APPENDIX 6: Aviation Assessment and OLS Recommendations (Astral Consultants)

To: **NZTE Operations**

From: **Dave Park**

Date: **27 Nov 17**

Re: **Te Kowhai airstrip development**

This memo summarises the information I have provided you to date and our discussions on 21 Nov relating to the long term development of Te Kowhai airfield and the adjacent proposed aeropark.

Aircraft design category

1. The design aircraft category is Code 1A+ (the plus being an allowance for a span of up to 18m compared to the normal 14.99m maximum for Code A). Specs for 14.99 span are provided for comparison in option (b) below.
2. The aircraft operations will be non-air transport day/night IFR for aircraft less than 5700kg all-up weight(AUW). The resulting design standard is CAA Advisory Circular AC139-7.
3. The specs for this also cover day VFR Air Transport per AC139-6.
4. Specs for Code 2A+ are concluded for completeness, Code 2 being a take-off reference field length (TRFL) of 800m or more but less than 1200m, and A+ being wing span up to 18m.

OLS and key dimension specifications

5. Key dimension specifications are as shown in options A, B and C on pages 3-5 (heights are above aerodrome elevation datum). A table of aerodrome aircraft design codes from CAA Rule Part 139-6 is also included on page 6.

Recommended design specs

1. We recommend designing the airpark layout to the specifications in Option A above as this will provide the maximum flexibility of use, including day VFR Air Transport operations. Lost aerodrome capability by designing to an inadequate standard, in particular the runway strip width, taxiway separation and building line location, cannot be recovered once buildings are constructed. This is because under the Resource Management Act it would be very difficult to get a new comparable aerodrome consented almost anywhere in NZ.
2. Any incompatibilities of existing infrastructure (e.g. the western hangars proximity to the runway) with the specification (A) layout can be addressed over time.
3. The removal of the “pinch point” on the airfield’s north boundary and a realignment of the strip to parallel the new north boundary would be ideal to ease the runway to hangar separation issue at the west end. This would require a DP change including re-alignment of the OLS.
4. Support of the District Council should be sought in ensuring the airfield is adequately protected in the District Plan for foreseeable future development as a regional resource. Thames-Coromandel District Council is set a good example of this in relation to Whitianga Airfield by protecting for future Code 2 air transport operations.
5. Designing to accommodate IFR operations by Code 1 non-air transport aircraft, requiring minimum 60m strip width, is recommended as developments in satellite based navigation are expected within the next 10 years in New Zealand that will permit IFR approaches to aerodromes without ground based navigation aids. This already occurs in the USA and Europe.

CAA Rule Part 157

6. Being an alteration to a non-certificated aerodrome, the aeropark design would require approval by the CAA under CAA Rule Part 157. An "aeronautical study" (risk assessment) would need to be done to ensure that all relevant risks are identified and where necessary appropriately mitigated.
7. Subsequent changes to aerodrome layout as may be approved in the DP per (7) above would technically require a re-application to the CAA for approval under Part 157. However as the design of the airpark would be largely unaffected and separations between west end hangars and the runway would be increased, in our view it is unlikely CAA would have any concerns.

Feel free to contact me should you require more information.

Dave Park

Director

Option A. DAY/NIGHT/IFR NON-AIR TRANSPORT CODE 1A+ (18m MAX WING SPAN) AND AIR TRANSPORT DAY VFR ONLY CODE 1A+ (18m MAX WING SPAN)

Design feature	**Specification**
Strip width	60m (note CAA asked to confirm)
Strip end length	30m at each end of runway
Tkoff/approach surface upslope	1:40 from the strip end
Tkoff/approach surface side splay	1:10 (10%) outwards from each edge of the strip
Tkoff/approach surface extent	2500m from strip end
Transitional surfaces	1:5 upslope from strip edges to 10m height then vertical to 45m
Inner Horizontal surface	45m height extending 2500m from runway centreline and strip ends
Taxiway to runway centreline separation	39.0m (increased from 37.5m due 18m design wingspan
Taxiway centreline to fixed object	18.0m (increased from 16.25m due 18m design wing span)
Taxiway centreline to building line (hangar/home front faces)	28.0m (allows for 10m deep apron in front of hangars/homes)
Runway centreline to building line	67m
North side of runway strip to building line	97m
Minimum runway width	18m
Minimum taxiway width	7.5m (main outer gear span limit 5.5m - see note 1)

NOTE:

1. For VRF air transport operations taxiway minimum width may need to be increased for main outer gear span of 4.5m or above.

Option B. DAY VFR ONLY NON-AIR TRANSPORT CODE 1A (14.99m MAX WING SPAN)

Design feature	**Specification**
Strip width	37.5m minimum
Strip end length	30m at each end of runway
Tkoff/approach surface upslope	1:20 from the strip end
Tkoff/approach surface side splay	1:20 (5%) outwards from each edge of the strip
Tkoff/approach surface extent	1600m from strip end
Transitional surfaces	1:4 upslope from strip edges to 2m height then ends
Inner Horizontal surface	No requirement
Taxiway to runway centreline separation	37.5m
Taxiway centreline to fixed object	16.25m
Taxiway centreline to building line (hangar/home front faces)	26.25m (allows for 10m deep apron in front of hangars/homes)
Runway centreline to building line	63.75m
North side of runway strip to building line	82.50m
Minimum runway width	9.0m
Minimum taxiway width	7.5m (main outer gear span limit 5.5m)

Option C. DAY/NIGHT/IFR NON-AIR TRANSPORT CODE 2A+ (18m MAX WING SPAN)

AND AIR TRANSPORT DAY VFR ONLY CODE 1A+ (18m MAX WING SPAN)

Design feature	**Specification**
Strip width	80m
Strip end length	30m at each end of runway
Tkoff/approach surface upslope	1:40 from the strip end
Tkoff/approach surface side splay	1:10 (10%) outwards from each edge of the strip
Tkoff/approach surface extent	2500m from strip end (see note 1)
Transitional surfaces	1:5 upslope from strip edges to 10m height then vertical to 45m
Inner Horizontal surface	45m height extending 2500m from runway centreline and strip ends
Taxiway to runway centreline separation	49.0m (increased from 37.5m due 18m design wingspan and 80m strip width)
Taxiway centreline to fixed object	18.0m (increased from 16.25m due 18m design wing span)
Taxiway centreline to building line (hangar/home front faces)	28.0m (allows for 10m deep apron in front of hangars/homes)
Runway centreline to building line	77m
North side of runway strip to building line	117m
Minimum runway width	18m
Minimum taxiway width	7.5m (main outer gear span limit 5.5m - see note 2)

NOTE:

1. Code 2A+ day VFR air transport operations require 3000m extent
2. For VRF air transport operations taxiway minimum width may need to be increased for main outer gear span of 4.5m or above.

Aerodrome Design Codes

Code element 1	
Code number (1)	**Aeroplane reference field length (2)**
1	Less than 800m
2	800m up to but not including 1200m
3	1200m up to but not including 1800m
4	1800m and over

Code element 2		
Code letter (3)	**Wing span (4)**	**Outer main gear wheel; span[a] (5)**
A	Up to but not including 15m	Up to but not including 4.5m
B	15m up to but not including 24m	4.5m up to but not including 6m
C	24m up to but not including 36m	6m up to but not including 9m
D	36m up to but not including 52m	9m up to but not including 14m
E	52m up to but not including 65m	9m up to but not including 14m

[a] Distance between the outside edges of the main gear wheels

Note:

Aeroplane Reference Field Length means the minimum field length required for take-off at maximum certificated take-off weight, sea level, standard atmospheric conditions, still air and zero runway slope.

TE KOWHAI AIRFIELD

RECOMMENDED OBSTACLE LIMITATION SURFACE PROTECTION

ASTRAL LIMITED

05 June 2018

Contents

1 Background and objectives

In Nov 2017 Astral Limited (Aviation Consultants) has been requested by Te Kowhai Airfield Operations Limited (NZTE), owner and operator of Te Kowhai Airfield, to advise it on protection of the airfield's flight path and runway areas to improve safety, allow for enhanced aircraft operations and facilitate the development of an aeropark.

Astral reviewed relevant aerodrome design standards in relation to Obstacle Limitation Surfaces (OLS) and runway strip width, both of which are designed to protect the safety of aircraft operations, for the proposed development and future aircraft operations.

We summarised our recommendations in a memo to NZTE on 27 Nov 17. This report expands on the memo to provide more information to Waikato District Council (WDC) on the requirements for flight path protection, which is an integral part of airfield design.

We are advised by NZTE that its intention is to upgrade the airfield to allow enhanced private aircraft operations of small single or twin-engine propeller powered aircraft under poor weather conditions, known as Instrument Flight Rules (IFR). In the past, private aircraft operations have been under good weather conditions ("Visual Flight Rules" or VFR) and IFR operations depended on very expensive ground-based radio navigation equipment to be installed each airfield at which IRF operations were sought.

With the advent of aviation precision satellite-based navigation systems for light aircraft, commonly known as Spaced Based Augmentation Systems (SBAS), and the implementation of the necessary SBAS ground infrastructure by central government it is possible for small aircraft to conduct IFR operations at any airfield, even down to simple grass runways such as at Te Kowhai.

This greatly improves the safety and reliability of aircraft operations. However, it does require a higher standard of airfield design to ensure sufficient clear ground and airspace exists for safe operations in the reduced visibility conditions of IFR.

While similar SBAS systems are used by large air transport aircraft we are advised, and have prepared this report on the basis that, no such operations will occur at Te Kowhai. The design requirements described in the following sections, together with the recommendations in this report are intended primarily to cover small aircraft IFR operations at Te Kowhai.

2 Aerodrome regulation and planning in New Zealand[1]

2.1 The Civil Aviation Authority

Aerodromes in New Zealand are regulated by the Civil Aviation Authority of New Zealand (CAA). The CAA only regulates from a safety perspective, it does not regulate aerodrome environmental matters such as planning consents, airport noise or aircraft engine emissions, other than to require certain types of aircraft to comply with international aircraft noise and emission standards.

The CAA categorises aerodromes as "certificated" or "non-certificated". Aerodromes which serve regular air transport operations of aircraft with 30 or more seats are required to be certificated. As

[1] The terms "airfield" and "aerodrome" are used interchangeably in this report. The Civil Aviation Authority of New Zealand adopts the internationally standard terminology of "aerodrome" meaning a site at which fixed wing aircraft operate, irrespective of size. In New Zealand the term "airfield" usually means a site where small fixed wing aircraft operate, typically single engined aircraft seating up to 10 passengers on provide operations. "Airport" is usually taken to mean a facility where larger aircraft operate scheduled public transport flights.

this is not intended for Te Kowhai airfield, certificated aerodromes are not discussed further in this report.

The CAA aerodrome design standards for non-certificated aerodromes with a maximum operating weight (MCTOW) of 5700kg or more are contained in CAA Advisory Circular AC139-6 and standards for aircraft below 5700kg MCTOW are contained in AC139-7.

In particular the two AC's define the runway strip width and length (being the dimensions of the level grassed area surrounding the actual runway) and the runway's obstacle limitation surfaces (OLS). The OLS are a series of protection surfaces arising upwards and outwards from the ends and edges of the runway strip intended to protect aircraft taking off, landing and circling.

It is essential that strip dimensions and the associated OLS are protected if a runway is to be safe to operate. The CAA requirements in this regard are based on those of the International Civil Aviation Organisation (ICAO), a body incorporated into the United Nations, which determines international aviation safety standards.

2.2 Aircraft size and speed categorisation

The CAA, in line with international (ICAO) practice, categorise aircraft in terms of their speed and size using a number-letter code; the number part (from 1 to 4) being a measure of the aircraft's speed based on its take-off runway length requirement and the letter part (from A to F) being a measure of its wing-span. The aircraft code for the most demanding aircraft type regularly operating at the aerodrome becomes the aerodrome reference code used for aerodrome design purposes. The higher the number and letter, the bigger and faster the aircraft is.

Table [1] below lists the aerodrome reference codes covering the smallest propeller aircraft up to the largest wide body air transport jet aircraft:

Table [1]: CAA Aerodrome reference codes:

Code element 1	
Code number (1)	**Aeroplane reference field length (2)**
1	Less than 800m
2	800m up to but not including 1200m
3	1200m up to but not including 1800m
4	1800m and over

Code element 2		
Code letter (3)	**Wing span (4)**	**Outer main gear wheel; span[a] (5)**
A	Up to but not including 15m	Up to but not including 4.5mm
B	15m up to but not including 24m	4.5m up to but not including 6m
C	24m up to but not including 36m	6m up to but not including 9m
D	36m up to but not including 52m	9m up to but not including 14m
E	52m up to but not including 65m	9m up to but not including 14m

[a] Distance between the outside edges of the main gear wheels

The aerodrome design code proposed by NZTE Operations for Te Kowhai airfield is Code 1A, i.e. the code appropriate to the small single or twin engined aircraft. However, the Code A wing span upper limit of 15m does not cover all small aircraft that may operate at the airfield, for example the Cessna C208 Caravan which has a span of 15.88m. For this reason, NZTE proposes an upper wingspan limit of 18m, referred to in this report as Code "1A+" i.e. accommodating aircraft with a required take-off field length of less than 800m and wing span of up to 18m, which is effectively Code A but with an upper wing span limit of 18m instead of 15m.

This recognises the fact that aircraft wing spans are generally increasing to obtain aerodynamic efficiencies and the larger aircraft types previously at the top end of Code A now have spans placing them just inside Code B.

In fact, the letter part of the code makes little difference to airport design except in relation to ground manoeuvring space including separations between taxiways and buildings.

2.3 Aerodrome Resource Management planning

In New Zealand, aerodromes are provided for in Territorial Authorities' District Plans. Provisions typically include:

- Underlying land use and/or permitted land use applied by designation for "aerodrome purposes" or similar. Designation is usually used if the facility owner is a Requiring Authority.
- Rules around what types of operations and activities may occur at the facility.
- Aircraft noise limits and associated land use controls around the aerodrome as specified in New Zealand Standard NZS6805:1992.
- Height controls over properties owned by other parties lying under the flight paths near the airport, intended to protect the OLS and those additional flight path protection surfaces that may be required to allow IFR and/or night operations. These latter surfaces are referred to

as instrument flight procedure surfaces (IFPS). They resemble the generic OLS but more specifically relate flight paths taken by IFR aircraft on a specific runway.

If the aerodrome owner is not a requiring authority, OLS protections have to be provided by the Territorial Authority within which the aerodrome is located (and occasionally adjacent authorities as well) via rules in the District Plan. Examples of privately owned airfields in New Zealand where OLS are protected in this way are Hastings (Bridge Pa), North Shore (Dairy Flat) and Whitianga airfields.

Territorial Authorities are motivated to do this in order to protect the airfield as a local amenity from encroachment by land uses, structures and vegetation that may have adverse effects on the existing and future use of the facility.

In Astral's opinion it is particularly important the Territorial Authorities provide this protection as we consider the consenting of a new "green fields" airfield would be extremely difficult almost anywhere in New Zealand given the local sensitivities to activities that can create noise disturbance.

3 The existing airfield and its operations

3.1 Facilities and operations

The existing airfield is listed in the New Zealand Aviation Information Publication (AIP) as a non-certificated aerodrome available for general use but with the proviso that commercial operations have the prior approval of NZTE Operations, the listed aerodrome operator.

Figure 1 shows the layout of the airfield as depicted in the AIP.

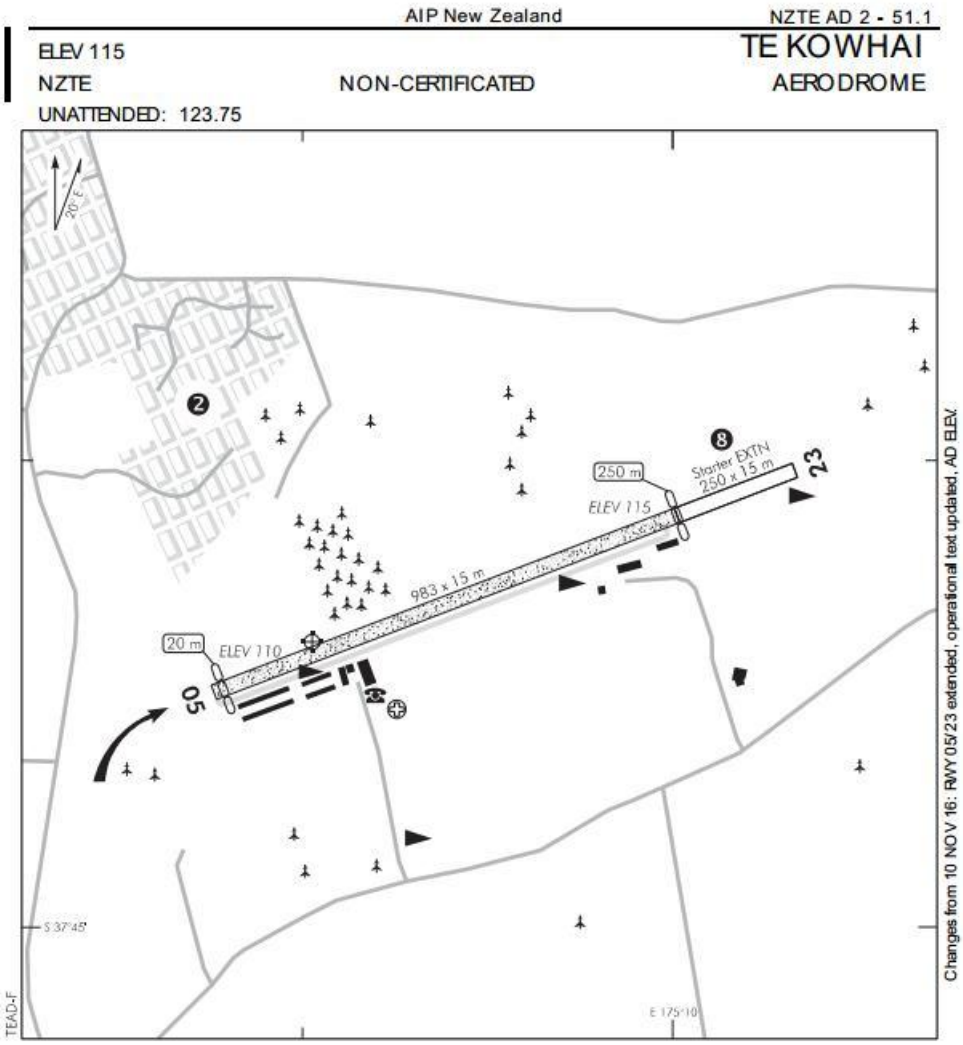
The single grass runway runs south west (SW) to north east (NE) and is 983m long. The runway direction for taking off or landing towards the NE is referred to as runway 05, and the reverse direction is runway 23.

The airfield has no night lighting and no published instrument approach procedures i.e. navigation procedures that allow a pilot to land (or to take-off) in poor weather conditions. On this basis the airfield (or more specifically its runway) is deemed to be a non-instrument day VFR runway.

Te Kowhai Aerodrome has a range of recreational and general aviation type operations with some basic flight training. The aerodrome is available for general use by visiting public aircraft.

There are currently around 55 aircraft based at the aerodrome. These aircraft are a mix of microlights (Bantam B22, Tecnam P96), and light aircraft (Cessna 152/172, Piper PA28) and ex-military aircraft (Yak 52) together with some helicopter operations.

Figure 1: Airfield layout



3.2 Planning provisions

The existing airfield is provided for in the Waikato District Council (WDC) Operative District Plan (ODP) at Part 3 Appendix K with approach OLS, depicted on the Te Kowhai planning map, between Limmer Rd and Te Kowhai Rd.

Appendix K provides the following specification:

(a) A runway 983.7m long and 15m wide contained within a runway strip of the same length but 30m wide.

(b) OLS associated with the runway strip are defined as follows:

(i) An approach surface originating from a 45metre wide base centred at the end of the runway strip, extending outward 1200m from each runway end along the extended runway centreline and rising upwards at a gradient of 1:20. The sides of the approach surfaces splay outwards at a rate of 1:20 symmetrically on either side of extended centreline.

Note that no separate take-off OLS is provided, it being taken that the approach OLS also provides protection for take-off. This is common practice at small airfields where the geometry of the take-off and approach OLS are identical.

(ii) A transitional surface rising upwards and outwards from each side of the approach surface at a vertical gradient of 1:4 to a height of approximately 2m above the runway level.

This OLS design is consistent with CAA requirements for day VFR airfields for non-air transport operations by aircraft with MCTOW 5700kg or less.

4 Future Te Kowhai airfield OLS requirements

As stated earlier, NZTE Operations wishes to provide for the IFR operation of Code 1A aircraft with wing spans up to 18m (Code 1A+) and MCTOW of up to 5700kg. Code 1A is at the lowest level of categorisation of aerodromes and aircraft by the CAA (and ICAO) representing and "entry level' of aerodrome design.

We are advised by NZTE Operations that the intent is purely to provide for sustainability of the airfield in light of the development of low cost GPS based IFR capability in small aircraft.

IFR capability will also provide capacity for emergency civil defence operations should these be required.

The weight limit of 5700kg MCTOW, together with the relatively short runway length of 983m and the grassed surface, means operations will effectively be restricted to aircraft with less than approximately 13 seats[2].

The limitation on space for the runway within the airfield's land holding prevents a significantly longer runway or a strip width of more than 60m. This will prevent the facility from ever accommodating larger aircraft.

IFR operations require a more stringent OLS design than that currently provided in Appendix K of the ODP. The specifications for the required strip and OLS are contained in AC139-7 sections 2.2 and 3.3. The differences for IFR from the existing runway strip and OLS provisions are:

(a) The required runway strip width increases to 60m.

(b) There must be a separation of 30m between the ends of the runway and ends of the strip ("strip ends").

(c) The combined take-off and approach surface slopes up at a lesser gradient of 1:40 and extends just over twice as far to 2500m out from each strip end.

(d) The base width of the combined take-off and approach OLS is 60m and the OLS side splay out at a rate of 1:10.

[2] The Cessna 208 caravan with an MCTOW of 3500kg and seating capacity of up to 13 is representative of the largest aircraft likely to be able to operate at Te Kowhai.

(e) The transitional surface extends upwards and outwards from each side of the runway strip at a vertical gradient of 1:5 to a height of approximately 10m above the runway level, then vertical to a height of 45m.

(f) An inner horizontal surface is introduced at a height of 45m extending outwards 2500m from the runway centreline and strip ends.

These proposed OLS are illustrated in Figure 2.

5 ODP height control rules to protect the OLS

The presence of structures (including but not limited to buildings, masts and chimneys) and vegetation (trees) that penetrate through the OLS surfaces could make it unsafe for aircraft to operate at Te Kowhai airfield.

The Operative Waikato District Plan (ODP) Part 2 section 25.49(c) currently lists construction or alteration of buildings and structures that penetrate the Te Kowhai Aerodrome OLS, defined in Appendix K of the ODP, as discretionary activities. We strongly recommend that this section of the ODP is updated to provide for the runway strip width and OLS geometry as shown in Figure 2 of this

report, and that Part 2 section 25.49(c) is extended to include vegetation penetrations of the OLS as a discretionary activity.

The Council should also be cognisant of the requirements of CAA Rule Part 77 - *Objects and Activities Affecting Navigable Airspace*, specifically Rule 77.5 *Notification of construction or alteration of a structure* which require that any person proposing to build or alter a structure notifies the Director of CAA if the structure will exceed heights specified in the Rule.

6 Conclusion and recommendation

In our view airports are a finite resource and any reduction in an existing aerodrome's capacity due to surrounding land development represents a loss of the region's potential recreational and air transport amenities.

We believe that Te Kowhai airfield needs an enhanced level of airspace protection to enable its owners to develop the facility to its reasonable potential for GPS based IFR operations, in light of developing light navigation aircraft technology.

Accordingly, we recommend that the Waikato District Council adopts the OLS protection specified in this report into its ODP. In our experience it is usually possible to reach an accommodation with affected landowners that allows them, within reason, to develop their properties without detracting from the airfield's development potential.

We believe any concern that operations may grow to include larger aircraft with greater environmental impacts are unfounded due to space constraints preventing the required runway strip and OLS geometry being developed i.e. operation of aircraft in excess of 5700kg and approximately 13 seats would not be approved by the CAA under current (and foreseeable) aerodrome design standards.