7.0 WATER QUALITY IMPACT ASSESSMENT

7.1 Water Based Sensitive Receivers

The Water Pollution Control Ordinance recognises four beneficial use groups for surface fresh waters, abstraction for water supply, irrigation, fish pond culture, and general amenity and secondary contact recreation. These have been described in detail in Section 3.5 of this report together with the additional functions of maintenance of aquatic life and the function of storm water channel. However the principal function of the culverts at, and down stream of, the Study Area is one purely of drainage to convey storm water to the Shing Mun River Channel. The culverted channels discharge into the tidal section of the Shing Mun River Channel the banks of which are engineered structures and hence have a highly limited ecological value. Despite the man made nature of the main channel in the vicinity of the exits of the culverts large numbers of fish can be found in the main channel, groups of Egrets can be seen fishing from the embankments and wagtails can be found feeding on invertebrates above the water line.

The principal potential impact from the construction and operation of the widened highway will be one of increased suspended solids loads during construction and the risk of the effects of an acute pollution incident following a traffic accident during operation of the Project.

The effect of increased suspended solids during construction would be the possible accumulation of solids in the bottom of the culverts, which if not flushed from the system by the natural storm water flows or tidal exchange in the culverts, would reduce the capacity. High concentrations of fine solids in the effluent from the culverts at their discharge point in the main river channel would give rise to visual nuisance to users of the waterfront promenade in the form of a turbidity plume. The main channel is sufficiently wide at the point of discharge that, if the turbidity plume is sufficiently high to cause distress, the fish will be able to take temporary avoidance action and so avoid damage to the mucous gill linings.

Black and grey wastewater which has a high oxygen demand and which contains pathogenic bacteria when discharged from the site to anywhere other than a foul sewer, would give rise to depletion of oxygen levels in the receiving water channels and also pose a health risk to people exposed to the discharged wastewater.

During operation the system is at risk from both chronic and acute effects of pollution from road traffic. The chronic effects relate to surface run off carrying dissolved and particulate materials from the normal wearing of the road surface and tyres and from leaking fuel, oil and hydraulic fluids. Acute effects relate to an incident following a road traffic accident in which either fuel or polluting load is washed into the storm water system.

7.2 Existing Water Quality Conditions

The Study Area lies in the extreme south east section of a catchment drained by a number of streams. The catchment watershed is defined by a line linking Needle Hill to Grassy Hill. The catchment is referred to the EPD Annual Reports on River Water Quality in Hong Kong as the Shing Mun River Water Course Sub-

zone (A). The upper sections of the streams are in open ground and a few of the lower sections pass through lightly wooded and sparsely inhabited areas. Immediately upstream of the existing road the streams have been culverted to pass under the reclamation before discharging in the Shing Mun River Channel through the north west bank of the Channel. Figure 7.1 shows the three principal stream systems which pass across the Study Area.

While EPD have ten routine river water quality monitoring stations in the Shing Mun. River catchment there are no stations located in the area drained by the streams which pass through the Study Area. However it is possible to use the water quality data obtained for the Kwun Yam Shan station which is in a similar area to the south east of the Shing Mun Channel as an indicator of the likely quality in the undeveloped part of the catchment above the Tai Po Road.

In the upper sections of the streams, where the gradient is steep, there are no pollution sources and so the water quality would be expected to be good/excellent. As the streams pass through the village areas in the less steep parts of the catchment there is the opportunity for a degradation in water quality.

Within the low gradient culverted sections under the reclaimed land between the foot of the hill and the bank of the Shing Mun River Channel storm water is progressively added to the flows prior to final discharge to the Shing Mun River Channel.

7.3 Impacts During Construction

7.3.1 Potential Impacts

The list of construction activities which will be carried out are given in the Project Description in Section 2 of this report. From this list it has been possible to identify potential causes of pollution and their impacts at the different stages of the construction. The impacts can be divided into three basic categories:

(i) Siltation in the storm drains caused by discharge of silt and sand into the storm drains;

(ii) Pollution arising from the discharge of other types of waste including black and grey wastewater from construction site facilities; and

(iii) Visual nuisance and impact on the biological community resulting from high turbidity water being discharged into the culverts.

7.3.2 Potential Sources of Impact

There are six sources or activities which are to be carried out at different stages during the construction process which will contribute to the potential impacts.

(i) Surface run off during storm rainfall on exposed areas of ground: Heavy rainfall falling directly on areas of exposed ground or running over exposed ground will carry suspended solids into the drainage system. Heavy rainfall will wash fine materials from any exposed stockpiles of excavated and construction material. Pumping of rainwater accumulating in trenches and foundations either onto the adjacent ground or directly in

to storm drains may also cause high concentrations of suspended solids to enter the drainage system.

(ii) Ground water pumped out of trenches and pits: Foundation excavations may require dewatering if there is an intrusion of ground water. The water which is pumped out of the trenches and pits into the storm drains will have a high level of turgidity and if pumped directly onto the adjacent ground would carry a high suspended solids load into the drainage system.

(iii) Wastewater from washing down of stationary mixers and mixer trucks used for concrete batching: The washing down of rotary mixers or mixer trucks following the on-site batching or delivery of pre-mixed concrete will produce water of high suspended solids and if allowed to run over exposed ground will pick up additional solids before reaching the drainage system.

(iv) Wheel washing water from vehicles prior to leaving the site: The washing of the wheels and subframe of vehicles leaving the site to travel on public roads is required to minimise dust impact along adjacent roads. The wash water from this will contain suspended solids and possibly oils and grease from the under chassis.

(v) Wastewater from site facilities: Site facilities will include plant maintenance and refuelling areas and also site offices for the contractor and the resident engineer. Runoff from the plant maintenance areas will contain suspended solids which will have adsorbed onto them fuel and lubricating and hydraulic oils. There also exists the possibility of a fuel leakage from storage tanks. The site office facilities will give rise to at least wastewater from toilets and, if sufficiently large, from kitchens. These waste waters will be high in oxygen demand and also contain pathogenic bacteria.

7.4 Mitigation During Construction

7.4.1 Function of the Mitigation Measures

The mitigation measures which are required during the construction phase are aimed at reducing the quantities of suspended solids, oils and grease which are discharged to water courses at or adjacent to the construction works. The mitigation measures are applied through the minimisation of flows containing solids or the removal of solids from the flow prior to discharge. The elements of the measures are common to many of the potential sources of impact. Since the works are to be carried out in an area already served by a storm water system this should be used to convey storm water away from the site subject to the implementation of the sand and silt containment measures described in the following section.

Measures to control the effects of black and grey wastewater are aimed at the prevention of the discharge of the contaminated water into the environment. The area in which the construction is to be carried is served by a foul sewer network. The site office should be located in such a position as to allow the waste water to be discharged to the foul sewer.

The specific requirements for mitigation measures applicable to each of the possible activities identified in Section 7.3 are described individually below.

7.4.2 Surface Water Run-off

(i) Whenever possible construction works should be programmed so as to minimise excavation during the wet season (April to September). If this is not possible then measures should be taken to minimise the areas exposed by covering temporary exposed slopes with tarpaulins or similar material, the protection of temporary road surfaces with gravel or crushed stone and the early reinstatement of final surfaces with hydroseed grass/shrub mixture. This latter measure would have the added benefit of reducing the windblown dust during the dry season. Where temporary covering of slopes is required this should be carried out before the onset of the rainfall or storm.

(ii) Existing and newly constructed open manholes should be covered and sealed to prevent run off and water borne debris entering the drainage network without having previously passed through a sediment trap.

(iii) Stock piles of construction materials, sand and gravel or excavated material should be covered with tarpaulins prior to rainstorms. The washing of material from the stockpiles directly into the storm drains should be prevented by passing the run off through a sediment trap.

(iv) The surface water from the site should be discharged into storm water drain after passing through sand and silt traps designed to accommodate the maximum discharge from the site. Within the site channels, bunds or sandbags should be used to direct run off into the traps. Storm water from outwit the site should be prevented from washing over the site by the construction of interceptor channels at the site boundary. Both perimeter channels and the sedimentation traps should be constructed prior to the commencement of site formation and earthworks.

(v) The efficiency of the interceptor channels, traps and sedimentation chambers should be maintained by regular cleaning of accumulated silt and sand. Particular attention should be paid to maintenance following heavy rainfall and immediately after the issue of heavy rainfall warning by the Hong Kong Observatory.

(vi) The ingress of rainwater into trenches should be minimised by the construction of bunds to prevent water flowing into the trench and covering by tarpaulins to prevent direct entry. The lengths of excavated trenches should be minimised and backfilled at the earliest opportunity. Water pumped from the trenches should be discharged to the storm water drains following passage through a suitable silt trap.

7.4.3 Groundwater

Any ground water seeping into any trenches or foundation works should be passed through a silt trap prior to discharge to the storm water drains.

7.4.4 *Wastewater from Concrete Batching*

The water used for the washing down of mixing drums used for onsite batching of concrete and delivery lorries for off site batched concrete should be recycled whenever possible. Wastewater generated from the washing which is discharged should be passed though a silt trap before discharge to the storm water system.

7.4.5 *Water from Wheel and Subframe Washing*

The waste water from the washing of the wheels and subframe of vehicles returning from the site onto public roads will contain suspended solids and debris. A washing bay should be provided at the exit from the site and should, where practicable, incorporate water recirculation. Water from the washing bay which is discharged to the storm water system should first be passed through a silt trap which also includes an oil/grease removal weir.

7.4.6 *Wastewater from Site Facilities*

(i) Run off from plant maintenance area will carry fuel and lubricating and hydraulic oils adsorbed on the suspended solids. Plant maintenance areas should be paved to prevent waste oils soaking into the ground. Where possible the area should be undercover to minimise the formation of runoff and any runoff from the paved area passed through an oil trap before being discharged to the storm drains. Fuel storage tanks should be surrounded by bunds with a capacity of at least 150% of the storage capacity. The bunded areas should be able to be drained of rain water through the petrol interceptor and accumulated rain removed at regular intervals.

(ii) Waste oils from the site should be collected and stored for recycling or disposal in accordance with the Waste Disposal Ordinance and absorbent cloths and granules should be available for the clean up of spillages.

(iii) Sewage from toilets and kitchens should be discharged directly into a foul sewer. If it is not possible to locate the site offices within easy access of a foul sewer a septic tank and soakaway should be constructed before the offices are occupied. If only toilets are provided then chemical toilets will be more appropriate. Chemical toilets should be emptied on a daily basis and the contents taken to a foul sewer or the Sha Tin Sewage Treatment Works for disposal. Wastewater collected from canteen kitchens should be discharged to the foul sewers via grease traps which provide a minimum of 20 minutes retention during peak flow. All discharges into foul sewers and storm sewers would have to be complied with TM standards under WPCO.

(iv) Run off from roofed surfaces of site facilities should be collected and diverted to a storm water drain. Passage through a silt trap is only required if the water is diverted via open channels which might accumulate solids during non rainy periods or which intercept surface run off from unpaved areas.

7.4.7 Licencing of Site Discharges

Discharges into foul sewers or storm water drains, other than domestic sewage and unpolluted water, and the discharge of septic tank effluent into the ground are controlled under the Water Pollution Control Ordinance (WPCO). The discharge from the construction site will therefore be controlled under the Ordinance. Discharges from the site will be required to meet the terms and conditions of a valid WPCO licence. The application for a WPCO licence is made though the EPD or District Office. The application for the licence should contain details of the points of discharge of the wastewater and storm water, and the volumes to be discharged and should be made before the commencement of any discharge. A minimum of twenty days is required for an application for a discharge to a foul sewer of storm drain and a minimum of fifty days for a discharge directly to surface waters.

7.5 Impacts During Operation

Impacts during operation may arise from:

(i) Paved area runoff containing suspended solids onto which will be adsorbed hydrocarbons and heavy metals, principally lead, copper, zinc and iron; and

(ii) Load spillage resulting from accidents.

Potential adverse chronic impacts from runoff from the paved road surfaces could arise from storm water carrying dissolved and particulate material from degradation of the road surface and tyres, from normal operational fuel, oil and hydraulic fluid loss from vehicles and from corrosion of metal body parts and wearing of brake linings. Although there is information available for the composition of run off from roads in Europe and the northern states of the USA at the present time there is no available reliable quantitative information on these losses for either Hong Kong roads or roads with a similar configuration and operational characteristics. Contaminants present in the normal operational runoff will, by their chemical nature, be strongly adsorbed onto particulate present and if transported to the main river channel are unlikely to have any significant effect on water quality or the biota.

The potential for acute impact arises in the form of accidents involving one or more vehicles where fuel from ruptured fuel tanks may run off or be washed off into the storm water drainage system. Similarly, spilled loads, either liquid or fine solids, may have significant effects on the water quality in the main river channel. The magnitude of the impact would depend on the quantity and nature of the load which was spilled.

7.6 Mitigation Measures During Operation

(i) Contaminants present in the runoff during normal operation normal will, by their chemical nature, be strongly adsorbed onto the particulate phase. The use of silt or sand traps, preferably built into the road drainage system will control both the suspended solids in the run off and the contaminants adsorbed onto them. These traps should be maintained regularly and frequently cleaned to prevent the accumulation of solids with the resultant reduction in retention time and thus efficiency.

+(ii) In the event of an accident giving rise to the spillage of fuel or vehicle load from a vehicle permitted to use the roadway, the primary objective should be to contain the spillage for removal from the road and its subsequent safe disposal. If this is not possible and the spillage enters the surface water drainage system, it should be held back by interceptor tanks with both under and overspill weirs to retain floating and settleable material. These should be readily accessible for emptying in the event of an accident.

7.7 Residual Impacts

If the mitigation measures described in the section above are implemented it is not anticipated that there will be residual impacts.