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24/07/2025

1618 ARARIMU ROAD,

PAPAKURA

EARTHWORKS REPORT

Development of 1618 Ararimu Road, Papakura | Earthworks Report

Dear Alistair,

Thank you for the opportunity for Civix Limited to provide an Earthworks Report for the Development of. The report and drawings contained in this document show infrastructure details for the Development of 1618 Ararimu Road, Papakura. The report and drawings contained in this document describe the works required to undertake the proposed earthworks for the site. These documents and drawings have been provided in support of a Resource Consent lodgement.

Please do not hesitate to contact us if you have any questions on this report.

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Document Control Record

Document Issue No	Author	Reviewed by	Date
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1 Existing Site Description

The site is located on the southern side of Ararimu Road within a predominantly rural setting, exposed with various open grass and vegetated areas with a small number of dwellings scattered around. The site has a roughly rectangular shape covering an area of 19,223.5m². Key features of the site include several trees, open grassy areas and vegetation, as well as overhead power lines running through its eastern section. The site is located nearby the residence at 1628A Ararimu Road, Papakura. The site includes several wetlands and has several overland flowpaths and associated floodplains within the site based on the Council GIS viewer.

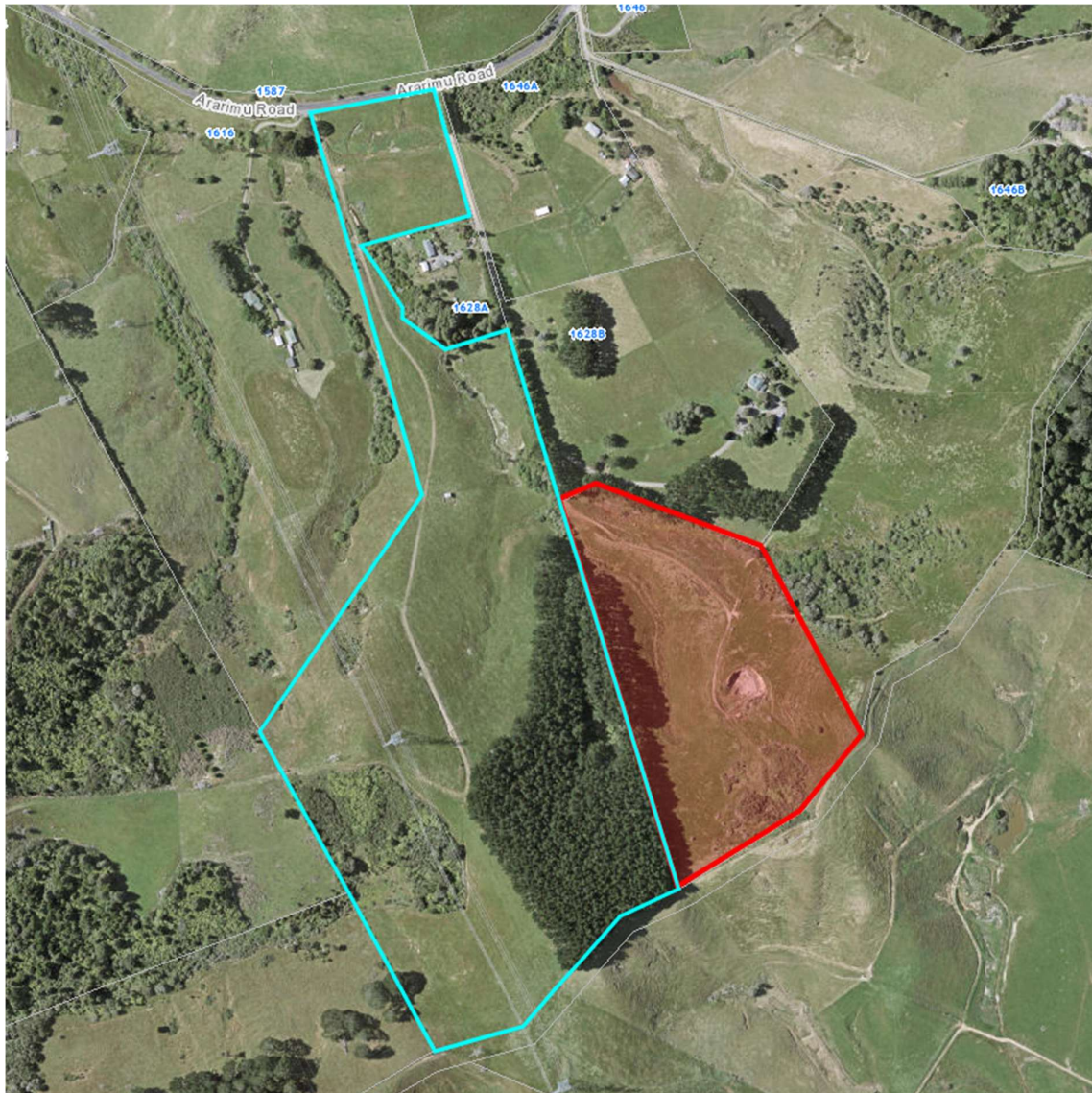


Figure 1 : Proposed development extent

1.1 Existing Topography

The site falls at a steep grade towards Ararimu Road, with an elevation change of approximately 78 meters across its length. The terrain slopes in a northeasterly direction toward a depression near the site's northeastern boundary. The southern portion has a steep average gradient of 13%, reaching its lowest elevation of around 140 meters. In contrast, the northern section features a gentler 2% gradient, with its lowest point at approximately 130 meters.

1.2 Site Contamination

A Detailed Site Investigation (DSI) and Remedial Action Plan (RAP) needs to be undertaken on the site to determine if the site contains any contaminated materials above the allowable threshold listed in the Auckland Unitary Plan (AUP). The additional investigation will provide insight on the contaminated areas for any soils or structures on site.

A brief outline of the sequencing of contamination removal has been listed below which is intended to take place prior to the main earthworks contractor's establishment. Depending on the results of the further investigation, some contamination removal may need to take place post main earthworks contractor establishing. If any environmental controls are necessary to undertake the contamination removal and clearing, silt fences may be installed at the low point of the site.

Clearing and contamination removal methodology

- Any building structures, fences and any other structures located within the proposed site will be removed by the suitably qualified demolition contractor.
- Areas identified in the RAP to clearly marked out and isolated as part of the clearing process to avoid contamination across the site. Once the RAP has been undertaken/received this is to be shared with Auckland Council for their reference records.
- If any additional contaminants are found across the site not previously listed in the RAP or DSI, we will notify Auckland Council immediately with the relevant information and proposal.
- Existing topsoil may be kept on-site or removed to managed fill. Written records will be kept of all topsoil leaving the site and Auckland Council will be notified if otherwise.
- Once confirmation has been received from a contamination expert on contaminated soils (excluding topsoil) have been removed, establishment of sediment controls will commence followed by bulk earthworks. The sediment control mechanisms deemed necessary for disturbed earth are mentioned in the report below.

1.3 Neighbouring Development

A portion of the neighbouring site has been leased and will be used for proposed scope of the development. The approximate leased area is shown as the red polygon in Figure 1 above.

The legal description of the site is Lot 2 DP 77813 and is within Rural - Rural Production Zone.

The leased additional area has a legal description of Lot 1 DP 166299, Lot 8 DP 3697811 and is also within Rural - Rural Production Zone.

2 Proposed Development

The proposed development involves using a portion of the site's central area for managed fill purposes. A gravel accessway will connect the managed fill area to Ararimu Road from the north. Additionally, two stormwater boxed culverts will be installed in the northern section of the site to allow for surface water flow. The culverts construction methodology has been provided in a separated document.

3 Earthworks

3.1 Cut Fill

Earthworks are proposed over the site, including both cut and fill for the managed fill area and access to the site. The Cut Fill Plan(s) on drawing series 30000 show the extent of the proposed earthworks for the development. Earthworks volumes are also shown in Table 2 below for clarity:

Table 1 Earthworks Volumes

EW ID	UNITS	EW001	EW002	TOTAL
AREA	m²	98,951	3,635	102,587
AREA OF FILL	m ²	95,734	1,245	96,979
AREA OF CUT	m ²	3,215	2,389	5,604
CUT	m ³	731	1,246	1,976
BULK TOTAL CUT	m³	731	1,246	1,976
MAX CUT DEPTH	m	1.5	2.5	2.5
BULK FILL	m ³	1,341,824	394	1,342,218
FILL +15% BF.	m ³	1,543,097	453	1,543,551
BULK TOTAL FILL	m³	1,341,824	394	1,342,218
FILL IMPORT	m ³	0	1,541,574	1,541,574
CUT TO FILL	m ³	1,976	1	1,976
CUT TO WASTE	m ³	0	0	0
BULK TOTAL VOLUME	m³	1,342,555	1,640	1,344,194
MAX FILL HEIGHT	m	45.1	1.4	45.1
BULK IMPORT	Trucks	0	256,929	256,929
BULK TO WASTE	Trucks	0	0	0
BULK TOTAL	Trucks	0	256,929	256,929
TOPSOIL STRIP TO WASTE	m ³	0	0	0
TOPSOIL STR. TO STOCKPILE	m ³	0	0	0
TOPSOIL TOTAL STRIP	m ³	0	0	0
TOPSOIL PL. FR. STOCKPILE	m ³	0	0	0
TOPSOIL PL. FR. IMPORT	m ³	21,911	186	22,097
TOPSOIL TOTAL PLACE	m ³	21,911	186	22,097
TOPSOIL TOTAL VOLUME	m³	21,911	186	22,097
TOPSOIL IMPORT TRUCKS	Trucks	0	0	0
TOPSOIL TO WASTE TRUCKS	Trucks	0	0	0
TOPSOIL TOTAL TRUCKS	Trucks	0	0	0
EARTHWORKS TOT. VOL.	m³	1,364,466	1,825	1,366,291
EARTHWORKS TOTAL TRUCKS	Trucks	0	256,929	256,929

Existing Surf. assumes topsoil depth of 0.0m
Proposed Surf. is to Building, Pavement and Grass Subgrade
Proposed topsoil depth of 0.225m

Based on the draft Geotech report undertaken by Baseline Geotechnical, the following are the findings:

- Topsoil was encountered in all hand auger boreholes to depths between 0.2-0.3 m bgl.
- Groundwater is encountered within the site. Detailed groundwater levels differ depending on the location. Please refer to the draft Geotech report prepared by Baseline Geotechnical.
- Clean fill to be constructed with a maximum slope of 1V:3H
- Foundation stripping to be undertaken to undercut and remove soft alluvium from within gully floor and exposed firm materials.
- Prior to placing fill within the central gully, additional targeted investigation is undertaken to verify the materials assumed.
- Sub-soil drainage is provided along gully axis, including picking up of any identified groundwater seepages.
- Excess porewater pressure generated during fill placement is managed and monitored.

In terms of ecological requirements, structures will be at a minimum of 10m distance to the wetland bank sides.

Detailed ecological reports will be provided at future consent stages.

3.2 Erosion and Sediment Control

In accordance with industry best practice, implementation of erosion and sediment controls will be undertaken during the construction works for the development. Erosion and sediment controls will be carried out in accordance with the Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region, June 2016 Guideline Document 2016/005 (GD05).

Works undertaken in accordance with this guideline will act to minimise and/or mitigate any adverse environmental effects of sediment discharge during the works through appropriate use and design of erosion and sediment control

techniques and measures. The measures proposed will mitigate the effect of earthworks on downstream properties and the environment.

Drawing series 34000 shows the proposed erosion and sediment controls for the site and drawing series 35000 shows the details of these controls. Drawing series 36000 shows the plan view of the proposed sediment retention ponds with their respective numeric information. The erosion and sediment controls for the site include a stabilised entrance with materials laydown and turn around area, silt fences/super silt fences, clean and dirty water diversion bunds, two sediment control ponds and two decanting earth bunds. Cut off drains will be installed throughout the earthworks period as required. Drop out pits will also be provided on steeper sections of the cut off drains or diversion channels to help reduce sediment runoff accumulation at the downstream sediment ponds. The measures proposed will help mitigate the effect of earthworks on downstream properties and the environment. The sediment and erosion control and earthworks cut-fill operations methodology has been written out below.

If disturbed areas require rapid stabilisation, this will generally be achieved via layering of GAP65 or similar material on proposed roading areas and straw mulching on all other areas.

All erosion and sediment control measures will be established prior to construction beginning and will be monitored throughout the various earthwork's phases (stage one to stage six). The removal of any measures will not occur until all surfaces have been sufficiently stabilized to the satisfaction of Council's monitoring officer.

A prestart meeting will be held with the Compliance Monitoring Officer, the contractor, client and consultant to confirm the methodology and that all works will be carried out in accordance with the consent conditions and Engineering Standards. A post construction meeting will be held with a Council field officer, the contractor, and consultant to confirm that all works were carried out in accordance with the consent conditions and standards, and to provide certification and as-builts.

General Summary of Proposed Controls

Clean / Dirty Water Bunds

A clean water bund is proposed to direct any surface water flow away from the development site. The concentration of the surface water is not expected around the development site; therefore, collection and disposal are not proposed.

A dirty water bund is proposed to collect any surface water runoff from the earthwork area. Surface water is collected via two sediment ponds.

Stabilised Construction Entrance

A stabilised construction access will be installed as the primary access to the site from Ararimu Road. The stabilised entrance will be maintained during the construction works.

Silt Fences

Silt fences will be installed around the sediment ponds areas to control sediment discharges.

Sediment Retention Ponds

Two sediment retention ponds are proposed to treat sediment laden runoff and reduce the volume of sediment leaving the subject site. They are to be constructed prior the start of stage 1 and are intended to remain in the lowest part of the fill operations right throughout all of the stages. As completed/ filled areas are progressively stabilised, they will be diverted away from the sediment ponds as clean water catchments, allowing the next uphill fill catchment to be directed into the sediment ponds.

The sediment ponds sizing is based on the catchment areas of stage 6, the largest catchment area among all stages. It means the ponds are to be used for all stages.

SEDIMENT POND SIZING CALCULATIONS

POND ID	UNITS	SP01	SP02
CATCHMENT AREA	m ²	31,900	21,900
CATCHMENT LENGTH	m	250	300
CATCHMENT SLOPE	%	17.0%	12.0%
VOLUME TO AREA RATIO		3.0%	3.0%
TOTAL STORAGE VOLUME	m ³	957	657
TOTAL STORAGE DEPTH	m	1.50	1.50
DEAD STORAGE VOLUME RATIO	%	30%	30%
DEAD STORAGE DEPTH	m	0.45	0.45
EMERGENCY SPILLWAY DEPTH	m	1.80	1.80
MAXIMUM POND DEPTH	m	2.10	2.10
LEVEL SPREADER LEVEL	m	2.00	2.00
LENGTH TO WIDTH RATIO		3.0	3.0
MAIN POND BASE LENGTH	m	42.6	35.1
MAIN POND BASE WIDTH	m	10.7	8.2
TOP LENGTH	m	50.1	42.6
TOP WIDTH	m	16.7	14.2
MAIN POND LENGTH AT MAXIMUM LEVEL	m	52.18	44.67
MAIN POND WIDTH AT MAXIMUM LEVEL	m	19.09	16.59
NO. OF DECANTS		3	2
ROWS OF 10mm HOLES IN EACH DECANT		5	5

Erosion and sediment control works are proposed to be undertaken as follows for each of the stages:

Stage 1

- All erosion and sediment control measures will be installed prior to commencement of earthworks. Removal of these measures will not be undertaken until the catchment is serves is suitably stabilised. Fill slopes are to be battered for each stage at a maximum slope of 1 in 3 before commencing onto the next earthworks stage. There are currently six stages anticipated for the filling operation works for the site. Erosion and sediment control devices are to be installed starting from stages one through to stage six.
- A Chemical Treatment Management Plan will be prepared by the contractor on site which will advise the required levels of chemical management required for the respective catchments discharging to the sediment control devices. This Plan will be updated as necessary throughout the filing operation and issued to Council accordingly when any updates are proposed.
- A stabilised entrance will be established from the North at Ararimu Road to provide access to the site. The stabilised entrance will be formed of washed stone aggregate between 50mm – 150mm in thickness, and at least 10m in length and 4m in width.
- A stabilised gravel accessway will then be upgraded and formed from the stabilised entrance to the site up to the base of the fill site. This will remain in place right through to the end of the filling operation and will be continually maintained as required to ensure it remains in a clean stabilised form.
- Stockpiling areas and maintenance areas will be established for the site as agreed with the compliance monitoring officer at the prestart meeting.
- Only necessary vegetation will be cleared.
- Topsoil will be stripped and stockpiled on site and reused for planting and stabilisation of batters.
- The filling operation is proposed to be split across the two gullies on site and works will alternate between the two filling areas (A and B), with the current intention that the furthestmost area, stage 1A, will be established and filled first and then once complete and stabilisation measures established the second fill area, stage 1B, will have controls established and filling will commence in that area.
- The access for stages 1A and 1B is proposed to utilise the existing access formed for the removal of the pine trees on site and shown on the drawing series 34000 (stage 1).
- Super Silt fencing will be constructed as a precautionary measure to ensure any sediment unaccounted for does not contaminate surface water in the nearby existing wetlands/ watercourses. The super silt fencing will remain until works are completed and all surfaces appropriately stabilized and approval from Council is granted to remove the controls.
- Clean-water diversion bunds will be established upstream of the earthwork areas on the property to prevent water from flowing overland into filling areas. These bunds will divert any overland flow (non-contaminated runoff) into the existing gullies at surrounding areas.
- Dirty water bunds will be established along the low side of all filling areas proposed and will remain in-place until the works are completed, and the surfaces have been appropriately stabilized. The indicative position of

the bunds are shown on drawing series 34000.

- Dropout pits are planned at locations where bunds are proposed on long, steep slopes to assist with minimising sediment that is carried down to the sediment ponds.
- Two Sediment Retention Ponds for controlling the sediment run-off during construction will be established downstream of the earthworks areas as indicated on the Erosion and Sediment Control Plans. These two sediment ponds are proposed to be constructed based on the ultimate largest catchment size that will runoff into them, to avoid the need for the sediment ponds to require re-sizing at each stage.
- An adaptive management plan (AMP) has been developed in conjunction with this report which outlines the ongoing procedures proposed to be implemented to ensure the monitoring of water being discharged from the sediment control devices meet the required standards and continual reporting is provided to the Council Monitoring Officer throughout the works to confirm compliance with the requirements. If any device is identified as not meeting the required standards, then alternative measures will be put in place as outlined in the AMP.
- Both sediment retention ponds will discharge into the existing OLFPs downstream to the managed fill areas.
- Underfill drains will be installed at the base of the gullies during earthworks if required by the geotechnical engineer.
- Following the completion of the earth worked area/stage, topsoil will be re-spread as soon as possible over the fill batter and will have matting covered over the batter followed by immediate planting to stabilise that catchment. Until satisfactory stabilisation has been achieved, the batter will still direct to the sediment retention ponds as dirty water runoff, and once stabilised, the clean runoff from the batter will be re-directed out to the edge into the clean water diversion bunds, away from the sediment ponds.

Stages 2 - 6

- The further progression of the filling within stages 2-6 will all follow the following similar methodologies, which are a continuation of the controls implemented in Stage 1.
- The two Sediment Retention Ponds will remain in place throughout all stages and be maintained in an ongoing basis, with major maintenance works like forebay de-silting/ clean outs and as required within the main pond as required.
- As the stages progress the location of the access to the earthworks areas is to be adjusted around each stage area. In general, it is the consent holder's intent to be tipping the fill material imported to site at the head of each fill area in a single stabilised tipping area to minimise the deposition of dirty material onto the stabilised access tracks. The indicative location for the accessway after stage 1 is shown on the stages 2-6 plans.
- Once the previous stage is appropriately stabilized a clean water bund will be placed downstream to capture the water drained from its slopes and lead it to the nearest watercourse. This clean water bund will be in place and upgraded as the stages progress.
- Dirty water bunds will then be established at the top of the stabilised fill batters for each stage where the dirty runoff will be directed out to the edge of the fill and channel down extensions to the dirty water bunds that lead down to the sediment ponds. This same process will continue for each following stage until the end where it will meet the clean water diversion at the head of the gullies.
- Dropout pits will continue to be implemented as required as extra measures and large rocks/ concrete pieces are also intended to be placed down steep sections of the dirty water channels to assist within minimising erosion in the channels leading down to the sediment ponds.
- Super Silt fencing will continue to be maintained at the downstream locations throughout the progression of fill stages.
- Underfill drains will also be extended up the base of the gullies as required by the geotechnical engineer.
- Following the completion of the earth worked area/ stage, topsoil will be re-spread as soon as possible over the fill batter and will be seeded, planted and mulched as necessary to stabilise that catchment. Until satisfactory stabilisation has been achieved, the batter will still direct to the sediment retention ponds as dirty water runoff,

and once stabilised, the clean runoff from the batter will be re-directed out to the edge into the clean water diversion bunds, away from the sediment ponds.

- At the completion of the entire filling operation, i.e. end of Stage 6 A and B, and once the full catchments are fully stabilised to the satisfaction of Council, the sediment control devices will be removed/ filled in and those areas stabilised to close out the entire operation.

4 Conclusions

- Environmental effects from erosion and sediment during construction can be mitigated by ensuring all erosion and sediment control devices are functional and stabilization occurs throughout the various stages.
- Erosion and sediment controls will be placed to ensure no negative effects occur from soil runoff.
- Gravel accessway for vehicle access from Ararimu Road will be provided in line with GD05.

5 Limitations

- This assessment contains the professional opinion of Civix Limited Staff relating to this development. Civix Limited Staff used their professional judgement and acted in accordance with the standards of care and skill normally exercised by professional engineers providing similar services in similar circumstances. No other express or implied warranty is made as to the professional advice contained in this report.
- We have prepared this report in accordance with the brief provided and following our terms of engagement. The information contained in this report has been prepared by Civix Limited for the client and is exclusively for its client use and reliance. It is not possible to make an assessment of this report without understanding the terms of engagement under which it has been prepared, including the scope of the instructions and directions given to and the assumptions made by Civix Limited. The assessment will not address issues which would need to be considered for another party if that parties' particular circumstances, requirements and experience were known and, further, may make assumptions about matters of which a third party is not aware. No responsibility or liability to any third party is accepted for any loss or damage arising out of the use of or reliance on this assessment by any third party.
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