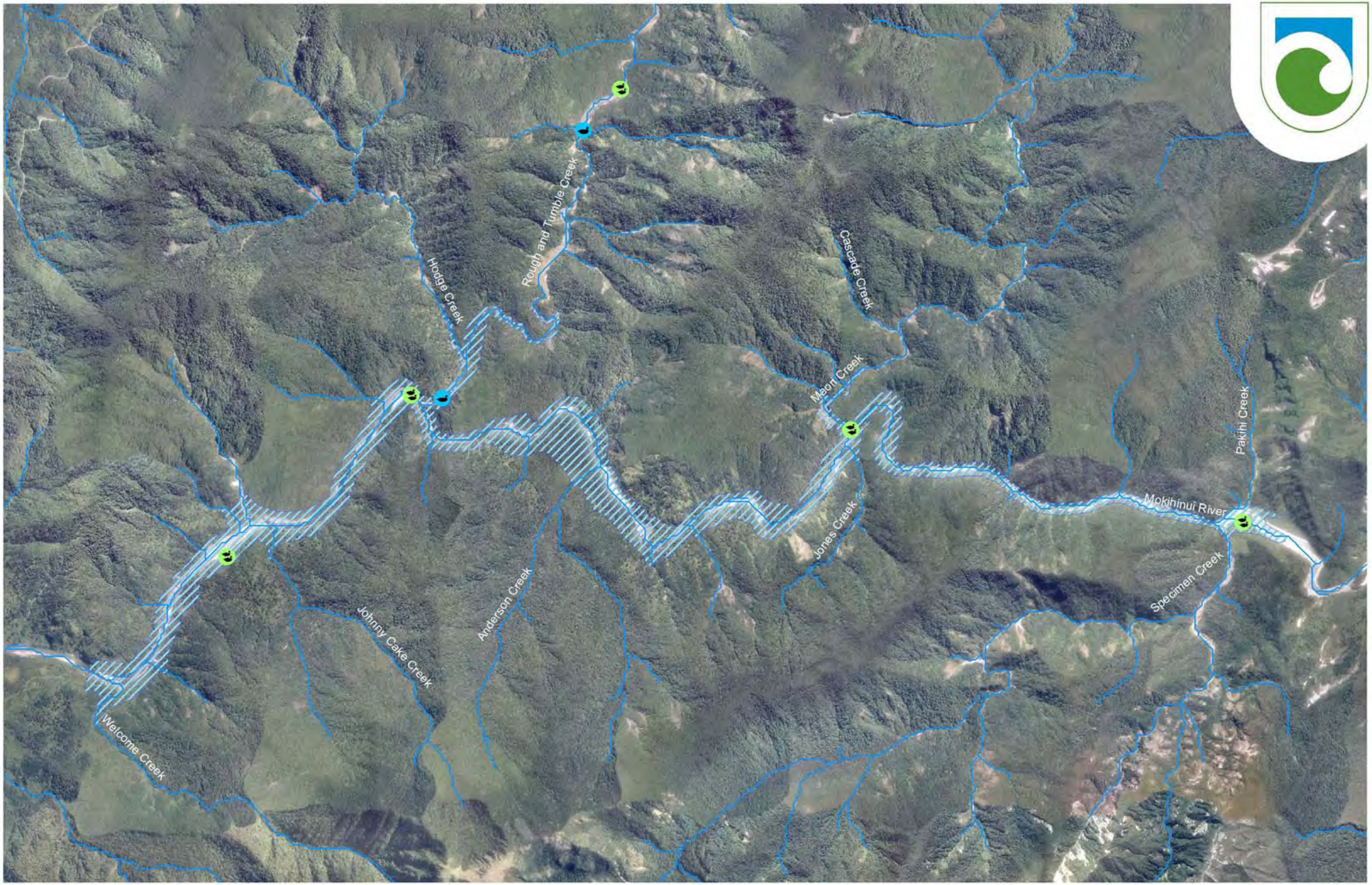
APPENDIX 1



Whio locations

- Single male
- Pair
- proposed_dam_polygon_nztm

Figure 1: Estimated distribution and abundance of whio in and around MHP

Projection: Transverse Mercator
Datum: NZGD 2000

N

0 1 2
Kilometres

Department of Conservation
Te Papa Atawhai

West Coast *Tai Poutini* Conservancy. Map prepared: 27/04/2012. Path: G:\GIS\Projects_2010\Community_Relations\190_Mokihinui_Environment_Court_Appeal\Tim_Shaw_Evidence\

APPENDIX 2

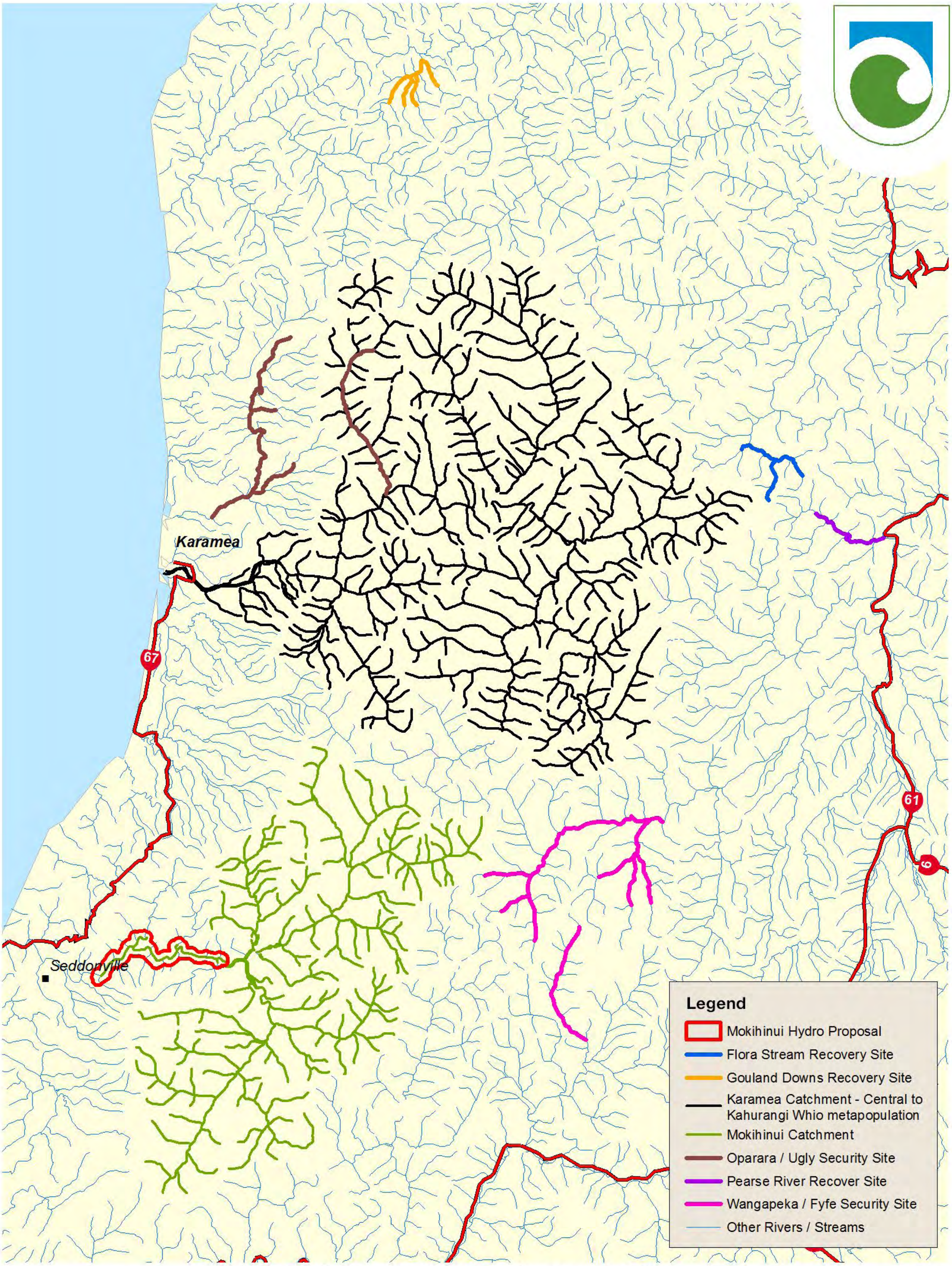


Figure 2: Location of currently managed whio sites and the Karamea catchment relative to the Mokihinui and area affected by the MHP

Map prepared: 27/04/2012

Projection: Transverse Mercator
Datum:NZGD 2000

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