APPENDIX B

CONSTRUCTION SPECIFICATION

KEVIN O'CONNOR & ASSOCIATES LTD
CONSULTING ENGINEERS, SURVEYORS & PLANNERS
71 PITT STREET, P O BOX 600, PALMERSTON NORTH
Telephone: 06 356 7000 Fax 06 356 7007 Email: reception@koa.co.nz

INDEX:

SPECIFICATION

1 GENERAL- CIVIL

1.2 Location of Work

The site of the work is located in Palmerston North.

1.3 Scope of Work

The work comprises the supply of all material, plant, labour and competent direction required to undertake work as indicated on sheets of Drawings No.

The work includes the following:

(a) Stormwater and sanitary drainage
(b) Stabilising the subgrade
(c) Metalling and sealing
(d) Trenching and backfilling
(e) Landscaping

1.4 Supply of Materials

The Contractor shall supply all materials in the best quality of their respective kinds, free from all faults and defects, for the proper execution of the work.

1.5 Drawings and Specifications

The drawings and specifications shall be read together and the works shall be completed in accordance with the true intent and meaning of the same. Anything shown on the drawings and not specified or vice-versa shall be equally binding as though included in both. Any item not expressly shown or specified shall be constructed or finished in conformity with the standard of construction and finish described throughout the job generally.

1.6 Setting Out

Before the Contractor commences work, the pegs shown on the plan will be located or reinstated where necessary, and in addition, reference pegs will be established to enable subsequent setting out alignment and grades. It shall be entirely the Contractor's responsibility to safeguard these pegs, and where earthworks require their removal, he shall place accurate holding marks so that they can be re-established. He shall be responsible for setting out all the work and shall employ a competent person to do so. Any work which is carried out that does not comply with the plan setting out details may at the discretion of the Engineer, be required to be broken out and replaced correctly entirely at the Contractor's own expense.

1.7 Protection of Work

It shall be the Contractor's responsibility to safeguard his work from damage by the public, and the property of others from damage by his operations. He shall at all times ensure that the work in progress is not damaged by storm or flood, by providing adequate means of stormwater disposal.

1.8 Materials and Workmanship

The whole of the work shall be constructed in complete accordance with the best trade practice, and be approved by the Engineer.

The standard of materials and workmanship shall, except as more particularly described in the specification, comply with the latest editions of the NZ Standards Institute Specification or the following TNZ Specifications.

TNZ C/01	General
TNZ F/01	Earthworks Construction
TNZ M/15	Lime stabilisation

The above TNZ Specifications may be inspected at the Offices of the Engineer.

Where duplication or discrepancies between the above occur the requirements of the PNCC "Minimum Engineering Standards" shall be allowed.

1.9 Underground Services

The Contractor shall be responsible for meeting all charges relevant to the work of each of the above authorities. Reimbursement to the Contractor shall be via relevant times in the Schedule.

1.10 As Built Plan

At the completion of or during the construction of the works, the Contractor shall co-operate with the Engineer to allow the latter to complete an as built plan. The work will not be considered as having been completed until this is done.

1.11 Work in Adjoining Properties

Where the Contractor is required to work within properties adjoining this subdivision the Contractor shall notify the relevant owner of his intention to commence work on that person's property. This work must be carried out as expeditiously as is practicable and the Contractor's working area shall be restricted to minimum on that property. The Contractor shall be responsible for the removal of all rubbish and debris left by his operations and restore all disturbed surfaces to a minimum standard of that condition that existed before work commenced.

1.12 Barricades and Lighting

The Contractor shall be responsible for the provision of all adequate warning signs, barricades and warning lights at night to ensure the safety of the public.

1.13 Existing Services

The Contractor must locate all underground services, as far as possible before work commences. Any information shown on the drawings is given in good faith but with no guarantee of accuracy as regards alignment or depth, furthermore, no guarantee is given or implied that the information provided covers all existing services. The contractor shall be solely responsible for all damages done to existing services and shall make good at his own cost all such damages without delay, to the satisfaction of the Engineer, and the appropriate controlling authority.

1.14 Supply of Electric Power and Water

The Contractor shall make his own arrangements with the appropriate authority for the supply of any electric power or water required.

1.15 Noise Levels

Noise from all construction and decommissioning work including (but not limited to):

- Site works,
- Wind turbine generator foundation construction,
- Wind turbine generator assembly and placement,
- Wind turbine generator removal,
- Foundation demolition and removal, and
- Land reinstatement.

shall be measured, assessed and controlled using NZS 6803:1999 *Acoustics – Construction Noise*. The noise limits shall be those set out in Table 2 of NZS6803:19999 for works of “long term” duration.

1.16 Statutory Requirements and Protection of Environment

The Contractor shall comply with all of the conditions of the resource consents at all times, where they relate to the civil works contract.

The Contractor shall be liable for any fines or penalties imposed by enforcing bodies for non-complying activities unless there is no fault on the part of the Contractor.

1.17 Earthworks & Dust Management

The Contractor shall comply with the Environmental Management Plan for the project and the consent conditions for earthworks management. The Plan requires staging of earthworks; the Contractor shall allow for this staging in the programme.

The Contractor shall pay particular attention to minimising silt and/or pollution of neighbouring properties, reserves and streams due to the construction operations. The Contractor shall nominate an appropriately qualified and experienced Manager to be responsible for earthworks management. This person shall be responsible for the control of sediment and dust in the course of earthworks construction on the site as outlined in the consent conditions.

The proposed silt control measures are shown on the contract drawings.

1.18 Site Cleanliness

The site shall be cleared regularly of rubbish and offensive material. The Contractor shall provide adequate fuel storage facilities and precautions against spillage. No material shall be allowed to enter any watercourse. On completion of the work the Contractor shall remove all plant, surplus material, construction debris, and construction buildings, and shall leave all areas affected by the works cleaned and tidied.

1.19 Excavation of Archaeological or Koiwi Remains

The Contractor shall immediately notify the Engineer if any archaeological or koiwi remains are discovered. The Contractor shall comply with the protocols developed and any instructions thereafter.

1.20 Temporary Traffic Control and Existing Roads

The Contractor shall provide any temporary traffic control required and ensure traffic on public roads and within the site are safe from construction activities and existing farm and windfarm operations are not detrimentally affected. The traffic control measures shall comply with local authority requirements on public roads and the relevant consent conditions. The Contractor shall be responsible for obtaining necessary approvals from relevant authorities for working on or adjacent to public roads, and complying with their requirements and these are

to be copied to the Engineer. The locations of public roads within the site are shown on the drawings. If the Contractor considers it is impractical to provide access for these operations in a particular area or time period the Engineer shall be informed. For existing roads affected by the construction works the standard of maintenance shall be such that all access roads are kept safe and comfortable for construction and other traffic. This may include but is not limited to placement of basecourse metal, filling of potholes/rutted areas, and grading.

1.21 Signage

The Contractor shall provide signage to inform the public of the timing of construction traffic in particular. The sign or signs shall be placed at positions agreed with the Engineer and local authorities, and to an agreed wording.

2 CLEARING AND STRIPPING

2.1 Scope

This specification covers the clearing and disposal of vegetation and other unwanted material and the stripping and stockpiling of topsoil from within the area of the work is defined in the drawings.

The Contractor shall supply all plant, materials, labour and supervision for the clearing and stripping of all such materials as is required for the proper execution of the work.

2.2 Clearing

The area of the work shall be cleared of all obstructions except those specifically required to remain. Clearing shall include complete removal from the site of buildings, foundations, trees, logs, scrub, grass, roots and other vegetation, paving materials, fences and garbage.

All trees and shrubs within the limits of the earthworks shall be felled unless otherwise specified. Trees and other vegetation beyond the limits of the earthworks shall be disturbed only when directed or approved by the Engineer. Any trees specifically designated by the Engineer shall be protected from damage by the Contractor's operations.

2.3 Disposal

Unless otherwise specified, all material cleared shall become the property of the Contractor, and shall be removed from the site and disposed of in a safe and legal manner and so as not to inconvenience the owners of adjoining property. The Contractor shall pay any tip fees required.

Where approved by the Engineer, disposal of cleared material may be by way of burning. The Contractor shall obtain and comply with the necessary permits, shall take precautions to prevent fire from spreading and shall have available ready for use suitable equipment and supplies for fighting fires. Fires shall be completely extinguished at night time unless full time attendance has been arranged.

2.4 Stripping

All topsoil, turf, humus and organic material remaining after the clearing of vegetation shall be stripped from the surface of the ground within the limits of the earthworks, to such depths as is directed by the Engineer.

Topsoil is defined as the top layer of soil characterised by the presence of organic matter.

The more suitable topsoil shall be stockpiled separately and neatly for layer respreading. The location and size of stockpiles shall be subject to the approval of the Engineer. Surfaces of topsoil stockpiles shall be rolled smooth to minimise erosion.

No topsoil shall be removed from the site without the prior approval of the Engineer.

3 EXCAVATION CIVIL

3.1 Scope

This specification covers the excavation of earth and rock to form the land as detailed on the drawings or directed by the Engineer

The Contractor shall excavate out all materials above the finished levels or contours of the site or above road formation levels where applicable, making due allowance for restoration of topsoil and the construction of pavements, foundations and underground utilities.

3.2 Preliminary

Where subsurface information obtained by the Engineer is made available, it is done so without guarantee as to its accuracy or completeness. Tenderers shall make their own deductions as to the nature and conditions of the materials to be excavated and to the accuracy or completeness of the information provided.

3.3 Operation of Plant

The Contractor shall be responsible for the determination of suitable types of plant to carry out the excavation operations in accordance with the Contract.

Where material being excavated includes mixture of topsoil, unsuitable material and material suitable for use as earthfill, the excavation shall be carried out so as to avoid mixing the materials as far as is practicable.

3.4 Disposal

All material removed from the excavation, and which is approved as suitable by the Engineer, shall be used as far as practicable in the construction of embankments and fills or backfilling within the work.

Should material suitable for use as sub base or base course for pavement construction or for use as selected trench backfill be encountered during excavation, the Contractor shall stockpile this material within the site as directed by the Engineer, who will give his directions for the use of this material.

Excavated material shall not be removed from the site without the approval by the Engineer. Surplus or unsuitable material which is approved for removal shall become the property of the Contractor and shall be disposed of away from the site in a manner approved by the Engineer.

3.5 Undercutting

Any excavation taken to greater depths than those detailed on the drawings, and any unauthorised excavations outside the limits of the drawings shall be backfilled with suitable material compacted in layers in accordance with the part of the specification entitled “Earth Fill”.

Where road and street sub grades are located in cut areas, excavations shall be undercut to a depth of 300 mm below formation level unless otherwise directed.

3.6 Slips

Slips of material from cut batters or natural ground shall be removed and disposed of as specified. Slips with an in place volume exceeding 40 cubic metres will be paid for at the appropriate rate or amount for excavation, provided such slips did not result from any foreseeable action of inaction by the Contractor, or through negligence.

3.7 Finished Surfaces

The finished surfaces of excavation shall conform to the levels, lines, grades and contours shown on the drawings or directed by the Engineer, within the tolerances specified.

At any point on finished surfaces which slope at less than 1 on 2, the finished level shall be within 50 mm of that shown or inferred on the drawings. Finished surfaces steeper than 1 on 2 may vary from designated slopes by up to 150 mm measured at right angles to the slopes, but any variation shall be gradual so as not to impair the appearance of the surface.

Where excavations abut against undisturbed ground, they shall be trimmed to conform with the shape of the adjacent ground so that the profile is continuous and compatible.

3.8 Classification of Material

Unless otherwise stated in the Schedule, materials excavated will not be classified for payment.

If however, classification is provided for in the Schedule, the following definitions shall apply:-

Common material excavation includes, but is not restricted to, earth, gravel, and also such hard and compacted material as cemented gravel and weathered or soft rock which required loosening by ripping before excavation. Common material excavation also includes all boulders or detached pieces of solid rock not exceeding one cubic metre in volume.

Unsuitable material shall be restricted to material which by virtue of its inherent properties of moisture content, organic content or grain size can only be excavated by a dragline, back hoe or other specially adapted plant. The Engineer will only classify material as “Unsuitable Material” if satisfied that its condition is not due to the Contractor’s neglect or of surface drainage, and that reasonable time has been allowed after rainfall to return the material to its normal condition.

Hard Rock excavation involves solid rock in place which cannot be removed until loosened by pneumatic equipment or blasting, and all boulders and detached pieces of solid rock more than one cubic metre in volume. Solid rock in this definition is rock of such hardness or texture that it cannot be loosened or broken down by hand picks.

4 EARTH FILL

4.1 Scope

This specification covers the construction of earth fill and all other subsidiary work necessary so that the areas of fill are brought to conform with the lines, grades, elevations and slopes shown or inferred on the drawings or as directed by the Engineer.

The Contractor shall prepare the areas on which fill is to be placed and shall transport, spread, stockpile, condition, compact and grade the fill material and finish the areas making due allowance for the restoration of topsoil and the construction of pavements and underground utilities.

4.2 Surface Preparation

The Contractor shall clear and strip the areas on which fill material is to be placed and along haul roads in accordance with the part of the specification entitled "Clearing and Stripping". Low density, saturated, weak or organic soils exposed by clearing and stripping shall be excavated as directed by the Engineer. If considered by the Engineer to be unsuitable for use as filling, some or all these soils shall be disposed of beyond the site, neatly stockpiled or wasted in approved areas as directed. If considered suitable by the Engineer, some or all of these soils shall be reused as filling in layers as directed.

The exposed surfaces of natural ground upon which fill is to be placed shall be compacted so as to achieve relative compaction at least equal to the specified for the fill to a depth of 150 mm. If necessary to meet this requirement, the ground shall be bladed until it is uniform, free of large clods and brought to suitable water content prior to compaction.

Before filling commences in any area of the site, the cleared and stripped surface shall be inspected and approved by the Engineer's Representative and if required shall be subjected to proof rolling using a fully laden rubber tyred motor scraper or similar approved plant. Where directed by the Engineer, any soft or compressible areas shall be excavated and refilled with suitable compacted material.

Where fill material is to be placed against a hillside or previous fill where the slope is steeper than 1 vertical on 4 horizontal the slope shall be prepared by benching. Near horizontal benches, suitably graded for drainage, shall be cut at vertical intervals of not less than 1 metre up the slope as the fill surface is raised, so that not less than 75% of the plan area on which fill is to be placed shall consist of such benches. Apart from the rates or amounts shown on the schedule for earthworks, no additional payment will be made for such benching.

Where shown on the drawings or where seepage is encountered, the ground shall be benched and subsoil drains installed to collect the seepage and discharge it to an approved point clear of the fill in accordance with details shown on the drawings or as directed by the Engineer. Where shown on the drawings, culverts shall be constructed as detailed.

4.3 Fill Material

Except for materials removed during clearing and stripping of topsoil or material designated as unsuitable by the Engineer, the on-site soils obtained from excavation may be used for general filling.

Wherever possible, the Contractor shall use suitable material won from cut areas or approved borrow areas within the site. When material imported from off the site is used, the Contractor shall obtain the required permission and permits, and pay all royalties and charges required in connection with its use.

Imported material shall be of consistent type and be subject to the approval of the Engineer prior to use. Material which is organic or highly plastic for example will not be considered as being suitable. A representative 10 kilogram sample of proposed imported material shall be delivered to the Engineer at least three days before approval is required.

4.4 Placing, Spreading and Water Conditioning

No fill material shall be placed until the Engineer has inspected and approved the surface preparation of that part of the site.

Fill material shall be placed and spread in a systematic manner and in uniform near-horizontal layers which, prior to compaction, do not exceed 200 mm in thickness.

Any lumps or rocks exceeding 100 mm in greatest dimension shall be either broken down to less than 100 mm or removed or used as may be directed by the Engineer.

When the water content of the fill material is below that which is necessary to achieve the specified degree of compaction, water shall be added and thoroughly mixed into the fill material until it is uniformly dispersed throughout the soil. Similarly, when the water content of the fill material is too high, the soil shall be air dried by scarifying, harrowing, discing or other aeration processes. The water content shall also be kept low enough to provide stable working surface for the hauling and compacting plant, free from heaving, weaving and excessive rutting.

No fill material shall be placed, spread, or compacted during or immediately following wet weather or when ground is frozen. Except for essential work to maintain safety, drainage or prevent damage to work, no equipment shall be moved on or over the site except along the access roads during or immediately following wet weather.

Where any compacted subgrade or fill has deteriorated due to wet weather or an interruption in the work, the material affected shall be scarified and recompacted to the required standard before any further fill material is placed or spread over it.

4.5 Compaction

After each layer of fill has been placed, spread evenly and brought to a suitable water content, it shall be compacted to at least the specified relative compaction.

The following percentages of maximum densities as determined by NZS 4402:1986 Test 4.1.1 shall apply.

(i) Within 0.6m of the street sub grade and extending to the outer edges of the footpaths etc the densities shall not be less than 100% of those given by the New Zealand Standard Compaction Test (Test 4.1.1).

(ii) Within 1m (vertical measurement) of the finished surface of all fill areas and within 3m (horizontal measurement) of all batter boundaries of unenclosed fills, the densities shall not be less than 97% of that given by the New Zealand Standard Compaction Test (Test 4.1.1).

(iii) Below 1m (vertical measurement) of the finished surface except within 3m of the boundaries, the densities shall not be less than 95% of that given by the New Zealand Standard Compaction Test (Test 4.1.1).

Compaction shall be accomplished with approved, special-purpose compaction equipment. The equipment shall make sufficient passes to ensure that the required compaction has been uniformly obtained everywhere.

Fill batter faces shall be compacted as a separate operation, either by overfilling and cutting back, or by rolling with compacting plant working up and down the slope.

4.6 Finished Surfaces

The finished surfaces of earth fill shall conform to the levels, lines, grades and contours shown on the drawings or directed by the Engineer, within the tolerance specified.

At any point on fill surfaces which slope at less than 1 on 2, the finished level shall be within 50 mm of that shown or inferred on the drawings. Finished slopes of 1 on 2 or steeper may vary from the designated slopes by up to 150 mm measured at right angles to the slope, but any variation shall be gradual so as not to impair the appearance of the surface.

In any area so specified on the drawings, the Contractor shall adjust the quantities of cut and fill as directed by the Engineer, varying finished levels as necessary to achieve a balance of earthworks quantities.

4.7 Backfilling

Backfilling around structures and as required to bring undercut areas to formation or finished levels shall, unless otherwise specified, consist of selected fill material, spread and compacted in layers using suitable plant such that the relative compaction requirements of the specification are satisfied.

4.8 Drainage:

During construction, the Contractor shall take all necessary measures to comply with the requirements of the part of this specification entitled "Stormwater Control".

Unless otherwise provided in the Schedule, no separate payment will be made for this work, and its costs shall be considered to be included in the rates or amounts scheduled for earthworks.

4.9 Inspection and Testing:

The Contractor shall facilitate inspection by the Engineer at all times during construction. The Engineer may from time to time carry out check tests of the soil properties, water content and the relative compaction being achieved in the fill but the Contractor shall remain responsible for achieving the required standard of work.

The Engineer shall have the right, at any stage of the work and until the end of the Maintenance Period, to have material which has not been compacted to the specified standard or which contains organic material, tree roots or the like, wherever it may be, excavated and recompacted to the specified standard without additional payment to the Contractor.

Fill construction shall be arranged to permit testing to be carried out as the work proceeds. The Contractor shall, on request and without further payment, provide excavating equipment and remove material from above the test level, and subsequently backfill to specification requirements. Whenever earthmoving, compaction or like work is in progress at the same time as compaction testing, the Contractor shall at any time required by the Engineer, without extra payment, provide safety protection for men carrying out testing to the satisfaction of the Engineer.

On request by the Engineer the Contractor shall provide a suitably loaded truck with driver, or other equipment for proof rolling which shall be paid for at the appropriate plant hire rate.

5 Metalling

5.1 Scope

The work described in this section of the specification comprises the supply, spreading, compaction and trimming of basecourse materials.

5.2 Protection of Kerbs, Channels and Services

The Contractor shall take care to avoid damage or marking of kerbs, channels, sumps, manholes tops, pipes or other services above or below ground level during construction. Any damage occurring shall be repaired to the satisfaction of the Engineer at the Contractor's expense.

5.3 Metal Courses

After carefully compacting and shaping the street subgrade in accordance with this specification the Contractor shall supply, spread and compact the basecourse metal in conformity with the lines, grades and typical cross-sections shown on the drawings.

If indicated on the drawings a topcourse layer is to be supplied, spread and compacted over the prepared basecourse in accordance with the lines, grades and typical cross-sections shown.

5.4 Straight River Run Metal

The subbase course aggregate shall consist of selected river run aggregate free of vegetation or other deleterious matter. The aggregate shall be graded from coarse to fine and when tested on Laboratory screens shall meet the following requirements:

Passing 0.1m square mesh screen	100%
Passing 63 mm square mesh screen	95%

Not less than 5 percent (5%) and not more than 25 percent (25%) shall be retained between consecutive pairs of the following screens: 38 mm, 19 mm, 6 mm. No 8 BSS, No 52, No 20.

5.5 Basecourse and Topcourse Aggregates

All basecourse and topcourse aggregate shall comply with TNZ Specification M/4.

The material used will be subject to tests at any time by the Engineer to ensure the material complies with the above specification. Such tests and required results will be in accordance with TNZ Specification M/4.

5.6 Construction of Basecourse

The construction of the basecourse shall comply with TNZ Specification B/2.

The subgrade shall have been inspected and approved by the Engineer, before any basecourse is spread over the area of the carriageway. No basecourse shall be laid on a wet subgrade and loaded trucks shall not be permitted to run over any prepared subgrade before basecourse is spread.

The basecourse material shall be placed on the prepared subgrade in layers of uniform thickness. When a compacted layer of 150 mm or less is required the basecourse shall be placed in a single layer. When a compacted layer of more than 150mm is required the basecourse shall be placed in layers of uniform thickness but no layer shall be in excess of 150mm except when the maximum particle size of the basecourse exceeds 75 mm in which case the layer thickness shall not be greater than 2.5 times the maximum particle size. No layer shall be less than twice nominal maximum particle size of the basecourse.

The layers shall be so placed that when compacted they will be true to the grades or levels required. The laying procedure shall be arranged to minimise segregation and the use of graders shall be restricted to essential shaping and final trimming with minimum working of the final surface.

Each layer of basecourse shall be compacted by multiple passes of either approved three wheel steel rollers or approved vibrating rollers. In some cases the Engineer may direct that the Contractor use a rubber-tyred roller for part of the compaction process.

Should the Engineer so direct, fine aggregate shall be hand spread in a comparatively dry state over any open textured portion of the compacted basecourse surface. The fine aggregate shall be vibrated or rolled into the interslices of the basecourse, and the minimum volume of water added necessary for compaction to achieve a stone mosaic surface. On no account shall a skin of fines be allowed to form on the basecourse surface while it is being prepared for sealing or paving.

5.7 Basecourse under Kerbs and Channel

Basecourse shall be laid under the lines of kerb and channel before the roadway subgrade is prepared or basecourse for the carriageway proper laid.

A strip of subgrade under the line of the kerb and channel is to be formed accurately to line and level and to the requirements of the section of this specification appropriate to the subgrade. After inspection and approval by the Engineer, basecourse is to be spread and compacted along the strip of prepared subgrade to a minimum compacted depth of 75mm to provide a foundation for the kerb and channel accurate to the appropriate lines and levels shown on the drawings.

Care must be taken not to damage the subsoil drains or other services.

5.8 Control of Construction

To ensure that the specified compacted depth of aggregate is obtained, construction shall be controlled by means of lift pegs, which the Contractor

shall supply, locate and level at practical intervals clear of the carriageway. The lift pegs shall be suitably marked to subbase and basecourse construction.

5.9 Inspection by the Engineer

In addition to any testing or inspection by the Engineer required by this or other sections of the specification, the Contractor must programme his work to allow and facilitate the following inspections, if required, by the Engineer and obtain their approval:

(a) of the prepared subgrade before any basecourse aggregate is laid (including Benkleman Beam or CBR tests),

(b) of the completed basecourse before any paving or first coat sealing (including Benkleman Beam tests).

The contractor must supply the loaded weighed truck.

5.10 Defects to be made good

Any weak patches or other localised defects which become apparent in the subgrade or in the basecourse itself during the compaction of the basecourse (except those defects which, in the opinion, of the Engineer do not result from the Contractor's method of laying or compaction, or from the Contractor's construction of the subgrade) shall be excavated and made good with approved material at the Contractor's expense.

6 STORMWATER CONTROL

6.1 Scope

This specification covers the precautions to be taken by the Contractor to prevent damage to the Works and to surrounding property by flooding, stormwater erosion or silt deposition, during the period of the Contract including the Maintenance Period.

The Contractor shall supply all plant, labour, materials and supervision necessary to ensure that the requirements of this specification are satisfied.

6.2 Extent of Earthworks

In order to reduce problems associated with increased stormwater runoff, the Contractor shall limit the extent of cleared ground to the minimum necessary to carry out earthworks details on the Drawings.

Unless otherwise directed, as soon as any reasonable sized earthworked area has been completed to final grade, it shall be topsoiled and/or sown with grass as specified, to minimise runoff and erosion and to improve its appearance.

6.3 Excavations

The Contractor shall provide and maintain slopes and drains on all excavations to ensure satisfactory drainage for the duration of the Contract, and to prevent damage to the work or surrounding property.

6.4 Fills

During construction, the Contractor shall take all necessary precautions to prevent materials yet to be compacted from becoming saturated, to prevent erosion of fill materials and to prevent ponding on surfaces of fills (except where specifically approved by the Engineer for use as settlement ponds).

Surfaces of fills shall be graded at all times to prevent ponding or scouring, and shall be specially compacted with rubber tyred or smooth wheeled plant when rain is impending or when the site is left unattended.

6.5 Watercourses

Catch drains shall be constructed to intercept surface water at the top of steep slopes such as cut and fill batters, and to lead water to stable channels or drains.

Where there is any likelihood of concentration of surface water sufficient to cause erosion, the Contractor shall erect sufficient temporary post and wire fences, choked with wire netting, brush or the like to prevent detritus continuing down the surface.

Stockpiles of topsoil, excavation spoil or other materials shall not be placed in a position where they can be eroded or washed into nearby watercourses.

6.6 Settlement Ponds

Prior to the commencement of mass earthworks, the Contractor shall construct settlement ponds to intercept and retard the flow of stormwater from earthworked areas and precipitate the gravel, sand and silt sized particles of transported sediment.

Each stormwater catchment shall be considered separately, and the optimum location of the settlement ponds shall be determined by the Contractor, subject to the approval of the Engineer. The location of settlement ponds shall be elected with accessibility for maintenance throughout the Contract period in mind.

Ponds shall be constructed so as to temporarily retain a volume of stormwater as detailed on the drawings, or if no volume is specified, equal to 1 cubic metre per 100 square metres of catchment area. Where it is feasible to divert water from undisturbed areas of catchment around earthworked areas, an appropriate reduction in pond volume may be made.

Ponds shall be constructed with sufficient provision for storm flows without overtopping of embankments or other damage. Where practicable ponds shall also be provided with a low level outlet to enable them to be drained and cleaned of detritus during fine weather.

The outlets from settlement ponds shall be located and constructed so as not to result in further erosion or deposition downstream.

Prior to, during and following rain, the Contractor shall arrange for attendance by plant, labour and supervision to ensure safe operation of settlement ponds, including associated catch drains, detritus fences and outlets.

Ponds shall be cleaned of all detritus at regular intervals to ensure at least the specified volume of stormwater is retained, and again at the conclusion of the work. Detritus removed from settlement ponds shall be spread to dry in areas approved by the Engineer and disposed of as directed, either as material for use in the construction of earth fill or by removal to dumps away from the site.

6.7 Damage to Property

Where, by reason of neglect by the Contractor of the requirement of this specification, damage results to any property by erosion, deposition of silt, flooding through blockage of drains or watercourses, or other consequences of uncontrolled stormwater runoff, such damage shall be repaired by the Contractor to the satisfaction of the property owner or authority involved, without additional payment.

6.8 Erosion and Sediment Control

At all times the documents “Erosion and Sediment Control Guidelines for the Wellington Region” dated September 2002 will be considered as the controlling documents.

7 Stormwater Drainage

7.1 General

The Contractor shall excavate for bed, lay and backfill.

(a) Stormwater sewers, in sizes and located as indicated on the drawings.

7.2 Materials

7.2.1 Pipes

The following types of rubber jointed pipework are approved for the stormwater reticulation:

(a) Spun reinforced concrete pipes to NZS 2238:1968.
(b) Unreinforced concrete pipes to NZS 2238:1968.
(c) UPVC Pipes to NZS 7649:1974.

7.2.2 Rubber Ring Joints

Rubber ring joints used in flexible joints shall comply with NZS 1311:1957 and shall be of a type approved for the use with the particular joint.

7.2.3 Concrete

All concrete work shall be in accordance with NZS 1900 Chapter 9.3A and shall be ordinary grade concrete having a minimum compressive stress at 28 days of 17.5 MPa. The concrete shall have a minimum cement of 320 kilograms per cubic metre.

7.2.4 Timbering and Formwork

All timber used for supporting the excavation shall be of adequate size and strength free from warps, twists and other serious defects.

7.3 Sumps

Stormwater sumps shall be constructed in the location and to the levels and details given in the drawings and shall be connected to manholes by means of 225 mm diameter pipes.

7.4 Manholes

Construct all manholes using Humes precast concrete manholes complete with precast concrete lids. The maximum height riser shall be used for each manhole to reduce the number of joints in precast sections. Where a joint is necessary the recess shall be filled with an approved jointing compound such as RB 200 in order to prevent infiltration at joint.

All manholes shall have 150 mm thick lids and heavy duty cast iron frames.

In carriage ways all concrete lids shall be located not closer than 300mm from the finished surface. Standard rings shall be used to position the cast iron frame and lid in the finished surface.

Provide step irons in all manholes over 1 metre deep.

In all cases a flexible joint shall be provided each side of the manhole to be located not greater than 1 metre from the outer face of the manhole walls.

In straight through manholes form the invert with a half pipe centrally bedded in concrete. In all manholes form the floor channels either with a half straight glazed earthenware pipe of half pipe specials, adapted to the inverts of branch pipes etc.

Alternatively, but only where authorised, form curved channels in the floor of the manholes in concrete rendered with cement mortar and finished with a steel tool and neat cement.

7.5 Excavation of Trenches

All excavation shall be carried out in accordance with part 6 of this specification.

7.6 Bedding, Laying and Jointing Pipes

7.6.1 Bedding

The bedding shall be constructed as shown on the drawings. Irrespective of the method of bedding used, the bedding, where the pipe joints are located, shall be recessed as necessary to ensure the whole of the barrel length of the pipe makes uniform contact with the prepared bedding.

Where a concrete bedding is used, the bedding shall not be continuous at pipe joints unless specified otherwise. No pipe laying or concrete bedding shall be commenced until the foundation has been inspected and approved by the Engineer.

7.6.2 Laying and Jointing Pipes

Pipes shall be laid with sockets pointing uphill. Each pipe shall be individually set true to line and level. Pipes to be bedded in concrete or surrounded with concrete shall be firmly supported behind the socket on precast blocks or bricks.

Pipe jointing shall be carried out in such a manner that the finished joints are watertight and present a smooth invert surface.

The spigot and the inside of the socket of pipes shall be clean before jointing.

Rubber rings for flexible joints shall be free of dust, grease or dirt. The rubber rings shall be mounted evenly on the extreme end of the spigot, and the pipe lined up truly concentric with the pipes already laid. Spigot shall then be forced into the socket leaving a gap between the socket shoulders and the spigot of between 5 mm and 10 mm, care being taken to maintain the pipes are concentric.

The rubber ring shall be at a constant distance from the end of the socket all round and at least 20 mm from the back of the socket chamber when the joint is completed.

7.7 Backfilling

7.7.1 Commencement of Backfilling

Backfilling shall be carried out for each installation type as specified.

7.7.2 Placement and Compaction

Where pipes are bedded at or near ground level the filling shall be built up in 150 mm layers, placed and compacted simultaneously on each side of the pipes, in order to effect balanced loading. Full use shall be made of hand operated compaction tools, such as the jumping frog and vibrating plate types, for either side of the pipe and within a height of 1.5 metres above the pipe. Heavy construction equipment and sheet foot rollers shall not be operated over or near the culvert until the amount of filling required by the job specification has been placed and compacted, as specified, around and over the pipes.

7.8 Concrete Structures

Concrete headwalls, windwalls, aprons, drops and the intakes shall be reinforced and constructed as shown on the drawings. No portion of any metal tie permanently embedded in the concrete shall be left within 40 mm of any concrete face. This clause relates also to the concrete outlet support structure.

7.9 Maintenance

The Contractor shall maintain the culverts and incidental works including the inlet and outlet drains, until the end of the Maintenance Period. He shall make good any subsidence which occurs in the earthworks above the culvert.

7.10 Riprap at Culvert Outlets

Riprap shall be placed at culvert outlets to the thickness, dimensions and levels shown on the drawings or as directed onsite. For culverts greater than or equal to 600mm diameter the rock shall comprise selected dense sound and durable material in the range 300-600mm diameter with a minimum D50 of 400mm. No more than 10% by weight shall be less than 200mm following placement. Filter fabric shall comprise Bidim A34 or an approved equivalent.

The fabric shall be placed with no gaps or holes. Cloth joints shall be lapped 500mm minimum.

7.11 Gabion Mattress and Gabion Retaining Walls

A gabion mattress and wall shall be constructed at locations shown on the drawings. The mattress shall be heavily galvanised gabions supplied by Macaferri Ltd. The supply and installing shall comply with the manufacturer's recommendations. The stone size shall be between 100mm and 250mm consisting of sound durable material not subject to breakdown. No more than 2% by weight shall be less than 100mm after placement.

7.12 Table Drains

Shaping
Shaping of the table drains shall be carried out to the profiles, lines and levels shown on the drawings or otherwise established by the Engineer. No drain invert should have depressions that will cause water to pond. The drains shall be neat in appearance to the eye and free of abrupt irregularities.

Topsoiling
Where shown on the drawings or otherwise established by the Engineer, following shaping the drains shall be topsoiled lightly compacted to a depth of 100mm and grassed.

Rock Riprap
Where shown on the drawings or otherwise established by the Engineer, rock riprap shall be placed in the table drains in a tight interlocking manner to the profiles shown on the drawings.

Rock shall be dense, sound, durable and resistant to weathering. The placed rock shall be evenly graded between 150-250mm diameter with an average diameter (d50) of 200mm. No more than 10% weight of the rock shall be less than 100mm diameter following placement. In selecting the material, the Contractor shall make full allowance for any reduction in boulder sizing through transportation, handling and placement.

8 CLEARING UP

8.1 Clearing

Upon completion of all works the site shall be cleared of loose spoil, plant and rubbish and left in first class order.