



# Appendix H

## Construction, Operation and Maintenance Considerations



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## Safety in Design Considerations

To ensure the health and safety of construction personnel, road users and network operators, 'safety in design' has been a fundamental consideration in developing the Consent Design. A Safety in Design workshop was held with the AMA on 2 November 2016.

### Minimise Construction Risks

Measures to reduce construction risks include:

- Existing infrastructure are retained where condition and hydraulic capacity are adequate. This minimises and reduce works near existing live lanes.
- Structures to convey captured stormwater runoff are to be above ground wherever practicable, avoiding trenching for pipes and thus improving timeliness and reducing construction hazards associated with excavations; and
- Adequate trench support or appropriate batters is provided to allow safe installation of pipes and culverts.

### Safety for Road Users and Public

The following considerations have been taken into account in order to provide a safe road environment for vehicles and the public:

- The use of scruffy dome manhole inlets provides a high inlet capacity with good resilience from inlet blockages. In areas that are not exposed to live traffic, these are proposed as the primary type of inlet for draining open channels;
- In areas unprotected by traffic safety barriers, the use of grill manhole inlets (in which the grill opening has the same diameter as that of the chamber beneath) provides a high inlet capacity. These inlet grills have a flat profile and can be safely traversed by maintenance vehicles or errant vehicles and do not impair visibility of road users;
- All drainage and treatment assets are either underground, flush with the finished ground level or protected by a traffic safety barrier;
- Manholes within the carriageway (including shoulders) are proposed to be buried;
- Anti-fall fencing is provided for wingwalls higher than 1m in accordance with the NZ Building Code; and
- Use of dense planting and/or fencing around wetlands and ponds to inhibit public access. Safety benches are also provided in all proposed wetlands and ponds.

## Safety of Maintenance Operations

### Road Network Drainage

The use of catchpit manholes removes the need for routine cleaning access of individual catchpits (which often require temporary traffic management) and avoids the duplication of stormwater assets within the network, therefore providing safety and maintenance benefits.

Manholes and access chambers are positioned away from live lanes where practical. This minimises works near live traffic and traffic management requirements for maintenance during operation.



## Stormwater Wetlands

The following measures have been taken to provide safe conditions for maintenance personnel for the operation and maintenance of wetlands:

- The use of plant types and density that provide a distinguishable barrier around wetlands;
- Where possible water depths in wetlands have been kept to a minimum and a safety bench (300mm below the permanent water level) is provided;
- Safe, all-weather access is provided to the wetlands for maintenance purposes from local roads or appropriately designed access points.

## Permanent Stormwater Operation and Maintenance Plan

The final stormwater network will be managed and maintained in accordance with the Auckland Motorways Alliance Operation & Maintenance Guidelines for Capital Projects (2009). The key considerations detailed in this document include:

- Whole of life cost;
- Safety in operations and maintenance
- Planning, design and construction of the stormwater network;
- Handover information required by the contractor upon completion of the works;
- Maintenance requirements and monitoring of the stormwater system post construction.

The Operation and Maintenance Plan will set out how the stormwater management system is to be operated and maintained to ensure adverse environmental effects are minimised.

## Maintenance of Stormwater Assets

A key focus of the consent design is to deliver the BPO for maintenance and operations. As such, safe and convenient solutions for maintenance and inspections have been built into the design, largely without the need for temporary traffic control. These are summarised in the following sections.

### Maintenance Access to Stormwater Assets

Stormwater operation and maintenance activities primarily target the removal of sediment and cleaning of debris from inlet structures. These activities are usually undertaken with machinery and as such require vehicle access. The use of catchpit manholes as the primary means for stormwater collection for the motorway reduces the required maintenance activities associated with maintenance of inlet structures. The use of catchpit manholes allows the conveyance of sediment and debris to downstream treatment devices to provide one central, safely accessible location for maintenance.

Maintenance access to cross culverts are generally accessible safely via local roads. These access points provide suitable, safe access for maintenance personnel and their machinery (typically excavators).

The preferred point of access to stormwater wetlands for maintenance purposes is from local roads; however, in some situations wetlands are located some distance from local roads. In these situations access is directly from the motorway, through designated breaks in barriers. All weather access tracks to stormwater wetlands have been coordinated with breaks in barriers and are formed in compacted aggregate to ensure access can be gained in all weather conditions, and include safe working and turn around areas for large vehicles to carry out routine maintenance.



## Stormwater Wetlands

Wetland forebay bases will be rock-lined with rip rap to provide tactile feedback to machinery operators during forebay cleaning. Wetland outlet structures will typically be accessible by a timber boardwalk.

## Planted Swales

The planting of swales and batters has been coordinated and developed with the Project's Urban Design expert.

Swales are planted with frangible, locally sourced and easily obtainable species that provide substantial safety and maintenance benefits by removing the need for regular and ongoing grass mowing.

## Stormwater Management during Construction

The Assessment of Construction Water Management outlines the proposed methods and practices to minimise the effects of construction activity associated with the Project including erosion and sediment control and the consequential effects on the aquatic receiving environments.

A detailed Construction and Environmental Management Plan (CEMP) will be prepared prior to construction commencing to address matters including, but not limited to, temporary stormwater diversions, staging, removal / modification of existing reticulation, construction traffic, pedestrian access and safety.