
PART 4: STORMWATER**400 SCOPE**

This part of the Standards sets out the engineering requirements for the storm water drainage issues associated with land development projects, including performance criteria, methods for design and construction, and materials specifications. The criteria are to be used irrespective of whether the network created on a site is to be accepted as part of the public network or to remain under private ownership and control.

400.1 Strategic Vision

The strategic vision for Rodney District Council with regard to Stormwater is:

- To provide and maintain public stormwater systems so that the effects of flooding, erosion and water pollution are minimised.
- This is to be effected through maintenance of natural flood plains, natural flow regime and perennial watercourses, through provision of stormwater treatment and adherence to hydraulic neutrality.

400.2 Performance Criteria

- Meet all standards and criteria of the District Plan and any Regional Plan.
- Control stormwater run-off in a manner that protects people, property and the natural environment from adverse effects.
- Provide a low flow stormwater connection point for each urban allotment.
- Provide an overland flow path clear of all buildings and high use areas.
- Cater for the whole of the design catchment.
- Provide for future development.
- Be compatible with connecting networks.
- Not require undue maintenance.
- Be easily maintained.
- Withstand design loads including any undue construction loads imposed as the result of earthworks or carriageway construction.
- Avoid the likelihood of blockage.
- Not interfere with other utilities.
- Provide a means of stormwater quality treatment.

400.3 Definitions

EROSION is the process whereby soil is washed away or frittered away by the process of water flowing. The process may instigate or worsen the stability of the banks leading to slippage.

OPEN CHANNEL OR OVERLAND FLOWPATH is the description applied to either a man-made or natural depression used to convey stormwater run-off.

PERMANENT is any river or stream which has continuous flow, natural stable pools or aquatic biota.

PRIVATE DRAIN is a piped or other form of channel which generally serves only one property and is under the control of one property owner. It has the meaning and status as described in the Local Government Act.

PUBLIC DRAIN is a piped or open channel used to convey waste or stormwater that is under the control of Council. Generally it is a conduit serving two or more properties. It has the meaning and status as described in the Local Government Act.

WATERCOURSE is a natural depression that conveys stormwater runoff from higher ground. Watercourse may be ephemeral, that is only having water during and immediately after rainfall or perennial, having flow or pools of water for the greater part of the year.

400.4 Documents Referred to in this Section:

- Resource Management Act 1991 Sections 9, 13, 14, 15, 221.
- Proposed Regional Air Land and Water Plan and variations (PRALWP).
- Rodney District Council District Plan.
- Rodney District Council Catchment Management Plans.
- Management of Stormwater in Countryside Living Zones, known as the “Toolbox”.
- ARC Technical Publication 90 “Erosion and Sediment Control Guidelines for Land Disturbing Activities”.
- ARC Technical Publication 108 “Guidelines for Stormwater Runoff Modelling in the Auckland Region”.
- ARC Technical Publication 10 “Design for Guidelines for Stormwater Treatment Devices”.
- Rodney District Council General Bylaw 1998 Chapter 21 Stormwater Drainage July 2006
- Tables for the Hydraulic Design of Pipes Sewers and Channels” HR Wallingford and D. Barr.
- . A/NZS 4058:2007 Precast Concrete Pipes (pressure and non pressure)
- AS/NZS 1260:2002 – PVC-U pipes and fittings for drains, waste and vent applications.
- NZS 4442:1988 – Specification for welded steel pipes and fittings for water, sewage and medium pressure gas.
- AS/NZS 4130:2003 Polyethylene (PE) pipes for pressure applications.
- AS/NZS 4131:2003 – Polyethylene (PE) compounds for pressure pipes and fittings.
- AS:NZS 5065:2005 Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications
- AS 2032:1977 – Installation of uPVC pipe systems.
- AS/NZS 2566.1 Supp1: 1998 Buried flexible pipelines Part 1: Structural design – Commentary, AS/NZS 2566.2: 2002 Buried Flexible pipelines Part 2: Installation.
- AS/NZS 3725:2007 – Loads on buried concrete pipes.
- NZS 7643:1979 Code of Practice for the installation of unplasticized PVC pipe fittings.
- AS 2033:1980 – Installation of Polyethylene pipe systems.
- AS/NZS 3500.2.2:1996 Sanitary plumbing and drainage – acceptable solutions.

401 GENERAL

401.1 Unless approved otherwise, all urban Residential, Commercial, Industrial and Business lots shall be provided with a piped connection to a stormwater drainage system. The stormwater system shall provide for the collection and control of all stormwater within the land being developed together with drainage from the entire catchment upstream of the proposed system. A connection for drainage of each upstream catchment shall be provided at the upstream boundary of the development.

- 401.2** All rural, landscape protected, Low Intensity Residential and Countryside Living lots shall have a dispersed or piped connection that does not cause erosion of any watercourse or exacerbate downstream flooding
- 401.3** Stormwater pipelines that extend to the upstream boundary or collect surface water from a public road or serve three or more properties will on completion be taken over by the Council as part of the public system.
- 401.4** Unless specifically approved otherwise in the RMA S.220 subdivisional consent, for all new developments, stormwater treatment shall be designed in accordance with the ALWP and ARC Technical Publication 10. Wherever practical, treatment shall be provided within riparian margin land shall be designated as Local Purpose (Stormwater Utility) Reserve adjacent to natural watercourses.
- 401.5** All lots in Countryside Living, Low Intensity Residential, Rural Settlement 1 and Landscape Protection Residential Zones that do not have direct physical access to existing natural watercourses shall be provided with a drainage system approved by the **Engineer**.
- 401.6** Unless specified differently in a Catchment Management Plan, rural residential lots are to be hydrologically neutral volumes and time of concentration of overland flows from an area during rainfall shall be the same, both before and after subdivision has occurred. "Management of Stormwater in Countryside Living Zones" (The Toolbox) recommends methods and provides design guidelines for stormwater management in these circumstances.
- 401.7** On site treatment and disposal should be encouraged to reduce the volume of runoff to downstream catchments. Impervious areas should be kept to a minimum.
- 401.8** For all sites greater than 1000m² created impervious area, on-site stormwater treatment shall be provided. Where this is not practicable or where Council proposes a regional device in the immediate catchment, the **Developer** will make a financial contribution towards the regional scheme. The contribution will be based on equivalent areas being treated.
- 401.9** Provision shall be made to contain, and discharge in an approved manner, run-off from undeveloped land up-slope of subdivided sites until such time as the individual site development diverts the run-off to on-site or reticulated systems as appropriate. The subdivider shall maintain these temporary measures until no longer necessary due to site development and shall provide such physical or legal protection for the measures as appropriate.
- 401.10** The design shall comply with any approved Stormwater Discharge Consent. Where the Council has a Catchment Management Plan for the catchment, whether a consent has been formally issued by the Regional Council or not, the recommendations contained within the Draft Management Plan shall be complied with.
- 402 LAND DRAINAGE**
- 402.1** The land drainage system shall consist of both a primary pipe or open channel system for frequent run-off and a system of secondary flow paths to cater for high intensity events or blockages in the primary system.
- 402.2** The land drainage system shall be capable of serving the entire fully developed catchment upstream of the development. The effect it may have on downstream waterways and adjoining areas shall be fully addressed.
- 402.3** The primary design flow shall be based on the following minimum storm frequencies.
- | | | |
|---------------------------------|----------------------|-----------------------|
| Residential Areas | 10% AEP | (10 year storm event) |
| Commercial and Industrial Areas | 10% AEP | (10 year storm event) |
| Bridges and road culverts | Refer to section 339 | (Roading) |
| Parks, reserves, open space | 10% AEP | (10 year storm event) |
- 402.4** The design rainfalls shall be determined in accordance with the intensity/duration curves, refer to Rodney District Council Drawing 18000 sheet 4.28.

- 402.5** For areas less than five hectares the pipe flows may be calculated using the Rational Formula.
- For areas greater than five hectares, Auckland Regional Council Technical Publication No. 108, April 1999 "Guidelines for Stormwater Run-off Modelling in the Auckland Region" shall be used for calculating peak flows in catchments that do not contain significant flood storage. Other methods of calculation of peak flows may be approved by the **Engineer**.
- 402.6** Where there is a requirement to attenuate flows to pre-development levels, the following values of C shall be used in determining pre and post development flows:
- Grassed and vegetated surfaces – 0.30
 - Impervious surfaces – roofs and driveways – 0.95
 - Residential urban catchments – 0.7
- 402.7** Separate analysis of pervious and impervious components applies in urban catchments.
- 402.8** All flows shall be checked for order of magnitude accuracy using conventional Rational formula, regional flows, or similar approved methods.
- 402.9** Where the watercourse is through private urban property, it shall be protected by a drainage easement in favour of Council. The extent of the easement shall be related to the flow volume during the 1% AEP event and any respective flood plain.
- 402.10** Where open watercourses are to form part of the land drainage system this shall be determined at scheme plan approval stage, and the **Developer** shall submit sufficient engineering design to enable Council to evaluate the proposals (refer to Section 401.4).
- 402.11** Open watercourses shall be retained within any area defined as such in any Catchment Management Plan for the area.
- 403 FLOOD PROTECTION**
- 403.1** All buildings shall be protected against the adverse effects of flooding resulting from rainfalls up to the 1% AEP (1 in 100 years) rainfall event.
- 403.2** Refer to Section 405 for flood protection related to secondary flow paths.
- 403.3** Open channels shall be designed to accommodate the 1% AEP (1 in 100 years) rainfall event. The 1% AEP rainfall event may be piped under extenuating circumstances subject to specific approval.
- 403.4** No buildings, structures or alterations to levels and grades of landscape shall be permitted within areas required to accommodate the 1% AEP rainfall event.
- 403.5** Freeboard in flood plains for the 1% AEP shall be a minimum of 500mm unless specified otherwise in a Catchment Management Plan. Freeboard in the Waimauku Catchment shall be 1000mm and in the Rangitopuni/ Dairy Stream Catchments shall be 1500mm.
- 403.6** The minimum floor level for all buildings and the minimum level for infrastructure shall be set in terms of the sea inundation level as determined by the Stormwater Assets Manager (Refer to section 103.1.3).
- 404 WATERCOURSES AND RIPARIAN MARGINS**
- 404.1** All permanent and intermittent watercourses should be retained in their natural state, and preferably be located in public utility reserves.
- 404.2** Open watercourses and riparian margins as identified in an approved Catchment Management Plan or in a Structure Plan shall be retained.

- 404.3** The minimum width of the riparian margin shall be 20 metres or such width as will accommodate a 1% AEP storm event within the boundaries of the reserve (whichever is the greater) unless specifically noted in a CMP or approved by the Asset Manager. (Refer to Rodney Drawing 18000 Sheet 4.27). As it is intended that the majority of the utility reserve will be extensively vegetated an appropriate Manning's 'n' value shall be used when calculating the width required to accommodate the Q1% AEP storm.
- 404.4** There shall be no direct discharges of stormwater to watercourses. Instead pipes shall discharge to an outlet structure at a point clear of the channel. The outlet to pipelines and the area between the point of discharge and the channel shall be designed to provide even overland flow without risk of erosion through vegetated margins prior to discharge to the open watercourse.
- 404.5** The extent of stream improvement work shall be agreed with the **Engineer** in order to achieve a satisfactory compromise between the retention of the natural topography and vegetation and:
- Maintenance of the stream and riparian margin
 - Hydraulic and safety considerations
 - The upstream and downstream impacts of the work
- Erosion protection measures may be required to reduce the risk of erosion in the watercourse.
- 405 SECONDARY FLOW PATHS**
- 405.1** These are required for all areas where primary design flows exceed 200 litres/sec.
- 405.2** Overland flow paths and secondary flow paths for pipe networks are to be designed to accommodate the 1% AEP rainfall event as follows:
- 10 % AEP flow up to 0.5 cumec – pipe condition fully blocked
 - 10 % AEP flow between 0.5 and one cumec – pipe condition fifty per cent blocked
 - 10 % AEP flow over one cumec - pipe condition 25 % per cent blocked
- 405.3** Where flow paths traverse pedestrian or vehicular accessways or public carriageways, the maximum depth of flow shall not exceed 200mm and 2.0 m/sec flood velocity. The **Developer** must demonstrate that damage to property and buildings will not result from excessive velocities or depths of water when the overland flow path is utilised.
- 405.4** Secondary flow paths shall, as far as possible be accommodated within Council reserves. Where this is not possible, the flow paths shall be brought through private property by the shortest route possible and the overland flow path shall be protected by an Easement registered on the Title (The dwelling shall be protected with an appropriate freeboard). In the latter case, a S.71-73) Notice under the Building Act 2004 may also attach to the Title at the time of building consent on the site.
- 405.5** In any new developments, overland/ flow paths shall be identified and provided for and protected by:
- In the case of new subdivisions - a Consent Notice pursuant to Resource Management Act 1991 Section 221.
 - In new developments other than subdivisions - a Memorandum of Encumbrance detailing the watercourse overland flow path as set out in Cls 404 and 405 of these standards.
- 405.6** The secondary flow paths shall be shown on the "Asbuilt" drawings for inclusion into Council's Services Drawings. The Asbuilts shall include invert levels and cross sections at regular intervals not exceeding ten metres and at every legal boundary crossed. The appropriate freeboard at each boundary crossing point shall be appended to the asbuilt and the whole information included in any consent notice on title for each affected lot.
- 405.7** All buildings or structures shall be located to ensure that they do not cause a blockage or obstruction to the secondary flow paths. No alterations to levels or grades of landscape shall be permitted which would alter the flow direction or characteristics of the flow path.

- 405.8** Raised median strips in roadways shall not be constructed at any point where they would create an obstruction to overland flowpaths.
- 405.9** The freeboard to design floor levels of buildings adjacent to the formed and defined overland flow path shall be as follows:
- Concentrated flow from contributory catchment less than 2 hectares, minimum freeboard 200mm.
 - Concentrated flow from contributory catchment more than 2 hectares, minimum freeboard 500mm.
 - Where a defined flow path is required to pass through either a private or public property the freeboard to design floor level for the dwellings shall be appended to the Title of the respective property together with any other requirement in respect of maintenance of any defined flow path.
 - The Notice on Title shall require specific reference to and certification by a Registered Surveyor that the building floor levels meet or exceed the freeboard of the requisite flood levels for the site.
- 406 THE HYDRAULIC DESIGN OF PIPELINES**
- 406.1** Piped systems shall be designed to cater for the peak design flow, without surcharge, based on a “Colebrook-White” roughness coefficient of $K_s+1.5$ for pipes up to and including 1000mm diameter and $K_s+0.6$ for larger diameter piped systems.
- 406.2** Culverts shall be designed for either inlet or outlet control as the specific site conditions demand.
- 406.3** Short culverts on streams shall either be provided with fish passages or preferably shall be designed to allow the pipe to have a minimum depth of 100mm of silt in the invert of the pipe. The design diameter shall encompass the need for fish passage which ever option is selected.
- 406.4** The design shall provide:
- (a) No stormwater drain (other than connections) and shall have an internal diameter less than 200mm;
 - (b) Road Catchpit outlets shall not be less than 225mm diameter;
 - (c) Catchpit leads and stormwater lines serving more than a single dwelling shall not be connected to other Catchpits.
- 406.5** The maximum and minimum velocities in any stormwater pipeline shall be 4.5m/s and 0.75m/s respectively. These values may be exceeded under extenuating circumstances subject to specific approval.
- 406.6** Special measures by way of energy dissipation shall be taken to reduce velocities at outfalls to no more than one metre per sec. These measures shall be checked for efficacy at 1/3, 1/2 and full flow conditions in the upstream pipeline.
- 406.7** Pipe entry conditions are to be considered at all pipe entries.
- 407 LAYOUT AND LOCATION OF PIPELINES AND MANHOLES**
- 407.1** Stormwater drainage pipelines shall generally be sited in front, side or rear yard areas of building sites or in reserve areas. Pipelines shall be located in the lowest lying portions of the property and shall run along any overland flow path. Access to all parts of the system for inspection and maintenance shall be maintained. Pipelines shall not be located in any location (e.g. rear yards) that may be obstructed by buildings or fences except with approval of the Stormwater Asset Manager.
- 407.2** For medium and high density developments and for commercial / industrial areas the stormwater pipe system shall be located in the road reserve as shown in 18000. 3.31 Where the pipe diameter exceeds 750mm and where the berm cannot be increased in width to accommodate the pipeline, the principal pipeline shall be located in the carriageway and a service line constructed in the location shown in 18000 3.31. Where the pipelines have to be located away from the road reserve it may be required to be located in a defined services corridor which is kept clear of buildings and obstructions.

- 407.3** Pipelines and open drains adjacent to buildings shall satisfy the requirements of Rodney District Council's "Building Over Or Close To Stormwater and Wastewater Pipelines" refer to Appendix "P" and Council Drawing Number 18000 Sheets 4.24 and 4.25.
- 407.4** In cases where pipelines are laid within the building area on lots, or at such depth that the influence line, defined in the Rodney District Council "Standards for Engineering Design and Construction" Appendix P will affect building foundations, the Council will require Consent Notices pursuant to Resource Management Act 1991 Section 221 prohibiting the erection of buildings within the minimum distances from the pipeline, and requiring specific design of building foundations.
- 407.5** Pipelines shall cross roadways as near to right angles as possible to the road centreline. Stormwater pipelines along the road alignment should generally not be laid within the carriageway.
- Manholes shall be a minimum of 500 mm from outside wall clear of any boundary or fenceline to ensure practicable access to the cover and frame.
- 407.6** In general pipelines between access points should be straight. However horizontal or vertical curves may be approved to minimise the number of main-entry points or to ensure minimal head loss through manhole inlet and outlets. These variations shall be subject to specific approval by the **Engineer**.
- 408 PIPES**
- 408.1** The following pipes may be used for stormwater drainage work,
- Reinforced concrete pipes to NZS 4058 (pipes larger than 200mm diameter).
 - PVC plain wall only minimum strength SN 16 with elastomeric joints. Sandwich and ribbed wall pipes are not permitted. Pipes to conform to AS/NZS 1260:2002 - pipes are generally 200mm diameter or smaller.
 - Concrete lined mild steel to NZS 4442 1988.
 - Polyethylene pipe to AS/NZS 4130:2003. Polyethylene (PE) pipes for pressure applications, manufactured from materials complying with AS/NZS 4131:2003 PE 80B, with a minimum SDR of 17. PE 80C pipes shall not be used.
 - Polypropylene pipes to AS/NZS 5065:2005 Type B minimum stiffness rating SN 16 may be used provided that they are accompanied by the relevant proprietary fittings for connections and manhole shorts.
 - Pipe materials such as galvanized steel and aluminium shall not be permitted. The preferred material for use in culverts under roadways is reinforced concrete either in circular pipe, pre-cast or insitu structures of requisite shape.
- 408.2** PVC: PVC pipe (plain wall), fittings and pipe laying shall comply with the relevant standards as follows: AS/NZS 1260:2002, AS2032:1977, AS/NZS 2566:1998.
- 408.3** Other pipes may be permitted subject to the specific approval of the Stormwater Asset Manager.
- 409 JOINTS**
- 409.1** All pipes shall have an approved flexible sealed joint with the exception of polyethylene pipes or pipes used for pipe jacking. Reinforced concrete flush jointed pipes will not be allowed. Solvent glue joints shall not be used. Concrete pipes used in pipe jacking operations shall have stainless steel covers to the joints.
- 409.2** PVC and polypropylene pipes shall be laid with a sliding joint to the manhole.
- 409.3** The trench width at the top of the pipe shall be kept to the minimum for the respective pipe material. Trench widths in excess of this minimum shall result in the pipe being deemed to be laid in embankment condition which will impact on the pipe class and bedding. In extreme circumstances this will result in the pipe being relaid in the class appropriate to the bedding condition.

- 409.4** Polyethylene pipes shall be laid with a watertight sliding joint at the connection into manholes. Joints shall be capable of accommodating a minimum of 50mm expansion and contraction and shall be detailed on the engineering plans and be subject to approval by the **Engineer**.
- 409.5** Where polyethylene pipes are butt welded, welding to be carried out by certified welder, and the testing procedure to be as per Rodney District Council's "Specification for Polyethylene Weld". Refer to Appendix "M".
- 410 STRUCTURAL STRENGTH OF PIPES AND BEDDING**
- 410.1** The pipe bedding shall be selected to meet the requirements of the class of pipe to be used and the design loading conditions. The design loading shall include any construction loading which may occur during the process of construction development such as temporary fill stockpiles, passage of construction machinery.
- 410.2** The combination of bedding class and pipe class for concrete pipes shall conform to the requirements of NZS 3725. The bedding class used shall be H2 unless specifically approved prior to construction by the **Engineer**. The type of bedding and class of pipes adopted shall be in accordance with the pipe laying tables and bedding diagrams in NZS 3725 and as shown in Rodney District Council Drawing Number 18000 Sheet 4.4, & 4.5.
- 410.3** The requirements for PVC and polypropylene pipelines shall be as set out in AS 2032 and AS/NZS 2566:1998. The depth of bedding and surround materials are to be as shown in Council Drawing Number 18000 Sheet 4.4.
- 410.4** Where the gradient of the pipeline exceeds 10% or where ground conditions, in the opinion of the **Engineer**, merit the need, sufficient cement shall be added to the granular bedding material to provide a weak concrete with a strength of not less than 7 MPa. The depth of bedding shall be as specified in ANZS 3725 for concrete pipelines and as described in 2566 for plastic pipelines.
- 410.5** Where the pipeline gradients are equal or greater than 20%, anti-scour blocks shall be constructed of ordinary grade 20 MPa cast in situ concrete blocks as shown on Council Drawing Number 18000 Sheet 4.3. Such blocks shall be placed at a maximum of 4m centres.
- 410.6** Where the pipeline gradients are equal to or greater than 33% the anti-scour blocks shall extend 150mm over the top of the pipeline.
- 410.7** Where the backfilling of trenches is required by Geotechnical assessment of the site to be undertaken in a particular manner the pipe class and bedding shall be specifically assessed and the exact manner of backfilling specified for the approval of the Stormwater Asset Manager.
- 410.8** Particular attention is to be paid to the possibility of a change in laying condition from trench to embankment as a result of geotechnical requirements in respect of pipe backfill. If the trench with requirements exceed those set out in Council Drawing 18000 4.4 and 4.5 then the engineering drawings must be marked up to show that a specific condition is necessary for that section or sections of the pipeline.
- 410.9** The methodologies of backfilling are to be agreed between the geotechnical engineer and the Asset Manager prior to construction. those agreed methodologies are to be shown on the engineering drawings.
- 411 SOFT GROUND CONDITIONS**
- 411.1** Where a pipeline is to be laid in soft ground the **Engineer** may require a geotechnical analysis of the site to determine the most appropriate bedding design and backfill material and process. Any such requirements shall be strictly adhered to and the **Developer's Representative** shall be required to confirm this in writing to the **Engineer**.
- 412 PIPELINE CONSTRUCTION**
- 412.1** The construction of concrete pipelines shall be carried out in accordance with the requirements of NZS 3725.

- 412.2** Construction of pvc and polypropylene pipelines shall be in accordance with ANZS 2566 parts 1 and 2.
- 412.3** Construction of Polyethylene pipelines shall be carried out in accordance with AS 2033 and AS/NZS 2566. The use of polyethylene is confined to trenchless construction methods and above ground pipelines which are subject to specific approval by the **Engineer**.
- 412.4** Trenchless methods of construction may be used subject to prior application to the **Engineer** specifying the methodology, pipe material and jointing system to be employed. The **Engineer** shall not unreasonably withhold approval provided that the materials are covered by the relevant specification for an equivalent trenched application.
- 412.5** The two types of pipe approved for this form of construction are polyethylene and reinforced concrete. In the latter case these shall be specially manufactured for jacking operations. Pipe classes for each type are subject to specific design. The joints for each are subject to specific approval by the **Engineer**.
- The methodology used shall be such as to ensure that the design gradients are met along with hydraulic efficiency of the pipeline. Micro-tunnelling is recommended where gradients are less than 1%.
- 412.6** Where the trenchless method involves drilling a pipeline under the drip line of a tree, an arborist report on the minimum cover from ground level to invert level may be required to ensure no damage is caused to the tree.
- 412.7** All testing required under these clauses shall be a charge on the **Developer**.
- 412.8** Where trenchless methods of construction are used the resulting pipeline shall not be accepted if it contains sags or crest in the vertical which will retain flow and consequently lead to siltation in the pipeline. Horizontal deviation from alignment is acceptable without loss of vertical alignment provided that the maximum deviation is not more than 1.5D for pipes up to 300mm nominal diameter, 1.0 D for pipes greater than 300mm nominal diameter.
- 413** **MINIMUM COVER OVER PIPES**
- 413.1** All pipelines shall be specifically designed to support the likely loadings – including construction loads - in relation to the minimum cover to be provided in accordance with the relevant standards. The cover shall not be less than 500mm except as otherwise required below.
- 413.2** The minimum cover over concrete pipes in private property shall be 750mm. Where due to the topography this cover cannot be provided **the pipe and bedding class shall be subject to specific design**.
- 413.3** Where the reticulation pipelines are laid in the front yard of lots and the lots are elevated above the carriageway the minimum cover on the pipelines shall be 1200mm diameter to avoid damage when building platforms and/or driveways are subsequently excavated.
- 413.4** Catchpit leads shall be minimum Class 4 reinforced concrete pipes complying with ANZ 4058 on H2 bedding. Overlay zone and backfill shall be Gap 40. All other pipes in carriageway areas shall be subject to specific design using H2 bedding. Pipeline cover should be a minimum of 1200mm diameter to avoid conflict with other underground utilities as shown on the detail for services layout – berm cross section Council Drawing Number 18000 Sheet 3.31.2.
- 413.5** Trenched pipelines under carriageways, private ways, or other trafficked areas shall be backfilled with approved compacted hard fill to sub grade level. Such backfill shall extend a minimum of 500mm beyond the paved areas.
- 414** **MANHOLES**
- 414.1** **General**

- 414.1.1** Manholes shall normally be provided at each change of direction or gradient, and at each branching line and at a spacing of not more than 100m. Manholes shall be made of pre-cast concrete except in special circumstances where the **Engineer** may approve cast in situ manholes.
- 414.1.2** Kerb or open channel collected stormwater must be captured by a catchpit with silt sump and then piped to a manhole.
- 414.1.3** All manholes should be built with out risers but if ground levels change, joints, riser to riser and riser to lid shall be fitted with holding down bolts and the joints filled with approved jointing compound.
- 414.2 Standard Manholes**
- 414.2.1** Manholes shall be pre-cast concrete pipes conforming to NZS 4058 for concrete pipe construction minimum Class 1 with an internal diameter of 1050 mm and an external flange base. Larger diameter manholes conforming to NZS 4058 shall where practicable also be supplied with an integral external flange base. These may be installed on pipelines up to 600mm diameter except for diameters over 500 mm where the pipelines deviate more than 20° from the centreline of the outgoing pipeline. In those cases specific design of the benching may be required to ensure full efficiency of the outgoing pipeline. Alternatively with pipelines with large angles of deviation approval may be given for the manhole to be sited on a straight outlet with a series of factory-made mitred bends immediately downstream, (refer to Council Drawing Number 18000 Sheet 4.6.1 & 4.12) and are to be used on pipelines up to and including 600mm diameter.
- 414.2.2** Manholes shall have holes cast in for step irons and holding down clamps.
- 414.2.3** Lids shall be pre-cast concrete with 600 openings to accept approved ductile iron covers and frames appropriate for their location. This shall be mandatory post 1 July 2009 and on a voluntary basis prior to that date for standard 1050 manholes.
- 414.2.4** All wall joints in manholes shall be including the lid to riser shall be clamped and have an approved joint sealer. A rubber/bitumen sealing strip shall be applied between the concrete faces. The joint between the wall and concrete lid sealed with Bostick Titan Seal or equivalent as approved by the Engineer.
- 414.2.5** Manholes up to 2.4m deep shall be constructed of a single riser where possible. A single 300mm riser may be used to make up final ground levels where necessary.
- Where manholes exceed 2400mm in depth, the base riser shall be a 2400mm riser topped with a single riser to final ground level. Where manholes exceed 5000mm in depth, they shall be built using two 2400mm risers topped with a single riser to final ground level.
- 414.2.6** Manholes shall be fitted with precast externally flanged bases. Where approved by the **Engineer** a cast in situ base using pre mixed 25 MPa concrete (with concrete support) may be used instead. The riser must penetrate a minimum of 75 mm into the wet concrete. The concrete is to be compacted using a mechanical insertion vibrator.
- 414.2.7** Manholes with depths to invert greater than 750 mm and less than 1200mm diameter shall be constructed using a centrally placed opening rather than the offset version.
- 414.2.8** Pipelines not greater than 550 mm internal diameter entering and leaving manholes shall have a flexible joint within one metre of the outside wall of the manhole. This will usually be effected by the standard rubber ring joint at a collar. Where a pipeline cascades into the manhole the bedding of the pipeline shall be brought up to the nominal bedding invert of the cascade pipe with an approved hardfill, GAP 40 or similar. In some instances where the ground may be geotechnically sensitive the use of rocker joints may be required by the **Engineer**.

414.3 Mini Manholes

- 414.3.1** The **Engineer** may approve the use of mini-manholes where the stormwater line does not exceed 250mm diameter, the depth to invert does not exceed 750mm, the upstream grade does not exceed 10% and not more than two lines or connections enter the manhole (i.e. three including the discharge).
- 414.3.2** Mini-manholes shall be constructed from Class 1 600 dia pipes complying with ANZS 4058, flush joint with the socket uppermost. The cast iron cover and frame shall be carefully set into the socket using an epoxy mortar. The invert of the manhole shall be fully benched as per standard manholes and shall not exceed 750mm to the invert.
- 414.3.3** Mini-manholes shall consist of a single length of 600mm diameter concrete pipe to a minimum of Class 1 standard, fitted with a standard 510 mm opening cast iron frame and lid. The invert shall be fully benched as for standard manholes.
- 414.3.5** Subject to approval by the **Engineer** the following Inspection Chambers may also be allowed:
- Plastics Shallow/Multi-base Inspection Chambers conforming to BS 7158:1989 and BS EN 124:1994 may be used on DN 100 and DN 150 drains at invert depths of up to 0.6m.
 - Plastics Universal Inspection Chambers conforming to BS 7158:1989 and BS EN 124:1994 may be used on DN 100 or DN 150 drains at invert depths of up to 1m.
 - Other non man-entry points manufactured from PVC, polyethylene and polypropylene will be approved but not for use in public carriageways, trafficked areas or in kerbside footpaths.

414.4 Deep Manholes

- 414.4.1** Any manhole in excess of 4000mm deep shall require specific approval of the **Engineer**. All such manholes shall be a minimum of 1200mm diameter, fitted with step irons and holding clamps, and 600mm opening lids, ductile iron covers and frames. The cover may be required to be fitted with an approved locking device. The opening shall be fitted with an approved safety curtain which may be removed prior to entry into the manhole. This shall be fitted with approved 316 10 mm pin anchors with chemical set into the concrete lid not the haunching. The benching shall be so arranged as to permit easy access off the bottom step and into the invert of the pipe by maintenance staff. Where the diameter of the outgoing pipeline exceeds 450mm diameter steps and hand-holds may be required to be provided to access the invert of the pipe.

414.5 Stormwater Manholes on Larger Pipelines

- 414.5.1** Manholes on stormwater pipelines generally 600mm or greater and/or except section 415.2 shall be specifically designed. Particular care is to be paid to the issue of entry, outlet, and bend losses in the manhole.
- 414.5.2** On stormwater pipelines equal to or greater than 1m diameter, the spacing of manholes may be extended up to 200m. For pipelines greater than 1,500mm in diameter curvature on the pipeline may be permitted providing that joint deflections are within the limits of the manufacturer's recommendations. Any pipeline curvature is subject to specific approval by the **Engineer**.
- 414.5.3** Manholes on straight sections of line 1200mm diameter and greater may be constructed using factory made intakes provided that the depth to invert does not exceed 4000mm. The intake shall be a minimum of 1050mm diameter fitted with an approved 600 mm opening lid cover and frame. The intake shall be fitted with an approved ladder capable of being retracted above the soffit of the pipe and reaching within 300mm of the invert when extended.

414.6 Hydraulic Flow in Manholes

- 414.6.1** In addition to the normal pipeline gradient all manholes shall have a minimum drop of 20 + 5mm per 10° of the angle of change of flow within the manhole. Manholes on pipelines greater than 1m diameter shall have the drop through the manhole designed to compensate for the energy lost due to the flow through the manhole at the design radius. Pipe inlets should at least match soffits with the outlet at manholes.
- 414.6.2** Drop connections on stormwater manholes up to and including 450mm diameter may have an open 'cascade' inside the manhole provided the height of drop does not exceed 1m and benching is hard finished 40 MPa concrete.
- 414.6.3** Drops through stormwater manholes of more than 450mm diameter shall be avoided and if unavoidable shall be subject to specific design and approval. Cascade falls may be permitted subject to the benching being hard finished 40 MPa concrete rather than plaster and flow into the manhole is directed through a deflector unit.
- 414.6.4** Specific design may be required for situations where pipe velocities are high, or downstream conditions will limit exit velocity from the manhole, and where manhole depths are relatively shallow.
- 414.7 Connections to Manholes**
- 414.7.1** Connections to manholes shall be effected by the use of power drills or saws. The practice of smashing holes in the liner using hammers is prohibited. All entry points shall be kept to a minimum diameter to accommodate the incoming manhole short and all holes shall be restored using epoxy mortar not ordinary sand cement mortar.
- 414.7.2** Catchpits should be piped directly to a manhole, except that if the stormwater drain is of greater diameter than 1.2m and a manhole is not conveniently located, the Catchpit leads may be saddled direct to that drain. A direct connection of the Catchpit lead to a stormwater drain with a diameter between 600mm and 1.2m diameter will only be permitted in exceptional circumstances, and at the **Engineer's** discretion. A typical catchpit design is shown in Council Drawing Number 18000 Sheet 4.29.
- 414.7.3** Branch lines 300mm diameter and smaller may be saddled on to pipelines 1.2m diameter or larger, providing a manhole is supplied on the branching line within 5m of the main line.
- 414.7.4** The saddle shall be effected by use of drilling or power saw cutting of the principal pipe at a point no more than 30 degrees of arc below the soffit of the pipeline. An approved saddle with a root proof seal is to be careful epoxied onto the main pipe and the inside bore of the principal pipe wiped smooth. No epoxy is to be dropped and allowed to remain on the invert of the principal pipeline.
- 414.8 Manhole Lids, Covers and Frames**
- 414.8.1** Standard manhole covers and frames shall have a nominal 510mm opening and shall be of a design approved by the **Engineer**, manufactured from a strong and durable material. Typical examples of heavy duty, light duty, and screw down covers supplied in high quality grey iron, coated with a bituminous protective compound are illustrated in Council Drawing Number 18000 Sheet 4.6. From 1 July 2009 the lid opening shall be a minimum of 600 mm and the cover and frame shall be an approved ductile iron model. There will be restrictions on the variety of covers and frames to facilitate maintenance and logistic requirements of the network operator.
- 414.8.2** The lid of inlet manholes required to capture overland flow shall be set a minimum of 200 mm below surrounding ground level. The design of the dome shall be subject to approval and shall be capable of being hinged to allow access to the manhole.
- 414.8.3** Grilled manholes, flat or domed may be installed in low areas to catch surface water. Domed lids are preferred as they have less tendency for blockage. Where a grilled cover is used, a sump with minimum depth of 500mm is required to trap coarse sediment.
- 414.8.4** Heavy duty lids and frames are to be used in all trafficked areas, including driveways.
- 414.8.5** The throats of all manholes shall be painted blue with a suitable paving paint. The covers can remain unpainted.

414.8.6 As of 1 July 2009 all manhole throats shall be formed using an approved internal former "Formathroat" or similar type approved by the **Engineer** . Strict compliance with throat maximum depths as shown on Council Drawing 18000 4.6.1 will be enforced. The use of precast rings or other materials other than minimum 17.5 MPa concrete is prohibited.

414.9 Manholes in Soft Ground

414.9.1 Where the trench subgrade proves to be particularly difficult the Engineer may require specialist advice from a geotechnical engineer on the most appropriate means of excavation, trench support and backfill procedures and materials. Additional measures may be needed for smaller diameter pipes in respect of the provision of flexible joints in such situations. The use of a rocker type joint at the manhole maybe called for.

414.9.2 Manholes in heavily vegetated areas shall be finished 500mm above ground level and marked with a 100x75 white painted stake 1000 mm above ground level to assist future location.

415 CONNECTIONS

415.1 Each lot on the development shall be provided with a gravity stormwater connection at the lowest point of and within the main body of the lot, at such a level as to provide a minimum elevation difference of 1 metre between projected floor level and the invert of the private drain at the point of connection to the principal pipe. The connection must be capable of serving the whole of the body of the lot. Where the connection is inside the body of the lot to be served the distinction between private and public line shall be the inspection at the end of the ramped riser. Where the connection to the principal pipeline is outside the body of the lot the whole length of connecting pipeline is deemed public and shall be laid in SN 16 uPVC pipe.

415.2 A connection is defined as being a 100mm nominal id pipeline:

- (a) Not more than six metres long
- (b) Passing not more than five metres through an adjacent lot measured from the point of connection on the main pipeline
- (c) Terminating one metre inside the boundary of the lot to be served
- (d) At a maximum depth not greater than 1200mm diameter and a minimum depth not less than one metre
- (e) Serves one household lot only
- (f) A line set straight with no deviation

415.3 Where it can be demonstrated that it is unreasonable for reasons of potential depth of the principal pipeline to meet the requirements of a and b above, the **Engineer** may approve a connection provided that it can be shown that the proposed connection is adequate for a pre-determined building location and associated impervious surfaces and those are enforced by a Section 221 Consent Notice on Title. Where a connection exceeds any of the above requirements it must originate from a manhole and be laid in nominal 150mm diameter pipe.

415.4 Where the connection is taken through an adjacent lot it shall be deemed public line and shall be laid in SN 16 uPVC pipe in accordance with AS/NZS 1260.

415.5 Dwellings in medium and high density residential developments and one into two lot infill developments may be served by a single 100 dia connection on a wet chamber with a maximum of two dwellings per wet chamber.

415.6 Connections shall be made to manholes.

415.7 Each commercial industrial allotment shall be served by a connection capable of serving the discharge from that lot based on a C value of 0.9 for that lot.

415.8 All connections shall be extended to within finished ground surface level as set out in section 415.2 (d) using a ramped riser.

- 415.9** Connections to main line will be permitted only where the crown of the main pipeline is not deeper than 2500 mm.
- 415.10** Connections shall terminate with a screw on blank cap. The use of solvent welded caps is prohibited. Connections shall be marked with a 25 mm pvc duct painted blue and projecting 600 mm above ground level (supported by a post). The end of the duct shall be sited over the blank cap.
- 415.11** The position of the blank cap shall be fixed by survey by a Registered Professional Surveyor and he/she shall provide a certificate to the Council that the caps are one metre inside the main body of the lot in accordance with Section 515.2 (c).
- 415.12** Where an existing single dwelling Lot is to be subdivided into a two dwelling lot development the existing connection may be used to serve both lots by constructing a wet chamber in accordance with RDC drawing number 18000 4.29. The furthest Lot can then be reticulated via an easement with a 100 mm connection.
- 415.13** Where approved by the **Engineer**, discharge of roof and paved areas may be made to kerb lines or watercourses subject to:
- (a) Attenuation of flows to equivalent pre-development 50% AEP flows (or as specified in any relevant Catchment Management Plan or zoning rules). This may be achieved using a suitably designed rainwater tank fitted with an inlet filter and outlet throttle.
 - (b) Raingardens may also be permitted, subject to adequate design and the approval of the **Engineer**.
- 415.14** In situations where re-use tanks are to be used, the tanks shall be designed to deal with a minimum of the total 10 % AEP flow from roof areas. The overflow shall be limited to a discharge equivalent to the 50 % AEP predevelopment flow. The actual discharge shall be designed to produce a broad swathe flow to mimic natural run-off from the site. Any run-off produced from the driveways and associated surfaces shall be attenuated by a separate device and discharged using the same criteria as the re-use tank.
- 415.15** Piping of stormwater directly to a catchpit or to a formed road channel without the express consent of the Road Assets Manager is prohibited. When such approval is granted the invert level of the discharge in the case of a catchpit shall be set a minimum of 100 mm above the soffit level of the outlet pipe. The discharge shall also be in accordance with section 415.12 above in respect of attenuation of flows.
- 416 RAMPED RISERS**
- 416.1** Where a connection is deeper than 1.2m below ground level a ramped riser shall be constructed to bring the connection to within 1.2m of ground level. A typical example of a ramped riser is shown on Council Drawing Number 18000 Sheet 4.7.
- 416.2** Where an extended connection is to be taken from a stormwater pipeline to the boundary of another Lot a ramped riser need not be used, and the extended connection may be sloped up at a continuous gradient from the principal pipe, at sufficient depth to drain the building site to terminate 1 metre inside the Lot to be served.
- 417 CONNECTIONS TO DEEP LINES**
- 417.1** Where an existing or proposed stormwater pipeline is more than 5m deep to the top of the pipe, connections shall not be made directly to it, but a new, shallower branch pipeline shall be laid from a manhole on the deep stormwater line and connections provided to the lots to be served.
- 417.2** The **Engineer** may refuse to permit pipelines (especially those of less than 1.2m diameter) where the depth to invert is more than 3 m, and where future maintenance of pipelines is a consideration.

418 INLET AND OUTLET STRUCTURES**418.1 General**

418.1.1 Approved structures shall be constructed at the inlets and outlets of pipelines. Structures shall be specifically designed to fit in with their natural surroundings.

418.1.2 Cast in-situ concrete is the preferred material for inlet and outlet structures. Gabions and rock lined structures or driven or drilled piles and whalers may be acceptable provided that the structure has the necessary structural strength to meet long term durability.

418.2 Inlets

418.2.1 Inlets shall be designed and constructed to provide efficient entry to the pipeline, minimise damage to surrounding ground and provide adequate and safe access for maintenance staff in the event of blockage. In particular instances the **Engineer** may require pedestrian or even equipment access to the inlet to be provided and for the installation of platforms across the inlet to permit cleaning under storm conditions.

418.2.2 Where a culvert is used across a watercourse to provide private vehicular access - driveway, private-way or joint owned accessway, then the whole structure shall remain a private asset.

418.2.3 Secondary overland flowpaths from all inlet structures shall be provided for flows greater than 200l/s.

418.2.4 All inlets to pipelines greater than 600mm diameter in urban areas require a galvanised steel safety grille or similar in an approved fibre reinforced plastic material with a maximum clear gap of 100mm. Inlet grilles shall be fitted at a flat grade to promote self-cleaning under high flow conditions. They shall have sufficient weight to prevent children lifting them aside. Where required by the **Engineer** the grille shall be fitted with a lockable entry gate contained within the grille.

418.2.5 Inlet grilles shall be designed so that the grille bars are laid in the vertical plane and the exterior of the grille presents a smooth surface to permit easy cleaning either by hand or machine. Bar spacing shall not exceed 100 mm. The supporting structure shall be contained on the inside of the grille to avoid it being damaged during cleaning. Web type grilles will not be permitted. Where required by the **Engineer** the inlet shall be fitted with secondary vertical inlet to facilitate operation of the inlet in the event of grille blockage.

418.2.6 In some cases where the Engineer deems that the upstream flows may carry high loads a tertiary and secondary screen may be required upstream to minimise debris loadings on the primary screen within the inlet structure. Such screens shall be specifically designed. Where the screens are to be located in a public reserve the screens shall be required to be designed and constructed to reflect safety, hydraulic and aesthetic considerations.

418.3 Outlets

418.3.1 Provision must be made for energy dissipation unless it is demonstrated by the **Developer** that outlet velocities and soil conditions are such as to make this unnecessary. The design shall achieve the minimal outlet velocity to preclude downstream scour of the channel and side banks, and address protection of the outlet, around the outlet, and the opposite bank.

418.3.2 Specific consideration must be given to provision for adequate fish passage where necessary.

418.3.3 The direction of the discharge shall be aligned with the natural downstream flow so as to prevent erosion of the opposite bank.

418.3.4 All outlets from pipelines greater than 600mm diameter in urban areas require a galvanised steel safety grille with a maximum clear gap of 100mm. Outlet grilles shall be top hung and free to swing to clear debris. They shall have sufficient weight to prevent children lifting them aside.

418.3.5 Energy dissipating blocks shall be made and cast into the apron in a way that no structural damage will occur under peak flow conditions. The number of blocks and position shall ensure that no flow can go directly from the end of the pipe without hitting at least one block.

418.3.6 Where energy dissipating blocks are to be used, they shall be cast and fixed into the apron in such a way that no structural damage will occur under peak flow conditions and that no undue hydraulic effects will occur at lesser flows where there may be a tendency for spray to be deflected over the wing walls.

419 TESTING

419.1 All manholes are to be watertight and shall require testing at the **Engineer's** discretion.

419.2 All pipelines 150mm and greater internal diameter shall be inspected internally with CCTV device capable of 360 degree coverage. The results of final state of the pipeline shall be provided to Council along with the asbuilt plans in an approved format and by an approved medium. In the case of flexible pipelines the **Engineer** may require profiling of the interior of the pipeline. This shall be done in accordance with the current version of NZ Pipe Inspection Manual. Pipelines of 1200mm diameter and greater internal diameter may be inspected manually, at the discretion of the Engineer.

419.3 Testing of pipelines may be required at the discretion of the **Engineer**. The methodology and outcomes will be agreed prior to the process being carried out by the **Engineer** and the **Developers representative**.

419.4 Final testing will not be carried out until approved As-builts have been received.

420 COUNTERFORT AND BORED SUBSOIL DRAINS

420.1 Council will not accept soil drains installed to maintain the stability of sites where such drains require on-going or periodic maintenance or monitoring.

420.2 Soil drains involving the use of perforated pipes laid in trench conditions must be terminated at the upstream end by a marked flushing point finished at ground level. They shall be connected into the public system at the downstream in a manner which allows both monitoring and easy maintenance. All such drains shall be as built and shown on the asbuilt plans submitted to Council and marked as **PRIVATE**.

420.3 Where the **Engineer** determines that the counterfort and/or bored drains will have no effect beyond the immediate site in which they are installed, the future maintenance shall be the responsibility of site owner, and this shall be recorded on the Title by a Memorandum of Encumbrance.

420.4 All other subsoil drains and drains behind retaining structures shall terminate in a catchpit or approved cleanable sediment trap before connection to the public system.

421 COASTAL AND CLIFFTOP DISCHARGES

421.1 General

421.1.1 Stormwater from roofs, driveways and any impermeable surfaces shall not be discharged over the top of cliffs. Discharge from impermeable surfaces on cliff top sections shall be disposed of by either:

- Discharging into a formal Council stormwater system where available, or
- Discharging into an existing open channel system that does not discharge over a cliff face, or
- Discharging through a lined inclined bore discharging to an energy dissipating structure at the base of the cliff, or
- An alternative method approved by the **Engineer**. 421.2 Piped/ Inclined Bore discharges at Coastal Cliff Faces

421.2.1 Where no other alternative disposal is possible consent to discharge through an esplanade reserve will be given subject to the following:

1. The applicant shall apply to the ARC for a coastal permit.

2. That consent shall be linked by way of Consent Notice on title to the property served and shall not be passed to Rodney District Council.
3. The pipeline and all associated components including the dissipation device and outlet shall remain a private drain within the meaning of Local Government Act 1974.
4. The applicant shall obtain the prior consent of the Parks Asset Manager as to the location and manner of discharge.

421.2.2 In the case of cliff top locations the discharge shall be disposed of by way of inclined lined bore behind the cliff face to discharge via an energy dissipation device at the base of the cliff. The location and form of dissipater shall be approved by the **Engineer**.

421.2.3 The pipe liner shall be polyethylene SDR 17 as per Section 4 Stormwater of these standards.

421.2.4 Construction of private discharge systems shall be subject to a Building Consent and the Building Consent Application must include the following:

- (a) Cross-sectional drawings extending at least 15m beyond the proposed pipe inlet and outlet positions.
- (b) Confirmation from a chartered professional engineer deemed competent in Geomechanics that the site is suitable, in relation to cliff and land stability and also that the proposed outfall will not cause scour or instability in the vicinity of the outfall.
- (c) Design details and calculations for peak flows and pipe capacity, including any allowances for pipe inlet and outlet losses.
- (d) Written approval of the owner of any other land affected by the alignment of the pipeline and in the case of Esplanade Reserve or other land vested in the Council, the written approval of the Council's Property Manager.
- (e) Sufficient details, including photographs, of the cliff face and shoreline at the outfall to show whether the outfall will have a visual or any other impact at and below the outfall.

421.2.5 The energy dissipater/outfall at the base of the cliff shall be constructed to blend in with the natural character of the coastline and shall be located on a low use area of foreshore where there is minimal risk of erosion from the discharge. Refer to Council Drawing Number 18000 sheet 4.14 to 4.19.

421.3 To Estuarine Areas

421.3.1 Where a discharge to an estuary is the only alternative, the following conditions shall apply:

- (a) Where the pipeline is to cross an esplanade reserve the prior consent of the Parks Asset Manager is to be obtained.
- (b) The discharge shall be attenuated in line with the provisions of any relevant catchment plan or in the absence of a plan to the pre-development runoff volume levels of the first 34.5 mm and to the 50 % AEP event.
- (c) Where required by the **Engineer** the outfall shall be filtered through a wide appropriately vegetated zone.
- (d) For sites with created impervious areas above one thousand square metres the discharge shall be treated by an approved quality treatment device. Refer to Section 422 Detention and Treatment Devices.

Refer to Council Drawing Number 18000 sheet 4.19.

421.4 To a Beach or Council Owned Coastal Reserve

421.4.1 The following principles shall apply where discharges of stormwater onto a beach or Council owned coastal reserve is the only alternative:

- Foreshore yard of private properties shall form well vegetated buffer areas.

- Where landowners have retaining or erosion control walls on the coastal edge the landward side of the wall shall be used for wide dispersal of stormwater.
- Where discharge through an outfall is the only alternative, the outfall shall be specifically designed to minimise beach erosion and adverse effects on beach amenity subject to specific approval of the Engineer.

Refer to Rodney District Council Drawing Number 18000 sheet 4.14 to 4.19.

422 DETENTION AND TREATMENT DEVICES

422.1 General

- 422.1.1** Ponds, wetlands, rain gardens and riparian planting shall provide for public amenity and wildlife habitat as well as for stormwater detention and/or treatment. Stormwater treatment devices will not be treated as stand alone pieces of infrastructure but are considered as an integral part of the social and environmental community. Features such as irregular pond shapes, islands, bird perching logs, shorelines which have a natural appearance and recreation facilities such as boardwalks will all help in achieving this aim. It is essential that the matter of pond design be dealt with as early as possible in the development process. This is to ensure that provision is made for the appropriate size of utility reserve to incorporate a pond or other device complying with this document and Stormwater Treatment Devices (TP10). Refer to Council Drawing Number 18000 Sheet 4.20 to 4.23.
- 422.1.2** Stormwater devices shall be designed for minimum long-term maintenance requirements. This should include provision for forebays and sumps for coarse sediment settling and a separate gross pollutant trap for floatables.
- 422.1.3** The design shall generally be in accordance with the requirements of the Auckland Regional Council Technical Publication 10 – “Stormwater Treatment Devices” (TP10) except as amended below.
- 422.1.4** Where the requirements of TP 10 and those detailed below are not practicable, application may be made to the **Engineer** to vary those requirements.
- 422.1.5** A complete set of stormwater device calculations and design drawings shall be submitted for approval.
- 422.1.6** A geotechnical report addressing general ground stability of the device under all operational conditions, slope and necessity for lining to prevent piping may be required by the Stormwater Assets Manager. When required it shall be carried out by a Chartered Professional Engineer proficient in Geotechnical Engineering.
- 422.1.7** Where ponds, wetlands and other devices are to be included by Council as part of the public network they shall be sited on separately titled utility lots vested in Council. In some cases these lots may be co-joined to recreation reserves but shall not be included as part of the reserve for any purpose.

422.2 Ponds and Wetlands

- 422.2.1** The use of retaining walls either above or below the normal operating level of the pond or wetland will not be approved by the **Engineer**. The use of retaining walls outside the normal operating level of the pond is not considered consistent with the values set out in section 422.1.1 above. Retaining walls will therefore not generally be approved by the **Engineer**.
- 422.2.2** Dry ponds shall not be permitted except by specific approval by the **Engineer**.
- 422.2.3** The maximum water level resulting from the operation of the pond or wetland must be contained completely within the drainage reserve area unless otherwise approved by the **Engineer**.
- 422.2.4** The external slopes of the pond shall be at a maximum gradient of one vertical to four horizontal.
- 422.2.5** The maximum permanent water depth shall be no more than 1500mm. The maximum depth of any pond shall not exceed 2000mm and no more than 10 percent of the pond area may exceed 1500mm in depth.

- 422.2.6** A planted shelf with slope of one vertical to ten horizontal shall be provided around the perimeter of the pond. The shelf shall be a minimum of two metres wide, extending for one metre above and one metre below the normal water level of the pond.
- 422.2.7** Internal pond slopes shall be at a maximum gradient of one vertical to 2.5 horizontal except where for geotechnical reasons the slope has to be reduced.
- 422.2.8** One sign shall be erected at all stormwater treatment devices.
- 422.2.9** The location, type and number of signs shall be determined in consultation with the **Engineer**.
- 422.3 Inlet, Outlet and Manhole Details**
- 422.3.1** Treatment device inlets, outlets and manholes shall comply with Sections 414 through 419.
- 422.3.2** Low flow splitters shall generally comprise two manholes: the first to dissipate energy and the second to split the flow. Variations shall be specifically approved by the **Engineer**.
- 422.3.3** Outlets shall be located to allow safe access from the bank of the pond without need for boats. Access to the outlet manhole shall be by way of a secured grille dome of approved size and design. The dome shall have a hinged opening to permit easy access to the steps or ladder within the outlet structure. The hinged opening shall be fitted with a padlock hasp to permit locking by Council.
- 422.3.4** Orifice outlets shall be designed with reverse slopes to protect the outlet from floatables.
- 422.3.5** Suitable measures for maintenance shall be installed to allow the pond to be de-watered using gravity through the outlet manholes. Manholes shall, as a minimum, have de-watering outlets at 600mm below the normal operating level and at the base of the pond.
- 422.3.6** De-watering pipes in the manhole shall comprise short lengths of SN 16 uPVC pipe with a puddle flange on the exterior of the manhole wall and a screwed cap on the inside of the manhole. The cap shall protrude no more than 150mm into the manhole. The dewatering pipes maybe required to be fitted with a flexible elephant trunk device to allow variation in the depth that the pond is to be dewatered and to control inflow to the outlet manhole.
- 422.4 Planting**
- 422.4.1** Site-specific planting plans and specifications are to be submitted for approval. These shall be based on achieving planting requiring minimum of long-term maintenance. Refer to Council Drawing Number 18000 sheet 4.22 & 4.23.
- 422.4.2** The planting plans and specifications are to include at least the following:
- (a) Timing of planting
 - (b) Density and species
 - (c) Planting and maintenance methodology
 - (d) Plant replacement during maintenance period
 - (e) Water level control for maintenance/establishment period
 - (f) Protection of plants against pests
 - (g) Weed control methodology
- 422.4.3** The plants shall be eco-sourced and shall be appropriate to, and tolerant of, particular site conditions.
- 422.4.4** All clay slopes are to be ripped to a depth of 300mm prior to 150mm of topsoil being applied. The topsoil shall have a ph in the range of 5.5 – 6.5. Weed species shall be sprayed out at least two weeks prior to planting.
- 422.4.5** A variety of native plants are to be used in the planting plan. A minimum planting density of two plants per square metre is required in the margin zone and one plant per square metre in the lower and

upper bank zones. No plant species used shall comprise more than 30% of the total plant mix in each zone.

422.4.6 The perimeter shelf of any pond is to be in dense wetland planting, unless specifically approved by the **Engineer**. This is essential to avoid edge erosion.

422.4.7 If a fence is used, one metre on each side of the fence is to be planted.

422.4.8 For the duration of the planting maintenance period the area shall be maintained at the cost of the **Developer** and to the satisfaction of the **Engineer**.

422.5 Sand Filters and Similar Devices

422.5.1 Sand filters and similar may be constructed using pre-cast proprietary units and their installation shall comply with the following general principles. Specifically designed pre-cast or cast in-situ structures are acceptable subject to the provision of producer statement by a Chartered Professional Engineer proficient in structural design

422.5.2 Particular attention is to be paid to the design and maintenance of the pre-sedimentation treatment for the device. Adequate and if necessary separate provision for floatables, organic matter and gross pollutants may be required.

422.5.3 Access and ventilation. Access to the chamber shall be through a 600 mm diameter ductile iron cover and frame of approved pattern. A separate ventilation access using a standard heavy or light duty 600 mm diameter opening ductile iron cover and frame shall be installed at the opposite end of the chamber from the access point.

422.5.4 The access lid shall be sited at a position where the throat depth does not exceed 400 mm. In the case of sloping sites particular attention must be paid to this point. The use of manhole liners on top of the filter chamber to provide an extended throat is subject to specific approval.

422.5.5 Manhole steps shall be installed directly below the access lid at standard 300mm intervals down the chamber wall. Care is to be taken to ensure that the steps line up vertically with the centre of the access hole. Steps are not required for the ventilation access. Alternatively an access ladder manufactured from approved fibre reinforced plastic components maybe employed.

422.5.6 Spreader bar. The inlet to the filter chamber shall be controlled by a spreader bar to prevent erosion of the sand within the chamber. The spreader bar shall be constructed level and be of a size to accommodate the inflow without overflow at any one point.

422.5.7 Units in parallel. Where units are installed in parallel, the inlets to each chamber shall be at the same invert level in the sedimentation chamber upstream of the filter chambers. This is to ensure an even flow to each of the filter chambers.

422.5.8 Location of filter units. The filter units are to be located on either road reserve, upon approval by Rodney District Council, or a separately titled lot, which is directly accessible by heavy maintenance vehicles. Likewise the outlets of each unit shall be set level with each other to ensure even outflow from the chambers to the discharge manhole.

422.6 Fencing and Maintenance Access

422.6.1 Access shall be provided for maintenance of any stormwater treatment device including the removal sediment. This applies particularly to the forebay of a pond or wetland which may require more frequent access by excavation equipment. Refer to Council Drawing Number 18000 sheet 4.21.

422.6.2 The width and gradient of the vehicle access routes shall be adequate for maintenance vehicles and machinery to reach the treatment device base and immediate environs.

422.6.3 Vehicle access routes shall have adequate measures against vehicle erosion of the surfaces. This may be achieved by the use of appropriate erosion matting or reinforced grass below the surface of the grass.

422.6.4 The construction plans shall detail the location of maintenance access points and routes.

422.6.5 Fencing shall be installed where required for health and safety reasons as directed by the **Engineer**. The criteria used in the determination shall include the following:

- proximity to dwellings
- proximity to schools, kindergartens child care centres and similar
- proximity to walkways or roadways
- pond use
- pond depth
- gradient of approach slopes

Note that if the pond complies with the requirements of section 422.2 then it is unlikely that there will be requirement for fencing. Council prefers to have complying unfenced pools rather than non-complying fenced ponds.

422.6.6 Gates are to be provided for access to any fenced treatment device. The overall width of the gateway shall allow for access of maintenance vehicles and shall have a minimum opening width of three metres.

422.6.7 Fencing and gates shall be hot dipped galvanised and powder coated matte black.

422.6.8 Gates are to be fitted with hasp and latch and a standard padlock.

422.7 Maintenance Manuals

422.7.1 A specific maintenance manual is required for each stormwater device.

422.7.2 A draft maintenance manual is to be submitted with the final design for approval. The maintenance manual shall include at least the following:

- Location Plan
- Site plan
- Construction Plans
- Planting plan
- General information:
- Data and Calculations summary
- Resource consent and ARC approval
- Survey designated to title plan status
- Geotechnical report from registered engineer specialising in geotechnics
- Fencing details
- Bonding information (terms and conditions) for maintenance
- Lists of any assets such as parks furniture and signs
- Maintenance requirements:
- Proposed frequency of maintenance
- Frequency Schedule
- Maintenance log to be prepared
- Pond de-watering method

- Planting maintenance – timing and methods
- Weed maintenance and control
- Sediment removal timing and methods
- Structural maintenance
- Inlet and outlet maintenance
- Pest inspections and control

The approved final maintenance manual is to be submitted on completion of the pond construction and shall include As-Built details in addition to those items given above.

Approvals

On completion of the stormwater works an 'As-built' plan conforming to the requirements of section 1 shall be prepared.

The following checklist shall be used as part of the sign-off process for treatment devices.

(a) Inspection after completion of earthworks:

On completion of earthworks and prior to landscaping and the construction of any fences a site meeting shall be held between the **Developer's Representative**, the **Engineer's Representative**. The purpose of this meeting is to confirm adherence to the submitted landscaping plans and to agree on any amendments.

(b) On completion of construction:

On completion of construction, the land/pond shall be vested or have an easement with the Council, and the following shall be confirmed/ provided:

- Device constructed in accordance with the construction plans and specifications.
- Planting in accordance with plans and specifications, or planting plans submitted and approved with proposed planting time.
- Geotechnical certification in the form of producer statements (if required).
- As-Built plans submitted/Maintenance manual.
- Legal documentation of vesting complete where applicable.
- Where planting has not been effected, a performance bond covering the work is to be lodged.

(c) On completion of the maintenance period:

The maintenance period shall be twenty-four months for pond planting unless otherwise approved by the **Engineer**.

(d) The following shall be confirmed/provided:

- Maintenance logs submitted for maintenance period.
- Planting established in accordance with planting plans.
- Details for consent sign-over confirmed where applicable.
- ARC final approval.

423 CARRIAGEWAY STORMWATER SYSTEMS

423.1 A piped stormwater system shall be installed to cope with the 10% AEP storm in all areas. The system shall be designed for the road reserve area and all contributory catchment. As a general rule a local road may act as a secondary flow path and as a flood retention area for storms in excess of the 10 % AEP storm.

423.2 In some areas it may be necessary to provide quantity detention and quality treatment of carriageway run-off. This may be by way of a number of devices (i.e swales, rain gardens etc). The location within the road reserve is subject to specific approval from the **Engineer**.

424 CATCHPITS

424.1 Catchpits shall be spaced to provide for local rainfall intensities and site coverage. They shall provide for the collection of runoff from the contributory catchment to the carriageway. In residential areas provided with reticulation for dwellings the run-off may be calculated using the rational formula for the 10 % AEP event and a modified C value of 0.5 for the whole catchment outside the road reserve.

- Run-off generated by half road reserve width for vehicle counts less than 3000 vpd may be assumed to be 10 litres per 50 metres of carriageway length.
- For carriageways with capacities greater than 3000 vpd specific design may be required for spacing and type of catch pit.
- Catch pit spacing shall then be determined using an inlet capacity value – for splay pits of 50 litres per second, for standard grate pits 20 litres per second.
- For carriageways with gradients exceeding 5% the spacing of pits may need to be reduced by a factor of 0.8 to ensure adequate trapping of run-off at the pits.
- For gradients in excess of 7% the channel may need to be modified to avoid supercritical flows which will bypass the cesspit.
- In the case where sag curves and major overland flow paths coincide the installation of a megapit maybe required. In this case the complete design including outlet pipe diameter must be provided with the engineering drawings.

424.2 Catchpits should normally be connected to a manhole on the stormwater drainage system by 225mm diameter pipes. The socket of the pipe shall be laid out from the catchpit to maximise hydraulic efficiency. In the case of a stormwater drain is of greater diameter than 1.2m and where a manhole is not conveniently located the catchpit lead may be saddled direct to that drain. A direct connection of the catchpit lead to a stormwater pipeline with a diameter between 600mm and 1.2m diameter will only be permitted in exceptional circumstances, and at the Engineer's discretion. A typical catchpit design is shown in Council Drawing Number 18000 Sheet 4.29. Splay and super pit installations are shown on the same series.

424.3 On footpaths and access ways, with an equivalent impervious catchment not exceeding 300 sq metres a mini catchpit (450mm by 450mm internal dimensions) may be permitted. An outlet of at least 150mm diameter will be required. The outlet is to be a minimum of 500 mm to invert below the grille level. These pits where used on vehicular access ways, the catchpit shall be fitted with a back entry. Particular attention is to be paid to the size of the contributory catchment to ensure that it conforms to the 300 square metre impervious criteria.

424.4 Particular attention is to be paid in constructing the catchpit to the grille, back entry and rake on the channel to ensure that capture of the flow is effectively achieved. In the case of slip form kerb and channel excessive rounding at the kerb/channel interface is to be avoided. The channel in all cases should have an increase in the cross fall for a minimum of two metres upstream of the catchpit to increase capture.