Stormwater, Wastewater and Water Servicing Assessment

Tahimana Limited

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1.0 Introduction

Envirolink Limited have been engaged by Tahimana Limited (the Client) to undertake a site assessment for onsite wastewater disposal, water supply and stormwater management for the proposed "Tahimana" subdivision.

The project is to subdivide and develop land for the purpose of establishing a residential and rural lifestyle development on approximately 70 hectares of land off Stagecoach Road, Tasman, in the Tasman District. The project will include works within the Stagecoach Road, Dicker Road and Williams Road reserves. The project will include:

- Subdivision to create approximately 145 allotments, including 4 allotments for reserve, roading and services, and enable construction of approximately 141 residential units across a range of densities
- Development of an open space network including a public reserve and walkways, and upgrades to shared pathways
- Landscape planting and restoration and enhancement of waterways and wetlands
- Associated infrastructure, including for three waters services and transport (including external road upgrade works).

The site of development is shown in Figure 1.1 below.

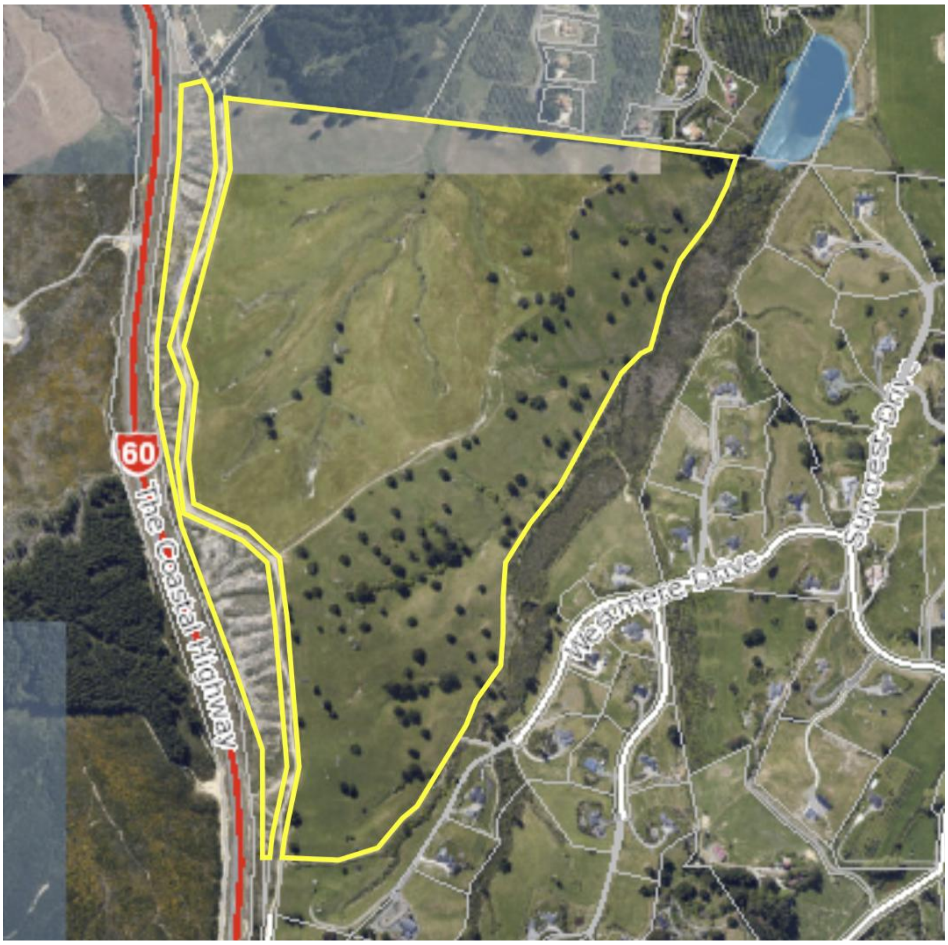


Figure 1.1: Proposed development site.

The purpose of this report is to present an assessment of wastewater, water and stormwater servicing to support the preparation of a Resource Consent application.

2.0 Proposed Development

2.1 Background

A layout plan has been developed in collaboration with the project team, with input from Envirolink as required. A layout plan of the proposed subdivision prepared by Staig and Smith Limited entitled "Tahimana Limited Stagecoach Road – Resource Consent Application Scheme Plan" dated 04 August 2025. A section of this drawing is presented in Figure 2.1 below.

Figure 2.1: Conceptual Development Layout

The development will consist of a range of lot sizes as follows:

- 2 rural conservation lots of 56,800 and 114,000m^2 in area
- 41 rural lifestyle lots, typically 4,000 to 15,000m^2 in area
- 98 residential lots, typically less than 1,000m^2 in area

Wastewater from most of the rural lifestyle lots will be managed on individual sites. Wastewater from the residential lots, and 3 lifestyle lots (87, 111, 145) will be managed with a communal wastewater treatment and disposal system.

3.0 Regulatory Context

The site is in the Rural 3 Zone under the Tasman Resource Management Plan (TRMP). The site is within the Wastewater Management Area (WMA). As a minimum, discharge of wastewater in this area is a Controlled Activity for sites greater than 2 Ha with a rate of discharge not exceeding 2m^3 per day. Some lots will be less than 2 Ha in size. Discharge from the communal wastewater treatment system will be considerably greater than $2m^3$/day. Onsite domestic wastewater discharges do not comply with Controlled Activity requirements and are a Restricted Discretionary Activity provided they comply with Rule 36.1.4.2 of the TRMP. Key requirements are summarised as follows:

- The rate of discharge of domestic wastewater (including greywater) does not exceed 2 cubic metres per day **per household**.
- The treatment and disposal system is designed to cater for the peak daily load (quantity and BOD-5).
- There is no surface ponding as a result of the discharge, nor any direct discharge or run-off of wastewater into any water body.
- There is no increase in the concentration of pathogenic organisms in any groundwater bore used for potable water supply as a result of the discharge.
- There is a minimum depth of 0.6 metres of unsaturated soil (depth to the normal winter water table) below the land disposal area.
- The disposal field is located more than:
    - 20 metres from any surface water body, including the margin of a wetland or the coastal marine area, but not including any stormwater drain that diverts water from the disposal field or any wetland constructed as part of the treatment system;
    - 20 metres from any bore used for potable water supply;
    - 5 metres from any adjoining property or road boundary;
    - 20 metres from the edge of any other domestic wastewater disposal field.
- The wastewater treatment system does not create an offensive or objectionable odour discernible beyond the property boundary.
- Overland stormwater flows are diverted away from the disposal field.
- There is no discharge onto land where the predominant slope is over 20 degrees from horizontal.
- Effluent quality must not exceed the following standards
    - Biochemical Oxygen Demand (BOD): $30g/m^3$
    - Total Suspended Solids (TSS): $45g/m^3$
- Where the disposal system serves a **single household**, there must be at least 100 percent of the design land disposal field area available as a reserve land treatment area.
- The wastewater is distributed evenly into the disposal field at a rate not exceeding 2 millimetres per day except where the soil category is assessed as being Category 6.

From previous discussions with TDC staff, Envirolink have clarified that the intent of the final point above is to limit the maximum loading rate to 2mm/day for Category 6 soils. This is consistent with AS/NZS1547:2012 – Onsite Domestic Wastewater Management.

The proposed development involves a new point (or points) of stormwater discharge from Rural 3 zoned land. The proposed stormwater discharge is a Controlled Activity. Compliance with rules 36.4.2.1 (a), (c) and (f)-(j) and (m) is required. The key rules relevant to this discharge are summarised as follows:

- The discharge does not cause erosion
- The discharge does not contribute to downstream flooding
- The discharge does not contain contaminants
- Where disposal to ground is used to manage stormwater, the site is not within the Slope Instability Risk Area or does not have a predominant slope angle greater than 15 degrees.
- The discharge does not contribute to damage of downstream habitat

In addition, development of the site is required to comply with the Nelson Tasman Land Development Manual (NTLDM). Key requirements, relevant to this site, are summarised below:

- As the site is a greenfield development with more than 50m^2 of additional impervious surface, detention must be provided such that peak flows do not exceed pre-development runoff during the 10% and 1% Annual Exceedance Probability (AEP) rainfall events.
- A minimum of 5mm of runoff from newly created impervious surfaces must be discharged to ground via soakage, assuming the site is in a groundwater recharge zone. Groundwater recharge requirements have been identified by PDP, the project hydrologist.
- Development of this site involves access roads within a residential development. Low traffic volumes are anticipated and the development will not include untreated roofing material, therefore treatment of stormwater is not required.

If the development results in a new point source stormwater discharge to an open channel or waterway, the following additional requirement also applies:

- Extended detention must be provided so that runoff from a 2 hour, 50% AEP rainfall event is stored and slowly released over 24 hours.

This final requirement is discussed in more detail subsequently.

3.1 Design Guidance

The Coastal Tasman Area Subdivision and Development Design Guide is intended by TDC to guide subdivision and land development in this area. As part of the design process, the site was investigated several times. Site constraints such as wetlands and stormwater drainage paths were identified, in consultation with the project team. This assessment was used to inform the design process. This guidance has been considered when determining servicing designs as follows:

- Stormwater
    - The existing drainage characteristics, namely flow paths converging via individual gullies to a primary/central gully, have been retained.
    - Several design approaches have been considered for stormwater management. The presence of multiple wetlands, in accordance with the NES-FW has dictated a design approach with multiple smaller detention basins.
    - Only very minor changes have been made to catchment areas. Significant re-contouring has been avoided.
    - The proposed detention ponds will utilise existing gullies for drainage whilst minimising earthworks.
    - The use of low impact stormwater design approaches is limited by soil type and topography. Low soakage clay soils with grades of 20-30% are unsuited to low impact design approaches such as rain gardens and conveyance swales. That said, these approaches have been used where practical, for example with swales along the main access road.
- Wastewater
    - A detailed inspection was undertaken before any detailed development plans were prepared.
    - This inspection identified that, with earthworks, the western side of the access road was well suited to effluent disposal from the communal system.

    - Use of this area has the lowest possible effect on existing site constraints such as stormwater drainage.
    - Disposal fields have been situated to not compromise the value of existing ecological features.
    - The land application area has been designed with an appropriate reserve capacity.
    - Water conservation measures have been recommended where appropriate.
- Water
    - The proposed hybrid of stormwater harvesting for rural lifestyle lots and TDC supply for residential lots minimises the effect of the development on reticulated water supplies.
    - The provision of a firefighting water supply reduces amenity effects associated with a significant number of tanks on each lot.

The proposed servicing design is considered to fit well withing the recommendations of the Coastal Tasman Area Subdivision and Development Design Guide.

4.0 Site Assessment

An initial site assessment was undertaken on 7th December 2021. Subsequent inspections have been undertaken with the project team as required. From the inspection, the following observations are made.

General Site Observations

- The site is generally covered in pasture at present with some vegetation in gullies and mature trees planted.
- Parts of the site appear to have been cultivated with some mixing of topsoil evident.
- Generally, surface condition was good with even pasture coverage and little evidence of erosion or surface scour.
- Standing water was observed in some gullies. Isolated areas were observed with reed type vegetation, indicative of long-term water logging.

Stormwater Specific Observations

- The site is defined by several gullies which converge to drain runoff into two directions, described below and illustrated in Figure 4.1:
    - Runoff from the west/north-west of the site drains via several gullies to a roadside drain in Horton Road.
    - Runoff from the east/south east of the site drains via several gullies into a revegetated wetland on neighbouring land which discharges into a dam. The dam drains to a roadside drain in Mamaku Road.
- Downstream of the site, channels servicing both catchments drain through neighbouring property before discharging into Tasman Bay Stream.
- Tasman Bay Stream discharges into the Moutere Inlet downstream of the Tasman Village.
- Some gullies onsite contained small dam structures with culverts, either for farm vehicle access or to provide stock water. None of these structures appeared to have any significant stormwater detention function.

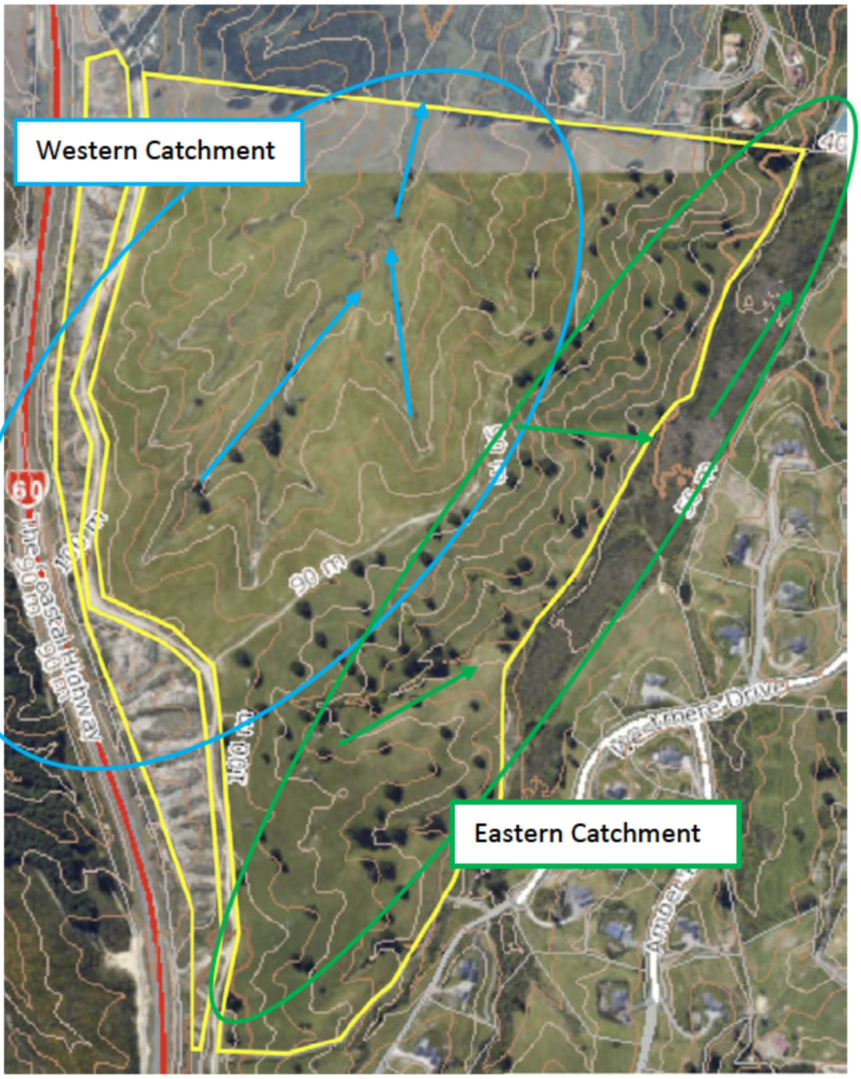


Figure 4.1: Observed Stormwater Flow Paths

Wastewater Specific Observations

Rural lifestyle lots will manage effluent onsite. Residential lots will discharge to a communal wastewater treatment and disposal system.

Onsite Wastewater Treatment

- Lots which will manage wastewater onsite typically have slope angles in the order of 20-30%. Some sites are steeper, up to 35%. Slope angles are generally relatively linear and converge to gullies.
- For this assessment, site slope angles have been assessed using LiDAR contours. Slope angles require re-assessment once earthworks are complete.
- Some channels were observed to contain standing water or evidence of waterlogging during the site inspection. These channels were assessed as waterways for the purposes of onsite wastewater disposal. A 20m offset between the wastewater disposal fields and waterways is required. Following this assessment, wetlands were mapped by the Project Ecologist. This mapping was included in the onsite wastewater assessment.

- A reduced offset of 10m is considered acceptable for gullies which appeared to only contain water during or immediately after rainfall events.
- A minimum topsoil depth of 150-250mm required by AS/NZS1547:2012. This was achieved in most locations however the addition of topsoil or mulch over dripline may be required on some sites.
- Diversion of stormwater runoff, including road runoff, around disposal fields is likely to be required for some sites. This will involve relatively minor earthworks that can be undertaken when the fields are constructed.
- Due to the slope angles, re-vegetating disposal fields with shrubs, flax and native grasses is likely to be preferable to planting with lawn. Mowing of disposal fields in this terrain can lead to premature damage to the fields.

Communal Disposal System

- For residential lots, effluent will be conveyed to a central treatment system and distributed over the area to the west of the realigned Stagecoach Road as shown in Figure 4.2.

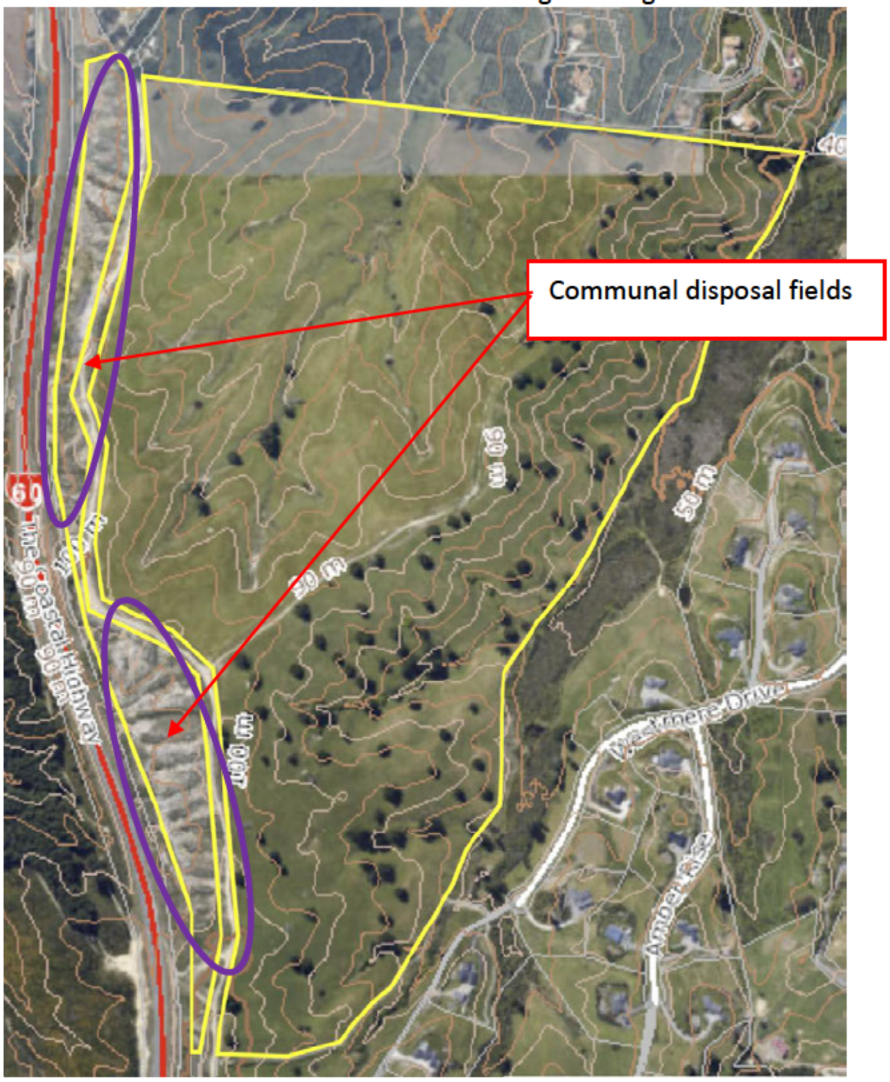


Figure 4.2: Proposed communal disposal areas

- The proposed communal disposal areas were previously covered with pine trees. These have since been harvested. Stumps and debris from pine trees have been removed. Some minor additional earthworks may be required form an even ground surface and direct stormwater prior to use for effluent disposal.

- Soil conditions in this area were reviewed however the area will be subject to further earthworks. All work has adopted the most conservative soil conditions in the communal disposal area.
- Topsoil and/or mulch must be placed over the completed disposal area.
- This area is graded towards State Highway 60. Diversion of stormwater through this area will be required however the catchment area draining through the proposed disposal fields is relatively small.
- An earthworks specification should be prepared as part of detailed design to ensure this area is developed to a standard suitable for effluent disposal. This is discussed subsequently.

4.1 Soil Assessment

A total of 6 bore holes were hand excavated. Logs for bore holes are included as Appendix A. Investigation locations are presented on Sheet 56 of the drawing set. The investigation concluded that soil conditions are generally consistent across the site, summarised as follows and presented in Figure 4.3:

- 100-250mm of topsoil was observed in most bore holes. BH3 did not have a clear differentiation between topsoil and underlying layers. This borehole was excavated in an area which appeared to have been recently cultivated. Minimal topsoil was observed in the area proposed for communal wastewater disposal.
- Beneath the topsoil layer, soil encountered was typical of Moutere clay with yellow-orange clay encountered to the extent of excavation. In most bore holes, lighter clays were countered at depths of up to 500-600mm Below Ground Surface (BGS). Minimal force was required to form 2-3mm peds in this soil horizon. This soil was assessed as a Category 5 Light Clay in accordance with AS/NZS1547:2012.
- At greater depths, heavier clays were encountered to the extent of excavation, up to 1100mm BGS. Considerably more force was required for this material to break up into peds. This soil was assessed as a Category 6 Medium Clay in accordance with AS/NZS1547:2012.
- Both Category 5 and 6 Clay formed 60-80mm ribbons when worked in accordance with the method outlined in AS/NZS1547:2012.
- In bore holes BH2 and BH4 minor grey mottling was observed at depths of approximately 500-600mm BGS. This material was dry at the time of inspection.
- In BH2 damp soil was encountered at 850mm BGS. Damp soil was encountered at 400mm BGS in BH3.
- No saturated soils were observed to the extent of investigation. Based on this investigation, there is a high probability that the TRMP requirement for 600mm of unsaturated soil beneath an effluent disposal field can be met at most sites.
- Whilst more favourable Category 5 Clays were identified in several locations, effluent disposal will generally be constrained by the heavier Category 6 clay observed at greater depths in most bore holes.
- To ensure a conservative assessment, it is recommended to adopt Category 6 Clay soil conditions for the entire site.
- The maximum rate of effluent disposal on Category 6 soils is 2mm/day in accordance with AS/NZS1547:2012. Once slope reduction factors are applied, the maximum disposal rates are:
    - 2.0mm/day for sites with a slope angle of less than 10%
    - 1.6mm/day for sites with a slope angle of 10-20%

    - 1mm/day for sites with a slope angle of 20-30%.
- This is less than or equal to the 2mm/day maximum specified by the TRMP.

Figure 4.3: Soil Conditions BH1

4.2 Soakage Testing

Due to the typical Moutere Clay soil conditions encountered, soakage testing was not undertaken. Soakage rates in this type of soil are typically low however they are likely to exceed the minimum rate of 5mm/hr specified by the NTLDM for a “groundwater recharge zone”. Soakage of a small amount of stormwater will occur in detention basins. Further soakage requirements have been identified by PDP, as the project hydrologist.

5.0 Wastewater Recommended Design Basis

Wastewater from rural lifestyle and rural conservation lots, other than Lots 87, 111 and 145, will be treated and applied to land onsite. For these lots, detailed design of each system must be undertaken in accordance with AS/NZS1547:2012 prior to Building Consent application for each wastewater treatment and disposal system. Wastewater management for these properties is discussed in Section 5.1. For residential lots, and Lots 87, 111 and 145, wastewater will be conveyed to a centralised treatment system. This is discussed in Section 5.2. Conceptual layout drawings of proposed wastewater servicing have been prepared by Staig and Smith, as directed by Envirolink. These drawings are included on sheets 55-58 of the plan set, included with the Resource Consent application.

"Standard" water saving appliances have been adopted in accordance with AS/NZS 1547:2012 for all properties. This includes dual flush toilets, shower flow restrictors and a water conserving washing machine.

5.1 Onsite Effluent Management

For the purposes of onsite wastewater disposal, calculations have allowed for all houses have up to 4 bedrooms. The properties will be supplied with water from rainwater tanks. Peak load is 145L/person per day. Assuming each bedroom is fully occupied with 2 occupants per bedroom, a total peak wastewater load of 1,160L/day has been calculated for each new dwelling. Design assumptions are presented in Table 5.1 below.

Table 5.1: Onsite Wastewater Management Design Assumptions		
Site Slope (%)	**Disposal rate (mm/day)**	**Required primary disposal area (m^2)**
0-10	2	580
11-20	1.6	725
21-30	1	1160

Treatment

To evenly distribute effluent at the relatively low rates recommended for this site, pressure compensating dripline is required. Secondary treatment of effluent is required where drip line is used for effluent disposal to reduce blockage of emitters. A range of proprietary secondary treatment systems are available which will meet or exceed the effluent quality standards specified in the TRMP. It is recommended that a treatment plant is selected by lot purchasers based on individual preference. It is strongly recommended that treatment plants are selected which have had their performance independently verified, for example as part of New Zealand On-Site Effluent Testing (OSET).

Land Application

In accordance with AS/NZS1547:2012, a maximum disposal rate of 2mm/day is possible on Category 6 soils. Reductions in disposal rates are required for site slopes greater than 10%. In accordance with AS/NZS1547:2012 (Table D1), "predominant" slope angles have been assessed, over a 20m length. The presence of relatively small areas with slopes exceeding 30% does not mean that the site is assessed as exceeding 30% for the purposes of wastewater disposal.

A preliminary assessment of onsite wastewater disposal suitability has been made making the following assumptions. Conditions which do not comply with the TRMP are highlighted in **bold** text.

- All disposal fields are a minimum of 20m from assessed water bodies and mapped wetlands.
- **All disposal fields are a minimum of 10m from normally dry gullies.**
- All disposal fields are a minimum of 5m from property boundaries which are downslope of the disposal field.
- **All disposal fields are a minimum of 2m from property boundaries which are upslope of the disposal field.**
- **All disposal fields are a minimum of 4m from adjacent disposal fields.**

TRMP rules for this zone require a 5m setback from boundaries and a 20m setback adjacent disposal fields. A 20m setback between disposal fields is considered an appropriate distance between septic tanks discharging primary treated effluent at relatively high rates. 2m offsets have been nominated between land application areas and boundaries which are upslope of disposal fields. All onsite land application within the proposed subdivision will be discharging secondary treated effluent at low rates. There is a very low risk of cross boundary effects for systems of this nature which are designed and maintained correctly. From Envirolink's experience, effluent should not travel more than 0.5m from drip line in a correctly designed drip irrigation system, hence the specification for a 1m spacing between adjacent lines in 1547. It is recommended to apply the TRMP specified boundary setback of 5m where the boundary is downslope of the disposal field as effluent will track further downhill. A 4m offset from adjacent disposal fields is considered acceptable where fields are located across a slope, reflecting 2 x 2m boundary setbacks. This will increase where one field is downslope.

The available area for effluent disposal has been assessed from the site layout plan. This assessment is presented in Table 5.2 below. This assessment has assumed that none of the 900m^2 Building Location Area (BLA) is used for effluent disposal. This is a highly conservative assumption and it is likely that some of the BLA can be used for effluent disposal such as in garden beds. The assessed suitable wastewater disposal areas are presented in on Sheet 56 of the drawing set.

Effluent disposal fields can be planted either with grass or with other appropriate native grasses and small shrubs. Appropriate plantings have been identified by the project Landscape Architect.

Table 5.2 – Tahimana Onsite Wastewater Suitability

Lot ID	Suitable Disposal Area (m2)	Site Slope (%)	Reserve Area	Comments
1	3,055	25	>100%	More steeper land available
2	2,290	24	97%	More steeper land available
3	2,560	20	>100%	
4	2,570	24	>100%	
5	1,900	22	64%	Disposal area reduced by approximately 600m^2 to provide offset to pond.
6	2,400	22	>100%	One field between house and wetland, reserve across wetland. 20m offset applied to wetland. Avoiding detention pond.
7	3,800	23	>100%	20m offset to wetland, 10m offset to gully. Avoiding detention pond.
8	2,900	17	>100%	
9	2,800	29	>100%	Avoiding steeper land. 20m offset to wetland.
10	2,500	22	>100%	20m offset required to existing ponding area.
11	1,900	29	64%	Disposal area reduced by approximately 7-800m^2 to provide offset to pond.
12	2,400	24	>100%	Disposal area reduced by approximately 500m^2 to provide offset to pond.
13	3,400+	22	>100%	20m offset required to existing ponding area.
20	2,000	22	72%	Avoid normally dry gully. May be possible to get closer to gully subject to BLA formation.
29	2,400	22	>100%	Disposal area reduced by approximately 100m^2 to provide offset to pond.
30	1,900	25	64%	Disposal area reduced by approximately 600m^2 to provide offset to pond.
31	2,000	29	72%	Disposal area reduced by approximately 400m^2 to provide offset to pond.
32	2,290	25	97%	20m offset to wetland.
33	2,260	29	100%	20m offset to wetland. Cutoff drain required through field slightly reducing area.
59	3,100+	28	>100%	20m offset to wetland.
60	2,680	22	>100%	20m offset to wetland.
61	2,600	30	>100%	More steeper land available.
62	2,860	29	>100%	More steeper land available.
75	2,430	30	>100%	More steeper land available.
76	2,260	27	95%	
77	2,080	22	79%	Avoid invert of gully.
78	2,900	22	>100%	
79	1,890	<20	>100%	Flat ridgeline available. Avoiding detention pond.
80	2,340	26	100%	

81	2,900	24	>100%	
82	2,200	31	90%	More steeper land available. Pond on lot. Already provided with a 12m offset to TWL, no further mitigation required.
83	2,500	30	>100%	20m offset to wetland.
84	2,780	29	>100%	Disposal area reduced by approximately $200m^2$ to provide offset to pond.
85	2,050	30	77%	Disposal area reduced by approximately $150m^2$ to provide offset to pond.
86	2,600	30	>100%	Disposal area reduced by approximately $100m^2$ to provide offset to pond (on adjacent lot).
112	2,100	30	80%	5m offset to formed stormwater drain through property. Can avoid this land for primary field. 20m offset to downslope wetland.
137	2,050	25	77%	More steeper land available. Avoiding invert of dry gully
138	>3,000	30	>100%	More steeper land available.
140	>3,000	Approx 20	>100%	Likely to restrict disposal to land <20%. 20m offset to wetlands.
141	>2,200	30*	90%	*$725m^2$ field available at a slope of less than 20% (ie 100% of primary area) with a 20m offset to wetlands. To achieve the reserve area, offset needs to be reduced to 10m. **Recommended tertiary treatment for this lot if the reserve area is ever required.**

Rural lifestyle lots 87, 111 and 145 will discharge effluent to the communal system. Of the 40 lots proposed for onsite wastewater management:

- 28 Lots, indicated in green, have adequate land area for the primary disposal area, and a reserve area equal to at least 100% of the primary disposal field area. Available disposal area is ample.
- 12 Lots, indicated in orange, have adequate land area for the primary disposal area, and a reserve area equal to at least 70% of the primary disposal field area. Available disposal area is ample however additional care is required when finalising the site layout to ensure an adequate reserve area remains available.

Onsite Wastewater Management Conclusions

Twelve lots do not have adequate area for a reserve area equal to 100% of the primary disposal field. The requirement for a 100% reserve area is critical for land application using disposal beds or trenches, where "creep failure" can occur, particularly when disposal relies on gravity rather than pumps. When creep failure occurs, areas of the field are preferentially loaded with effluent. Biomass builds up in these areas, limiting hydraulic conductivity of soil pathways, increasing loading rates in remaining bed areas. In these cases, the entire area eventually becomes unsuitable for effluent disposal and a new disposal field is required.

Whilst a 100% reserve area is recommended by the TRMP, this requirement is not considered relevant to the pressure compensating dripline systems proposed for this site. These systems apply effluent at a rate which is less than 2-3% of that typically used for effluent disposal beds. The most common failure mechanisms for dripline include:

- Physical damage to a small section of line, in which case the affected section of line is cut out and replaced.
- Eventual failure of drippers due to blockage. In which case, the soil structure is largely unaffected and new drip lines can be installed between existing drip lines.
- Field areas become waterlogged due to preferential drain-back of effluent, faulty emitters, poor soil conditions in an isolated area etc. In this case, the affected area is isolated from the disposal field using solid (non-dripper) pipe and an extension to the field is required elsewhere.

If wastewater fields ever require repair, it is most likely that new drip lines can be installed between the existing lines. Earthworks will occur as part of the proposed subdivision. This could encroach on some of the assessed "suitable" wastewater disposal area. From consultation with the project geotechnical engineer, it is possible to dispose of effluent on fill batters at the low proposed rates, subject to a maximum slope angle of 30% consistent with wastewater design recommendations. This should be reviewed as earthworks designs on each lot are finalised.

To provide ample land area for onsite wastewater disposal, it is recommended that all lots are required, by condition of consent, to have a minimum reserve area equal to 50% of the required primary field area. This will be achieved with the proposed layout. From this analysis it is possible to avoid slopes greater than 36% in accordance with the TRMP.

It is recommended that the following conditions of consent are imposed. Items in addition to, or which do not comply with the TRMP requirements for this zone are indicated in **bold**:

- Secondary treatment plants must be installed for all lots.
- A minimum of annual maintenance inspections of the plant and disposal field are required by a licenced plumber or drainlayer who is experienced in the management of onsite wastewater treatment plants.
- Land application must be via pressure compensating dripline at a maximum disposal rate of 2mm/day, reduced for slope angles greater than 10% in accordance with AS/NZS1547:2012.
- **A minimum of 50% of the primary disposal area must be available as reserve wastewater disposal field.**
- Disposal fields must be located a minimum of 5m from any adjoining downslope boundary
- **Disposal fields must be located a minimum of 2m from any adjoining upslope boundary**
- **Disposal fields must be located a minimum of 10m from the edge of any other wastewater disposal field within the development area.**
- Disposal fields must be well vegetated with either grass or appropriate shrubs or similar upon completion of dripline installation.
- Slopes greater than 20° (36%) must be avoided for effluent disposal.
- **Standard water saving appliances must be used in accordance with AS/NZS1547:2012.**
- **In cases where the elevation difference within the disposal field is more than 5m (expected to be all fields) additional design measures must be implemented to prevent overloading of low-lying areas. This may include:**

- **The disposal field is designed so that the elevation difference is no more than 5m between the highest and lowest point.**
- **OR**
- **The disposal field is designed with multiple disposal zones and no more than 5m elevation difference within each zone.**
- **OR**
- **Pressure sustaining valves (DNL valves) are used as an alternative to multiple disposal zones.**

- Diversion of stormwater away from disposal areas will be required for most lots. The exact flow paths should be determined as part of detailed disposal field design, taking advantage of existing gullies.

Swimming Pools

Occupants of rural lifestyle lots could install swimming pools. Chlorinated water should not discharge to site stormwater systems. It is not appropriate to discharge large amounts of pool water to an onsite wastewater treatment plant, this could effect the health of the treatment plant or result in excessive land application rates. Additional management must be put in place to prevent swimming pool water effecting either onsite wastewater treatment systems or the site stormwater system and downstream environment. The following controls are recommended:

- A minimum of 150mm of rain must be managed without the pool overflowing through additional freeboard or overflow to a holding tank. This is equal to a 10% AEP 24 hour rainfall event.
- Any significant discharge, such as draining and replacement of pool water, will require offsite cartage by a licenced waste transport contractor.
- Piped connections between the pool and onsite wastewater management system (or stormwater system) must be prohibited.

With these conditions, overflow of pools will be very rare.

5.2 Communal Wastewater Disposal

Effluent from 101 lots, including residential lots and rural lifestyle lots unsuitable for onsite effluent disposal will be conveyed to a communal wastewater treatment system. Initially, the wastewater system will be owned and operated by the Developer. Once complete, the system ownership and maintenance will transfer to a Wastewater Association. A proposed legal framework is attached as Appendix G.

The communal wastewater system is expected to require a Building Consent however the system is beyond the scope of the New Zealand Building Code G13 – Foul Water. To ensure robust review by TDC, Envirolink propose that an "Engineering Plan Approval" process would still be followed, as occurs for assets to be transferred to public ownership, to allow TDC to provide design input if required. This process would occur in parallel with a Building Consent application for the system, ie the design would be submitted for Building Consent however the review would be completed by TDC Engineering staff who have more experience in the design of wastewater treatment systems. To ensure the system is well maintained in the long term, it is recommended that an Asset Management Plan is required as a condition of consent. This should include an appropriate funding mechanism for both routine maintenance as well as future system replacement. Innoflow have undertaken preliminary calculations, included in Appendix I, to provide an example of how appropriate funding and charges will be determined.

TDC design standards, as articulated by the NTLDM, do not specifically relate to systems of this nature. Some elements such as emergency storage requirements, pipe materials and minimum cover etc are within the scope of the NTLDM and these requirements will be met. The scope of the NTLDM does not specifically cover treatment plants.

Flow Allowance

For the communal disposal system, wastewater design assumptions are summarised as set out in Tables 5.3 and 5.4 below. The nature of the discharge is generally consistent with that anticipated by AS/NZS1547:2012 however the weekly effluent volumes will considerably exceed the maximum $14m^3$/week stated to be within the scope of AS/NZS1547:2012. The site will have a reticulated water supply. All calculations outlined below are preliminary and will be revised as a final system is selected and detailed design is commenced. Several sources of information have been considered to assess the rate of effluent production:

Nelson Tasman Land Development Manual (NTLDM): Design for 2.5 persons per house and an average dry weather flow of 225L/person per day. Peak dry and wet weather factors are also provided however these are typically used to calculate peak instantaneous flows, relevant to reticulation and pump station design.

AS/NZS1547:2012: AS/NZS1547 recommends design for 145 to 200L/person per day for sites using a reticulated water supply, subject to the degree of water saving appliances. In this case, all new dwellings will be constructed. As discussed previously, it is recommended to volunteer “Standard” water saving appliances are used for all lots in accordance with AS/NZS1547:2012 as a condition of consent. Peak load is 165L/person per day. 1547 recommends the design for peak occupancy assuming a minimum of 10 occupants per dwelling where dwelling use is unknown. This is a reasonable assumption for individual systems where peaking has a significant effect. For a community system, there is an averaging effect as all dwellings are unlikely to have peak occupancy at the same time. According to Statistics New Zealand[1], the average occupancy for occupied houses across the Tasman District is 2.6 persons per household. To ensure a conservative design, it is recommended to allow for an average occupancy of 2.5 persons per lot as per the NTLDM with a peak of 5 persons per household.

Auckland Regional Council Guideline Document 2021/006 (GD06): GD06 provides further design guidance for onsite wastewater treatment systems. TP58, the predecessor to GD06, recommends adopting a minimum occupancy of 4 persons for clustered rural developments, plus allowing for additional occupancy based on the area where “large modern dwellings” are proposed. In this case the size of dwellings to be constructed is unknown however lot sizes are typical of a residential development rather than particularly large rural dwellings. An allowance for one additional occupant is considered reasonable, validating the assumption of 5 occupants per dwelling discussed above.

[1] https://www.stats.govt.nz/tools/2018-census-place-summaries/tasman-region

Table 5.3: Communal Wastewater Disposal System					
Lot Category	Occupants per lot[1]	Wastewater Load Per Person[2] (L/person per day)	Dry Weather Peaking Factor[1]	Wet Weather Peaking Factor[3]	Peak Daily Flow Allowance (L/connection per day)
Residential dwelling	2.5	165	2	0.1	907.5

1) As per NTLDM
2) As per AS/NZS1547:2012 assuming a reticulated water supply and standard water saving appliances.
3) Discussed in further detail below.

Table 5.4: Communal Wastewater Disposal System				
Lot Category	Lot Numbers	Peak Dry Weather Flow (L/day)	Peak Wet Weather Wastewater Flow (L/day)	Instantaneous Flow (L/s)
Residential	101	83,325	91,658	3

The NTLDM requires design for peak wet weather flows three times peak dry weather flow. This is a reasonable allowance for an aged reticulation, and to assess instantaneous flow. In this case, daily and even weekly flow is more important to design the treatment plant as the plant will have some storage/buffer capacity. All new wastewater reticulation will be installed. A pumped, fully sealed reticulation will be installed with proprietary plastic or fiberglass on property sewer pump stations. This significantly reduces the volume of stormwater inflow and effectively eliminates groundwater infiltration.

The site is intended to use "Prelos" on property combined septic tank/pump stations, supplied by Innoflow. These are a fully sealed tank unit. From discussions with the supplier, wet weather peaking for similar subdivision developments using this system in New Zealand has been low, in the order of 10%. For this reason, wet weather peaking of 10% has been adopted.

This allowance for wet weather infiltration is lower than that typically used for a municipal gravity reticulation. Because the reticulation is sealed, the risk of infiltration in the reticulation is eliminated. Pumps have run counters, recording every time a pump operates. This allows any on property infiltration issues to be identified. The risk of inflow and infiltration with this system is substantially reduced.

Conveyance

The treatment plant will be installed adjacent to the communal disposal fields on the western side of the development. Effluent from individual properties will be conveyed to the treatment plant via individual on property pump stations.

From preliminary discussions with suppliers, it is anticipated that a Orenco “Prelos” sewer pump station will be installed with the Advantex treatment plant. The Prelos system performs a dual role as both a septic tank, offering primary treatment, and a pump station. Primary treated effluent storage at the treatment plant can be reduced. Preliminary details are included in Appendix I.

Regardless of the treatment system, on property pumps will be used for conveyance. Individual on-property pump stations increase the probability that any misuse of the system results in issues occurring on-property rather than within the communal reticulation or treatment plant. Issues of debris blockage, such as flushing of wet wipes, typically cause a pump failure on the residents property. This ensures responsibility for miss-use of the system can be more easily determined, and the consequences of failure are reduced. In the worst case, if a blockage causes a spill, it is from a single occupied property rather than potentially from multiple properties.

On property pump stations will have emergency storage and pump to the treatment plant via a common rising main. The Tasman District Council’s Owner and Occupier’s Manual for Pressure Wastewater Pumping System recommends a minimum of 24 hours storage, typically assessed at average dry weather flow. This is equivalent to 412 L storage per house. Typical onsite pump stations have approximately twice this amount of storage. To ensure the system is resilient, further emergency storage will be provided at the treatment plant.

Recommended conditions of consent for wastewater conveyance are summarised as follows:

- A minimum 24 hours of emergency storage must be provided for average dry weather flow conditions.
- A packaged/proprietary pump station must be used.
- An Operation and Maintenance plan must be provided for the pump station at the time of Building Consent.
- The lot owner must enter into a maintenance contract with an authorised contractor, approved by the system supplier.

Treatment Standards

Secondary treatment of effluent is required to meet TDC requirements for this region, reiterated as follows:

- Effluent quality must not exceed the following standards
    - Biochemical Oxygen Demand (BOD): 30g/m^3
    - Total Suspended Solids (TSS): 45g/m^3

TDC do not impose a limit on nitrogen application for onsite wastewater disposal systems however a limit of 200kg/Ha per year is imposed for application of animal effluent. The draft Guidelines for Beneficial Use of Organic Materials on Productive Land[2], obtained from Water New Zealand, also propose a nitrogen limit of 200kg/Ha per year, as an average over 2 years. Whilst these guidelines have not progressed beyond a draft, they are considered a reasonable standard from which to assess the proposed discharge.

Typical total nitrogen concentrations in effluent treated by a “compact activated sludge” process without dedicated nitrogen removal is 20 to 40 mg/L based on information from GD06. This is a change

[2] Water New Zealand (2017) Guidelines for Beneficial Use of Organic Materials on Productive Land (draft) accessed via website.
https://www.waternz.org.nz/Attachment?Action=Download&Attachment_id=3291

from the previous TP58 document which stated total nitrogen concentrations in effluent treated by an aerated wastewater treatment system without dedicated nitrogen removal was 25 to 60 mg/L. Whilst nitrogen concentrations have been revised down in the newer edition of the standard, nitrogen is not specifically treated in a secondary treatment plant without dedicated nitrogen removal. Due to the specification of low water use appliances, wastewater could be more concentrated hence the TP58 nitrogen concentrations have been adopted. Potential nitrogen loading has been assessed as follows:

- Maximum 83m^3/day effluent production (dilution occurs in wet weather)
- Average 42m^3/day effluent production
- Maximum design land application rate of 2mm/day, 4.6Ha of primary effluent disposal field
- Average land application rate of 1mm/day
- Nitrogen concentration of 25-60mg/L in treated effluent.

Based on the anticipated range of average to maximum flow, the nitrogen application is 92-222 kg/Ha per year. Based on the calculated average load, the anticipated nitrogen application rate is 92 kg/Ha per year. Theoretically, it would be possible to exceed the recommended maximum nitrogen application rate of 200 kg/Ha per year if a consent limit for nitrogen is not imposed. It is recommended to volunteer a nitrogen limit of 34mg/L as a condition of consent. This will ensure that even if the system operates at 50% greater than anticipated average flows, the annual average nitrogen loading rate will be less than 200kg/Ha per year. This is discussed further in Section 8.

The Water New Zealand guidelines do not specify any maximum BOD loading rates. BOD and TSS rates of 20mg/L BOD and 30mg/L TSS, lower than the TRMP standards, are commonly imposed for modern secondary treatment systems. It is recommended that the lower limits are adopted to reduce the risk of biomass and suspended sediment leading to clogging of emitters and poor irrigation field performance.

For clarity, recommended treatment parameters to be volunteered as a condition of consent are summarised as follows:

- The system is to be designed for peak effluent loading of 908L/day per connection or 95m^3/day assuming 105 dwellings are serviced. The actual number of properties to be serviced is 101, ensuring a conservative assessment.
- Effluent quality must not exceed the following standards
  - Biochemical Oxygen Demand (BOD):
    - 90% of samples ≤20g/m^3
    - No samples exceeding 30g/m^3
  - Total Suspended Solids (TSS):
    - 90% of samples ≤30g/m^3
    - No samples exceeding 45g/m^3
  - Total Nitrogen
    - 90% of samples ≤34g/m^3
    - No samples exceeding 50g/m^3

As discussed above, TP58, the previous version of GD06 identified nitrogen concentrations of 20-60g/m^3 for aerated treatment. An absolute limit of 50g/m^3 has been proposed for nitrogen to provide operational flexibility. With 10% of samples at this limit, the rate of nitrogen application is less than two thirds of the TRMP nitrogen application limit at average flows.

A condition of consent is not volunteered for faecal coliforms. Faecal coliforms could present a risk to downstream habitat and human health if treated effluent is allowed to flow into downstream waterways. At the very low rates of effluent disposal proposed, the risk of discharge to surface water or ground water is very low. The risk of coliform contamination is mitigated through the low rate of land application and further mitigations such as UV disinfection are not considered to materially alter the effect of the discharge on the receiving environment.

Treatment

A secondary treatment plant is required for the proposed communal system. For the anticipated peak load, it is feasible to utilise a modular system with multiple smaller treatment plants installed in parallel. Advantex AX100 packed bed textile reactor produced by Innoflow will be used for this site. This is an "advanced" secondary treatment plant, which includes media for biological growth, improving treatment over a system with aeration only. This can improve treated effluent quality and offer more resilience to changes in load. This system is proven in similar application within New Zealand and is considered to offer a high standard of treatment. Performance has been independently verified as part of OSET program.

Innoflow have an established service network within the region and a high level of technical support within New Zealand. The treatment plant location is a considerable distance from existing and proposed dwellings, partially mitigating the risk of odour issues. As a further mitigation, the treatment plant includes a carbon filter as passive odour treatment.

A design basis for the treatment plant is recommended as follows. Further design information is included in Appendix I. In consultation, Innoflow have confirmed that the recommended design standards can bet met by the proposed system. Most of these conditions can eventually form part of a specification for system design however they are not necessarily required as a condition of consent. Recommended conditions of consent are *italicised*:

- Designed for influent quality as follows:
  - Biochemical Oxygen Demand (BOD):
    - ≤450g/m^3
  - Total Suspended Solids (TSS):
    - ≤500g/m^3
- Designed for peak flow of 100m^3/day to ensure adequate capacity if dwellings produce more effluent than that calculated.
- Design for average flows of 43m^3/day

The above conditions are to be specified to the treatment plant supplier. They include conservative allowances to ensure the treatment plant design is robust, hence the flow allowance is higher than the recommended consent limit. Again, recommended conditions of consent are *italicised*:

- *The system is to be designed for peak effluent loading of 908L/day per connection or 95m^3/day assuming 105 dwellings are serviced.*
- *A minimum 24 hours of emergency raw effluent storage at average dry weather flow (nominally 43m^3) shall be provided.*
- *Effluent quality must not exceed the following standards*
  - *Biochemical Oxygen Demand (BOD):*
    - *90% of samples ≤20g/m^3*
    - *No samples exceeding 30g/m^3*

- Total Suspended Solids (TSS):
    - *90% of samples ≤30g/m^3*
    - *No samples exceeding 45g/m^3*
- *Total Nitrogen*
    - *90% of samples ≤34g/m^3*
    - *No samples exceeding 50g/m^3*

- *A packaged/proprietary treatment system must be used.*
- *The treatment plant must be provided with water for washdown purposes.*
- *The proposed treatment system must be accepted by TDC as part of Engineering Approval for the proposed wastewater treatment plant and land application design.*

In order to be approved, the performance of the proposed system should have been independently verified, for example as part of OSET program. The selected treatment plant should have a demonstrated history of use in larger residential and commercial installations within Australasia.

- *Treated effluent storage equivalent to 12 hours of average dry weather flow is to be provided to allow further storage for management of peak inflows* without overloading the disposal field.
- *Effluent must be conveyed to the treatment plant using individual onsite pump stations.*
- *Pump stations are to be maintained as directed by the Operation and Maintenance Plan and Resident Association rules.*
- The treatment plant is to be designed for 10-20% of future load for the first 2-3 years, subject to development staging.

Depending on the model selected, some treatment plants will not operate effectively with organics loading far less than the design capacity. In this case, the system will need to be split into several smaller treatment stages. Construction of both the treatment plant and land application area could be staged if the development is staged.

Again this does not need to be a condition of consent, rather this is a condition that the treatment plant supplier must meet.

- *The system should have passive odour treatment installed.*
- *A detailed Operation and Maintenance plan must be provided including an equipment schedule, 3 monthly and annual maintenance check lists, operating responsibilities, emergency response procedures and as built drawings.*
- *An Asset Management Plan shall be provided. This must include a register of all assets, their anticipated service life and replacement costs. The plan must include a budget for both routine maintenance and system replacement to enable appropriate fees for system operation to be determined.*
- *Maintenance by an authorised contractor, trained by the system designer, must be undertaken at the interval specified by the system designer.*
- *Treated effluent samples must be obtained on the following frequency:*
    - *First 6 months of operation: Monthly*
    - *First 2 years of operation: 3 Monthly*
    - *Thereafter: 6 Monthly*
- *Samples must be analysed for BOD, TSS and total nitrogen.*
- *Flow to the disposal field must be continuously recorded. Flow must be recorded on both an instantaneous and totalised daily basis, recorded automatically with historic data retained electronically.*
- *Wastewater inflow to plant must be continuously recorded. Flow must be recorded on both an instantaneous and totalised daily basis, recorded automatically with historic data retained electronically.*

Land Application

Available land for drip irrigation has been assessed by Staig and Smith Limited, as directed by Envirolink. The Client has obtained a written undertaking that a Licence to Occupy will be granted to allow the irrigation of treated effluent in adjacent area of Crown Land/ex legal road which has been stopped. Email correspondence from Waka Kotahi is attached as Appendix F.

Land which will be used for the treatment plant and access tracks has been excluded from the "suitable" wastewater disposal area. A reduced offset from the land application area to boundaries of 1.5m has been applied. This is considered acceptable as the system will be closely managed and effluent disposal will not occur on adjacent properties.

Where possible, trunk pipework, manifolds and cutoff drains will be located within the proposed 1.5m buffer to boundaries however this will not be practical in all cases. Calculations have allowed for 10% of all wastewater disposal areas to be unsuitable for effluent disposal due to these features. On this basis, site effluent disposal capacity is presented in Table 5.5 below.

Table 5.5: Tahimana Land Application Areas

Area	Total Available Area (Ha)	"Suitable" Area (Ha)	Irrigation Rate (mm/day)	Total daily Effluent Capacity (L/day)
Communal Wastewater Field 0-10% slope	6.4	5.76	2	115,200
Communal Wastewater Field 10-20% slope	0.58	0.52	1.6	8,350
Lot 139 (10-20%)	1	0.9	1.6	14,400
Total Volume				137,950
Primary Volume (L/day)				91,658
Reserve Volume Available (L/day)				46,292
Reserve Area (%)				50.5%

The available area of land is adequate for the calculated wastewater load with a 50% reserve area available within Lot 139 and 144. This allows for the least favourable soil category under 1547. As discussed in Section 4, this is a conservative assumption and in practice, more favourable soil conditions are present in much of the site. Adopting a higher disposal rate would considerably increase the available reserve disposal area. Envirolink consider a better practice is to adopt the most conservative design basis from the commencement of operation to reduce the probability that reserve disposal areas will ever be used.

The manufacturer of commonly supplied drip line[3] specifies that their product is designed for BOD/TSS of 30/30mg/L respectively. The proposed treatment standards are consistent with dripline supplier recommendations.

The communal disposal area will be divided into multiple disposal zones, each approximately 10-20% of the total field area. This will allow field areas to be rested, or isolated from the system if ever required for maintenance.

At present, the proposed land application area requires further earthworks to be suitable for effluent disposal. Further details are provided on Sheets 55-58 of the plan set. An earthworks specification will be developed as part of detailed design, in conjunction with the project geotechnical engineer. The specification will include:

- Removal of woody debris and other unsuitable material.
- Cutting where required to form disposal areas and cut off drains.
- Placement of fill material in layers, including topsoil stripped from other areas of the site.
- Light compaction, this is expected to include minor track rolling with harrowing or similar to break up large clumps of soil. Firm compaction is not preferred.
- Final harrowing of top soil.
- Planting with grass seed or other vegetation.

Recommended conditions of consent for communal land application are as follows:

- Land application must be via pressure compensating dripline at a maximum disposal rate of 2mm/day, reduced for slope angles greater than 10% in accordance with AS/NZS1547:2012.
- A minimum of 50% of the primary disposal area must be available as reserve wastewater disposal field.
- Disposal fields must be located a minimum of 1.5m from any adjoining boundary
- Disposal fields must be well vegetated upon completion of dripline installation.
- Vegetation shall be maintained in accordance with advice from a suitably qualified wastewater engineer, subject to recommendations by the Agricultural Scientist.
- The extents of disposal fields and surface features such as valve boxes shall be marked with robust posts such as 100x100mm treated pine posts.

Design Service Life

System Components

The NTLDM does not specifically state a minimum service life for wastewater assets such are treatment plants. In pre-application consultation, Council have requested an assessment of the treatment and disposal areas required over an 80-100 year design horizon. To guide an assessment of service life, Envirolink have considered the following sources of information:

- In accordance with the Durability Performance requirement of the NZBC Part B2 Table 1, a septic tank which is built into or under the structure of the building is required to have a service life of 50 years. A septic tank which is “in-ground but accessible”, minimum service life is 15 years. The minimum service life of an effluent field is 15 years.

[3] Netafim, 200, Wastewater Reuse and Drip Dispersal Guide

- Section 6.8.1.6 of the NTLDM requires sufficient wastewater pumping capacity to handle the design flow rate from the catchment area for 25 years. This indicates that municipal pumps are expected to last in the order of 25 years.
- Section 7.3.3.1 of the NTLDM requires water supply networks to have a minimum design life of 70 years. A wastewater network would be generally expected to have a lessor service life due to more aggressive operating conditions.

Pipework and storage tanks associated with the treatment plant will be constructed from polyethylene, PVC, concrete and fiberglass, all materials typically used for municipal wastewater treatment and reticulation systems. Based on guidance from the Plastics Industry Pipe Association of Australia, the service life for plastic pipe (PE and PVC) is expected to be in the order of 100 years[4]. This exceeds the minimum service life required by the NTLDM for water reticulation networks. Fiberglass tanks are expected to last up to 30 years[5] and thin-walled concrete tanks, with appropriate corrosion protection, up to 50 years[6].

The service life for pumps within the communal system has been considered by Innoflow as part of their Net Present Value (NPV) assessment. From a funding perspective, Innoflow have assessed the system assuming an application specific year service life for pumps process equipment ranging from 15 years for smaller process pumps to 30 years for the control panel.

Based on Envirolink's experience, dripline within the effluent field can be expected to last 15-20 years before replacement is required. Netafim indicate a service life of more than 20 years is possible[7].

For all assets, the system can continue operating effectively indefinitely with appropriate asset maintenance and renewal, as identified by Innoflow. Asset service life will exceed the minimums recommended by the NZBC. Whilst the NTLDM does not specify a service life for systems of this nature, from the information available, the proposed maintenance will ensure that the design will meet or exceed the design life anticipated by the NTLDM for comparable assets.

The proposed layout allows ample area to rebuild or construct a replacement system whilst the existing system remains operational. New dripline can be installed between existing lines and a new treatment plant could be built next to the existing plant, or a containerised plant could be installed, without affecting existing operations.

Land Application

The Design Loading Rates (DLR) provided in 1547 are equivalent to the Long Term Acceptance Rates (LTAR) "of the land application system reduced by a factor of safety". LTAR are the "steady state rate that a land application system can absorb primary or secondary effluent".

For the proposed system, a DLR has been selected based on "worst case" soil conditions under 1547. There are several layers of conservatism in the assessment:

- Category 6 soils have been adopted, rather than Category 5 which is present in much of the property. Category 5 would allow a 50% higher DLR.
- The LTAR is a "steady state rate", ie this can continue indefinitely in the nominated soil type.
- The LTAR is reduced by a "factor of safety" (by 1547) to determine the DLR.

[4] https://www.pipa.com.au/wp-content/uploads/2018/09/tn013.pdf
[5] https://hudsonfiberglass.com/what-is-the-life-expectancy-of-a-fiberglass-reinforced-plastic-frp-tank/
[6] https://aqualift.com.au/wp-content/uploads/2019/04/13-Tank-Design-Life-Expectancies-101.pdf
[7] https://www.netafimusa.com/bynder/315B6CDD-68DA-4A15-AC82FA9C2FDAB129-a012-drip-system-ops-maint.pdf

There is no reason to expect that the proposed rate of effluent disposal cannot occur within the nominated primary/reserve areas indefinitely.

It is noted that a wastewater discharge consent will have a fixed duration, likely in the order of 35 years. This will mean that a detailed inspection and assessment of the system is required for each renewal, providing further certainty that the assets will provide an appropriate service life. The conservative recommended irrigation rates will ensure soils remain appropriate for very long term effluent disposal.

6.0 Stormwater Management

The development area includes two main stormwater catchments as described previously. As shown on the post development catchment plan, there is also a "southern catchment" which drains west, towards State Highway 60, away from the rest of the catchment. The small amount of additional runoff draining from road areas in this catchment is offset by the reduction in catchment area. Flows are not materially increased to the southern catchment and hence have not been modelled or attenuated.

Runoff from the two main catchments flows through neighbouring properties before converging downstream of the development site. A plan showing the assessed stormwater catchments has been prepared by Staig and Smith Limited, as included with this application. Catchments will change slightly as a result of development. This effect has been accounted for in the model. Allowances for impervious areas are summarised in Table 6.1 below.

Table 6.1: Tahimana Western Catchment Runoff Assessment		
Source	**Roof Area**	**Asphalt/Concrete/Chip seal area**
Rural lifestyle lots – 2,000m^2+	500m^2/lot	500m^2/lot
Residential lots - <1,999m^2	270m^2/lot	100m^2/lot
Public Roads	N/A	6m sealed width per linear meter plus 2 x 1.5m wide footpaths
Right of Way	N/A	2.75m sealed width

All analysis of stormwater runoff has been undertaken using HEC-HMS making the following assumptions:

- Assessment undertaken using the soil conservation service (SCS) method
- Curve numbers taken from United States Department of Agriculture TR-55 assuming Class C sandy clay loam soils.
- Rainfall depths taken from the HIRDS database produced by NIWA (for RCP 8.5 climate change scenario in the year 2100), as required by the NTLDM
- Rainfall intensity assumed to follow the temporal pattern outlined in HIRDS V4. HIRDS provides coefficients for 1 hour and 6 hour rainfall events only. Parameters from HIRDS for a 1 hour event have been adopted for the 30 minute and 2 hour rainfall events.
- Lag time equal to 2/3rds of the time of concentration in accordance with TP108.
- The assessment has allowed for future landscape plantings, where identified by the project team. Calculations have allowed for approximately 0.9Ha of plantings. Actual plantings will far exceed this allowance, ensuring a conservative assessment.

6.1 Stormwater Management Options

Envirolink have arrived at the proposed design after considering several alternatives both in terms of stormwater generation and detention solutions. The design process for stormwater detention commenced in mid 2021 and the present layout was arrived at in 2024 and was further revised in 2025. This process has involved ongoing consideration of stormwater management and detention options to mitigate the effect of development, including collaboration with ecologists and hydrologists to determine the most appropriate design response for the site.

To provide some context, the proposed detention dams are presently designed to detain a total of approximately 10,000m^3 of runoff (in total across all dams) during the worst case design event. Detention intercepts approximately two thirds of the total catchment area. Any alternative detention solution would need to provide roughly the same capacity and detain a similar proportion of the site. Small, on property or at source solutions on every site are not feasible to provide this detention volume and catchment coverage.

Storage needs to be either in locations where water naturally flows (gullies) or runoff must be diverted to a suitable location. In considering those constraints, we have also factored in the need to avoid reducing flows to wetlands (which could happen with piping or cut off drains). Options have been considered as follows:

Source Management

- The use of lower runoff surfaces has been considered. On property design responses such as gravel driveways or semi permeable paving have been considered, in addition to green roofs. This has minimal benefit during longer duration, high intensity rainfall events which can cause downstream flooding.

At Source Detention

- On site management could involve tanks intercepting roof runoff and soak pits to manage driveways. The site is heavy clay, soakage is poor and not a viable option to manage stormwater. A very high proportion of the total development effect is due to roads (typically 30-50% of the overall effect depending on the catchment). It is not possible to offset the effect of roads by intercepting on-lot runoff only, as described previously, approximately two thirds of the total site runoff needs to be intercepted.

Communal Stormwater Detention

This option was identified as the most appropriate for the site and several different communal detention options have been considered:

- A single large basin. This option has historically been a common design response for stormwater detention in the Tasman Rural 3 zone. Where practical, a single basin reduces ongoing maintenance, improving management of stormwater detention. This is not possible on the eastern side of the property as gullies converge on neighbouring land (ie offsite). This was considered on the western catchment. A single dam would be required at the downstream end of the catchment to intercept as much runoff as possible. The location assessed as part of preliminary work.
- **Multiple smaller ponds. This was identified as the best option for the site, balancing design requirements including ecology.** Dams have been moved to the extent practical to avoid natural inland wetlands and mapped watercourses.
- One dam in the **western catchment** did encroach on a watercourse. Following further work, this basin has been moved and re-designed to avoid the waterway.
- In the **eastern catchment**, two dams encroached on waterways. The alternative, final design plan has been developed, avoiding all mapped waterways and wetlands.

Following further collaboration with PDP, the project Hydrologist, it has been determined that 10 soak pits will be incorporated into the western catchment to mitigate the effect of development on wetland recharge. Soak pits will fill during rainfall and drain slowly to provide groundwater recharge. This will have a relatively minor effect on stormwater management during peak flow events discussed subsequently and hence soak pits have not been included in the stormwater runoff model.

6.2 Eastern Catchment

The eastern side of the development drains via several gullies to a revegetated wetland area on a neighbouring property. This area drains into a dam downstream. For this assessment, the catchment has been broken down into 23 post development sub-catchments as illustrated in plans prepared by Staig and Smith.

An assessment of the effect of development has been made making the following assumptions:

- All predevelopment surface is assessed as low permeability clay with pasture cover.
- Post development, additional impervious areas include:
    - No residential lots
    - 27 rural lifestyle lots
    - Public Roads, Minor Roads, and Right of Way Roads.
- Minor changes to catchment areas occur post development, as illustrated in Appendix B. These changes have been accounted for in model parameters.
- All other post development surface is allowed to be low permeability clay with grass/pasture cover. In reality, shrub vegetation may be established across much of the steeper areas on site which will slightly reduce runoff, hence this is a conservative assumption.

The assessed effect of development, and the parameters used to model the catchments are included in Appendix C.

The time of concentration between the eastern sub-catchments and the site boundary varies from approximately 10 to 40 minutes. Downstream of the site, this catchment flows for approximately 4.4km before flowing into coastal marine waters through the culverts at Kina Beach Road. The channel profile and hence the downstream flow time varies depending on the water level in the downstream channel. Assuming the channel is relatively full, the flow time is estimated to be a further 33 minutes. The flow duration will be longer when the water level in the channel is lower.

The effect of development has been assessed for a 30 minute and 120 minute rainfall event, equal to the time required for all catchments on site to reach their peak, and the time taken for peak runoff to reach coastal marine waters under a relatively low flow condition. Once the discharge reaches coastal marine waters, the effect of this discharge is insignificant compared to tidal levels. That said, longer duration 6 and 24 hour events have also been considered to fully assess the effect of development. The NTLDM does not require detention design in greenfield developments for events with intensity less than 10% AEP. Extended detention is not recommended for this site. For this reason, lower intensity events have also been considered, as discussed subsequently.

A total of sixteen detention basins are proposed within the eastern catchment. Dam locations have been identified to avoid wetlands identified by the project ecologist. A depth vs storage relationship has been determined by Staig and Smith based on a preliminary detention basin design. Storage characteristics will be reviewed as the design is progressed. Basins are either located in gullies which are generally dry, only flowing during and immediately following rainfall events, or created in dry areas with runoff diverted into basins with cutoff drains. Basin outlet configurations have been varied based on the capacity and storage characteristics in each catchments however a general outlet configuration is as follows:

- A 150-200mm primary outlet in the basin floor. Detailed design will address a design approach to mitigate the risk of blocking a small diameter outlet, likely to involve an oversized sump with a debris grille.
- From collaboration with the project Ecologist, two detention basins have been identified where fish passage is required, basins E5d and W4. For these ponds, an enlarged pipe, nominally a 300-450mm pipe will be installed at pond invert level and partially submerged with a 150-200mm orifice plate. This design will restrict flow as necessary whilst allowing passage for eels at low flow.
- Secondary and tertiary outlets, consisting of 100-300mm holes core drilled in the side of a manhole riser, typically 1-2.5m above the pond floor.
- An open manhole with a debris grille to function as an overflow outlet, typically located at or close to top water level.
- A spillway providing as close as possible to the 500mm of freeboard to top water level, as required by the NTLDM.

As the basins are optimised for detailed design, these parameters will change. The post development HEC-HMS model framework is presented in Figure 6.1 below.

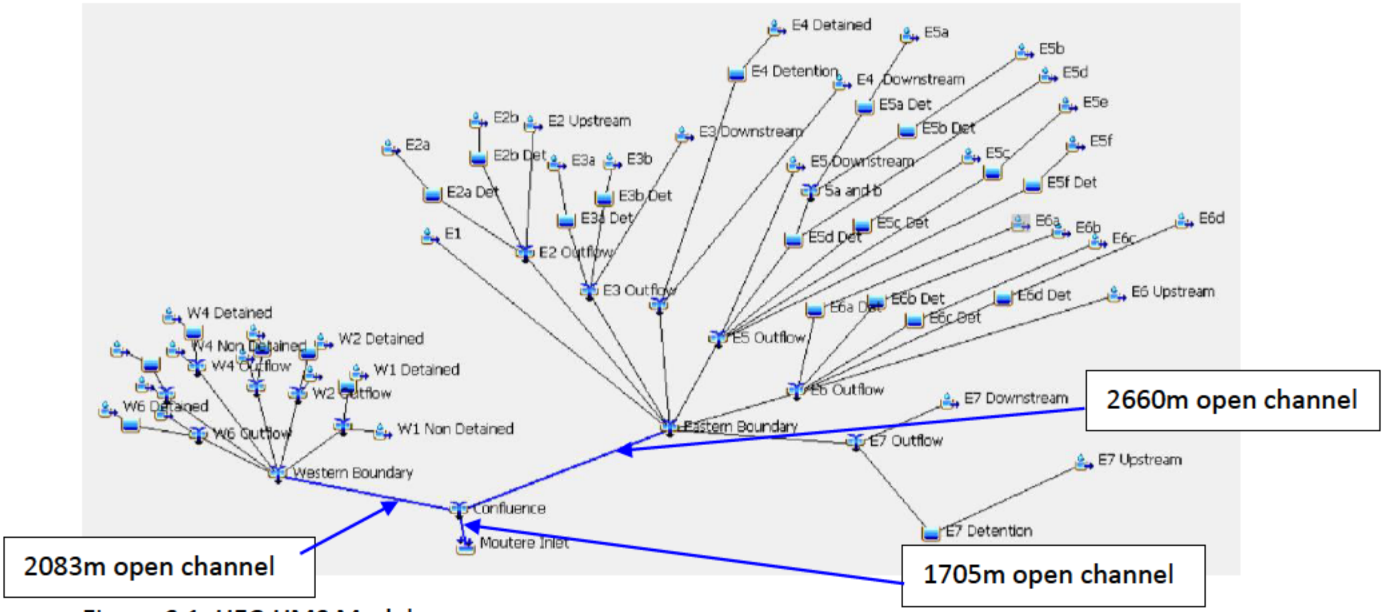


Figure 6.1: HEC-HMS Model

With these assumptions, pre development runoff and post development runoff with detention are presented in Table 6.2 below. Values highlighted in red indicate an exceedance of pre development flows.

Table 6.2: Tahimana Eastern Catchment Runoff Assessment (m3/s)												
Event	30 Min 50% AEP		30 Min 10% AEP		30 Min 1% AEP		120 Min 50% AEP		120 Min 10% AEP		120 Min 1% AEP	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
E1	0.033	0.035	0.087	0.09	0.202	0.206	0.044	0.046	0.1	0.102	0.204	0.205
E2 Outflow	0.054	0.062	0.147	0.136	0.347	0.266	0.082	0.09	0.185	0.158	0.378	0.283
E3 Outflow	0.065	0.065	0.181	0.137	0.438	0.255	0.118	0.107	0.265	0.185	0.544	0.353
E4 Outflow	0.042	0.046	0.119	0.111	0.29	0.226	0.084	0.087	0.19	0.165	0.389	0.319
E5 Outflow	0.112	0.11	0.322	0.26	0.796	0.519	0.276	0.233	0.626	0.453	1.287	0.831
E6 Outflow	0.055	0.083	0.158	0.194	0.391	0.377	0.146	0.18	0.331	0.348	0.683	0.632
E7 Outflow	0.037	0.042	0.106	0.098	0.264	0.176	0.102	0.097	0.231	0.163	0.475	0.298
Eastern Boundary	0.309	0.347	0.894	0.837	2.222	1.648	0.807	0.799	1.83	1.503	3.768	2.783
Event	360 Min 50% AEP		360 Min 10% AEP		360 Min 1% AEP		24 hr 50% AEP		24 hr 10% AEP		24 hr 1% AEP	
E1	0.032	0.033	0.066	0.067	0.126	0.126	0.038	0.038	0.071	0.07	0.122	0.121
E2 Outflow	0.061	0.065	0.125	0.12	0.237	0.204	0.065	0.068	0.123	0.114	0.213	0.182
E3 Outflow	0.09	0.09	0.185	0.162	0.352	0.295	0.089	0.085	0.166	0.141	0.289	0.239
E4 Outflow	0.065	0.07	0.135	0.131	0.256	0.24	0.063	0.065	0.117	0.112	0.204	0.185
E5 Outflow	0.23	0.203	0.474	0.385	0.903	0.669	0.209	0.181	0.392	0.324	0.681	0.528
E6 Outflow	0.126	0.16	0.259	0.303	0.494	0.531	0.113	0.142	0.212	0.244	0.368	0.402
E7 Outflow	0.089	0.09	0.183	0.149	0.349	0.242	0.08	0.082	0.149	0.126	0.259	0.201
Eastern Boundary	0.686	0.702	1.413	1.299	2.691	2.283	0.613	0.624	1.149	1.074	1.995	1.778

Catchments where fish passage has been recommended do have very minor ephemeral base flows, estimated in the order 1-2L/s. This is sufficiently minor to have no material effect on the accuracy of the model.

Based on detention basin volumes provided by Staig and Smith, detention basin storage depths are presented in Table 6.3 below for the 2 and 6 hour events which were found to generate the greatest volume of detained runoff.

Table 6.3: Tahimana Detention Dam Capacity Summary			
Basin ID	**120min 1% Volume (m3)**	**360 min 1% Volume (m3)**	**Design Capacity**
E2a	**139**	119	139m^3 at 1.0m depth
E2b	**131**	108	131m^3 at 0.9m depth
E3a	556	**572**	572m^3 at 2.4m depth Likely only 200mm freeboard
E3b	**92**	66	100m^3 at 0.8m depth
E4	**223**	188	223m^3 at 2.1m depth
E5a	**133**	128	133m^3 at 0.9m depth
E5b	**241**	231	241m^3 at 1.3m depth
E5c	**86**	66	86m^3 at 0.7m depth
E5d	328	**389**	370m^3 at 2.7m depth
E5e	**71**	51	71m^3 at 0.7m depth
E5f	**118**	77	118m^3 at 1.4m depth
E6a	**421**	389	421m^3 at 2.9m depth
E6b	**49**	33	49m^3 at 0.6m depth
E6c	**188**	180	188m^3 at 1.1m depth
E6d	**61**	44	61m^3 at 0.6m depth
E7	650	**820**	800m^3 at 2.9m depth

Ample storage and freeboard is available in all basins to provide the necessary detention. As indicated in Table 6.2, the overall peak runoff flow rates leaving the site will be less than pre development in all critical design events, 10% AEP intensity and greater, as defined by the NTLDM. Some minor exceedances of pre development flows occur within the development area. This increase is sufficiently minor that it is unlikely to cause any material scour or erosion. If scour does occur, it is easily addressed, for example through additional plantings.

During low intensity events, a minor increase in runoff will occur post development. Changes are very small, in the order of 10-20L/s at most. This is considered insignificant in context of the overall catchment. The effect of flow increases from minor rainfall events is discussed in Section 8 below.

From this assessment, it is considered unlikely that scour will materially increase on the neighbouring property downstream of un-detained gullies, however minor effects could occur. To mitigate this risk, the project ecologist will develop a planting and maintenance plan. This will allow any issues to be identified and addressed quickly.

6.3 Western Catchment

An assessment of the effect of development has been made making the following assumptions:

- The model has allowed for all pre development surface to be low permeability clay with pasture cover.
- Post development, additional impervious areas include:
    - 98 residential lots
    - 16 rural lifestyle lots
    - Public Roads, Minor Roads, and Right of Way Roads.
- All other post development surface is assessed as low permeability clay with grass/pasture cover other than where the project team have identified a requirement for plantings.

This catchment has been separated into five sub-catchments as shown in Staig and Smith plans. The time of concentration for these sub-catchments varies from 10 to 21 minutes.

Downstream of the site, this catchment flows for approximately 3.8km before flowing into coastal marine waters through the culverts at Kina Beach Road. Again, the downstream flow time varies depending on the water level in the downstream channel however it is estimated to be in the order of 23 minutes.

The effect of development has been assessed for rainfall events consistent with the assessment for the eastern catchment. Allowances for impervious areas and modelling parameters are presented in Appendix C.

Again, detention basin locations have been identified by Staig and Smith in consultation with Envirolink and the project ecologist. Varying outlet structures have been adopted for different basins, similar to that outlined for the eastern catchment. From collaboration with the project Ecologist, basin W4 requires fish passage. This will be managed as described for the eastern catchment. Pre and post development runoff rates are presented in Table 6.4 below. Values highlighted in red indicate an exceedance of pre development flows. As discussed above, calculations ignore minor additional reductions in runoff due to proposed soak pits.

Table 6.4: Tahimana Western Catchment Runoff Assessment (m3/s)												
Event	**30 Min 50% AEP**		**30 Min 10% AEP**		**30 Min 1% AEP**		**120 Min 50% AEP**		**120 Min 10% AEP**		**120 Min 1% AEP**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
W1 Outflow	0.115	0.052	0.269	0.082	0.058	0.042	0.131	0.061	0.268	0.089	0.115	0.052
W2 Outflow	0.226	0.101	0.534	0.184	0.122	0.073	0.275	0.118	0.561	0.204	0.226	0.101
W3 Outflow	0.208	0.275	0.497	0.57	0.123	0.174	0.278	0.331	0.568	0.609	0.208	0.275
W4 Outflow	0.353	0.339	0.862	0.75	0.245	0.245	0.552	0.503	1.132	0.979	0.353	0.339
W5 Outflow	0.286	0.089	0.683	0.153	0.169	0.075	0.381	0.144	0.78	0.234	0.286	0.089
W6 Outflow	0.333	0.275	0.789	0.616	0.187	0.176	0.422	0.369	0.862	0.731	0.333	0.275
Western Boundary	1.461	1.1	3.519	2.287	0.894	0.78	2.015	1.499	4.127	2.792	1.461	1.1
Event	**360 Min 50% AEP**		**360 Min 10% AEP**		**360 Min 1% AEP**		**24 hr 50% AEP**		**24 hr 10% AEP**		**24 hr 1% AEP**	
W1 Outflow	0.042	0.039	0.087	0.057	0.166	0.086	0.05	0.039	0.094	0.054	0.163	0.081
W2 Outflow	0.089	0.066	0.184	0.097	0.35	0.171	0.1	0.066	0.187	0.098	0.324	0.172
W3 Outflow	0.092	0.131	0.189	0.23	0.36	0.392	0.096	0.127	0.179	0.208	0.311	0.331
W4 Outflow	0.19	0.196	0.391	0.374	0.744	0.744	0.183	0.179	0.342	0.32	0.594	0.527
W5 Outflow	0.126	0.074	0.26	0.153	0.495	0.257	0.131	0.09	0.246	0.154	0.427	0.25
W6 Outflow	0.138	0.142	0.285	0.281	0.542	0.519	0.149	0.144	0.279	0.249	0.485	0.43
Western Boundary	0.676	0.645	1.392	1.18	2.65	2.118	0.685	0.618	1.285	1.058	2.231	1.731

Again, based on detention basin volumes provided by Staig and Smith, detention basin storage depths are presented in Table 6.5 below for the 6 hour event. Values in red indicate freeboard is less than the NTLDM requirement.

Table 6.5: Tahimana Western Catchment Detention Capacity		
Basin	**360 min 1% Actual Depth (m)**	**Freeboard m)**
W1	1.8	0.7
W2	2.4	0.3
W3	1	0.9
W4	2.3	0.1
W5	3.5	0.3
W6	1.8	0.4

Freeboard is within the range that would be expected at this point in the design process however it is less than 500mm in some basins. Detention is greater than necessary during high intensity rainfall events. With further optimisation of outlet structures and basin design, it is likely that at least 0.3-0.4m of freeboard can be provided in all basins. This is considered suitable for the proposed basin design.

Again, as indicated in Table 6.4, the overall peak runoff flow rates leaving the site will be less than pre development in all assessed critical design events, 10% AEP intensity and greater.

During low intensity events, a minor increase in runoff will only occur post development during the 30 minute 50% AEP event. Again, this is considered insignificant in context of the overall catchment. As discussed previously, soak pits will be incorporated into the western catchment to mitigate the effect of development on wetland recharge. Soak pits are not included in the stormwater runoff model. Soak pits will cause further attenuation of runoff during the low intensity rainfall event where a minor flow exceedance is modelled.

6.4 Stormwater Treatment

Treatment of stormwater is not specifically required by the NTLDM. To ensure a best practice approach is adopted, treatment of surface runoff from public roading areas will be adopted where practical. This will include:

Grass treatment swales: In general accordance with ARC GD01. Generally, site topography will make widespread use of treatment swales difficult however swales could be utilised along the main site access road and other areas where road grades are less than 3%.

Rain gardens: The use of rain gardens has been considered however due to heavy clay soil conditions these are considered unsuitable for the site.

Proprietary gross pollutant traps: These will offer a flexible solution to treat road runoff from residential development areas and are likely to be implemented in most cul-de-sacs. At this point, it is proposed that a Hynds First Defence or similar device will be used. A device of this type can remove 80% of particulate contaminants greater than 75 micron based on manufacturer supplied information. In accordance with the NTLDM, stormwater treatment is required for rainfall intensities up to 10mm/hr for flow based devices. In events exceeding this intensity, the bypass function within the treatment manhole will operate and stormwater will discharge with minimal treatment.

Detention Basin Plantings: In consultation with the project ecologist, areas of channel upstream or within detention basins will be planted. This will assist with managing water temperature and enhancing natural; filtration processes. Appropriate species will be determined in consultation with the project team. Species which shed debris will not be used.

6.5 Stormwater Infrastructure Maintenance

Stormwater detention basins will be located on individual lots. Responsibility for operation and maintenance of the basins will lie with the developer for a maintenance period following construction, assumed to be a period of 2 years.

Following this period, owners of the relevant lots will be responsible for maintenance of basins. Whilst TDC will not take over management of these assets, compliance with NTLDM specifications for detention basins is recommended. This includes the requirement to design the spillway for Probable Maximum Precipitation flows without erosion of the spillway and provision of access to the inlet/outlet structures.

A draft management plan in included as Appendix H. This plan will be used as a template, finalised to suit each specific basin as the development progresses. Management plans will be provided to future lot owners where properties include detention basins. Final management plans will be lodged with Council prior to issue of a completion certificate for the relevant stage.

7.0 Residential Lot Water Supply

In consultation between the Client and TDC, TDC have confirmed through correspondence that a water supply is available for residential lots, subject to the provision of infrastructure by the developer. Confirmation of this supply is attached as Appendix D. Water will be supplied for firefighting to all lots, with potable water supplied to residential lots only.

Water is supplied to the Mapua Rural Restricted Scheme by a TDC operated pump station at the Pomona Road Reservoir site. Water is conveyed to storage tanks located approximately 500m south of the development area. Envirolink have analysed data provided by TDC to understand the flow which could be obtained from existing assets, presently terminating in Stagecoach Road. The analysis of Pomona Road pump station flow is summarised as follows:

- TDC have provided Scada data from December 2021 to July 2023
- This highest ever instantaneous flow was 15.6L/s, the typical peak is less than 14L/s. The analysis has adopted 13.5L/s as the maximum the pump station can produce.
- The highest ever daily flow was 1066m^3 on the 27th of January 2022. Between the 25th of January and the 11th of March 2022 there were 7 days where use was close to, or more than 800m^3. Since March 2022, there has not been a single day where use was more than 500m^3. Envirolink are unaware if the high use in early 2022 was linked to commissioning new equipment however it is assumed to be an outlier.
- The Tahimana Development will offer a restricted supply with 1m^3 per day per connection and a total of 101 residential connections, plus one additional water connection for the wastewater plant. For simplicity, calculations have allowed for peak water demand of 102m^3/day. This is different to flows discussed for wastewater as it also accounts for outdoor use such as irrigation.

An analysis of residual flow has made the following assumptions.

- The TDC pump station can operate for a maximum of 18 hours per day at 13.5L/s, it can supply 875m^3/day.
- The assessment has assumed that the January 2022 use is real and not due to mains flushing or similar.
- The Tahimana development builds a 300m^3 storage tank with 50m^3 dedicated to firefighting
- Every house will be required to have 3,000L of storage. The wastewater connection does not have a storage tanks, therefore 101 x 3,000 = 303m^3 of on property storage is available.
- Peak use is 200L per person, 4 occupants per house (81.6m^3/day, greater than wastewater demand) other than the 3 peak days for the TDC reticulation where every house uses the full 1m^3 allocation.
- The system can never take more than 102m^3/day, the maximum allocated flow for 102 connections.
- Tanks are full at the start of the event. This is easily achievable based on demand in the previous week.

The results of this analysis are presented in Table 7.1 below.

Table 7.1: Tahimana Water Flow analysis						
Date	TDC/Existing Scheme Use (m3)	Residual Flow (m3)	Daily Demand (m3)	Storage Change (m3)	Storage (communal tank – m3)	Storage (property tanks – m3)
21-Jan-22	509	366	81.6	0	300	303
22-Jan-22	628	247	81.6	0	300	303
23-Jan-22	606	269	81.6	0	300	303
24-Jan-22	669	206	81.6	0	300	303
25-Jan-22	793	82	81.6	0	300	303
26-Jan-22	867	8	102	-94	206	303
27-Jan-22	1066	0	102	-102	104	303
28-Jan-22	956	0	102	-102	50*	255
29-Jan-22	477	398	81.6	20.4	50*	275.4
30-Jan-22	388	487	81.6	20.4	50*	295.8
31-Jan-22	435	440	81.6	20.4	63.2	303
1-Feb-22	365	510	81.6	20.4	83.6	303
2-Feb-22	378	497	81.6	20.4	104	303
3-Feb-22	361	514	81.6	20.4	124.4	303
4-Feb-22	366	509	81.6	20.4	144.8	303
5-Feb-22	336	539	81.6	20.4	165.2	303
6-Feb-22	413	462	81.6	20.4	185.6	303
7-Feb-22	333	542	81.6	20.4	206	303
8-Feb-22	382	493	81.6	20.4	226.4	303
9-Feb-22	302	573	81.6	20.4	246.8	303
10-Feb-22	324	551	81.6	20.4	267.2	303
11-Feb-22	362	513	81.6	20.4	287.6	303
12-Feb-22	293	582	81.6	20.4	300	303
13-Feb-22	356	519	81.6	20.4	300	303

*Management intervention for tank to prevent further drawdown below minimum firefighting storage plus safety margin of 5m^3.

- If the January 2022 results are representative, the event could be managed using approximately half of the total available storage.
- If the January 2022 results are not representative, use for the 2022-23 summer never exceeded 470m^3/day and an additional 102m^3/day can easily be delivered by the existing pump station.
- This allows for only 18 hours at peak flow during the worst case demand day. Actual data indicated the pump station would have operated 22 hours on 27 January 2022.

Even based on the "worst case" data, the existing TDC infrastructure, together with the proposed storage, can provide the required portion of the allocation to the development. Based on the lower Mapua Rural Restricted Scheme use since 2022, Tahimana can be serviced from the existing TDC assets without any need to use storage capacity.

Firefighting requirements will be serviced with a 150mm reticulation. Pressure will be less than 10m at most hydrants, the supply will be a suction source in accordance with NZS PAS 4509:2008 Firefighting Water Supplies Code of Practice. The Client has consulted with the NZFS to confirm this is acceptable. In consultation, the NZFS have indicated that compliance with SNZ PAS 4509:2008 for a suction source is acceptable. Correspondence is attached as Appendix C.

From Envirolink's work on the Mapua water treatment and supply system more generally, we are not aware of any other limitations that would prevent the supply of an additional 102m^3/day to this development.

7.1 Infrastructure Upgrades

The project includes a communal 300m^3 storage tank, together with individual on property 3,000L tanks. Flow metering and level sensing are required to manage the water supply. Individual on property water meters are recommended to assist in management, even though restrictors will be used. An automated control system and outlet valve are required to ensure the dedicated firefighting storage remains available.

A new pipeline is required to connect the water tank at the development site with the existing TDC storage system on Stagecoach Road. Approximately 450m of 100mm diameter pipeline has ample capacity for the calculated demand, in compliance with TDC standards. Installation of this pipeline will be at the developer's cost.

This analysis demonstrates that to provide 102m^3/day of water to the Tahimana Development, a new pipeline is required to connect the site only with the Stagecoach Road reservoir. No wider TDC reticulation upgrades are necessary.

7.2 Water Supply Standards

The proposed water supply system is considered a "downstream" supply under the Water Services (Drinking Water Quality Assurance) Rules 2026. Compliance obligations have been considered by Matt Molloy Consulting Limited. A technical memorandum outlining compliance obligations is presented in Appendix J.

The operator of the water system will require registration with Taumata Arowai. Further details are included in Appendix J.

8.0 Assessment of Environmental Effects

8.1 Wastewater

The most significant actual or potential environmental effect associated with any wastewater discharge to land is the release of additional nutrients or pathogens to the receiving environment. In this case, site runoff flows through downstream open channels to the Moutere Inlet. The environmental values of the Moutere Inlet are recognised and hence the receiving environment is recognised to have elevated sensitivity.

The specification of secondary treatment plants partially mitigates the effect of this discharge by reducing nutrient concentrations of the wastewater. Biological processes which are critical to further reducing concentrations of nutrients and pathogens take place within the soils of the disposal area.

Envirolink have consulted with LandVision Limited, the project Agricultural Scientist, to understand the effect of nutrient application on grass within the disposal field. A response prepared by LandVision is attached as Appendix F. LandVision conclude "The N loss from the proposed system is significantly lower than under a pastoral system. " and "P lost from pastoral farming the 65 ha is estimated at about 130 kg P whereas under the proposed effluent irrigation the worst-case scenario could be 27.6 kg P. The effects from farming are considered significantly greater than the proposed subdivision."

The recommendations in the LandVision report including the rates of effluent application and buffer distances between wastewater application areas and gullies/waterways ware noted and complied with in the proposed design.

Provided there is no direct flow path between effluent and the adjacent gullies, the effect on the environment of the proposed discharge is considered insignificant. This can be managed provided that effluent is retained in the soil and there is no 'daylighting' or surface ponding of effluent.

For the proposed systems, the application of effluent using dripline subsurface is an important control to eliminate the potential for such a direct link. The application of effluent at such low rates means that even under prolonged wet conditions, there is a very low probability of effluent ponding on the ground surface provided the system is correctly maintained. The probability of effluent seeping into the gullies is considered very low with the proposed rate of effluent disposal and setback distances.

The proposed minimum reserve land application area is equal to 50% of the primary disposal field area. This is considered ample for several reasons:

- Calculations have assumed the least favourable soil category under 1547. As discussed in Section 4, this is a conservative assumption and in practice, more favourable soil conditions are present in much of the site.
- The assessment has not allowed for any of the BLA to be used for effluent disposal. Garden beds adjacent to houses are frequently used for effluent disposal.
- Calculations have allowed for 8 occupants per house for individual systems and 5 occupants per house for the communal system. This occupancy will rarely occur, noting the average occupancy of less than 2.5 persons per house in the Tasman region. Sustained high loads rather than rare peak flows are more likely to result in the failure of land application areas.
- Effluent disposal calculations have allowed for slope reduction factors in accordance with the 2012 edition of AS/NZS1547. The previous iteration of this standard did not include these factors. It is noted that existing communal systems servicing Rural 3 development in the Tasman region were developed before slope reduction factors were recommended.

- There is an extremely low probability that a failure in a drip irrigation system will render the entire field unsuitable for future effluent disposal. In most cases, a field can be remediated by isolating the failed area of field and providing a relatively small extension.

For these reasons, the proposed reserve areas are considered ample for both the communal and individual on property systems.

Provided all wastewater management systems are maintained in sound operating condition, the effect of the proposed discharges on the environment is considered less than minor. To further justify the selected design basis, Envirolink have compared the proposed system with two similar communal systems operating in the Tasman District.

Envirolink have not requested permission to use data from systems for this purpose, therefore they are referred to as System A and System B. Key parameters for both systems are summarised in Table 8.1 below.

<table>
<tr><th colspan="4">Table 8.1 – Tahimana Wastewater Comparison</th></tr>
<tr><th>Parameter</th><th>Tahimana Proposed</th><th>System A - Consented</th><th>System B – Consented</th></tr>
<tr><td>Consented Maximum discharge volume (m^3/day)</td><td>95</td><td>90</td><td>55</td></tr>
<tr><td>Number of Connections (ea)</td><td>105</td><td>99</td><td>72</td></tr>
<tr><td>Consented Maximum Effluent Flow Per Connection (L/day)</td><td>908</td><td>909</td><td>764</td></tr>
<tr><td rowspan="2">Actual Maximum Effluent Flow Per Connection (L/day)</td><td>N/A</td><td>756</td><td>670</td></tr>
<tr><td></td><td>From 2013 to May 2018</td><td>From 2018 to Sept 2020</td></tr>
<tr><td rowspan="2">Average Effluent Flow Per Connection (L/day)</td><td>412</td><td>412</td><td>314</td></tr>
<tr><td>Estimated</td><td>Actual, from 2013 to May 2018</td><td>Actual, from 2018 to Sept 2020</td></tr>
<tr><td>Maximum Consented Land Application Rate (mm/day)</td><td>2</td><td>3.6</td><td>2</td></tr>
<tr><td>Actual Average Land Application Rate (mm/day)</td><td>0.9</td><td>1.6</td><td>1.3</td></tr>
<tr><td>Maximum BOD</td><td>90% of samples ≤20g/m3
No samples exceeding 30g/m3</td><td>10</td><td>20</td></tr>
<tr><td>Maximum TSS</td><td>90% of samples ≤30g/m3
No samples exceeding 45g/m3</td><td>10</td><td>30</td></tr>
<tr><td>Maximum Total N</td><td>90% of samples ≤34g/m3
No samples exceeding 50g/m3</td><td>25</td><td>25</td></tr>
<tr><td>Theoretical Annual BOD Application Rate (kg/Ha/yr)</td><td>66.5</td><td>59.6</td><td>94.6</td></tr>
<tr><td>Theoretical Annual N2 Application Rate (kg/Ha/yr)</td><td>113.0</td><td>148.9</td><td>118.2</td></tr>
<tr><td colspan="4">For calculation purposes, it is assumed that this development has the same average flow as System A. System A appears to have more significant inflow/infiltration than System B and therefore this is considered a conservative assessment.</td></tr>
<tr><td colspan="4">Actual land application rate is calculated by pro-rating the consented land application rate based on the average vs maximum flow per house. In reality, house construction and staging of disposal areas means that the application rate varied.</td></tr>
<tr><td colspan="4">Envirolink understand that a 1.6 Ha disposal field was constructed at System B. 66 lots presently discharge to the system. It is unclear why the field was constructed considerably smaller than that required by the consent.</td></tr>
<tr><td colspan="4">Theoretical BOD/N2 application rates assume the average land application rate with the maximum consented BOD/Nitrogen concentrations. Actual performance will vary.</td></tr>
</table>

The two similar systems both involve relatively large clustered rural subdivisions with discharge onto Moutere Clay. As such they are considered highly relevant to this application. In context of this comparison, Envirolink note the following:

1. The proposed loading rate will ensure that the actual annual average loading is considerably lower than that used by similar systems operating in the area. The actual annual average daily flow for this system is likely to be even lower:
    a. The use of water conserving plumbing fixtures has improved since houses were constructed in System A/B.
    b. System A operates a pressure reticulation. This development was relatively early in the adoption of pressure sewerage schemes in the Tasman district. A range of sewer pump stations were used. Anecdotally, site fabricated concrete wet well type pump stations were observed to have significant inflow and infiltration issues.
    c. System B operates a gravity sewer. There is significantly more opportunity for inflow and infiltration issues with a gravity sewer reticulation. Anecdotally Envirolink understand stormwater inflow does occur and represents a high proportion of peak flow.

   The proposed design basis is considered sufficiently conservative when viewed in context of similar consented systems which have been operating for 10-15 years.

1. Comparing the proposed design maximum to the actual maximum flows from similar systems indicates that the inflow/infiltration allowance made by Envirolink is ample.
2. From consultation with Innoflow, the system is suitable for initial loading from only a single house. Constructing the system in 2 stages with approximately 50 houses per stage will result in a robust system as load comes online. The system will be procured as a "design and construct" contract and the supplier will be required to design for a turn down ratio, calculated as part of future detailed design. It is expected that a minimum average flow will be specified based on 10-20% of lots from the first stage being occupied with average flows as set out in Table 8.1. The contract will also require a performance proving period to ensure performance requirements are met.
3. The development will use the Innoflow Prelos System which include pump run time counters as standard. This feature will provide important data to allow investigation of an inflow or infiltration issue:
    a. Pump starts from individual properties can be compared to identify properties where inflow could be occurring.
    b. Total pump starts for the development could be compared to total flow over wet and dry weeks to identify the extent of reticulation inflow issues vs on property infiltration.

   This information is not available for other similar system Envirolink are aware of. It is recommended that, as a condition of consent, all dwellings use a packaged pump station, constructed by the same manufacturer to ensure the consistency of data.

In summary, the design basis proposed by Envirolink is considered suitable to ensure robust, long-term operation.

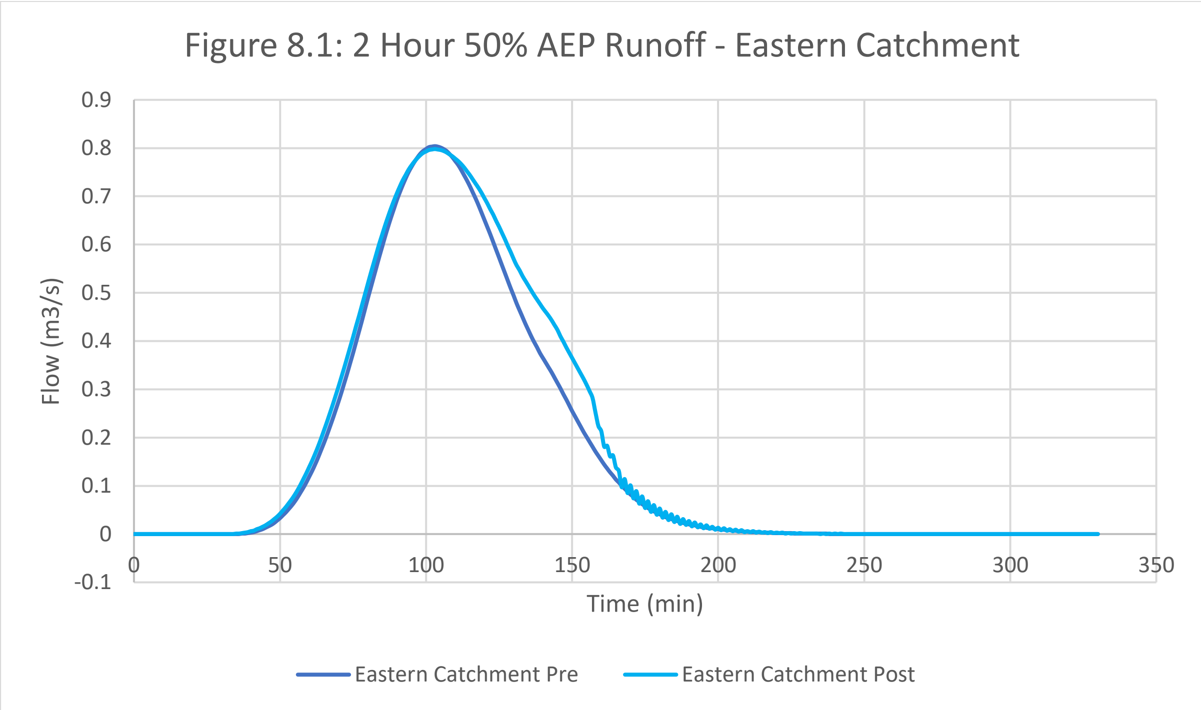
A failure of the proposed communal wastewater system could have a greater consequence in comparison to an individual treatment plant due to the volume of wastewater which is managed by the system. The probability of failure is likely to be lower as the system will be maintained to a far higher level than for an individual onsite system. The exact frequency of maintenance will depend on the nature of the system installed however as a minimum, it is recommended that monthly maintenance is undertaken with 3 monthly effluent quality sampling and continuous automated outflow recording.

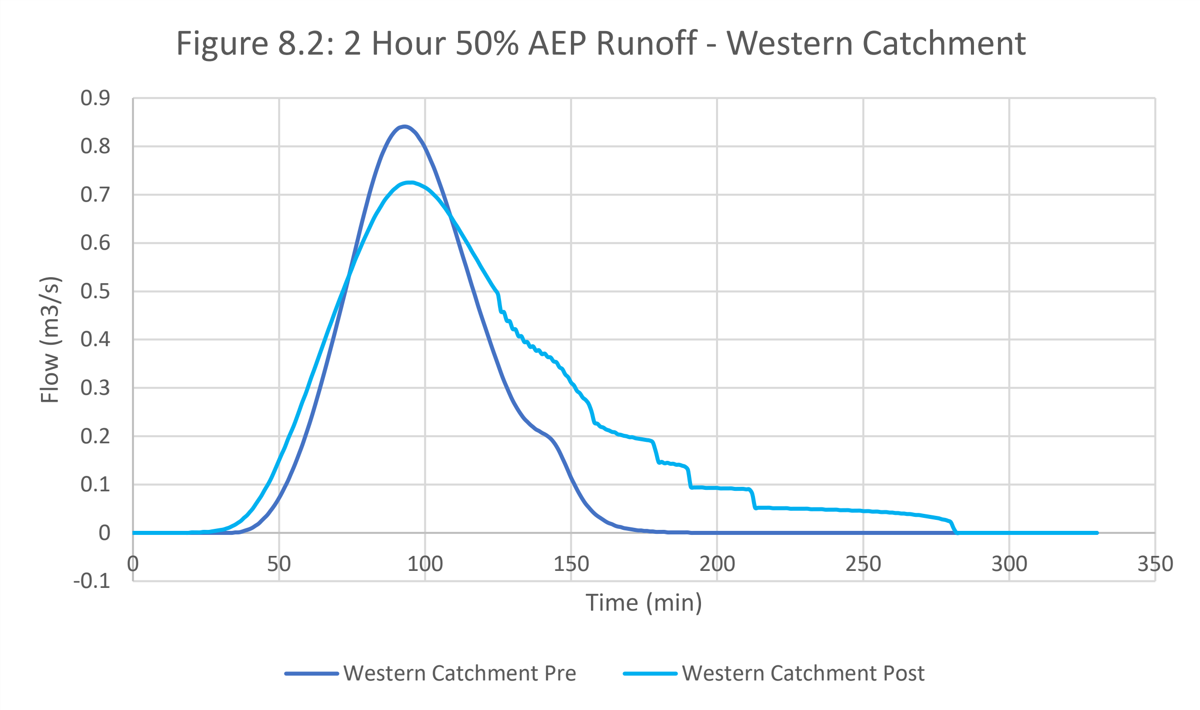
For the individual onsite wastewater systems, a minimum of annual inspections and maintenance should be undertaken by a licenced plumber who is experienced in the maintenance of onsite wastewater treatment plants. Maintenance requirements should be specified once the treatment plant is specified.

8.2 Stormwater

The proposed detention basins as outlined above will ensure that post development peak runoff does not exceed pre-development peak runoff during the design events. As such, the proposed development will not contribute to downstream flooding, as required by the TRMP.

Detention has been designed for 10% and 1% AEP rainfall events in accordance with the NTLDM. Whilst detention is effective in mitigating peak flows, an increase in site runoff will occur after the storm peak has passed. A comparison of pre and detained post development at the site boundary for the 50% 2 hour event is presented in Figures 8.1 and 8.2 below.





As can be observed by comparing Figures 8.1 and 8.2, peak runoff for the post development detained scenario is reduced below pre development peak runoff. After the runoff peak has passed, post development runoff is elevated above pre development runoff for 2-3 hours. This may cause water levels in downstream channels to be slightly elevated once the storm peak has passed. Based on approximate channel dimensions from LiDAR, the total increase in channel flow depth from the site after the storm peak has passed is less than 20mm assuming channels are approximately half full. Peak flows during this event are considerably less than channel capacity. This effect is considered insignificant in context of the events which are likely to cause scour of channels.

Extended detention of approximately 440m^3 in the eastern catchment and 1,040m^3 in the western catchment is necessary to comply with NTLDM requirements. It is possible to provide additional storage in detention basins which is released over 24 hours to meet this requirement. The presence of standing water could increase the temperature of water discharged to downstream waterways. From consultation with the project Ecologist, this is considered detrimental to the wetland in comparison with a minor increase in non-peak runoff. Peak flows are satisfactorily attenuated, including during low intensity events. For these reasons, detention is considered to adequately mitigate the effect of development without the inclusion of extended detention will be provided.

The catchment model does not allow for any infiltration through the pond floor. From consultation with the project Hydrologist, some infiltration will occur, and this will have an effect on runoff rates during low intensity rainfall events. Soak pits are also proposed in the western catchment. This will increase annual average groundwater recharge, providing a benefit to downstream wetlands.

Based on preliminary design work, the operation of detention basins W5 and W6 has the potential to inundate identified wetlands. The extent and duration of inundation varies depending on the event. From consultation with the project Ecologist, Envirolink understand that inundation for less than 12 hours is unlikely to have any significant effect on the wetlands. Longer duration of inundation may be detrimental to plant health. Of the analysed events, the longest ponding duration occurs in basin W5 where the wetland is partially inundated for approximately 11.5 hours during a 24 hour 1% AEP (Annual Exceedance Probability) rainfall event. The wetland upstream of basin W6 is inundated for approximately 6 hours during the same event. During the 10% probability event, inundation in basin W5 occurs for approximately 6 hours. During shorter duration events the duration of ponding is considerably less. It is recognised that stormwater modelling makes a range of assumptions and the rainfall profile during the 24 hour event will vary from that modelled which may increase (or reduce) the duration of ponding. Longer events have not been analysed. From the analysis that has been undertaken, the probability that the wetlands in basin W5 will be inundated to a sufficient extent to affect plantings is considered very low.

Other potential effects associated with a point source stormwater discharge include the possible introduction of contaminants in runoff. The proposed use of the development is for a domestic dwelling. No activities are proposed which could present an elevated risk of stormwater contamination such as maintenance of vehicles or equipment. Any exposed ground created as a result of construction will be reinstated, either with vegetation or developed surfaces such as asphalt. Treatment of stormwater will be implemented as described in Section 6.4. As such, the discharge of contaminants or sediment should not change following development.

During the construction phase, sediment runoff could occur. This will be exacerbated by the slope angles on site. A site specific dust, erosion and sediment control plan will be required to manage these effects.

As discussed previously, the overall flowrate in gullies will increase upstream of detention basins and in un-detained gullies. Dense planting of gullies is recommended, particularly where scour is already evident. The NZBC recommends a maximum velocity of 1.3-1.5m/s for clay surfaces. The landscape assessment graphics include a revegetation plan and planting list. This includes dense planting of gullies, meeting these recommendations. With this mitigation, the consequence of scour within gullies is considered less than minor. Mechanical scour protection such as rock or geotextile fabric will be required in areas where this velocity is exceeded. Ongoing inspection and maintenance of all scour protection will be required.

The site has been considered in context of the National Policy Statement for Natural Hazards 2025. The hazard, ie flooding, does not exist for proposed development areas in a 2130 1% AEP event, it may exist in an event beyond the required design basis however, at most, the probability is “unlikely” (1-0.2%). These events have not been modelled however based on site topography, the probability of water entering buildings is low and the consequence is assessed to be minor to negligible. On this basis, the natural hazard risk associated with flooding is low.

9.0 Conclusions

A site evaluation for the purposes of onsite wastewater and stormwater disposal has been undertaken for a proposed subdivision located at Stagecoach Road, Tasman.

The site is assessed as Category 6 – Medium Clay for the purposes of onsite wastewater disposal. Peak effluent production is expected to be in the order of 1,160L/day for each of the proposed rural lifestyle lots. Secondary treatment of effluent is recommended followed by disposal using pressure compensating dripline. A maximum disposal rate of 2mm/day is recommended, reduced by the slope reduction factors as specified in AS/NZ 1547:2012. Adequate land area is available for both the required primary disposal area and a reserve area equal to at least 50% of the primary area.

101 residential and rural lifestyle lots unsuitable for onsite effluent disposal will discharge effluent to a communal treatment and disposal system. It is recommended to design this system to manage a peak flow of 91.7m^3/day. A higher peak design flow rate will allow a greater tolerance for wet weather infiltration. This should be treated with a secondary treatment plant. A treatment plant must be selected which has a proven track record of successful use on a development of this scale. Land application will depend on the final earthworks design for the proposed disposal area. From a preliminary assessment, the available area is adequate for discharge using pressure compensating drip line with a 50% reserve area.

Pre and post development stormwater runoff rates have been assessed for the two stormwater catchments identified on site. The assessment has been completed based on the proposed extent of development and indicative detention basins in each catchment. From this work, it is possible to offset the additional post development runoff with detention basins as outlined in Staig and Smith plans.

A water supply for the development will be implemented including a 300m^3 tank, with approximately 50m^3 dedicated to firefighting. Residential lots will have a restrictor to limit supply to 1m^3 per day. Each dwelling will have a 3,000L tank and pressure pump.

Based on adopting the recommendations in this assessment report, the effects arising from wastewater, stormwater and water servicing of the development are considered less than minor.

10.0 Limitations

This report has been prepared solely for the benefit of our client, Tahimana Limited, as per our brief and consultancy agreement. This report has relied on the investigations detailed above and further site investigation may identify conditions different to that assumed. The reliance by any other parties on the information or opinions contained in this report shall, without our prior agreement in writing, be at such parties' sole risk. Structural and geotechnical engineering design or assessment is excluded from this work. Envirolink have not undertaken any service location, and this is recommended prior to detailed design.

Appendix A: Bore Hole Logs

ID:	BH1	**Type:**	Test pit then Bore hole	
Depth	Colour	Texture	Structure	Comments
0-200mm	Medium Brown.	Fine Sandy Clay.	Moderate.	Frequent gravel inclusion.
200mm	Grey.	Fine Sandy Clay.	Moderate.	Very dry. Grey appears due to smearing of topsoil interface rather than water logging.
200-500mm	Transition Grey to Yellow.	Sandy Clay. Category 5.	Moderate towards massive structure. Takes more force to form peds than previous layer.	Dry. Soil Test at **300mm** and test to form ribbon as per AS/NZS1547:2012. Forms 70-80mm ribbon. End test pit at 500mm
500-1100mm	Yellow clay	Fine silty clay		
1100..				End of Hole

ID:	BH2	**Type:**	Test Pit then Bore hole	
Depth	Colour	Texture	Structure	Comments
0-200mm	Light Brown	Coarse sandy Clay.	Moderate.	Frequent hard textured soil. Soil Mixing evident.
200-400mm	Orange Yellow	Fine Clay.	Moderate.	Soil Testing at **400mm** and test to form ribbon as per AS/NZS1547:2012. 60-70mm ribbon. Dries rapidly when exposed to water. End test pit at 500mm.
400-660mm	Orange Yellow	Bands of heavier Clay. Category 6.	Moderate.	Damp soil.
660-1000mm	Grey mottling	Heavy Clay	Moderate.	Grey mottling from 660mm and beyond. Damp but not wet.
1000mm				End of Hole.

ID:	BH3	**Type:**	Bore hole	
Depth	Colour	Texture	Structure	Comments
0-200mm	Orange, Brown.	Topsoil. Heavy Clay.	Moderate.	Appears to have topsoil mixed with underlying layers.
200-400mm	Yellow Orange.	Damp Clay.	Moderate verging towards massive, noted to be heavier clay than previous holes.	Category 6 clay. Slightly damp.
400-1000mm	Light Orange.	Damp Clay.	Moderate.	Overall medium clay, category 6.
1000mm				End of hole

ID:	BH4	**Type:**	Bore hole	
Depth	Colour	Texture	Structure	Comments
0-150mm	Medium Brown.	Topsoil. Clay.	Moderate	
150-250mm	Grey, Brown.	Clay.	Moderate	Category 6 clay.
250-500mm	Orange with white layers.	Medium to Heavy Clay	Moderate	
500-900mm	Grey Mottling	Minor Plastic clay	Massive, takes force to break up	

ID:	BH5	**Type:**	Bore hole	
Depth	Colour	Texture	Structure	Comments
0-600	Brown mixed with orange yellow	Clay	Takes force to form peds	
600-900mm	Yellow orange	Clay.	Moderate.	Category 5 clay
900mm				Refusal on vegetation/debris

ID:	BH6	**Type:**	Bore hole	
Depth	Colour	Texture	Structure	Comments
0-300mm	Yellow	Clay	Moderate	Vegetation and debris. No topsoil.
300-800mm	Yellow	Fine sandy clay	Moderate	
800mm				End of hole

Appendix B: Stormwater Modelling Parameters

Appendix C: NZFS Correspondence

Appendix D: TDC Confirmation of Water Allocation

Appendix E: Waka Kotahi Acceptance of Licence to Occupy for Effluent Irrigation

Appendix F: Land Vision Review of Nitrogen Loading

Appendix G: Wastewater Management Structure

Appendix H: Draft Stormwater Operation and Maintenance Manual

Appendix I: Draft Innoflow Wastewater Design Information

Appendix J: MMC Water Supply Memorandum