Watercare Services Limited

Huia Replacement Water Treatment Plant

Consenting Phase Site Layout Development Report

May 2019

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1. Introduction

1.1 Background

The existing Huia Water Treatment Plant (WTP) was constructed in 1929 and upgraded in the 1940s and again in the mid-2000s and is now nearing the end of its operational life. In 2008 Watercare Services Limited (Watercare) identified that the existing Huia WTP needed to be replaced.

Alternative locations to construct a replacement WTP were considered and evaluated through a comprehensive site alternatives assessment. In May 2017 the Watercare Board adopted the Manuka Road option as the preferred site for the development of the replacement WTP. This option is located in close proximity to the existing Huia WTP, on the corner of Manuka Road and Woodlands Park Road on land owned by Watercare and designated for Water Supply Purposes. A new reservoir is proposed to be located on designated land also owned by Watercare directly across from the existing Huia WTP on the northern side of Woodlands Park Road, with future reservoir(s) located on the to-be-demolished Huia WTP site.

The Watercare Board's resolution included the direction to avoid wherever possible significant trees and significant ecological effects. In light of this direction, and taking into account the sensitivity of the receiving environment and the policy framework of the Auckland Unitary Plan - Operative in Part (AUP), a detailed consideration of on-site alternatives has been undertaken to determine the most appropriate footprint for the proposed replacement WTP and reservoirs.

1.2 Overview of methodology

A team of Project specialists has been appointed by Watercare to assess onsite alternatives and to subsequently prepare the resource consent application and Outline Plan of Works to authorise the construction and operation of the proposed infrastructure. The team of specialists includes:

- GHD – Water treatment process and civil engineering;
- Tonkin & Taylor Ltd – Planners;
- Boffa Miskell – Landscape architects, terrestrial and freshwater ecologists;
- Alta – Construction contractors;
- Marshall Day Ltd – Noise and vibration specialists;
- Beca – Transport engineers and reservoir development; and
- Watercare Operations team.

The Project team specialists above undertook detailed site investigations to identify technical and environmental constraints, and to determine the most appropriate footprint for the proposed replacement WTP and reservoirs taking these constraints into account. The on-site alternatives assessment also needed to factor in the requirements of a water treatment plant, both in terms of the necessary components, their sizing and layout on site, as well as broader operational and health and safety requirements, and construction-related requirements.

GHD's input into this site layout development phase has been to modify the original site layouts to best reflect the new information established at this stage as part of the specialist assessments completed by others.

1.3 Purpose of this report

The purpose of this report is to document the iterative development of the WTP and reservoir site layouts at the preferred Manuka Road site undertaken as part of the onsite alternatives assessment. This is based on further design work which takes into account various opportunities and site constraints which were identified by the Project team specialists, including:

- Topography;
- Landscape and visual effects and associated mitigation;
- A detailed assessment and mapping of ecological values and ecological integrity across the site so that development could, as far as practicable, be directed away from the higher value areas and centred on the lower value areas within the site;
- Constructability requirements and constraints;
- Traffic and access considerations; and
- Additional Watercare operational requirements identified at this stage

1.4 Scope and limitations

This report: has been prepared by GHD for Watercare Services Limited and may only be used and relied on by Watercare Services Limited for the purpose agreed between GHD and the Watercare Services Limited.

GHD otherwise disclaims responsibility to any person other than Watercare Services Limited arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

GHD has prepared this report on the basis of information provided by Watercare Services Limited and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

2. Process basis of design and layout

The following section identifies key elements that relates to process design sizing, equipment unit sizing and the spatial relationships of the various water process units.

2.1 Watercare Basis of Design Framework

As part of the initial asset planning phase, Watercare determined that traditional treatment processes used in the existing plant should be replaced by advanced processes more appropriate for the treatment of water now received from the western dams. Watercare subsequently developed a conceptual gravity water treatment process and associated WTP layout. The basis behind the gravity water supply treatment process is set out in Watercare Huia WTP Replacement – Basis of Design Framework Rev 14, 2018 (BODF). The Huia WTP Master Plan (Hunter Water, March 2010) influenced the development of the BODF.

The starting point for the site layout is therefore the BODF that stipulates Watercare's requirements of the new infrastructure, and the pre-concept site layout developed by MWH. The water treatment process was determined on the basis of pilot trials of various water treatment processes undertaken during 2013 - 2015 to identify the most suitable treatment process to treat water from the western dams (Huia Pilot Plant Trial Stage 2 Draft Report Rev A, Hunter H_20, February 2016)('Pilot Report').

The original WTP and reservoir layout for the Manuka Road site option based on the BODF is shown in Figure 1below. Further drawings are presented in Appendix A. This layout was developed for the site alternatives short list assessment and reflects the BODF and MWH pre-concept site layout. It was developed prior to the current understanding of the site environmental constraints and the Watercare Board direction to "avoiding wherever possible significant trees and significant ecological effects", as such represents a technical and operational layout.

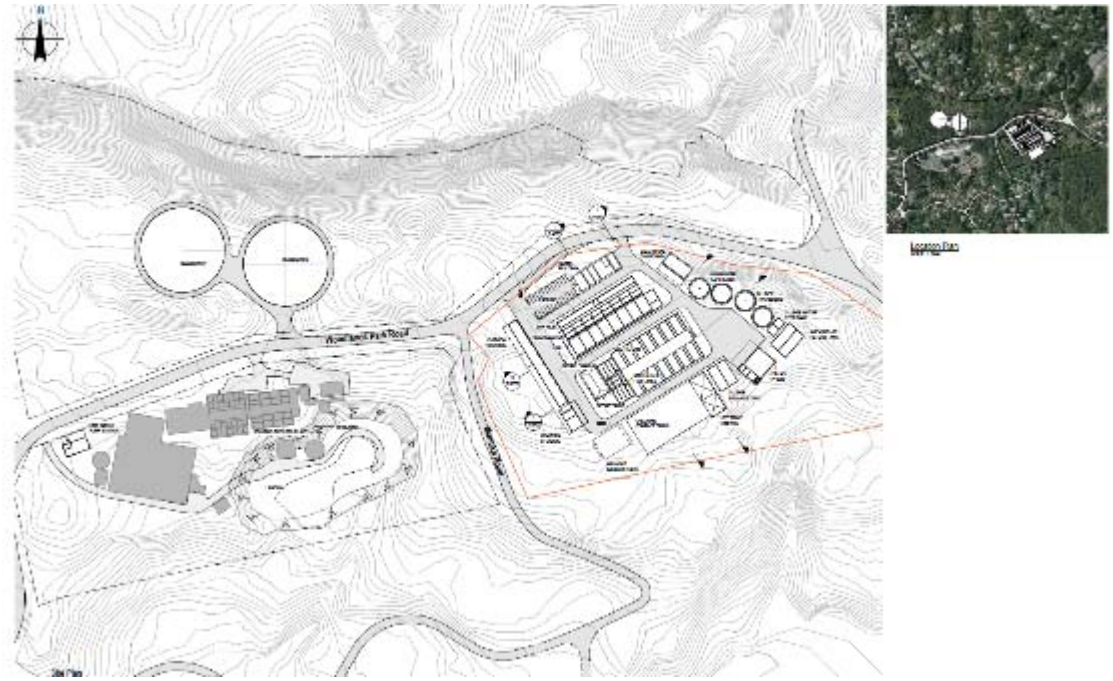


Figure 1 Manuka Road Overall Site Plan

2.2 Process design sizing and equipment unit sizing

The key process units for the replacement Huia WTP were nominally sized in the *WTP Site Selection Study Shortlist Site Development Report* (September 2016, GHD). The process design sizing and equipment unit sizing adopted generally complies with Watercare's BODF. Drawings of the main process units are presented in Appendix B. The summary of the key process units and associated sizing is outlined in Table 1 below.

Table 1 Key Process Design Criteria as set out in Watercare's BODF

Parameter	BODF Design Criteria	Comments	Key opportunities / constraints
PRIMARY FLOW			
Design Inflow	154 MLD (140 MLD raw water inflow/production)	Includes recycle flows	
Delay Tanks	Two trains x 100% each 2.5 minutes @ N-1 5 minutes @ N	BODF Pilot Report: 2 minutes	Integrated into Dissolved Air Floatation (DAF) structure. Sizing is a volumetric function of plant capacity and required retention time.
Flocculation	8 No. trains 2 stages 15 minutes total @ N	Pilot Report 7.5 min	Integrated into DAF structure. Sizing is a volumetric function of plant capacity and required retention time.
DAF	8 No. trains 10 m/h rate @ N 11.4 m/h @ N-1	Pilot Report ≤ 12 m/h	Mechanical items requiring access for operation and maintenance activities. Sizing is a volumetric function of plant capacity and required rise rate.
Ozone Contact	2 No 15 minutes HRT @ N	Pilot Report 15 minutes Long contact not required and increases risk of bromate formation (Pilot)	Integrated into Biologically Activate Carbon (BAC) Filter structure. Sizing is a volumetric function of plant capacity and required retention time.
BAC Filters	14 No. 6 m/h rate @ N-1 15 min EBCT @ N-1	Pilot Report < 9.5 m/h Pilot Report > 15 minutes	Mechanical items and filter media material requiring access for operation and maintenance activities i.e. filter media replacement. Sizing is a volumetric function of plant capacity and required bed contact time.
Chlorine Contact	2 No. tanks 30 minutes @ 0.6 baffle factor at 75% flow and N-1	BODF More conservative 0.6 factor (MWH) used in lieu of 0.7	20 minute contact time permissible following approval from WSLs Drinking Water Assessor (DWA). Tank elevation required for gravity flow into storage reservoirs. Sizing is a volumetric function of plant capacity and required contact time.

Parameter	BODF Design Criteria	Comments	Key opportunities / constraints
Treated Water Tanks	2 No. tanks 15 minutes @ 75% flow @ N-1	BODF	Tank elevation required for gravity flow into storage reservoirs.
RESIDUALS HANDLING			
De-aeration Tanks	2 No. tanks 4 hours per tank	BODF	Integrated into DAF structure
BAC Up wash Tanks	2 No. tanks 1.5 washes per tank 3 washes total	BODF Equivalent to 75% criteria	Located underneath BAC Filters
Washout Balance Tank	2 No. tanks 1.5 washes per tank 3 Washes total	BODF Equivalent to 75% criteria	Located to fully drain filters by gravity flow
Filter-to-Waste Tanks	2 No. tanks 1.5 wastes per tank	BODF Equivalent to 75% criteria	Located underneath BAC Filters
Washout Thickeners	2 No. 75% design flow @ N-1	BODF	Sizing is a volumetric function of flow rate.
Supernatant Return Tanks	2 No. tanks 2 hours per tank		Sizing is a volumetric function of storage capacity required.
Sludge Thickener Feed Tanks	2 No. tanks 4 hours per tank		Sizing is a volumetric function of storage capacity required.
Sludge Thickeners	2 No. 6000 kg/d 1.2 kg/m2.h @ 75% load @ N-1	MWH pre-concept site layout	Sizing is a volumetric function of flow rate.
Sludge Balance Tanks	2 No. tanks 100% Capacity @ N-1	Sized to suit operation during weekday working hours only	Sizing is a volumetric function of storage capacity required.
Sludge Dewatering Presses	2 No. minimum Minimum 30% w/w product	Sized to suit operation during working hours only	Requires vehicle access for sludge removal
On-site Attenuation Storage	-	2 hours @ 140 MLD = 12 ML	New raw water pipeline permits inlet control. On-site attenuation storage can be accommodated within existing lagoon.
NON-PROCESS BUILDINGS			
Admin Building and Car parking	Fifteen (15) permanent staff, ten (10) transient staff	BODF	Car parking proposed located underneath admin building. To be located at entrance of site for H&S purposes to provide control of visitors to site.
Chemical Storage and Dosing	Lime, Alum, Polyelectrolyte, Chlorine Gas, HFA, Carbon Dioxide Gas	BODF	Spatially unconstrained. Chemical deliveries required to be carried out within bunded areas. Rationalised for shared delivery bund.

Parameter	BODF Design Criteria	Comments	Key opportunities / constraints
Electrical	5 Mega Volt-Ampere (MVA) Load 100% generator back-up	BODF	Not spatially constrained

2.3 Spatial Relationship Considerations

As part of the onsite alternatives assessment, consideration was given to the spatial relationship between individual water treatment units, the size of process units and equipment and the required distance between the various components.

The onsite alternatives assessment was carried out within the context of Watercare's site principle of only pumping the main flows once (i.e. raw water pump station, then gravity flow through to the storage reservoirs). This principal eliminates on-site re-pumping, providing operational benefits by minimising mechanical equipment maintenance with the added benefit of not requiring additional space associated with relift pump stations.

Where practicable, the size of the proposed infrastructure or distance between the units was reduced and/or the WTP configuration was amended to minimise the overall WTP footprint and in particular to avoid the higher valued ecological areas within the site.

A summary of the key spatial relationships and considerations used to develop the preferred WTP layout and the changes made to refine the layout are set out below:

- Gravity flow (main process units) – flow between the major process units (DAF, BAC/Ozone, Chlorine Contact Tank (CCT)) is arranged in descending levels to provide gravity flow between the units. To assist this, distances between the units were minimised to, in turn minimise pipework lengths between the units and minimise the overall WTP footprint. Therefore the DAF, BAC/Ozone and CCT were laid out on the site first.
- Gravity flow (supplementary process units) – where possible, flow to supplementary process units (Washout Balance Tank, Washwater Thickeners, Sludge Thickeners, Sludge Balance Tank, Filter Press, Supernatant Tank) are arranged to provide gravity flow from main process units. This is not possible in all instances due to site constraints, but it is preferable to pump the comparatively smaller volumes of waste flows than main process flows. Given the general North/Northeast to South/Southwest fall on the site, these units tended to be best located towards the South of the site to enable this.
- Administration Building – Watercare Operations expressed a strong preference for the Administration Building to be located at the entry to site for security, and health and safety reasons. To reduce footprint, the administration building changed from a ground floor standalone building to being constructed on top of onsite car parks.
- Chemical facility – the chemical facility requires tanker delivery of chemicals for water treatment purposes. Tanker deliveries require a dedicated spill area during chemical delivery to provide containment of minor and major spills during the chemical delivery process. For space efficiency, the chemical storage and delivery bay are integrated into a combined chemical facility.
- Chlorine facility – not spatially constrained, but the preference is to locate the facility away from site boundaries adjacent to residential properties. B-train vehicle access is required for chemical deliveries.

- Chlorine contact tanks – the last treatment process before water leaves the site, must be located at a lower elevation than the BAC Filters. Chlorine contact time reduced from 30 min to 20 min reducing the size of the chlorine contact tanks minimising the extent of the WTP footprint within higher value areas.
- Electrical compound – no particular spatial constraints. Preferable to locate centrally if possible.
- Raw water pump station – no particular spatial constraints. Preferable to locate near DAF.
- Access – all of the various process units require vehicle access to at least one side to enable operations or maintenance activities. Where vehicle access cannot be provided then pedestrian access should be provided at a minimum i.e. to erect scaffolding etc.
  The filter press requires trucks to back into the facility to remove bins or similar. The chemical facility requires B-train or similar access for chemical deliveries. Watercare have a strong preference that the main process units (DAF, Ozone, BAC, Chlorine Contact) have full vehicle access around the structures i.e. to permit crane access for when mechanical equipment needs replacing.
  Personnel parking is also required for site operational and maintenance staff, and contractors.

3. Site layout development

The original WTP and reservoir layout developed based on Watercare's BODF (illustrated in Figure 1 above) provided the starting point for the iterative development of the site layout. As noted above, following detailed site investigations and assessments prepared by the wider team project specialists, the original WTP and reservoir layout has been through an iterative design process. The objective of this process has been to determine the minimum footprint necessary to meet the technical and operational requirements of a WTP whilst seeking to avoid as far as practicable, and otherwise minimise, adverse effects on the environment.

3.1 Additional Constraints and Requirements

The following sections summarise the key environmental and engineering constraints and requirements considered as part of the on-site alternatives assessment to develop the preferred WTP and reservoir layout.

3.1.1 Significant Ecological Area (SEA)

The proposed Manuka Road site is almost completely covered in native vegetation most of which is identified as a Significant Ecological Area (SEA) overlay under the AUP.

The Project Team Planners advised that it is critical the WTP footprint is minimised as far as practicable to reduce vegetation removal requirements. Key aspects of design incorporated into the layouts to minimise the proposed WTP and reservoir footprints include:

- No vacant areas for future upgrades in capacity.
- Elimination of batter slopes or other retaining structures with a large footprint.
- Roads are the minimum size required to accommodate a design vehicle type.
- No provision for additional ancillary facilities and structures e.g. stormwater treatment areas. These must be contained within the footprint.
- Water treatment process units were reduced in size where practicable.
- Administration building constructed on top of onsite car parks.
- No provision for off spec and/or overflow discharges to be managed on site. Discharges are to be managed within existing Huia WTP lagoon.

3.1.2 Landscape Buffer

To minimise potential landscape and visual effects, the Project Team landscape architects recommended retaining a minimum 10 m wide landscape buffer around the perimeter of the WTP and reservoir property parcels. The proposed replacement WTP and reservoir footprints preserve a landscape buffer of this order.

3.1.3 Topography

The reservoir and WTP sites have varying topography that poses both constructability constraints and opportunities that were taken into account during the development of the preferred WTP and reservoir layout.

Treatment Plant Site

The proposed replacement WTP site topography and associated constructability constraints / opportunities are summarised below:

- Mild slope towards the centre of the site from the West/Northwest. Locating the majority of the WTP footprint within this area is most favourable from a constructability perspective.
- Steep slopes towards the centre of the site from the East/Northeast. These are unfavourable from a constructability perspective, and would require retaining and earthworks to form suitable construction areas.
- Moderate slopes from the centre of the site to the South/Southeast and Southwest. These areas are suitable from a constructability perspective, but are less favourable compared to the milder slopes elsewhere on site.

By avoiding the steeper slopes on the site, risks associated with manoeuvring earth working machinery are minimised while establishing the treatment plant "platform". Additionally by avoiding steeper areas of the site, heights/volumes of retaining (cut/fill) is also reduced which subsequently results in fewer traffic movements.

Reservoir Site

The proposed reservoir site topography and associated constructability constraints/opportunities are summarised below:

- Steep escarpment to the north which could present significant challenges with respect of surcharging underground structures, risk of destabilisation during construction, risk of rock falls.
- Steep "knolls" on the east and west of the reservoir site which would require significant earthworks to remove and could present difficulties for construction if not removed in entirety i.e. cutting through the middle of a knoll would result in a tall, small mass requiring retaining. The proposed reservoir layout (since further developed by others) avoids and does not impact the western knoll (located within the high value ecological area).

These constraints are broadly identified in the constructability constraints map below, with orange representing areas of poor constructability, and yellow areas of medium constructability.

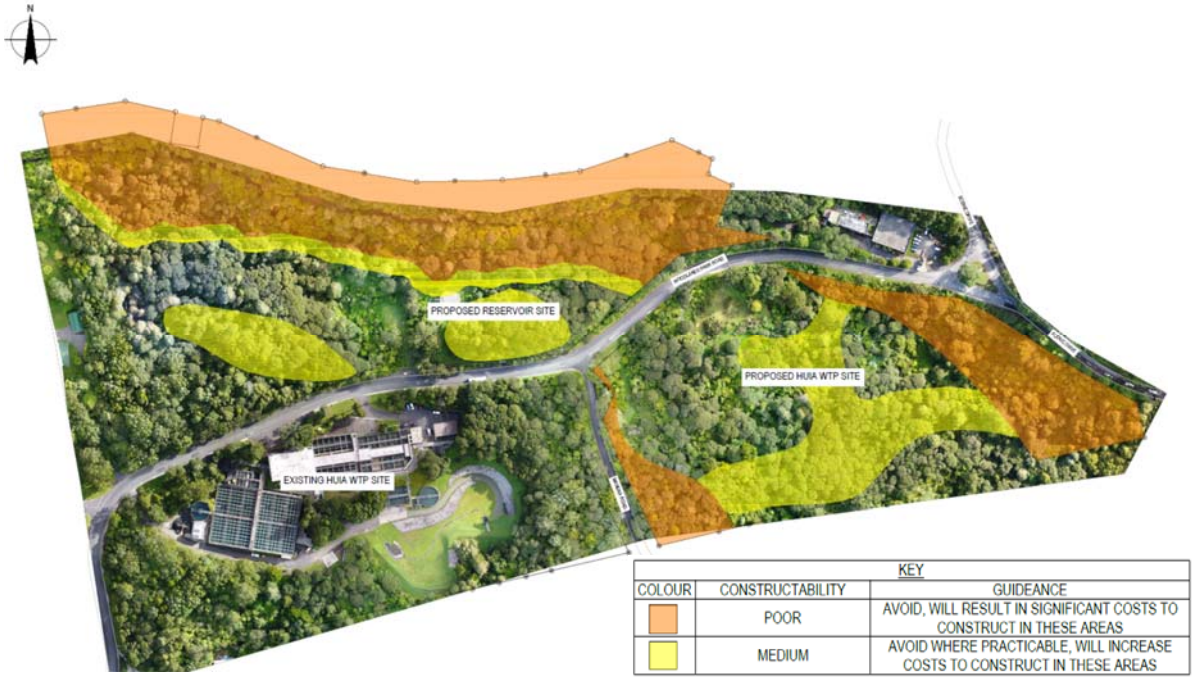


Figure 2 Topography Constraints Map

3.1.4 Traffic

Traffic constraints/requirements were identified and provided for as part of the onsite alternatives assessment. Refer to the *Huia WTP Transport Assessment, Beca, May 2019* for traffic considerations for the proposed sites.

3.1.5 Watercare Requirements

Raw Water Pump Station

The wider replacement WTP project includes a number of supporting infrastructure projects to be undertaken by Watercare. In this regard, it has been established by Watercare that, at this stage, the most practicable location for a new raw water pump station (required to pump water from the raw water supply network up and into the treatment plant) is at the replacement WTP site.

This requirement is reflected in the updated Watercare BODF.

General Health and Safety Considerations

The following general health and safety considerations were considered as part of the development of the layout of the WTP. It is noted that formal health and safety assessments will be required as part of developing the plant layout in the following stages. Key considerations of the analysis so far were:

- Vehicle traffic – this includes separation of pedestrians and vehicles within the plant (e.g. footpaths), minimising/eliminating vehicle reversing and manoeuvring,
- Administration building – located at the entry to the facility for sign-in purposes and to prevent unauthorised entry. This allows WSL operational staff to have more direct control of all vehicle movements within the site, improving H&S by reducing the likelihood for conflicts.
- Woodlands Park Road – the need to have a full B-train vehicle off Woodlands Park Road when awaiting entry to site.
- Structures Access – a minimum of 2m pedestrian access around all structures to enable scaffold installation for maintenance activities
- Underground structures – generally makes a confined space for Operations & Maintenance activities (increased risk). Strong preference for this to be eliminated wherever possible (e.g. not undergrounding a chemical facility).

These considerations have documented in Appendix C.

General Water Safety Requirements

A WTP must meet a number of water safety requirements in order to provide safe, clean drinking water to the public. Whilst an in-depth analysis is required at future stages, some key elements are included in the layout as follows:

- Security – generally the facility must be secure, and prevent entry from unauthorised persons.
- Future proofed – the WTP is designed for a service life of 100 years, current water quality conditions, and current Drinking Water Standards. The site does not provide provision for additional treatment processes should raw water quality decline further or new contaminants of concern be identified.
- Chlorine contact time – the CCT must be of a sufficient size to achieve required bacterial inactivation. WSL has received approval from the Drinking Water Assessor (DWA)

allowing for a 20 minute contact time at an increased Chlorine dosage, using C.t values to demonstrate that compliance with the DWSNZ has been achieved.

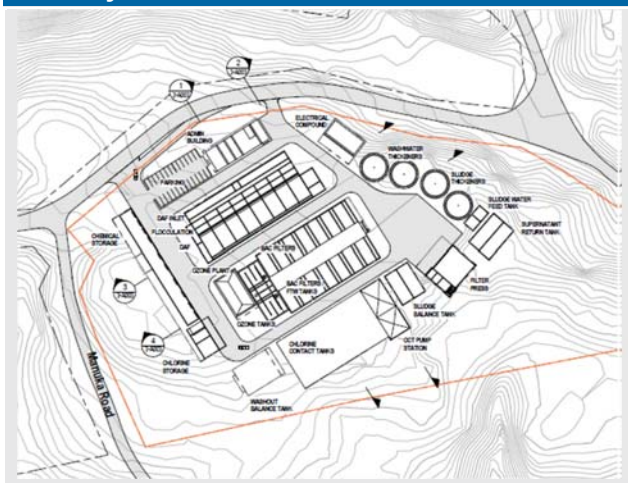
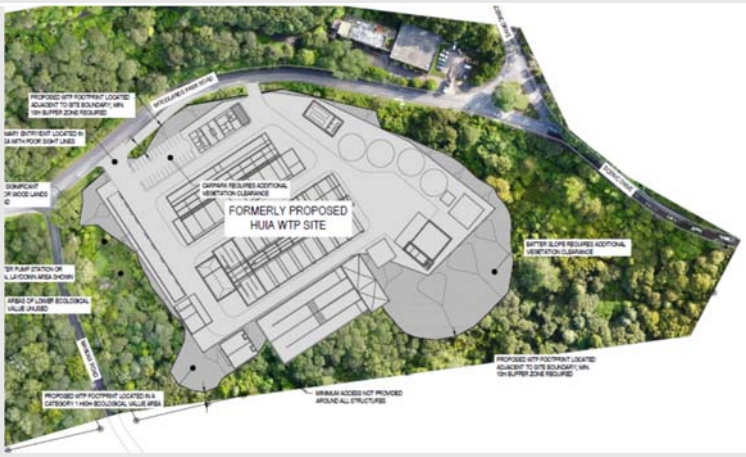
- Stacking process units, generally – it is important that, as the water is processed, it is prevented from coming into contact with untreated or less treated water, or be contaminated in any way. This means that, generally, stacking of processes is not preferred as this eliminates this risk. This consideration is the same for any situations where leakage could occur into a process e.g. vehicles parked on top of processes (leaking fuel) or chemical facilities on top of processes (leaking chemical)

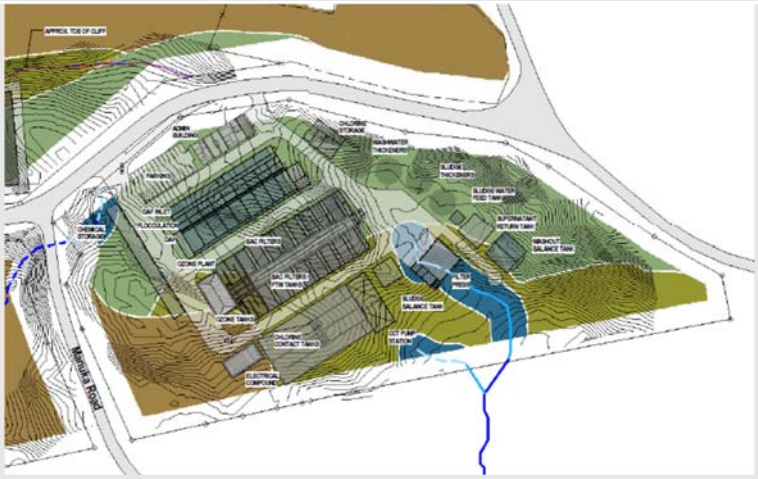
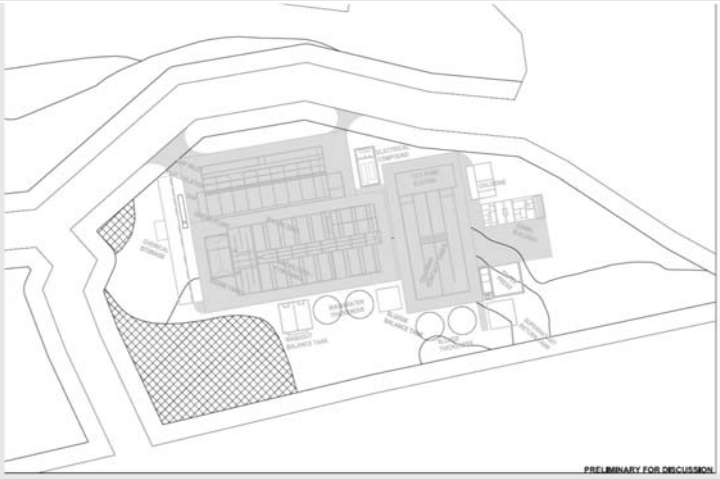
3.2 These considerations have documented in Appendix C. Revised WTP and Reservoir Layouts

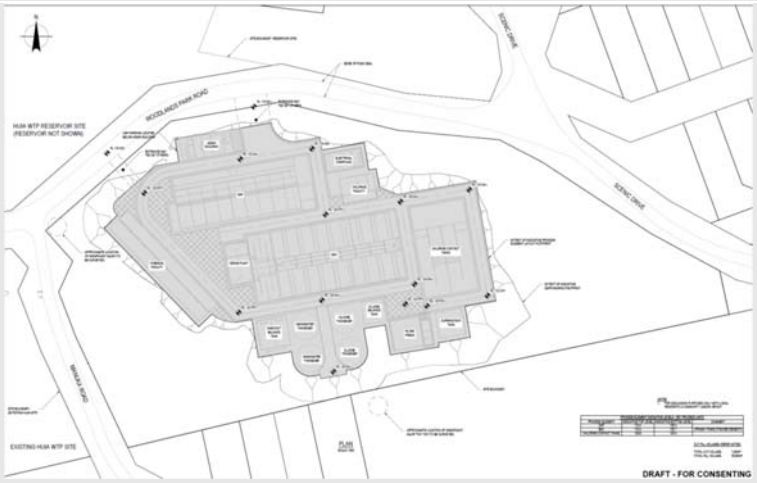
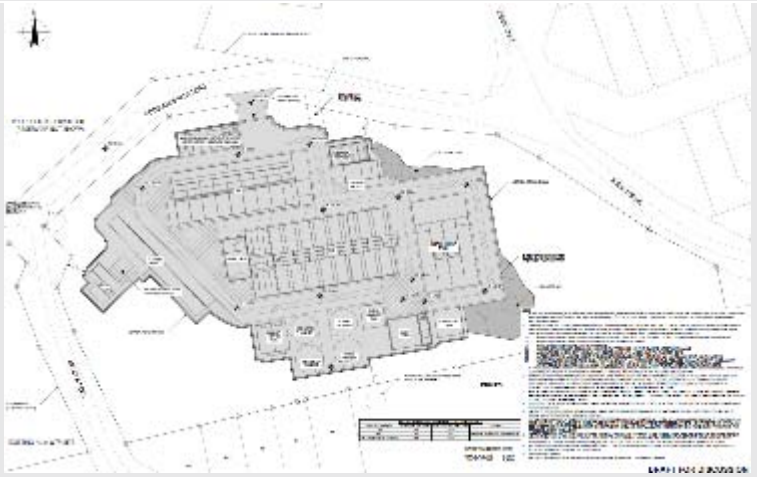
Based on the additional constraints and requirements identified in Section 3.1 above, the original WTP and reservoir layouts (refer to Figure 1 above) were amended to refine their location, size and reduce the footprint to respond to the sites constraints and opportunities with the overall objective to reduce environmental effects.

The evolution of the WTP and reservoir layouts and a brief explanation of the changes made as they progressed through the onsite alternatives assessment is provided in Table 2 and Table 3. The drawings are attached as Appendix D.The Reservoir has been further developed by others in the *Reservoir Site Layout Development Report, Beca, May 2019*.

Table 2 WTP Site Layout Plan Evolution

Site Layout	Summary of Changes
	Original layout based on Watercare BODF prepared as part of the shortlist site development report (starting point).
	Shortlist site development report updated with indicative cut/fill batters to understand extent of vegetation removal required to construct the proposed layout.

	Off spec discharges to be managed within existing lagoon. Extension of existing lagoon to 12 ML no longer required significantly reducing the impact on higher value vegetation immediately adjacent to the existing lagoon.
	Washout balance tank moved out of highest valued vegetation to lower value area in the south east of the site. Access road added to provide access to revised balance tank location. Electrical compound moved to south west to avoid higher value area. Chlorine facility moved to north east to avoid higher value area.
	DAF, BAC and CCT rearranged to reduce WTP footprint located within higher value area. Supplementary processes moved to the south in lower value area. Administration building moved from entrance to the east as part of reorganising the site. Chemical facility realigned to avoid higher value areas. Proposed slip lane on Woodlands Park Road removed to reduce width of vehicular access to minimise visual dominance and reduce vegetation removal. Vehicle access widths within the WTP site reduced to accommodate only one-way vehicle access in appropriate locations across the WTP site. Process units located to the south of the site reorganised to provide vehicle access to one side of required structures and provide pedestrian access to the back of structures. This reduced the overall footprint of WTP. Electricity substation moved out of higher value area into lower value area (noting washout balance tanks relocated back to

	original position in high value area). (Batter slopes not determined for this layout).
	Chemical facility realigned to remain out of higher value areas, but respond to revised layout. Administration building moved to site entry for health and safety reasons, and away from steep cliff to the east to reduce construction risks. Administration building overtop of carpark to minimise overall WTP footprint. DAF, BAC and CCT adjusted to meet chemical facility and administration building movements. CCT shifted south to avoid steep slopes to east of site (consequence of shifting east). BAC filter media laydown areas for media replacement. Supplementary processes realigned along south of site but still avoiding higher value area located to the south west of the site. Electrical compound moved to north east located in lower value area. Batter slopes proposed to retain WTP site platform CCT reduced in size to reflect changed process requirement reducing the size of the CCTs in the higher value area by a third. Single vehicle access to reduce footprint and visual dominance from Woodlands Park Road
	Raw water pump station moved to Manuka Road site (from Existing site). Retaining wall adopted in lieu of batter slope to the north, south and west of Site to reduce the WTP footprint and extent of vegetation removal. WTP layout amended to utilise lower value vegetation to the west of the site. Further refinement of vehicle access turning circles and widths of roads to reduce WTP footprint.

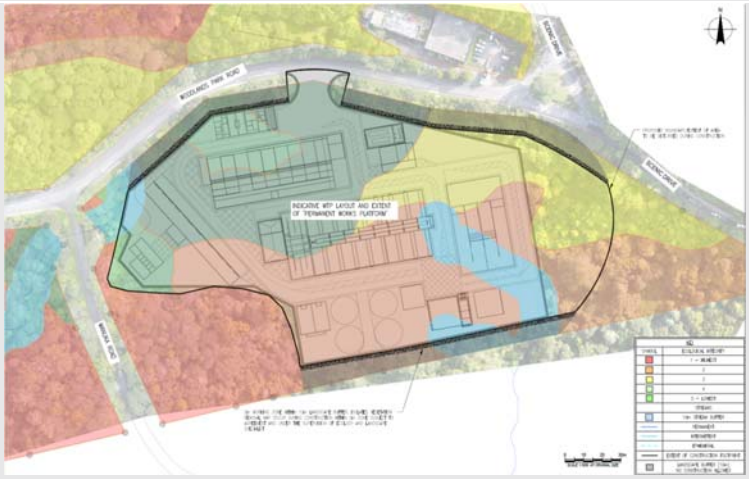
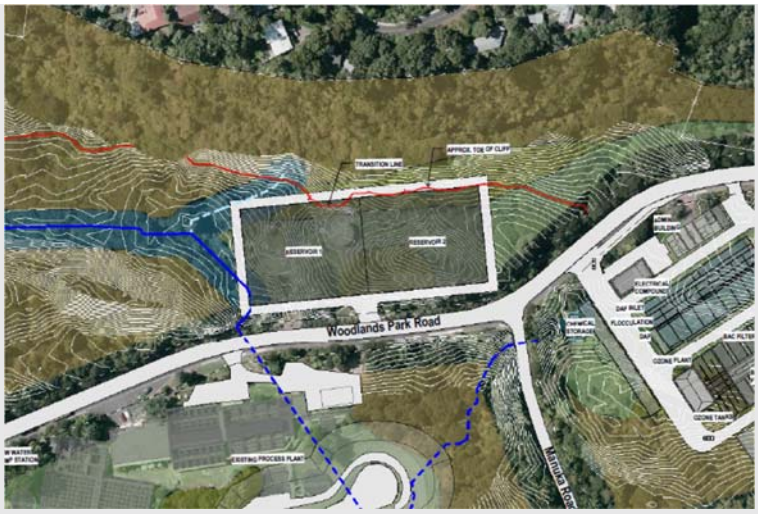
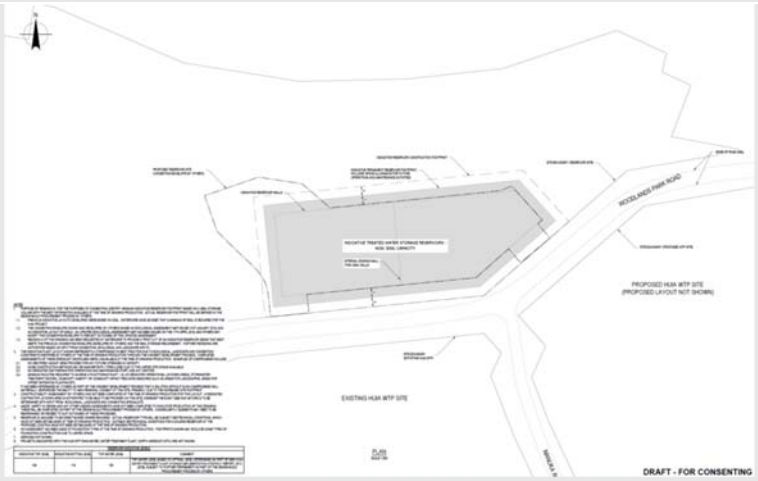
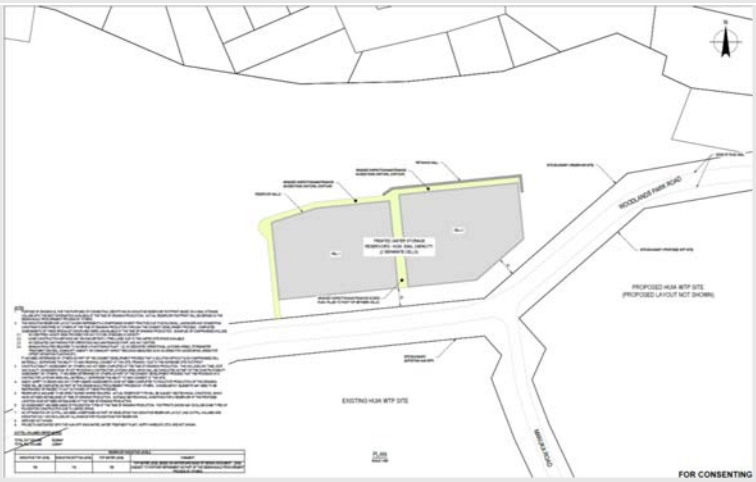
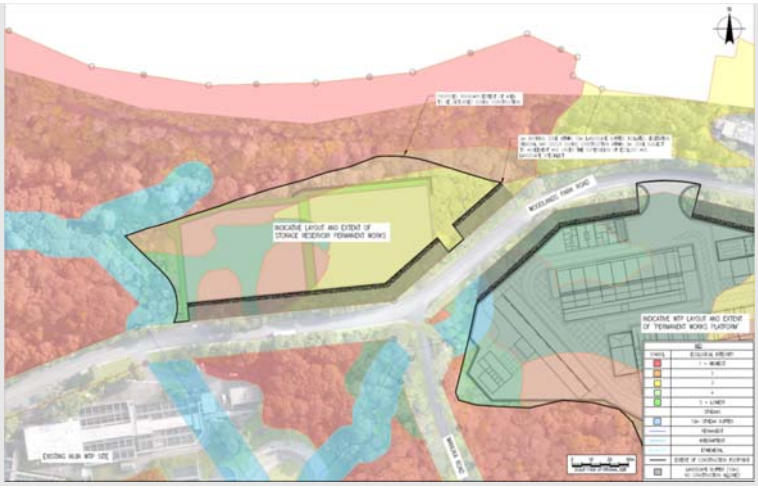
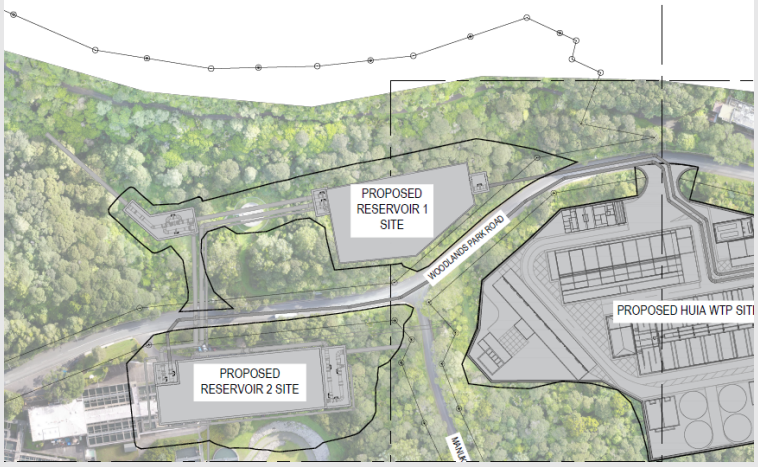
	Retaining wall adopted in lieu of batter slope to the east of site to reduce the WTP footprint and extent of vegetation removal. Retaining wall reconfigured to South West of site to reduce the WTP footprint and extent of vegetation removal.
	Retaining wall reconfigured along the perimeter of the site due to difficulty to construct i.e. straight lengths of retaining will accelerate construction and provides improves access. Additional space provided to the east of the site for construction laydown area/stormwater controls/etc. to reduce duration of construction period and overall project costs.

Table 3 Reservoir Site Layout Plan Evolution

Site Layout	Summary of Changes
	Original reservoir layout based on Watercare BODF prepared as part of the shortlist site development report (starting point). Circular shaped reservoirs with vehicle access around both reservoirs. Reservoirs as proposed located on top of Armstrong Gully stream and close to the wetland. Both reservoirs located very close to the toe of the northern cliff.

	Reservoirs circular design changed to rectangular joined cells to move reservoirs to the east of the site to avoid higher value vegetation located to the west of the site. Reservoirs moved to avoid reclamation of Armstrong stream and potential effects on wetland.
	Reservoir footprint moved further to the south east to avoid Armstrong Gully stream. Modification of aspect, including reshaping of eastern reservoir cell to avoid steep cliff and reduce constructability risk. 10m landscape buffer applied around site. Two construction accesses proposed to provide safe construction access. Vehicle access proposed around entire reservoir footprint.
	Splitting of reservoir into two cells to reduce risk of total failure to the entire storage capacity as a result of failure of common wall. Extension of reservoir to the north, including retaining wall to north east. This modification of reservoir shape was to accommodate landscape buffer in the eastern corner of site where secondary construction access was proposed. Single vehicle access proposed to reduce footprint and vegetation removal. Vehicle access around reservoir reduced to one side (northern side) to reduce construction footprint and retain 10m landscape buffer.

	Second vehicle access to east added for construction only to accommodate large construction vehicles.
	Updated reservoir layout by others – refer to *Reservoir Site Selection Report.*

3.3 Proposed Site Layout

Through an iterative on site alternatives process with the wider Project team, the original WTP and reservoir layout was updated to avoid, as far as practicable, adverse environmental effects, while still meeting constructability and operability requirements and constraints.

Key changes made to the layout of the treatment plant and storage reservoirs which reduces the environmental impact are:

- Reconfigured WTP, and moved Storage Reservoirs so as to avoid “high value” ecological areas entirely.
  - The consequence of this is an increase of earthworks volumes and construction difficulty, in large part due to the storage reservoirs being buried at the base of the escarpment.
  - The works can no longer be full developed and commissioned separately from the existing Huia WTP – new reservoirs can only be installed on the existing Huia WTP site once the existing site is fully decommissioned, which in turn requires the new plant to be full operational. This will result in an extended construction duration.
- Changing storage reservoir shape to better fit within spatial and topographical constraints
  - The likely consequence of this is to increase construction costs due to complexity/less efficient structural designs. Unusual shapes will also increase the construction risk i.e. non-standard detailing
- Use of batter slopes (for cut and fill) has been minimised/eliminated in favour of engineered retaining structures.

– The likely consequence of this is to increase construction costs due to complexity/additional engineered structures.

Overall the extent of the WTP gross footprint within the high value ecological area was reduced completely, refer to Table 4 below. There was a slight decrease in the WTP gross footprint, noting though this also includes for the Raw water pump station, being relocated from the existing WTP site.

During the broader team workshops, it was identified that the maximum construction footprint needed to accommodate a construction laydown area to be able to construct the WTP within the required construction period while managing escalation of construction costs. Development of the original WTP gross footprint did not take any of these factors into consideration and therefore the gross footprint does not provide for space required for construction purposes.

Table 4 Layout Comparison Table

	Original Layout	Preferred Site Layout (current)
WTP		
Gross footprint	28,200[1] m^2	27,200[2] m^2
Footprint within “high value” ecological area	2,300 m^2	0 m^2
Percentage of footprint within “high value” ecological area	8.2 %	0 %
Storage Reservoirs		
Gross footprint	10,000[3] m^2	*Reservoir Site Layout Development Report, Beca, May 2019*
Footprint within “high value” ecological area	7,300 m^2	*Reservoir Site Layout Development Report, Beca, May 2019*
Percentage of storage reservoir footprint within “high value” ecological area	73 %	*Reservoir Site Layout Development Report, Beca, May 2019*

The proposed WTP and storage reservoir footprints - developed on the Watercare BODF - have been minimised as far as practicable and are illustrated in Figure 3 and Figure 4 below. Drawings of the proposed layouts are also attached in Appendix D (note the Reservoir has been further developed by Beca in the *Reservoir Site Layout Development Report, Beca, May 2019*).

[1] Excludes raw water pump station (located on the existing WTP site)
[2] “Disturbed area” footprint - includes additional space for construction laydown area/stormwater management/other east of plant footprint
[3] Excludes allowance for North Harbour #2 Watermain jacking shaft

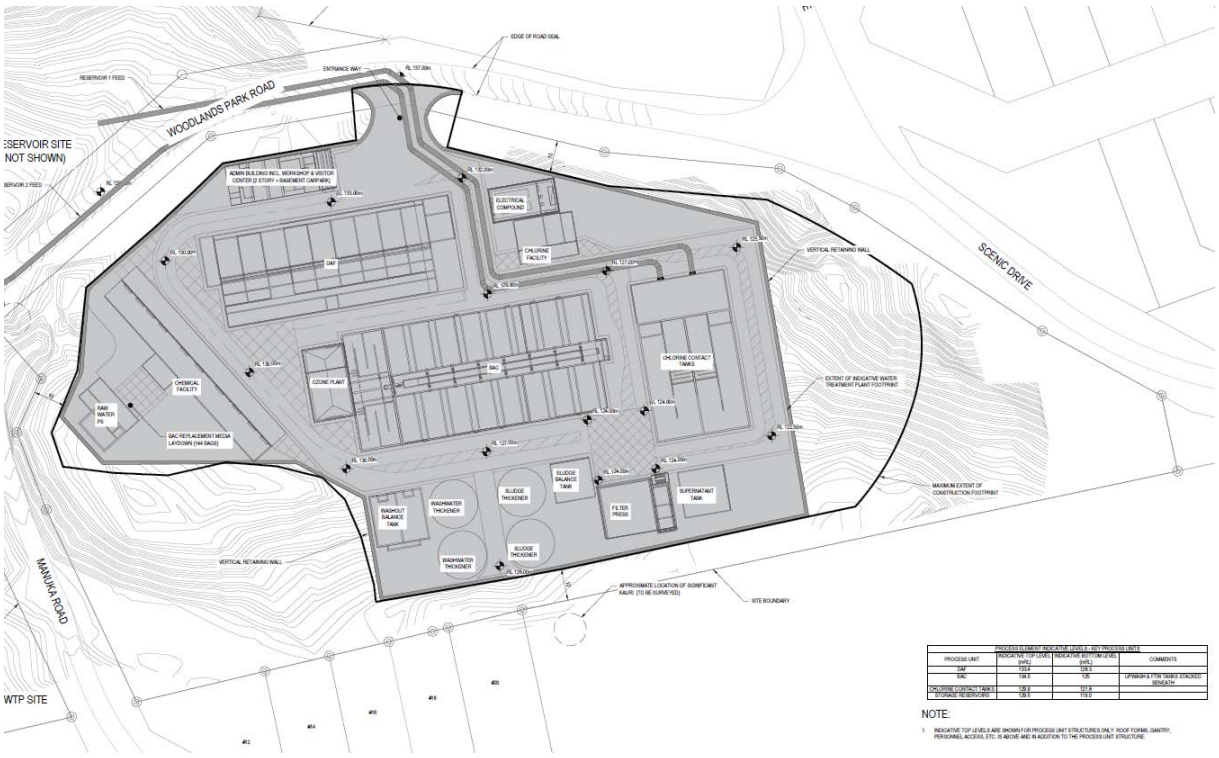


Figure 3 Proposed Huia WTP Site Layout

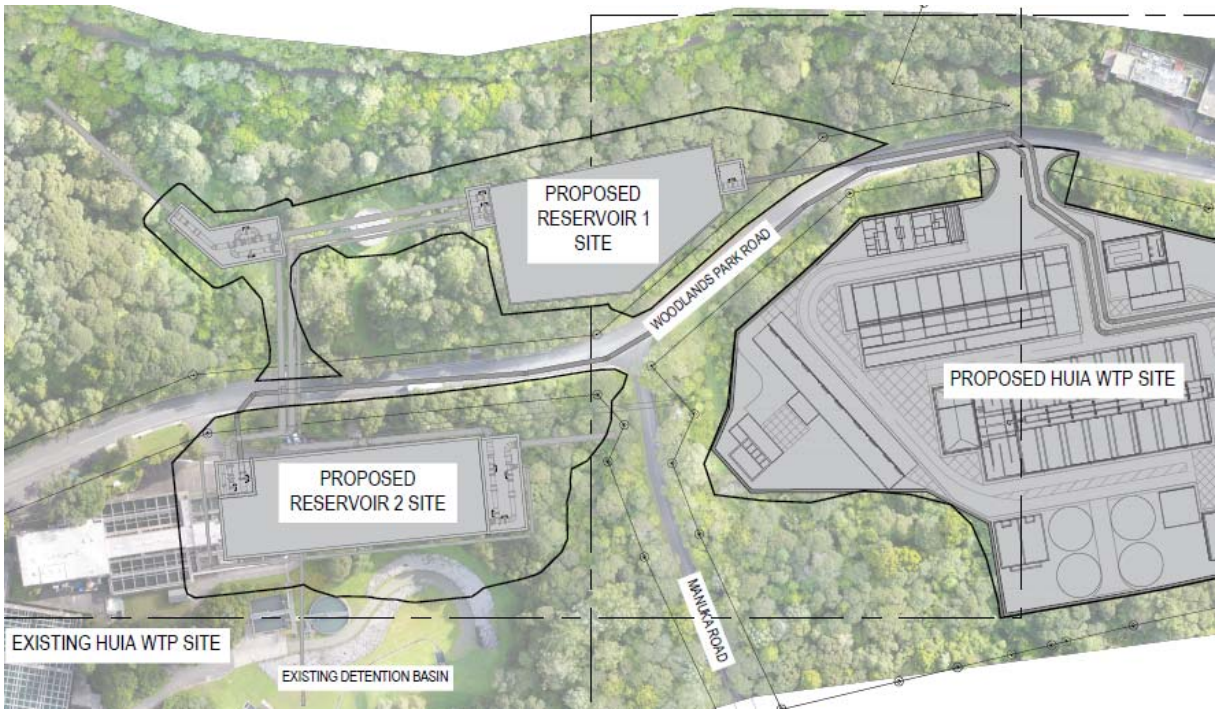


Figure 4 Proposed Huia Reservoir Site Layout (now revised - Refer *Reservoir Site Layout Development Report, Beca, May 2019*)

4. Conclusion

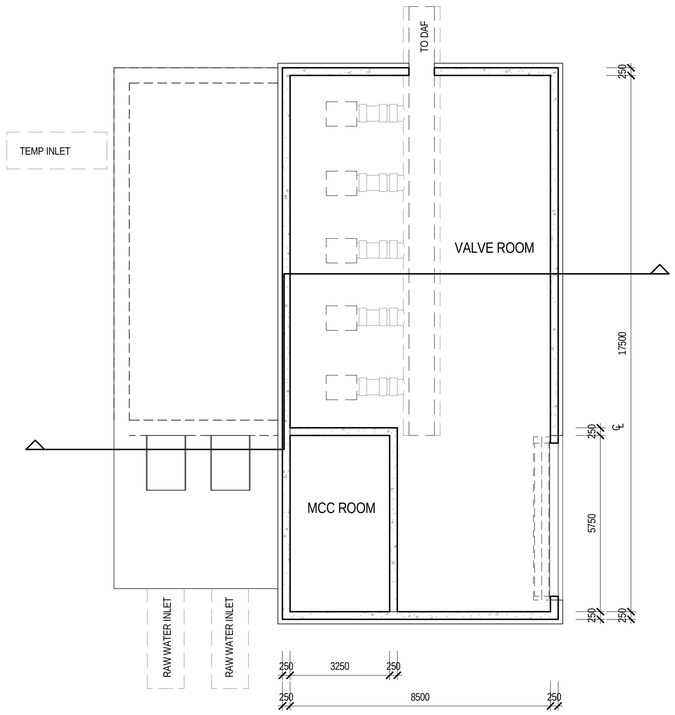
Working collaboratively with the wider team of specialist for the Huia Water Treatment Plant consenting phase, the proposed Huia Water Treatment Plant and Reservoir layouts (finalised by others) were iteratively developed to best reflect the new information established at this stage as part of the specialist assessments completed by others.

The proposed WTP and storage reservoir footprints (finalised by others) have been minimised as far as practicable given the range of site constraints identified by the contributing parties. The proposed layouts best represent the intent of the Watercare Board's resolution to avoid significant trees and significant ecological effects for this site, which are reflected in the Specialist assessment constituted by others as part of the overall Huia WTP Resource Consent Application,

This report serves to document and the iterative process undertaken in this consent application in achieving the outcomes above.

Appendices

Appendix A Short List Development Drawings – Manuka Road Site



FLOOR PLAN
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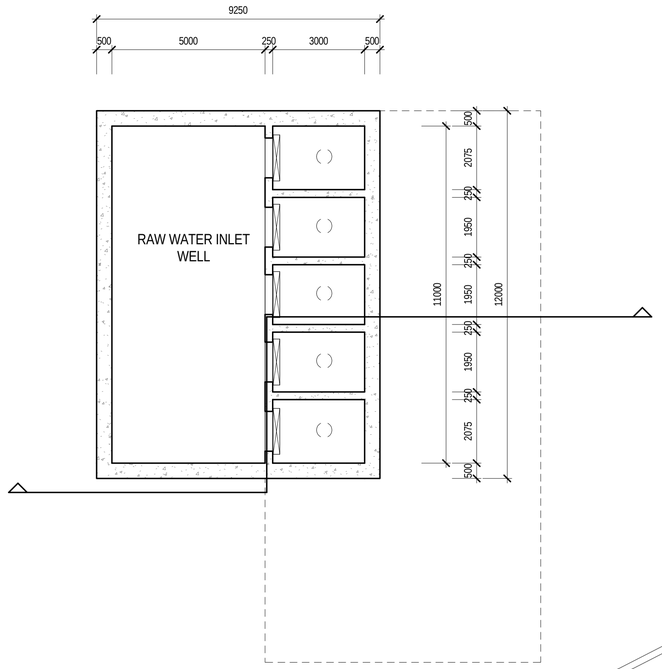
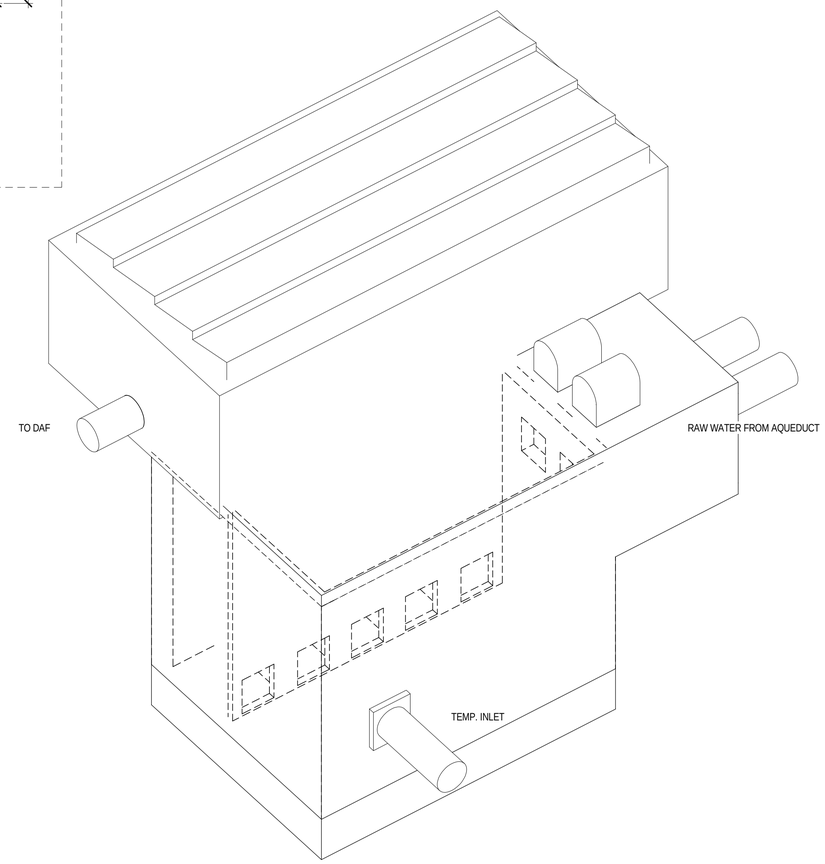


INLET WELL FLOOR PLAN
SCALE 1 : 100



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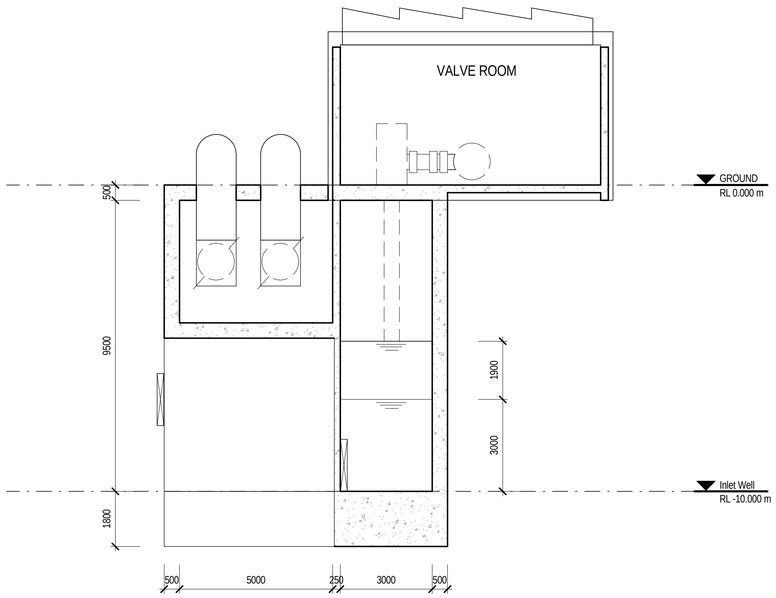
SCALE



CROSS SECTION
SCALE 1 : 100

Material Takeoff	
Material: Name	Material: Volume
31_Concrete_Cast	650 m³

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	SITE SELECTION STUDY		AC	CG	MM	09/16

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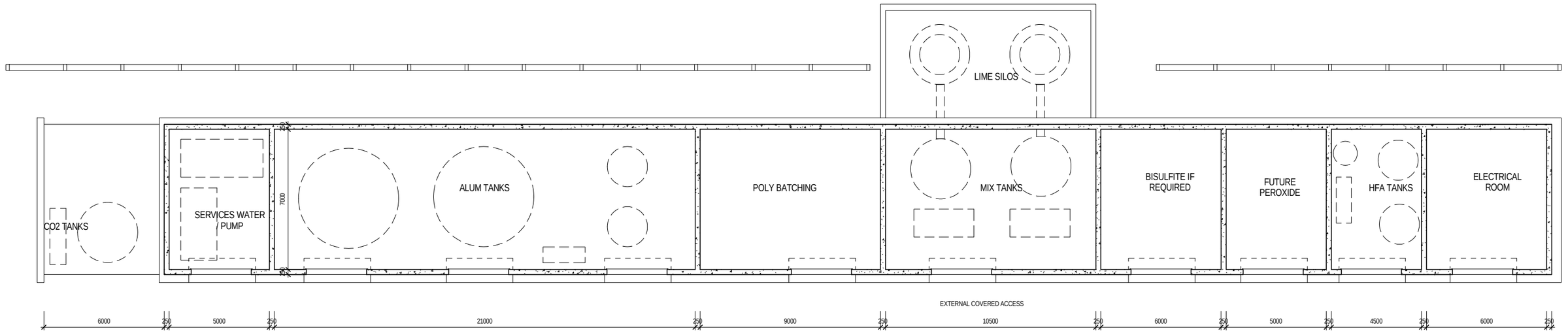
Drafting Check	CG	Design Check	MM
Approved (Project Director)	MM		
Date	SEP 16		
Scale	1 : 100		

This Drawing must not be used for Construction unless signed as Approved

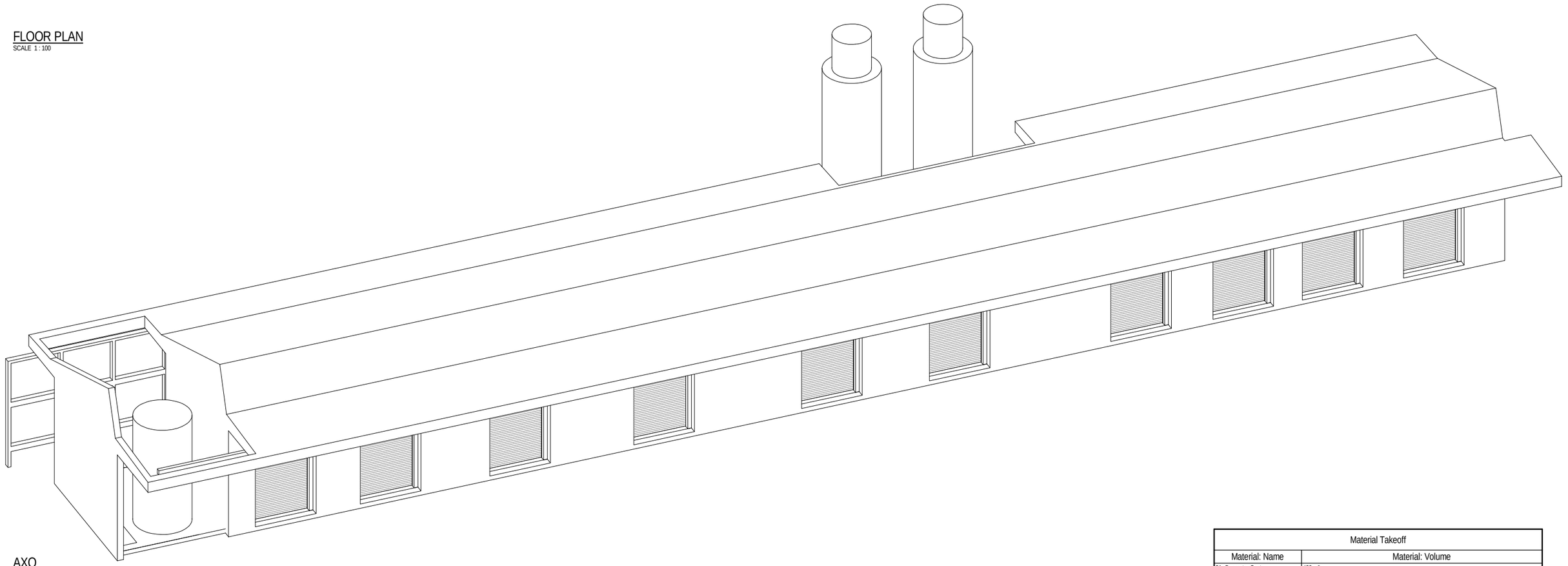
Client **Watercare Services LTD**
Project **HUIA WTP Implementation Strategy**
Title **RAW WATER PUMP STATION**

Original Size **A1** Drawing No: **51-33575-A100** Rev: **A**

Plot Date: 2/09/2016 9:16:16 AM Cad File No: N:\NZ\Auckland\Projects\51\33575\CADD\Revit\A-Raw water pump station.rvt



FLOOR PLAN
SCALE 1 : 100



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SCALE

Material Takeoff	
Material: Name	Material: Volume
31_Concrete_Cast	430 m³

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
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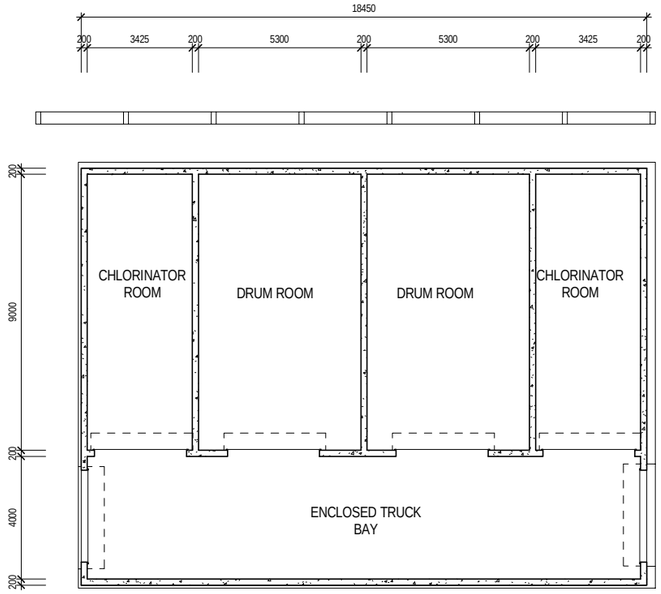
Approved (Project Director)	MM		
Date	SEP 16		
Scale	1 : 100	This Drawing must not be used for Construction unless signed as Approved	

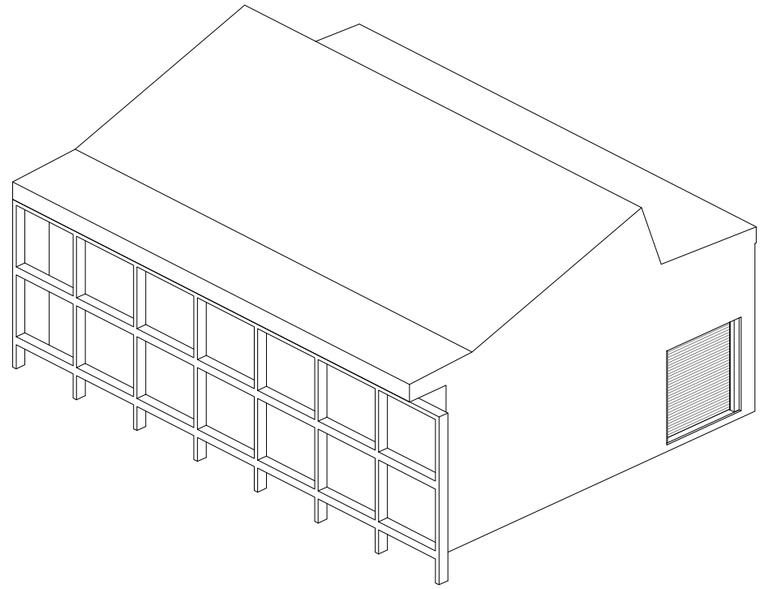
Client **Watercare Service LTD**
Project **HUIA Water Treatment Plant**
Title **Chemical Storage Building**

Original Size **A1** Drawing No: **51-33575-A102** Rev: **A**

Plot Date: 2/09/2016 9:05:48 AM Cad File No: N:\NZ\Auckland\Projects\51\33575\CADD\Revit\A-Chemical Storage Building_V2015.rvt



FLOOR PLAN
SCALE 1 : 100



AXO
SCALE

Material Takeoff	
Material: Name	Material: Volume
31_Concrete_Cast	180 m³

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
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Approved (Project Director)	MM		
Date	SEP 2016		
Scale	1 : 100	This Drawing must not be used for Construction unless signed as Approved	

Client **Watercare Service LTD**
Project **HUIA Water Treatment Plant**
Title **Chlorine Storage Building**

Original Size **A1** Drawing No: **51-33575-A103** Rev: **A**

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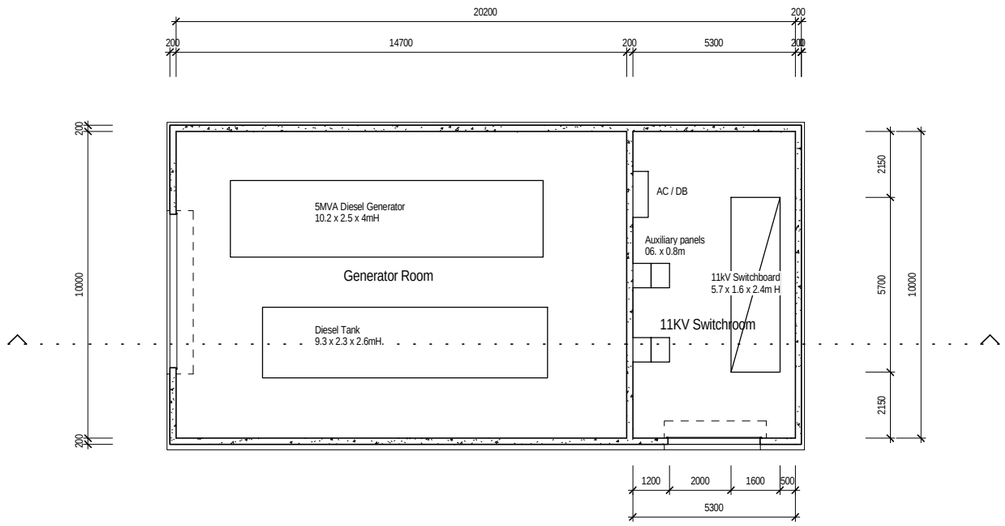

FLOOR PLAN
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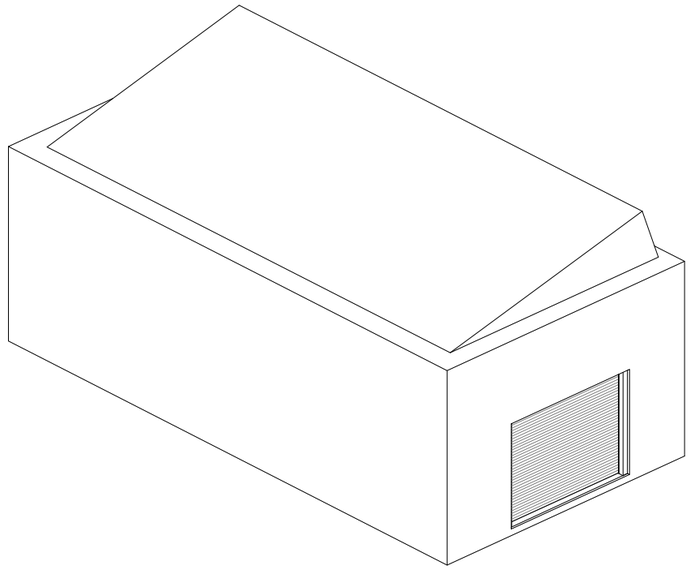

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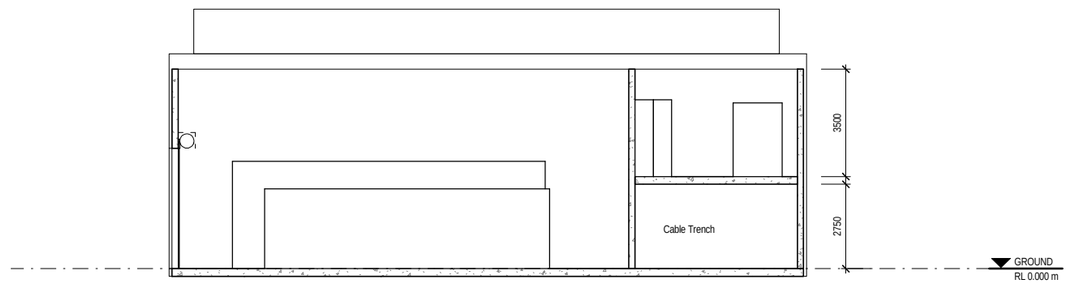

LONGITUDINAL SECTION
SCALE 1 : 100

Material Takeoff	
Material: Name	Material: Volume
31_Concrete_Cast	140 m³

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	SITE SELECTION STUDY		AC	CG	MM	09/16

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Drafting Check CG		Design Check MM	
Approved (Project Director)	MM		
Date	SEP 16		
Scale 1 : 100	This Drawing must not be used for Construction unless signed as Approved	Original Size A1	

Client **Watercare Service LTD**
Project **HUIA Water Treatment Plant**
Title **Electrical Compound**

Drawing No: 51-33575-A104 **Rev: A**

Plot Date: 2/09/2016 9:11:56 AM
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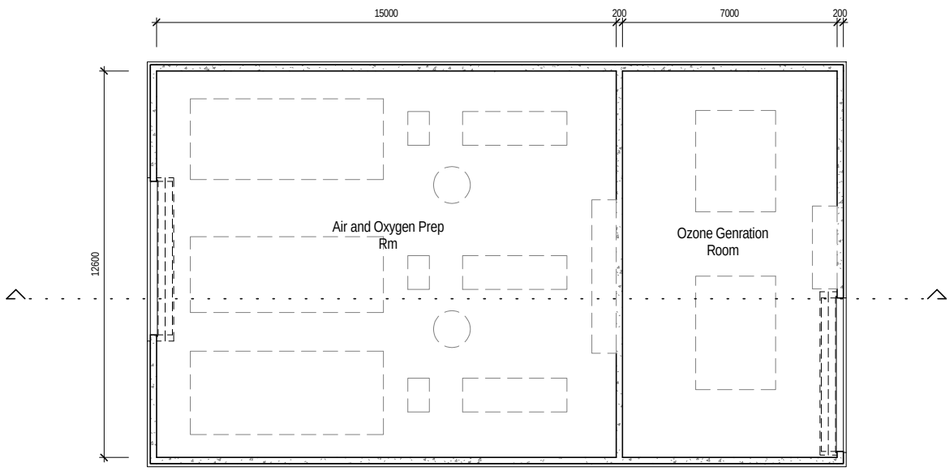
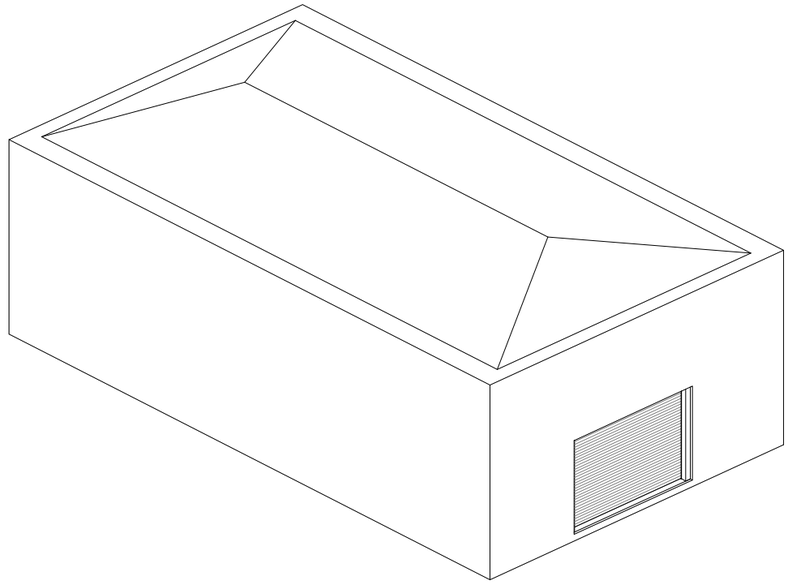


FLOOR PLAN
SCALE 1 : 100



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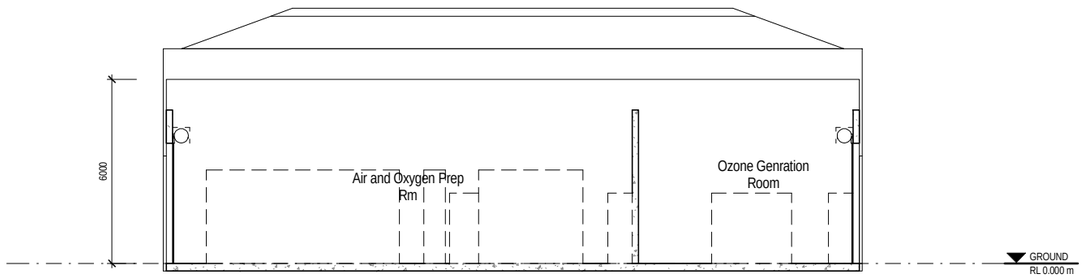

LONGITUDINAL SECTION
SCALE 1 : 100

Material Takeoff	
Material: Name	Material: Volume
31_Concrete_Cast	150 m³

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
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Approved (Project Director)	MM		
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Scale	1 : 100	This Drawing must not be used for Construction unless signed as Approved	

Client **Watercare Services LTD**
Project **HUIA WTP Implementation Strategy**
Title **Ozone Generator Room**

Original Size **A1** Drawing No: **51-33575-A106** Rev: **A**

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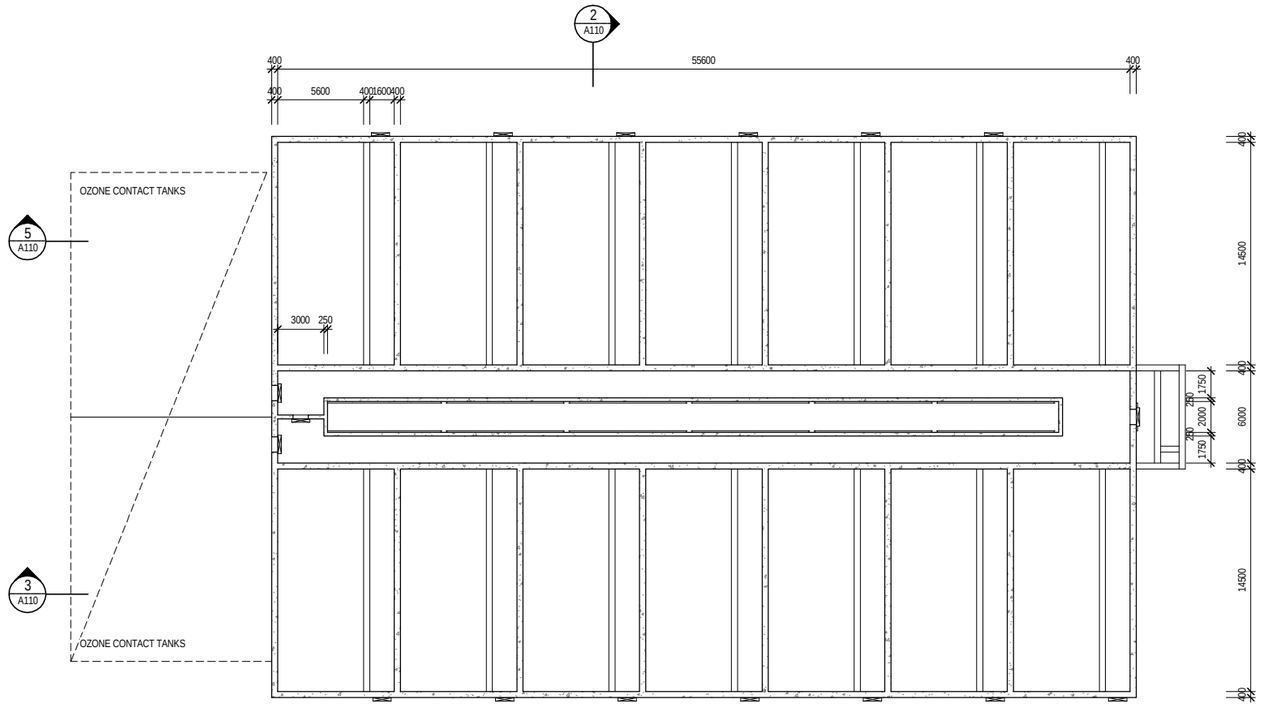
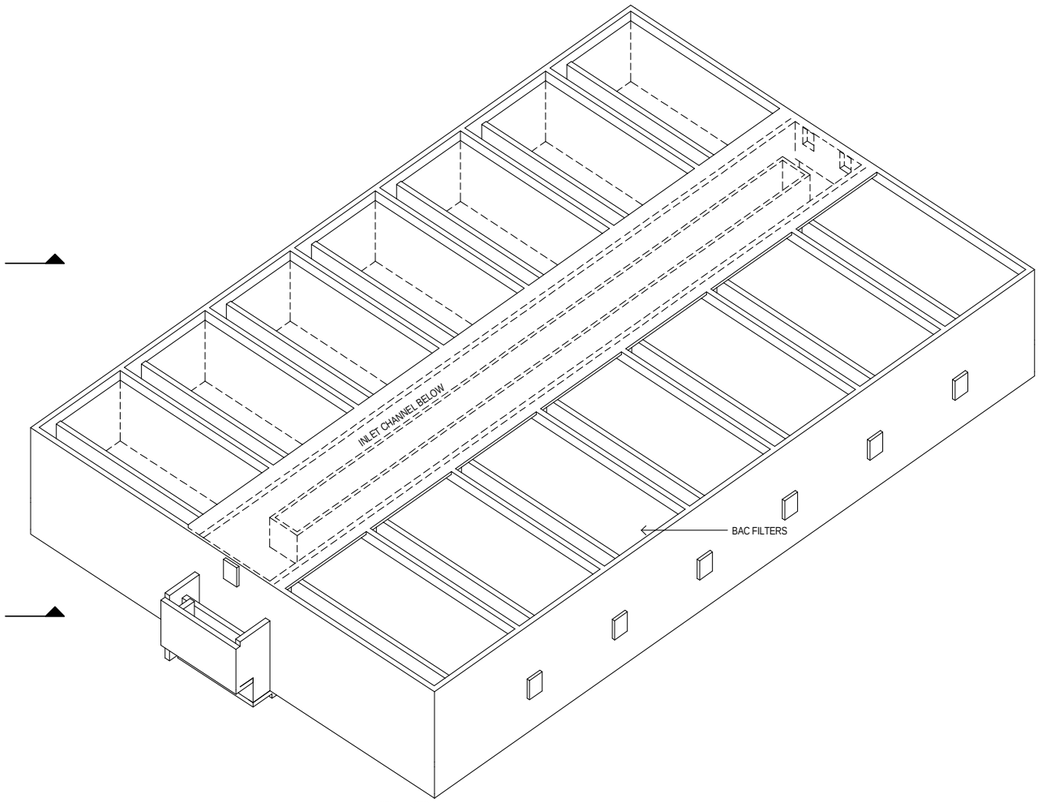
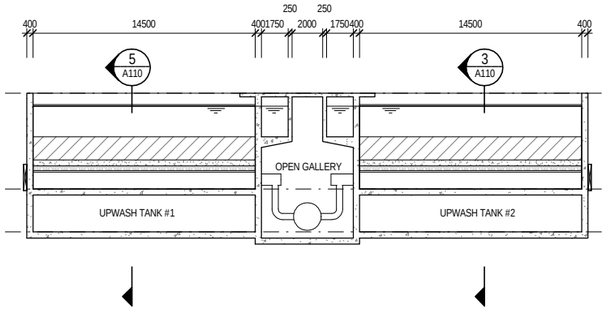
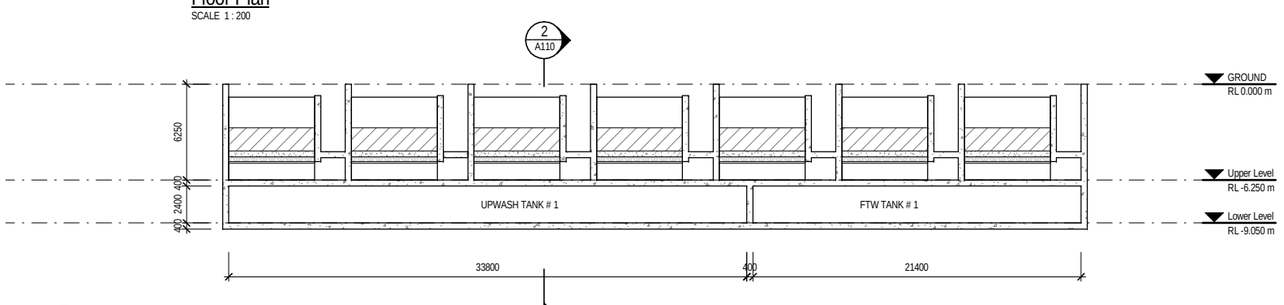




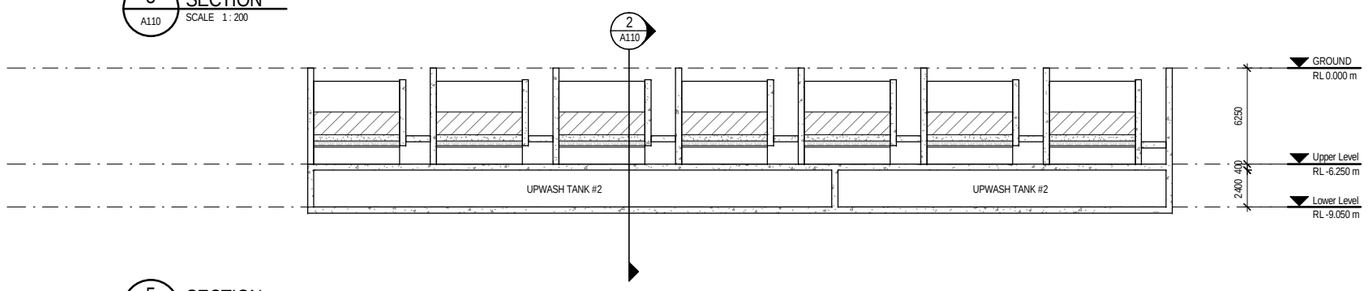
Floor Plan
SCALE 1 : 200





3 A110 **SECTION**
SCALE 1 : 200

2 A110 **SECTION**
SCALE 1 : 200



5 A110 **SECTION**
SCALE 1 : 200

Concrete volume	
Material: Name	Material: Volume
31_Concrete_Cast	3830 m³

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
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Date	SEP 16		
Scale	1 : 200	This Drawing must not be used for Construction unless signed as Approved	

Client **Watercare Service LTD**
Project **HUIA Water Treatment Plant**
Title **BAC FILTER TANK**

Original Size **A1** Drawing No: **51-33575-A110** Rev: **A**

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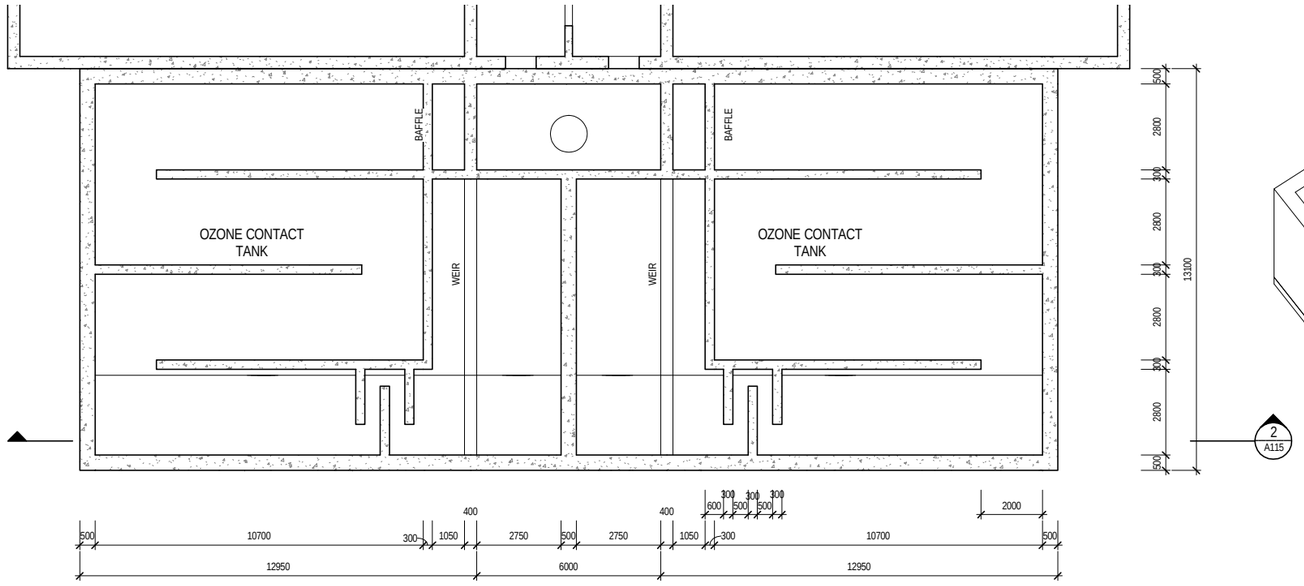
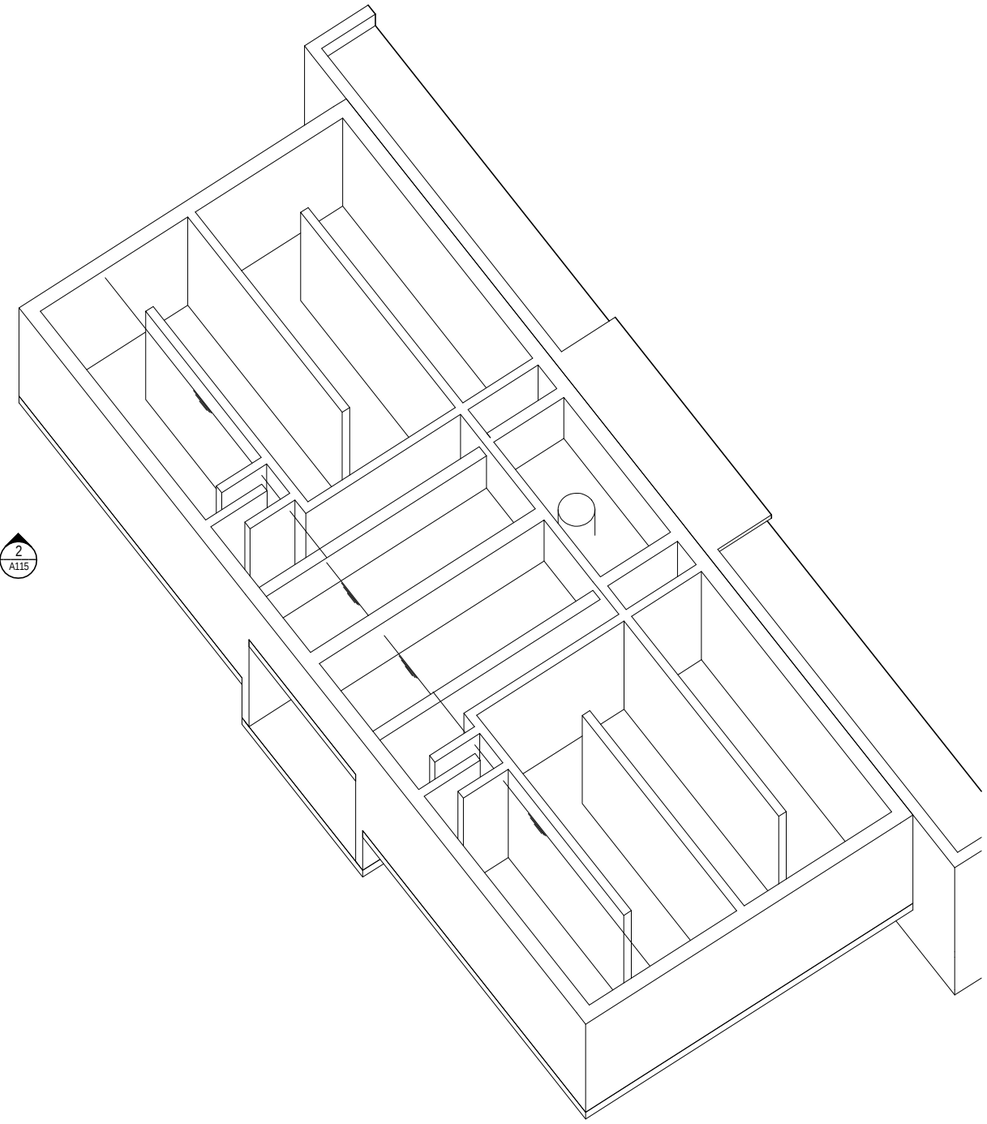
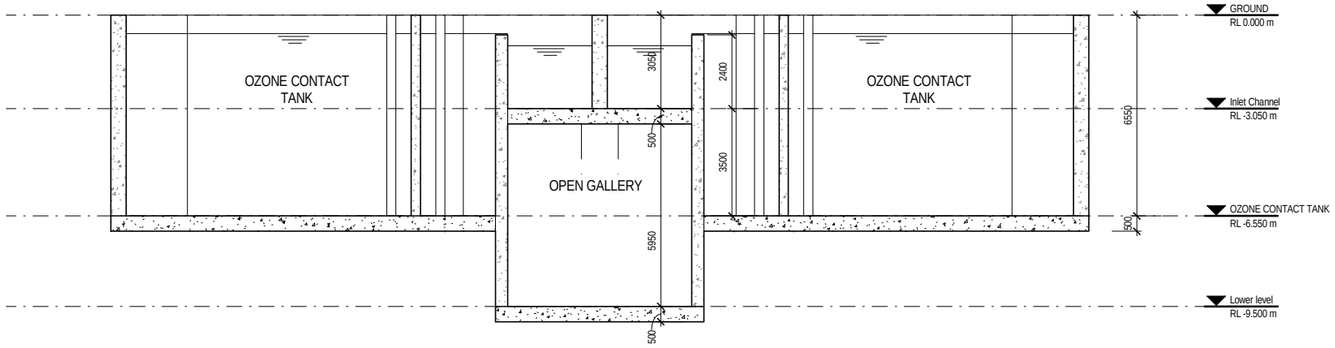


FLOOR PLAN
SCALE 1 : 100





2 A115 SECTION
SCALE 1 : 100

CONCRETE VOLUME	
Material: Name	Material: Volume
31_Concrete_Cast	540 m³

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	SITE SELECTION STUDY		AC	CG	MM	09/16

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Drafting Check CG		Design Check MM	
Approved (Project Director)	MM		
Date	SEP 16		
Scale 1 : 100	This Drawing must not be used for Construction unless signed as Approved		

Client **Watercare Services Limited**
Project **HUIA WTP Implementation Strategy**
Title **OZONE CONTACT TANK**

Original Size **A1** Drawing No: **51-33575-A115** Rev: **A**

Plot Date: 2/09/2016 8:37:45 AM
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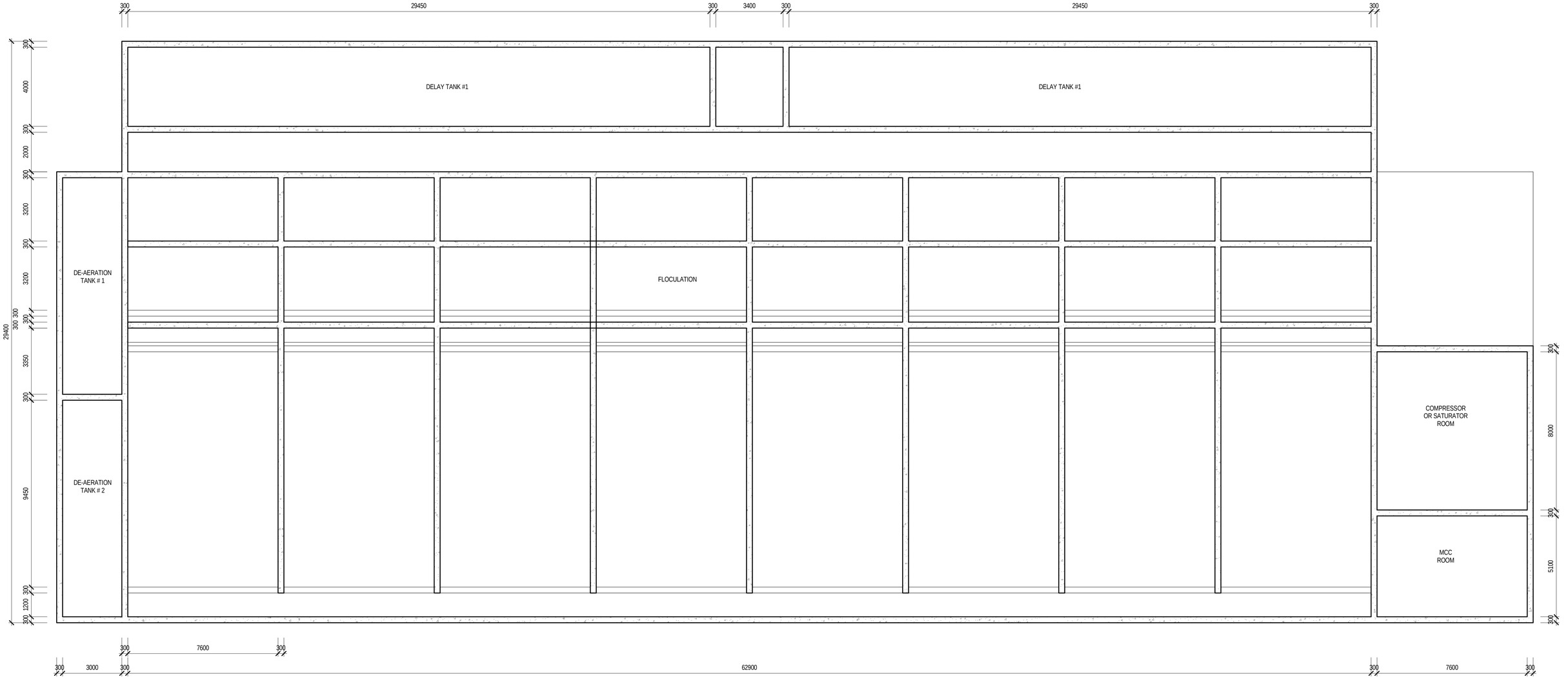

Floor Plan

SCALE 1 : 100

CONCRETE VOLUME	
Material: Name	Material: Volume
31_Concrete_Cast	1800 m³

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
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Approved (Project Director)	MM		
Date	SEP 16		
Scale	1 : 100		

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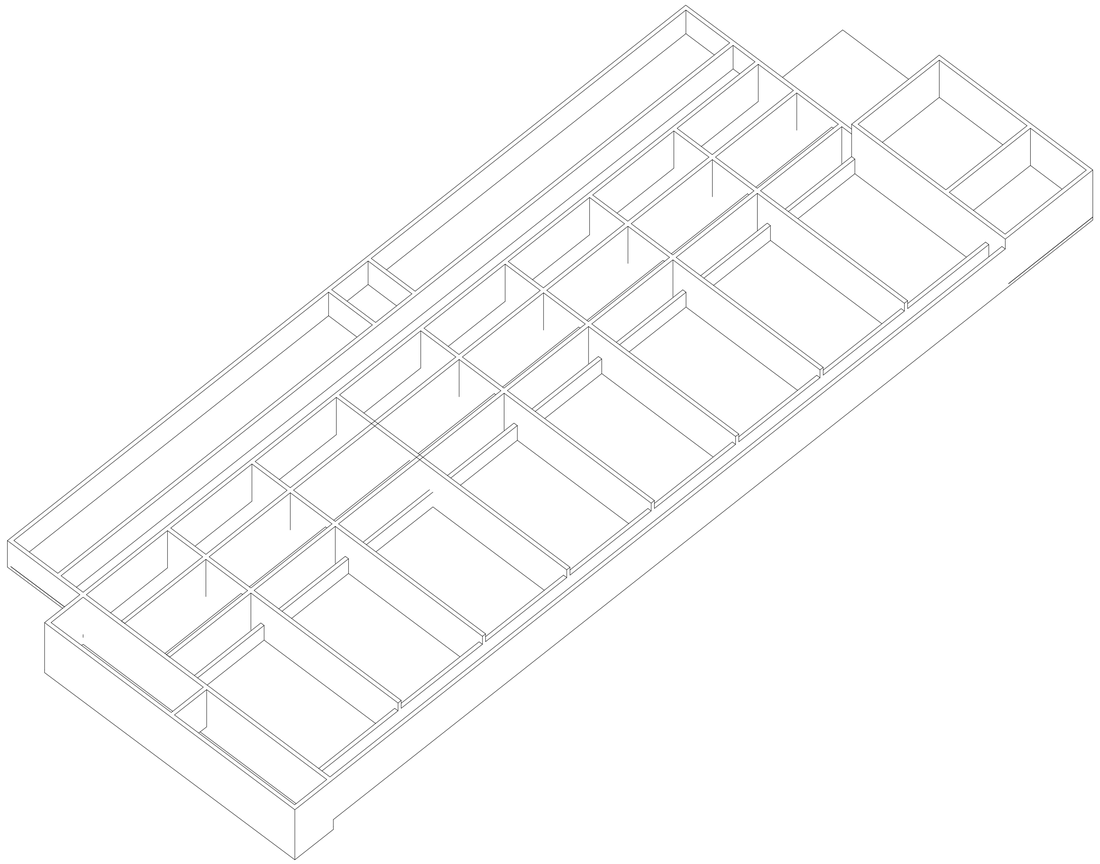
Client **Watercare Services Limited**
Project **HUIA WTP Implementation Strategy**
Title **DAF TANK PLAN**

Original Size **A1** Drawing No: **51-33575-A120** Rev: **A**

Plot Date: 2/09/2016 8:34:30 AM Cad File No: N:\NZ\Auckland\Projects\51\33575\CADD\Revit\A_DAF Tank_V2015.rvt



AXO
SCALE

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
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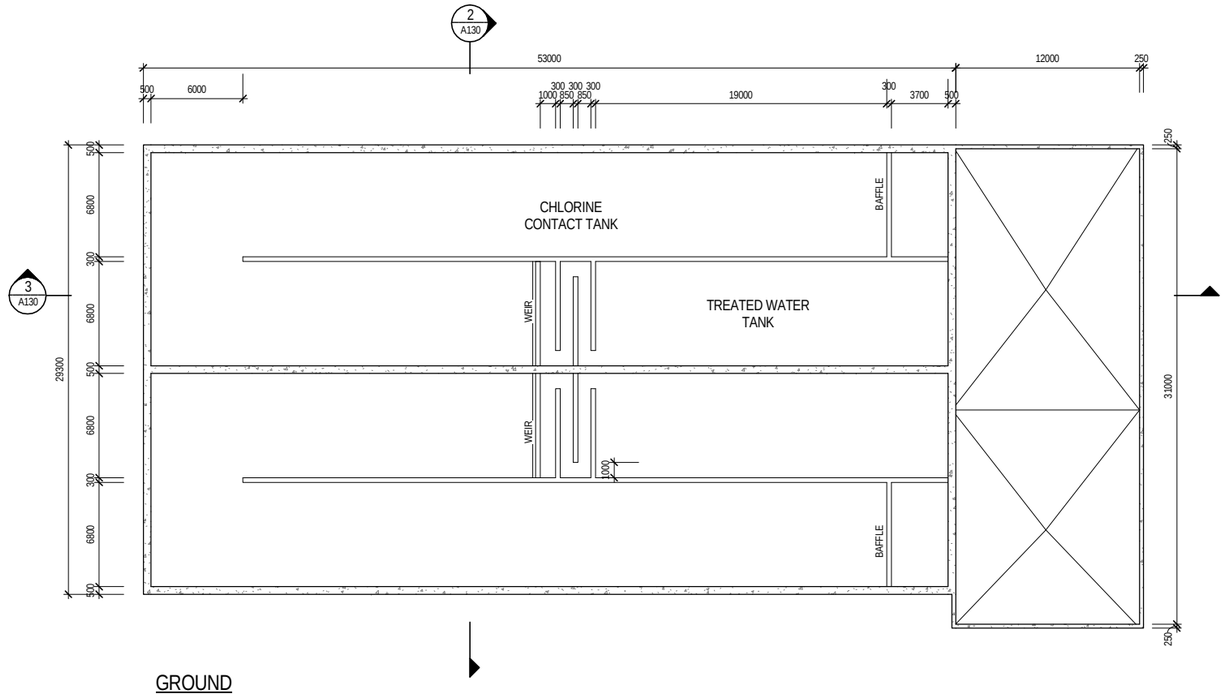
Drafting Check	CG	Design Check	MM
Approved (Project Director)	MM		
Date	SEP 16		
Scale		This Drawing must not be used for Construction unless signed as Approved	

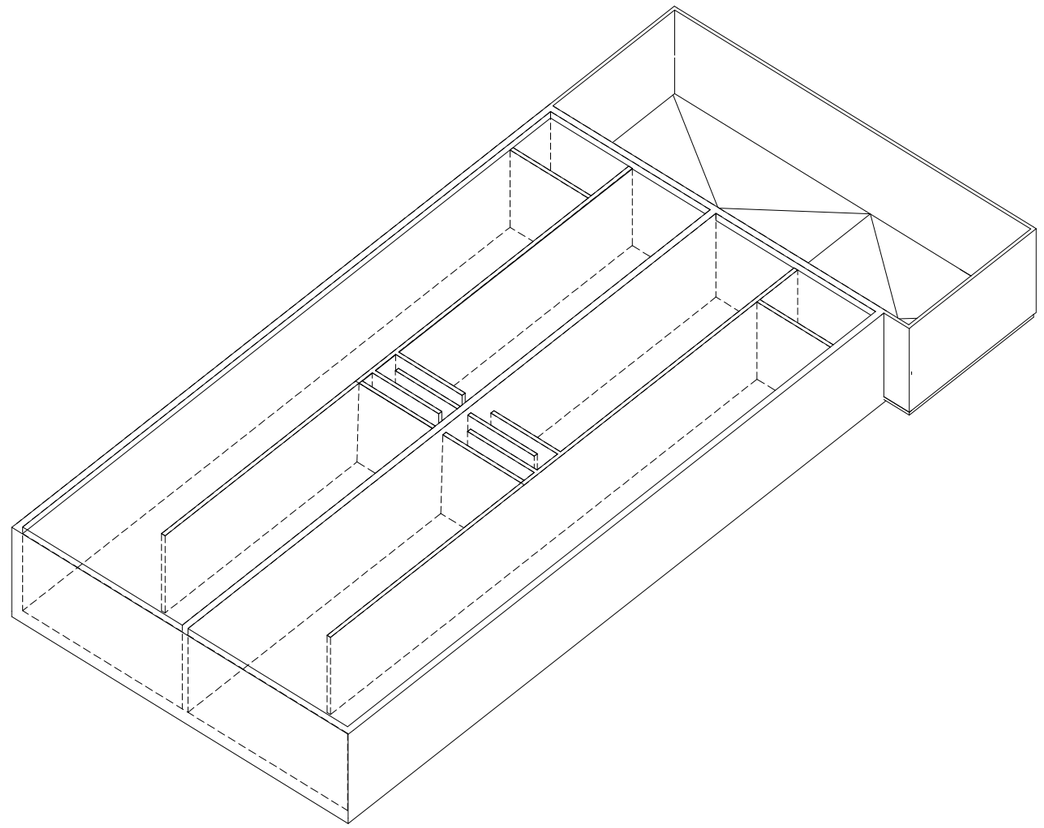
Client **Watercare Services Limited**
Project **HUIA WTP Implementation Strategy**
Title **DAF TANK SECTIONS**

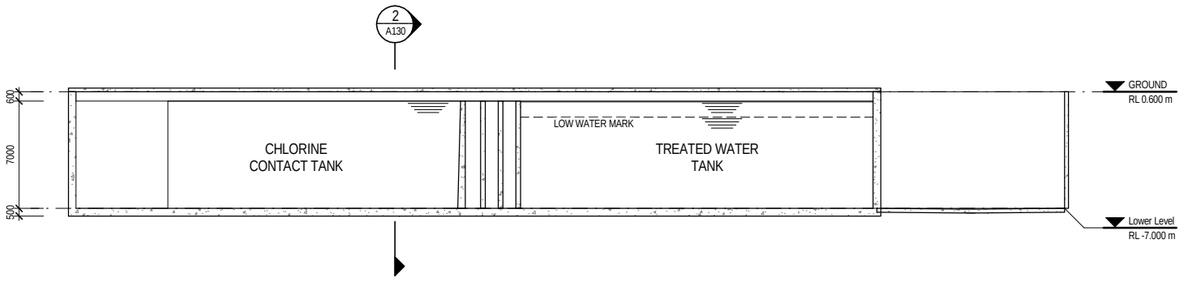
Original Size **A1** Drawing No: **51-33575-A121** Rev: **A**

Plot Date: 2/09/2016 8:34:30 AM Cad File No: N:\NZ\Auckland\Projects\51\33575\CADD\Revit\A_DAF Tank_V2015.rvt

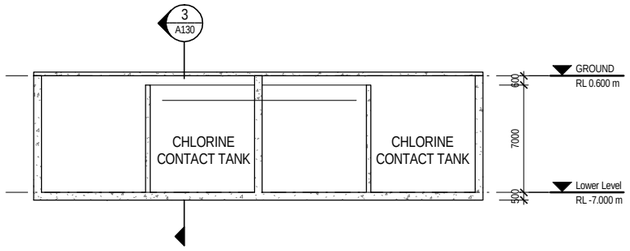


GROUND
SCALE 1 : 200





3 A130 SECTION
SCALE 1 : 200



2 A130 SECTION
SCALE 1 : 200

Material Takeoff	
Material: Name	Material: Volume
31_Concrete_Cast	2520 m³

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	SITE SELECTION STUDY		AC	CG	MM	09/16

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Drafting Check CG		Design Check MM	
Approved (Project Director)	MM		
Date	SEP 16		
Scale 1 : 200	This Drawing must not be used for Construction unless signed as Approved		

Client **Watercare Services Limited**
Project **HUIA WTP Implementation Strategy**
Title **CHLORINE CONTACT TANK**

Original Size **A1** Drawing No: **51-33575-A130** Rev: **A**

Plot Date: 2/09/2016 9:09:43 AM
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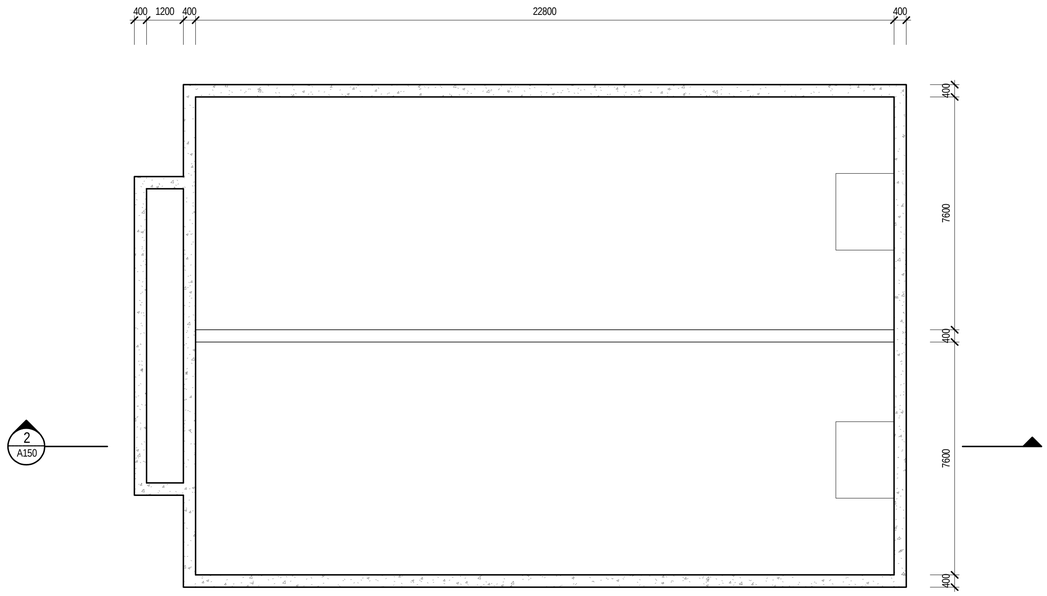
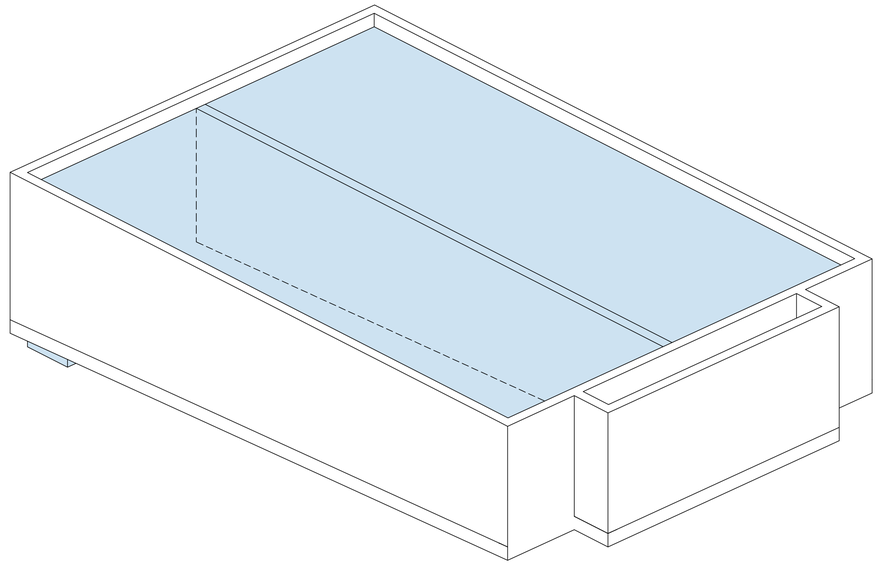
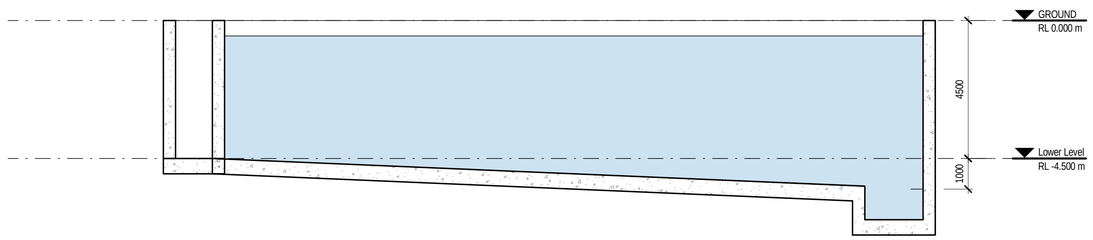


FLOOR PLAN
SCALE 1 : 100





CROSS SECTION
SCALE 1 : 100

CONCRETE VOLUME	
Material: Name	Material: Volume
31_Concrete_Cast	430 m³

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
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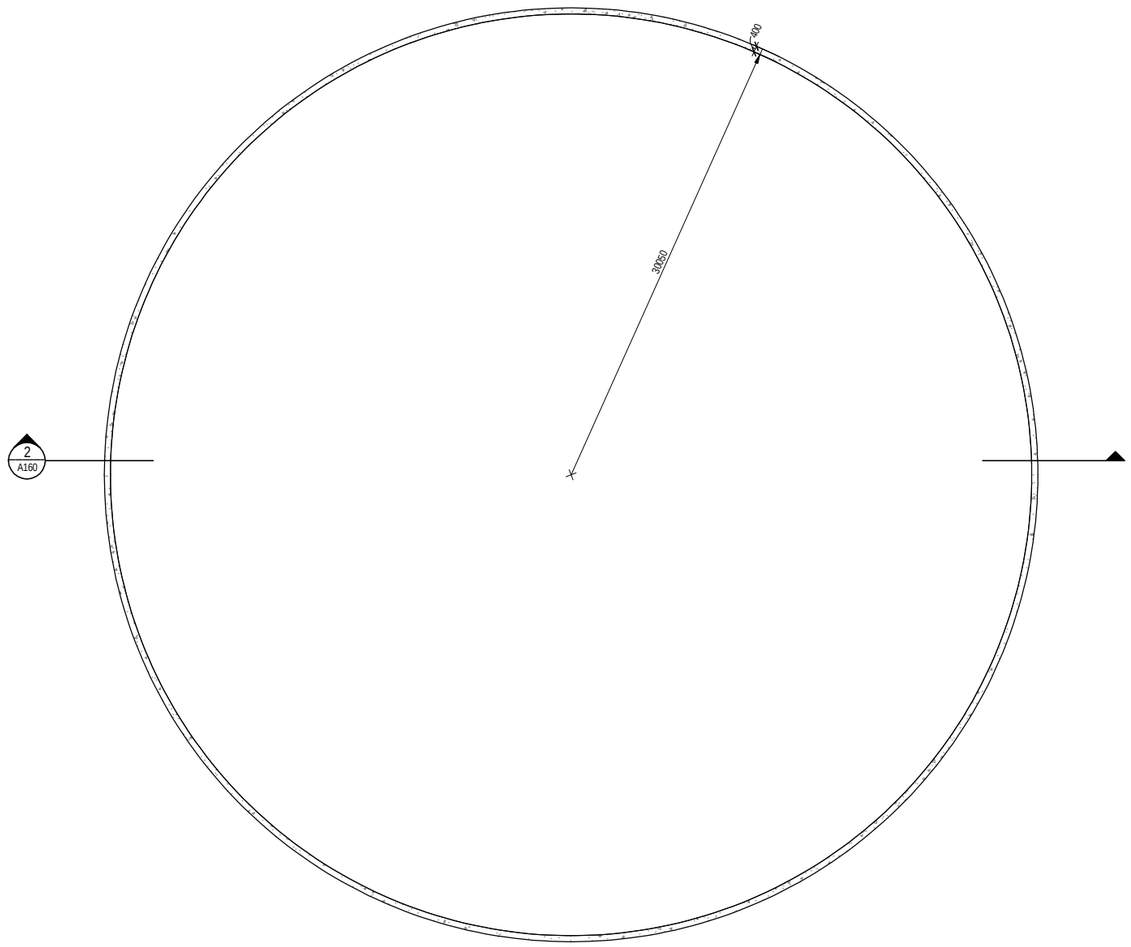
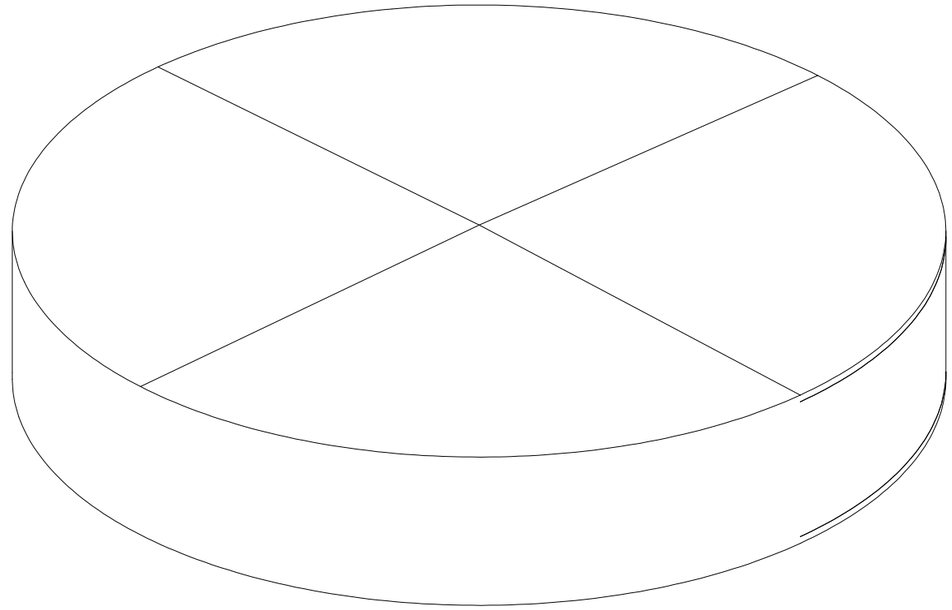
Client **Watercare Service LTD**
Project **HUIA Water Treatment Plant**
Title **WASHWATER TANK**

Original Size **A1** Drawing No: **51-33575-A150** Rev: **A**

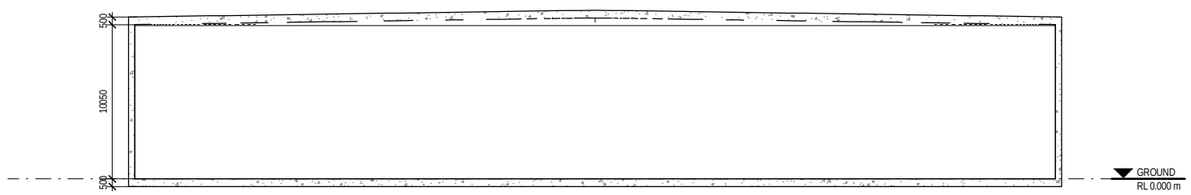
Plot Date: 2/09/2016 9:45:26 AM Cad File No: N:\NZ\Auckland\Projects\51\33575\CADD\Revit\A-Washwater Tank_V2015.rvt



FLOOR PLAN
SCALE 1 : 200



AXO
SCALE



2 SECTION
A160 SCALE 1 : 200

CONCRETE VOLUME	
Material: Name	Material: Volume
31_Concrete_Cast	3680 m³

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
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Drafting Check	CG	Design Check	MM
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Date	SEP 16		
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Client **Watercare Services Limited**
Project **HUIA WTP Implementation Strategy**
Title **RESERVOIR**

Original Size **A1** Drawing No: **51-33575-A160** Rev: **A**

Plot Date: 2/09/2016 9:17:39 AM
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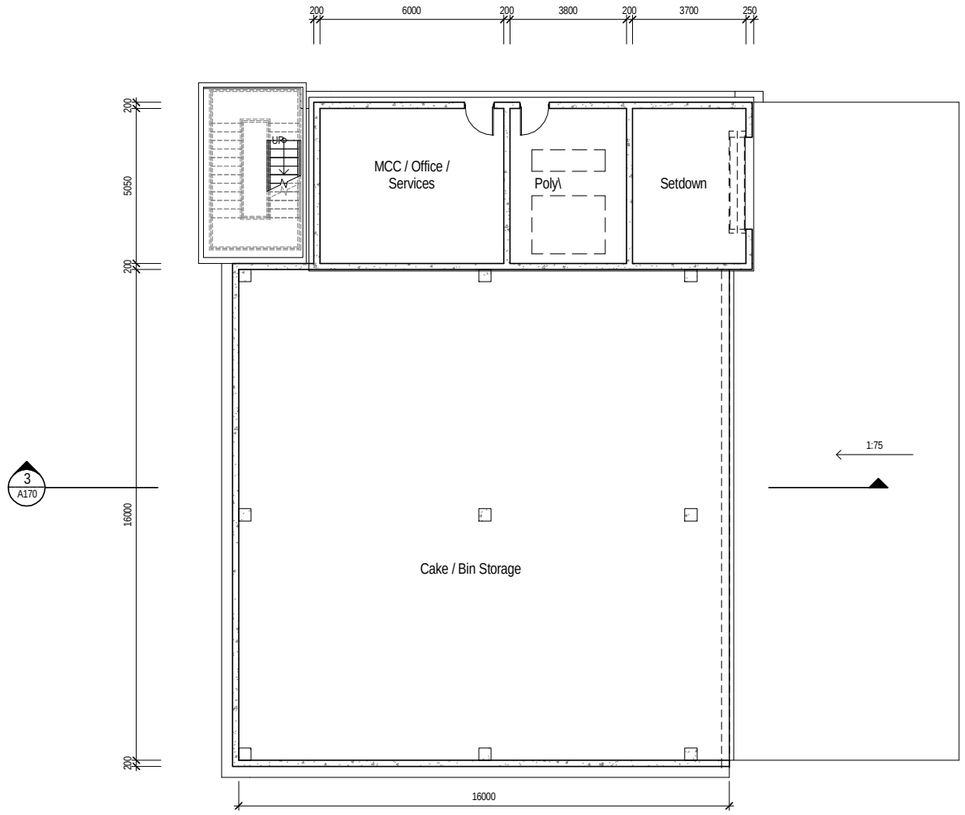
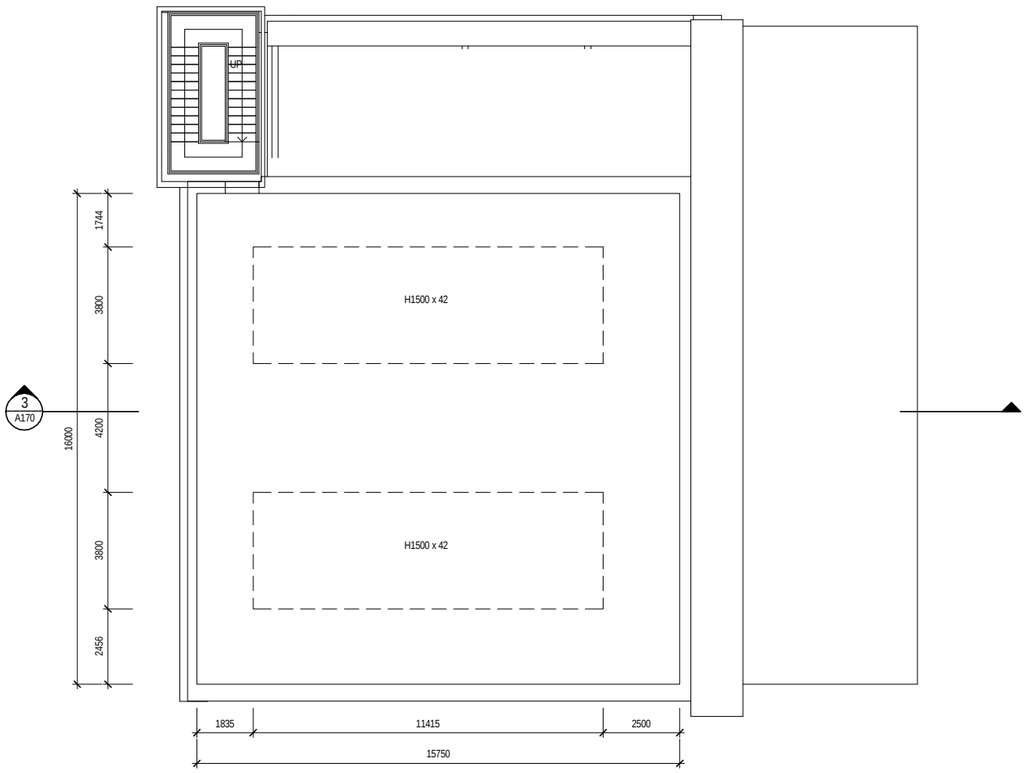
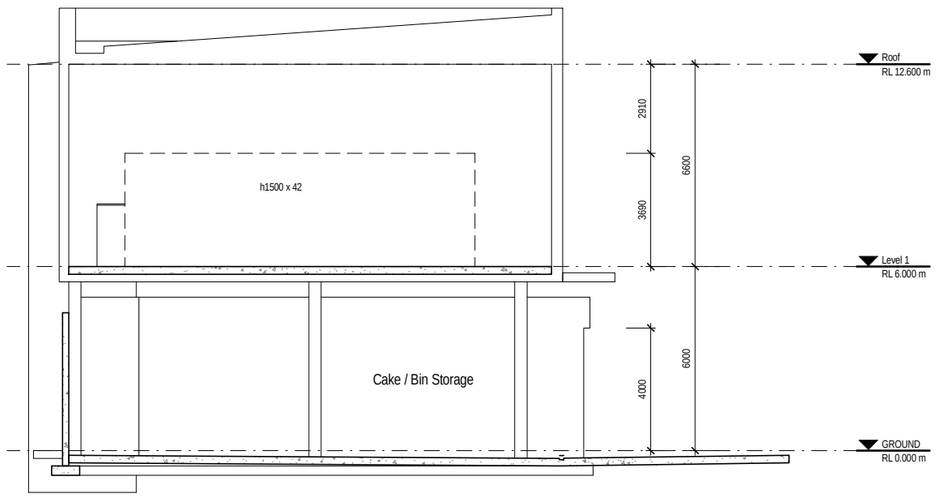


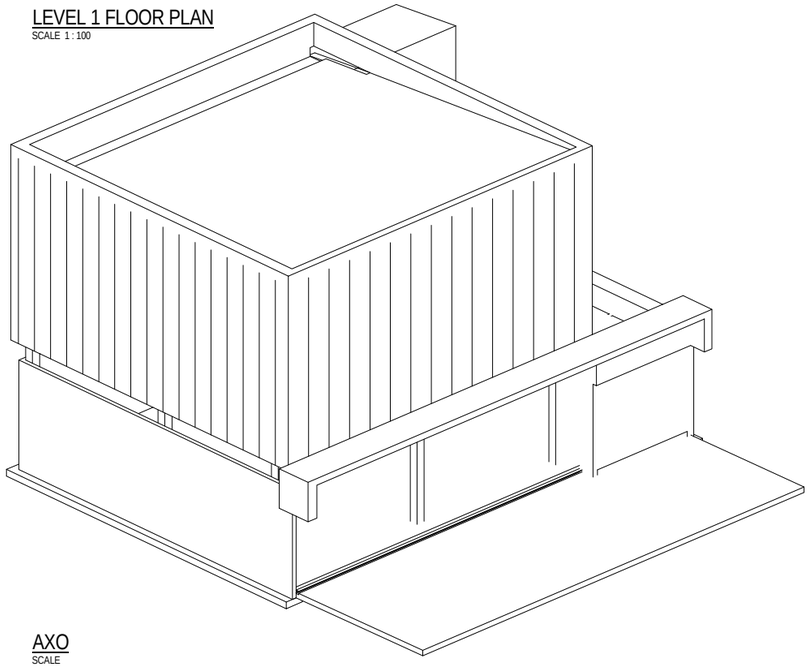
GROUND FLOOR PLAN
SCALE 1 : 100



LEVEL 1 FLOOR PLAN
SCALE 1 : 100



CROSS SECTION
SCALE 1 : 100



AXO
SCALE

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
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Approved (Project Director)	MM		
Date	SEP 16		
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Client **Watercare Services LTD**
Project **HUIA WTP Implementation Strategy**
Title **SLUDGE DEWATERING BUILDING**

Original Size **A1** Drawing No: **51-33575-A170** Rev: **A**

Plot Date: 2/09/2016 9:21:23 AM
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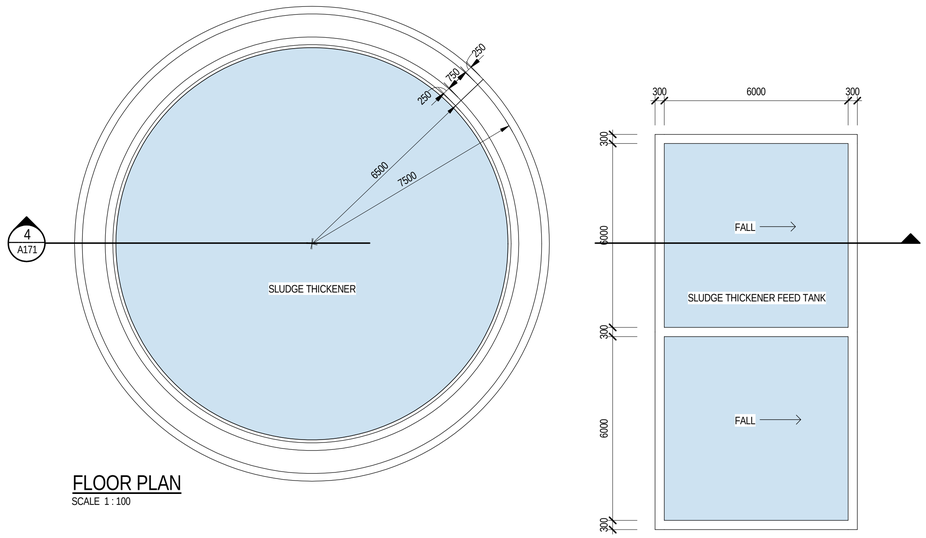
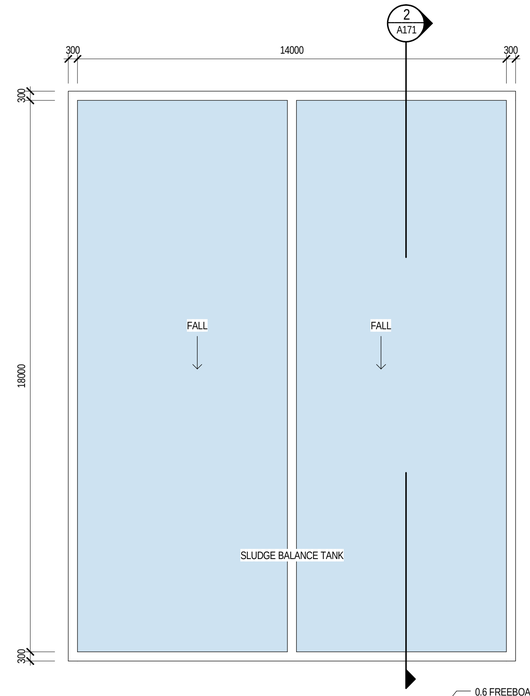
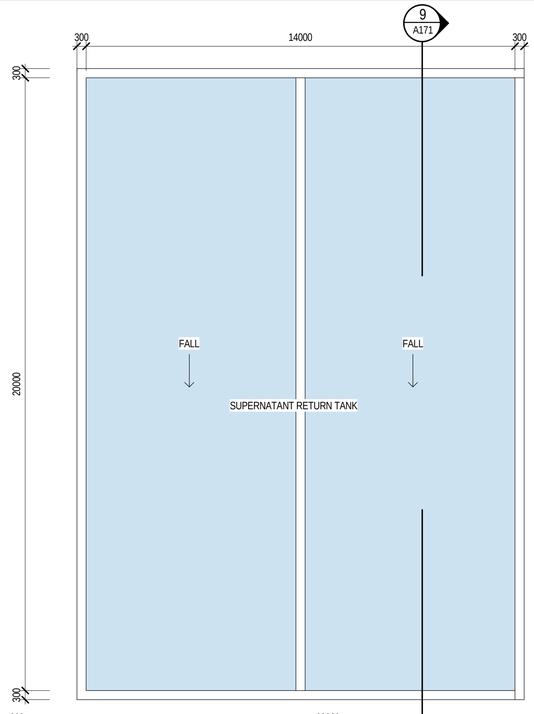
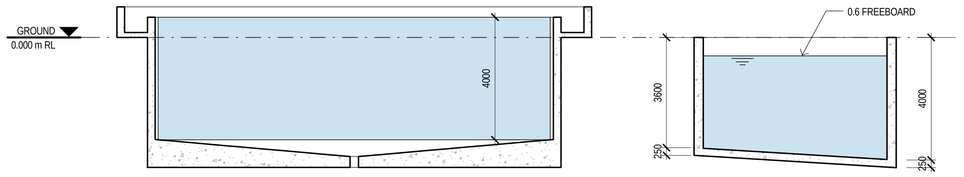


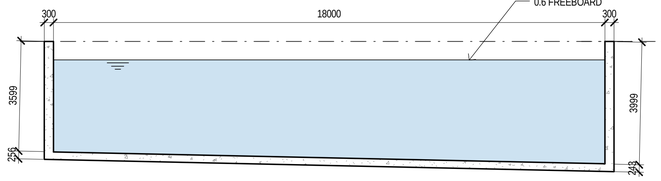
FLOOR PLAN
SCALE 1 : 100



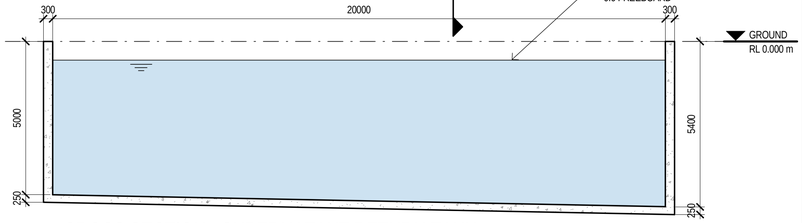




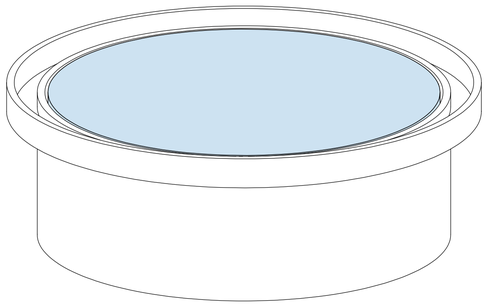
CROSS SECTION - SLUDGE THICKNER AND FEED TANK
SCALE 1 : 100

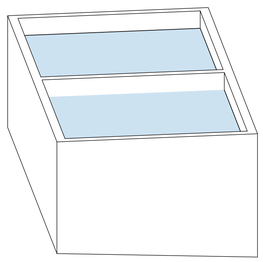


CROSS SECTION - SLUDGE BALANCE TANK
SCALE 1 : 100

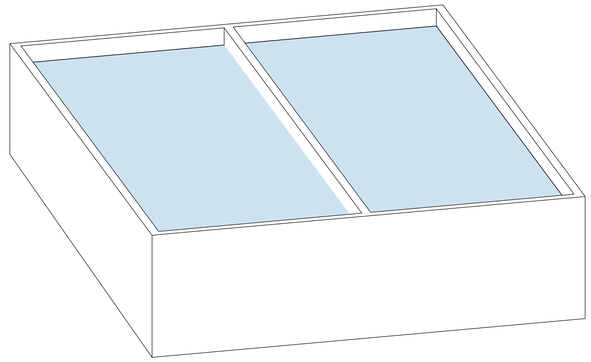


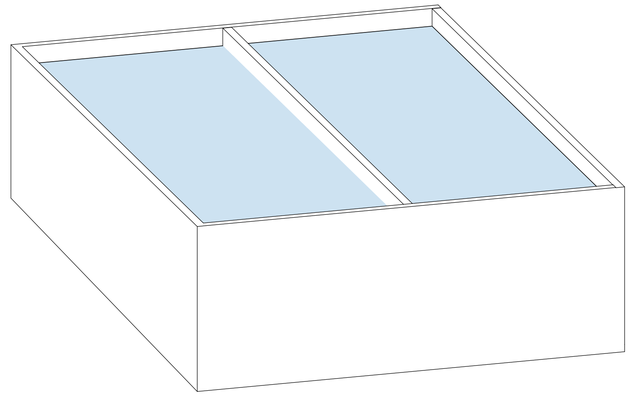
CROSS SECTION - SUPERNATANT RETURN TANK
SCALE 1 : 100





AXO
SCALE





Material Takeoff	
Material: Name	Material: Volume
31_Concrete_Cast	160 m³
31_Concrete_Cast	160 m³
31_Concrete_Cast	70 m³
31_Concrete_Cast	210 m³

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
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DO NOT SCALE

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Drafting Check	cg	Design Check	mm
Approved (Project Director)	MM		
Date	SEP 16		
Scale	1 : 100	This Drawing must not be used for Construction unless signed as Approved	

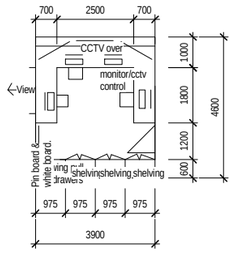
Client **Watercare Services LTD**
Project **HUIA WTP Implementation Strategy**
Title **SLUDGE THICKENER, SLUDGE FEED & BALANCE TANK, SUPERNATANT RETURN**

Original Size **A1** **Drawing No: 51-33575-A171** **Rev: A**

Plot Date: 2/09/2016 9:43:51 AM
Cad File No: C:\Users\ACunningham2\Documents\A-Sludge Thickener Tank_V2015_aaron.cunninghamUMCFH.rvt

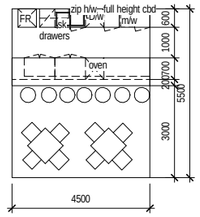
11.4.1 Huia Control Room

1. 3 x operator control room workstations
2. A/Con
3. filing/bookshelves for site operation and maintenance manuals & drawings
4. white boards, isolation and tagging stations, notice boards
5. security access card
6. CCTV monitors and control
7. Telephone facilites
8. view over the WTP site where possible



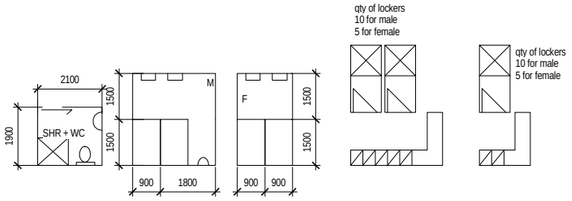
11.4.2 Spatial approximation Kitchen facilities

Notes:
1. double sink with h/c water
2. 2 drawer d/w
3. benchspace for food preparation
4. storage cup/d
5. zip boiler
6. fridge/freezer
7. M/wave
8. chairs and tables
9. Oven
10. Coffee & Tea
11. Extraction fans, telephone faciliteis, A/Con



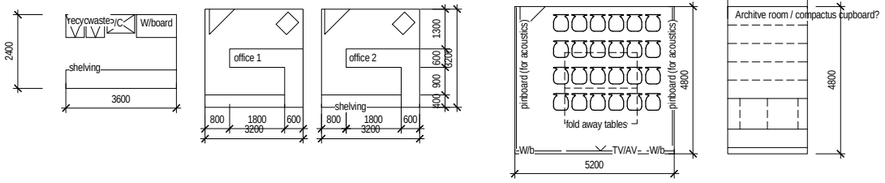
11.4.3 Spatial design sanitary compartments

Notes:
1. Separate male and female facilities for total of 15 permanent staff and 10 transient staff.
2. Separate changerooms for male and female.
3. Shower's / change and locker facilities to be separate to toilet facilities.
4. Hot and cold water supply to basins.
5. Female WCs required: 2
6. Male WCs required: 2
7. Male Urinals required: 1
8. Disabled WCs required: 1
9. Male shrs required: 3
10. Female shrs required: 2
11. Disabled shrs required: 1



11.4.5 office space

Notes:
1. 15 permanent staff and 10 transient staff.
2. Meeting room to hold 25 people including video conferencing
3. bookshelves / filing cabinets
4. whiteboards/notice board
5. swipe access
6. telephone facilites
7. natural lighting
8. two enclosed offices for senior management
9. Archive storage



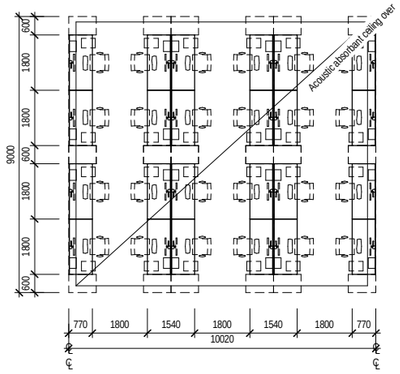
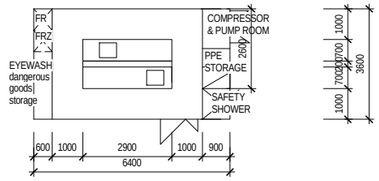


Diagram of Spatial Requirements

SCALE 1 : 100

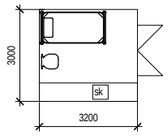
11.4.7 Laboratory

Notes:
1. 3 working people
2. benchspace to undertake water quality sampling and analysis
3. permanent setup of DAF jar testing equip
4. compressed air connection for jar tester
5. bench top instrumentation
6. treatment process samples piped directly to lab
7. fridge freezer for samples
8. requirement for pumping process samples to lab.
9. Dangerous goods storage cabinet
10. eyewash on bench. dousing shower req?
11. fire extinguisher
12. cup'd for coats
13. protective equipment
14. gloves dispenser
15. Double door / half set door.



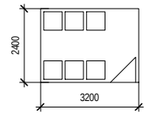
11.4.8 SICK BAY

Notes:
1. 1 Person to be treated in sick bay
2. ambulance loading area
3. medical storage cupboard, sink,



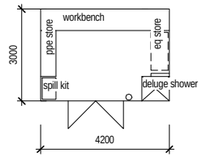
11.4.9 Server room

Notes:
1. Considered as part of fire resilience strategy



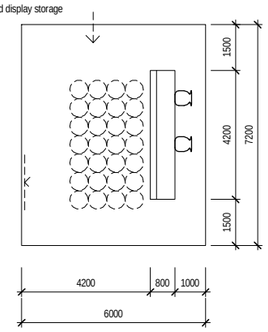
11.4.9 Storage Area and workshop

Notes:



11.4.9 Reception / Lobby

cater for presentations and display storage



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Drafting Check CG		Design Check MM	
Approved (Project Director)	MM		
Date	SEP 16		
Scale 1 : 100	This Drawing must not be used for Construction unless signed as Approved		

Client **Watercare Services Limited**
Project **HUIA WTP Implementation Strategy**
Title **ADMIN BUILDING**
BASIS OF DESIGN DIAGRAMS

Original Size **A1** Drawing No: **51-33575-A200** Rev: **A**

Plot Date: 2/09/2016 9:51:13 AM
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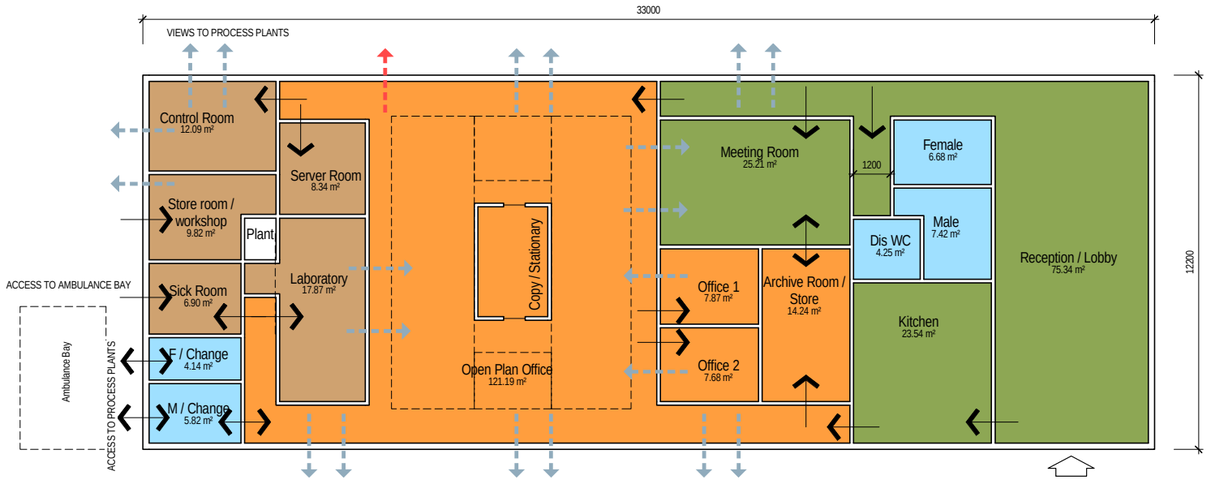


AREA PLAN
SCALE 1 : 100

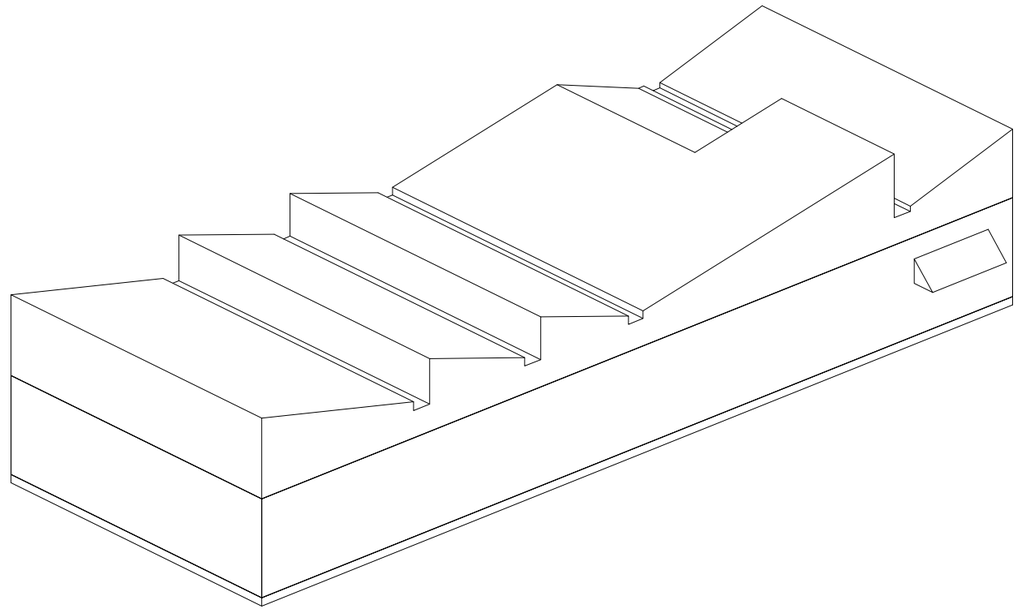
ZONING LEGEND

- Admin and Office
- Amenities
- Public
- Site Services

- Possible Fire Escape
- Sight lines
- Room Entry / Direct Relationship
- Room Relationship
- Building Front Entry

Room Area Schedule

Number	Name	Area	Department
1.01	Reception / Lobby	75.34 m²	Public
1.02	Female	6.68 m²	Amenities
1.03	Male	7.42 m²	Amenities
1.04	Dis WC	4.25 m²	Amenities
1.05	Meeting Room	25.21 m²	Public
1.06	Office 1	7.87 m²	Admin and Office
1.07	Archive Room / Store	14.24 m²	Admin and Office
1.08	Office 2	7.68 m²	Admin and Office
1.09	Kitchen	23.54 m²	Public
1.10	Copy / Stationary	8.25 m²	Admin and Office
1.11	Open Plan Office	121.19 m²	Admin and Office
1.12	Control Room	12.09 m²	Site Services
1.13	Server Room	8.34 m²	Site Services
1.14	F / Change	4.14 m²	Amenities
1.15	M / Change	5.82 m²	Amenities
1.16	Laboratory	17.87 m²	Site Services
1.17	Store room / workshop	9.82 m²	Site Services
1.18	Sick Room	6.90 m²	Site Services
1.19	Plant	1.39 m²	
		368.04 m²	



AXO
SCALE

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A	SITE SELECTION STUDY		AC	CG	MM	09/16

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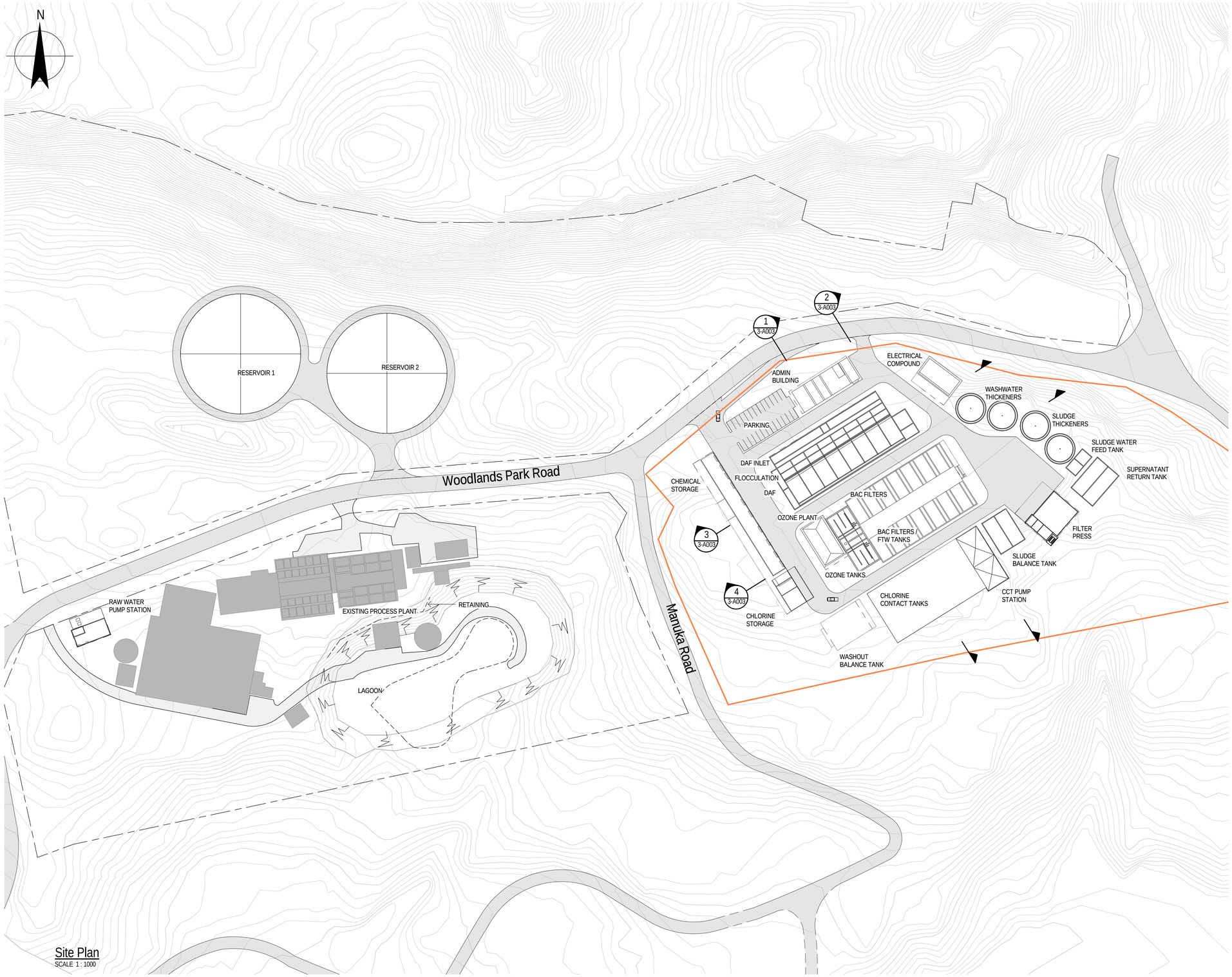
Client **Watercare Services Limited**
Project **HUIA WTP Implementation Strategy**
Title **ADMIN BUILDING SKETCH AREA PLAN**

Original Size **A1** Drawing No: **51-33575-A201** Rev: **A**

Plot Date: 2/09/2016 9:51:14 AM
Cad File No: C:\Users\ACunningham2\Documents\A_Admin Building_V2015_aaron.cunninghamUMCFH.rvt

Appendix B Main Process Unit Drawings



Site Plan
SCALE 1 : 1000

Location Plan
SCALE 1 : 5000

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	SITE SELECTION STUDY		AC	CG	MM	09/16

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SCALE 1:5000 AT ORIGINAL SIZE

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SCALE 1:1000 AT ORIGINAL SIZE

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Scale	As indicated		

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Client **Watercare Services LTD**
Project **HUIA Water Treatment Plant**
Title **Manuka Road Option Overall Site Plan**

Original Size **A1**
Drawing No: **51-33575-3-A001**
Rev: **A**

Plot Date: 1/09/2016 5:25:22 PM
Cad File No: C:\Users\ACunningham2\Documents\A_Site_Woodlands Park_aaron.cunninghamUMCFH.rvt

N

RETAINING

Cut / Fill Schedule			
Name	Cut	Fill	Net cut/fill
	8650 m³	9270 m³	620 m³
Admin Building	580 m³	0 m³	-580 m³
BAC	2580 m³	0 m³	-2580 m³
BAC / Upwash	5420 m³	0 m³	-5420 m³
BAC Gallery	3650 m³	0 m³	-3650 m³
BAC Washtank	4890 m³	0 m³	-4890 m³
Chemical Storage Building	1660 m³	340 m³	-1330 m³
Chlorine Contact Tanks	12020 m³	0 m³	-12020 m³
Chlorine Contact Tanks Pump Station	2260 m³	0 m³	-2260 m³
DAF	4100 m³	0 m³	-4100 m³
DAF Flocculation	5160 m³	0 m³	-5160 m³
Electrical Compound	280 m³	110 m³	-180 m³
Lagoon	28990 m³	50 m³	-28940 m³
Ozone Contact Plant	720 m³	0 m³	-720 m³
Ozone Contact Tanks	820 m³	0 m³	-820 m³
Raw Water Pump Station	10 m³	10 m³	0 m³
Raw Water Well	1440 m³	0 m³	-1440 m³
Reservoir 1	580 m³	4300 m³	3720 m³
Reservoir 2	10 m³	13310 m³	13310 m³
Sludge Balance Tank	170 m³	70 m³	-100 m³
Sludge Dewatering Building	0 m³	1990 m³	1990 m³
Sludge Thickener	330 m³	270 m³	-60 m³
Sludge Thickener Feed Tank	0 m³	150 m³	150 m³
Supernatant Return Tank	530 m³	0 m³	-530 m³
Washdown Thickeners	500 m³	210 m³	-280 m³
Washwater Tank	1680 m³	0 m³	-1680 m³
	87050 m³	30090 m³	-56960 m³

SITE FILL

SITE EXCAVATION

EXISTING BUILDING

EARTHWORKS EXTENT

CONSTRUCTION LAYDOWN AREA

Cut and Fill Site Plan

SCALE 1 : 1000

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
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0 10 20 30 40 50 m

SCALE 1:1000 AT ORIGINAL SIZE

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Date	SEP 16		
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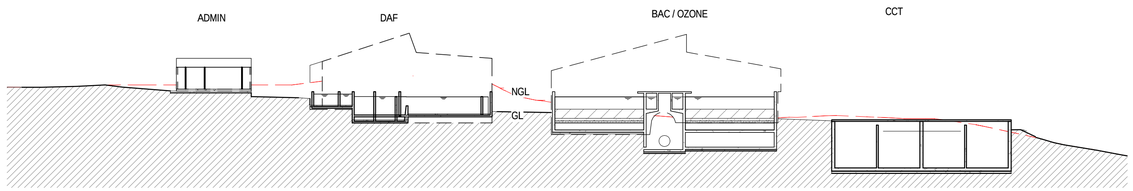
Client **Watercare Services LTD**
Project **HUIA Water Treatment Plant**
Title **Manuka Road Option**
Cut and Fill Site Plan

Original Size **A1**
Drawing No: 51-33575-3-A002 **Rev: A**

Plot Date: 1/09/2016 5:25:38 PM Cad File No: C:\Users\ACunningham2\Documents\A_Site_Woodlands Park_aaron.cunninghamUMCFH.rvt



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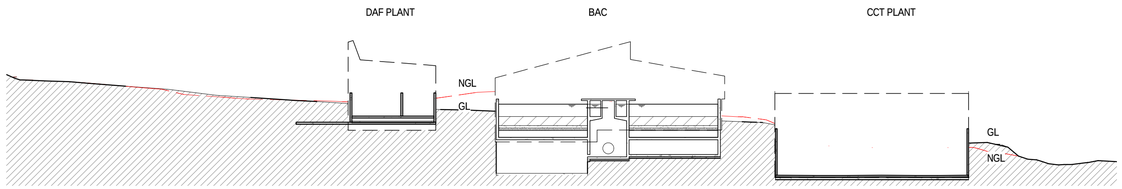

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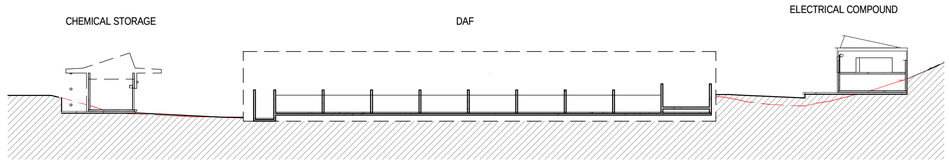
3-A001 SCALE 1 : 500



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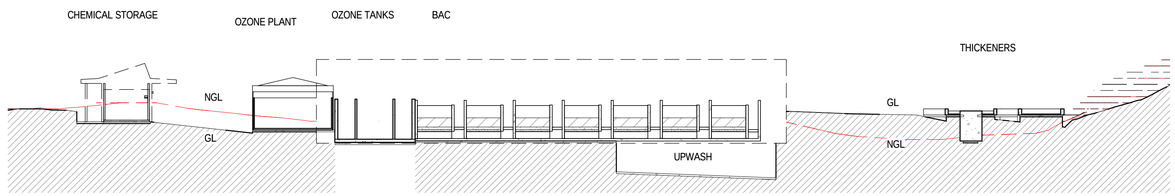

4 SECTION
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Client **Watercare Services LTD**
Project **HUIA Water Treatment Plant**
Title **Manuka Road Option**
Overall Site Sections

Original Size **A1** Drawing No: **51-33575-3-A003** Rev: **A**

Plot Date: 1/09/2016 5:25:40 PM Cad File No: C:\Users\ACunningham2\Documents\A_Site_Woodlands Park_aaron.cunninghamUMCFH.rvt

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HIGH LEVEL OF ENVIORMENTAL SIGNIFICANCE (INDICATIVE ONLY)

LEGEND:

- RAW WATER
- TREATED WATER
- OVERFLOW
- DISCHARGE

Aerial Plan

SCALE 1 : 1000

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	SITE SELECTION STUDY		AC	CG	MM	09/16

0 10 20 30 40 50 m

SCALE 1:1000 AT ORIGINAL SIZE

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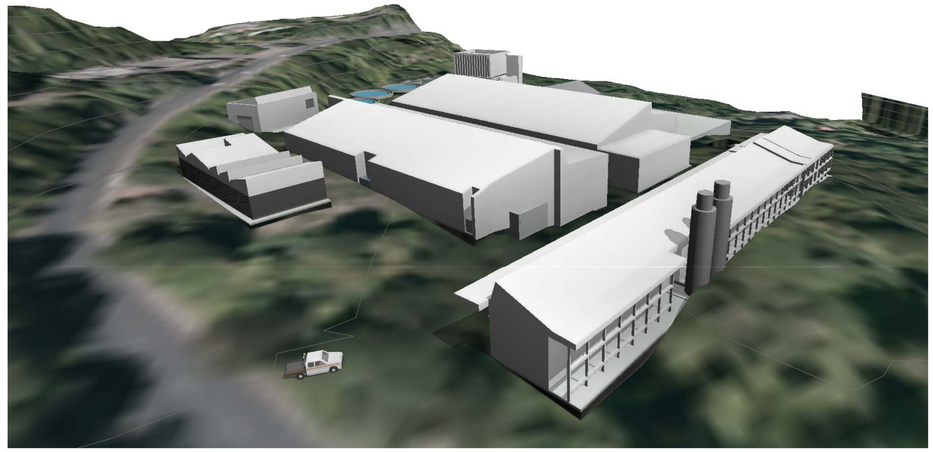
Client **Watercare Services LTD**
Project **HUIA Water Treatment Plant**
Title **Manuka Road Option Overall Aerial Site Plan**

Original Size **A1** Drawing No: **51-33575-3-A004** Rev: **A**

Plot Date: 1/09/2016 5:25:45 PM Cad File No: C:\Users\ACunningham2\Documents\A_Site_Woodlands Park_aaron.cunninghamUMCFH.rvt

Site Axo
NOT TO SCALE



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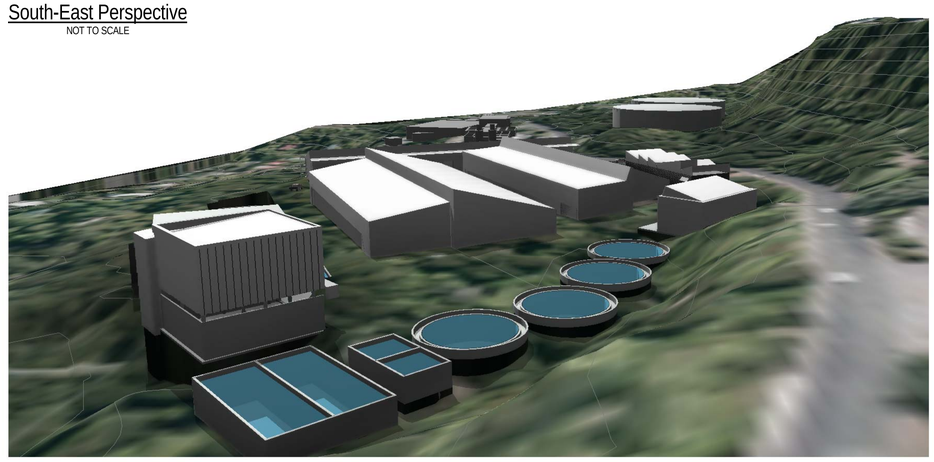

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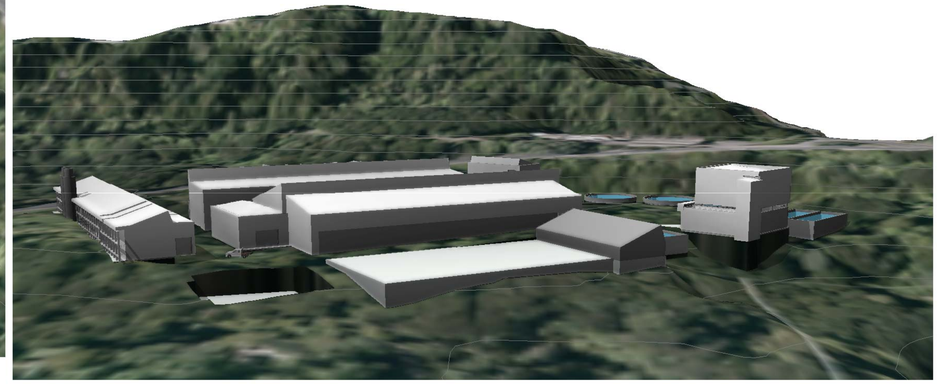

South-West Perspective
NOT TO SCALE

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
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Approved (Project Director)	MM		
Date	SEP 16		
Scale	NOT TO SCALE	This Drawing must not be used for Construction unless signed as Approved	

Client **Watercare Services LTD**
Project **HUIA Water Treatment Plant**
Title **Manuka Road Option**
Site Works Axonometric

Original Size **A1** Drawing No: **51-33575-3-A005** Rev: **A**

Plot Date: 1/09/2016 5:26:23 PM Cad File No: C:\Users\ACunningham2\Documents\A_Site_Woodlands Park_aaron.cunninghamUMCFH.rvt

Site Plan 140MLD

SCALE 1 : 1000

Site Plan 160MLD

SCALE 1 : 1000

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0 10 20 30 40 50 m

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Date	SEP 16		
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Client **Watercare Services LTD**

Project **HUIA Water Treatment Plant**

Title **Manuka Road Option**
Overall Site Plan 140/160MLD

Original Size **A1**

Drawing No: **51-33575-3-A006**

Rev: **A**

Plot Date: 1/09/2016 5:26:37 PM

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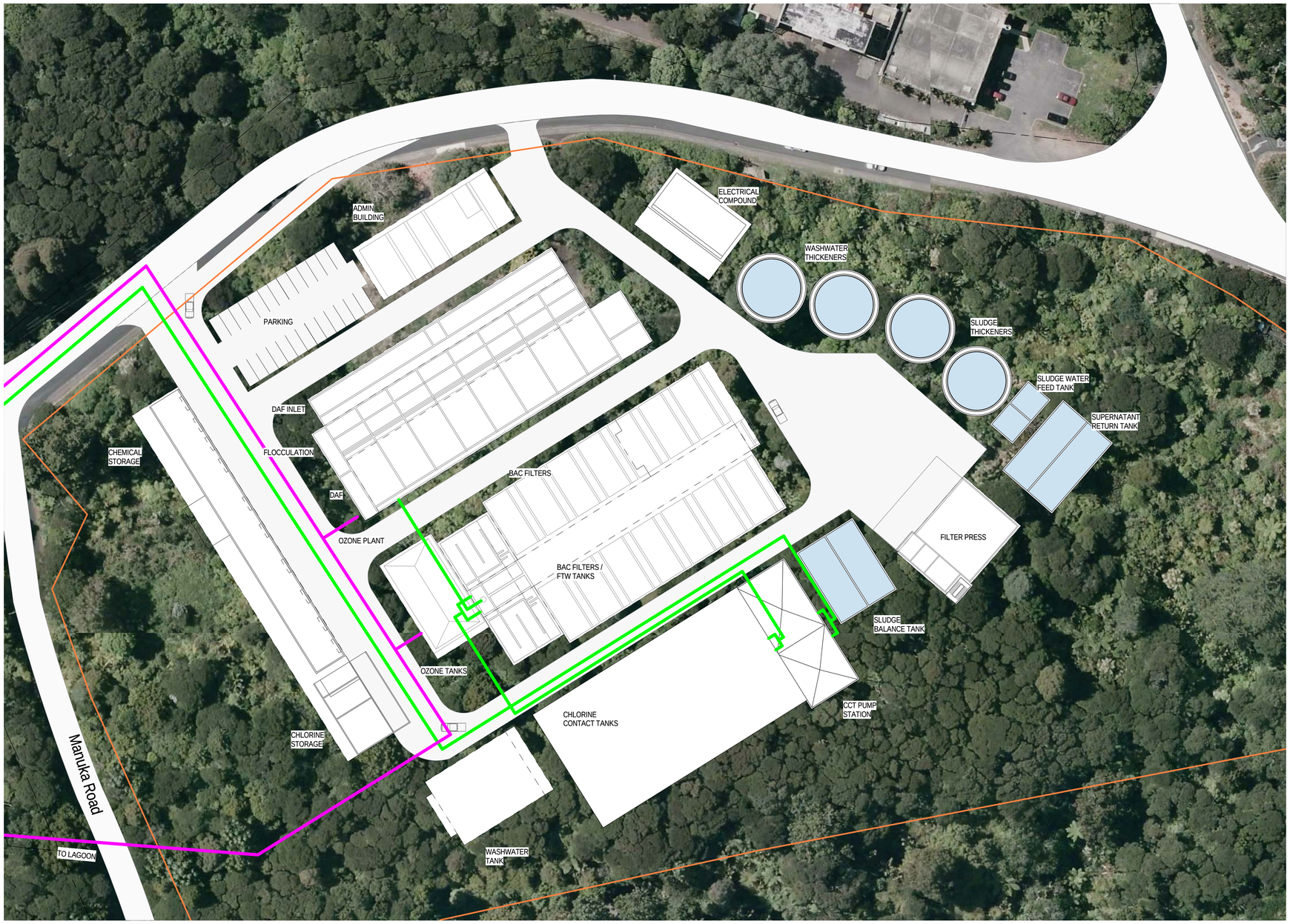
LEGEND:

TREATED WATER

OVERFLOW



Pipework Layout Plan

SCALE 1 : 500

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	SITE SELECTION STUDY		AC	CG	MM	09/16

0 5 10 15 20 25 m

SCALE 1:500 AT ORIGINAL SIZE

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Approved (Project Director)	MM		
Date	SEP 16		
Scale	1 : 500		

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Client **Watercare Services LTD**

Project **HUIA Water Treatment Plant**

Title **Manuka Road Option**
Pipework Layout Plan

Original Size **A1**

Drawing No: 51-33575-3-A007 **Rev: A**

Plot Date: 1/09/2016 5:26:44 PM

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Appendix C Huia Operational Requirements Workshop Register

Huia WTP - Register of Design Considerations

Date: 20/04/2018

				Identification		Design Consideration Consequence								Outcomes
Item	Category	Plant Element	Min. Requirement	Design Consideration Query	Design Consideration Benefit	Design	Operability	Maintainability	Constructability	Future Proofing	Possible Cost Implication	Decommissioning	External Impacts	Adopted Outcome
1	Process Structures	Size of process structures	As per Basis of Design, 140MLD capacity	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Process units adopted as per Basis of Design
2	Access	Permanent Access (distance between structures)	Minimum road width suitable for two cars Full road access around DAF/BAC/Ozone process units, other units required at least one face road facing	Could the access be less than this? Could there be less roads?	Reduced footprint, reduced impervious areas	Impervious areas can be reduced through inclusion of permeable paving - detailed design consideration.		All process facilities need to have the ability to remove heavy equipment (valves/pumps) externally - requires crane access on at least one face. BAC facility will require media replacement on a regular basis for each cell, therefore requires crane access all-round DAFF facility will require overhaul of air diffusers, therfore requires crane access all-round	Need clear space to install tank components and equipment	Wider roads required to ensure that furture larger B-trains. Truck and trains may be required for future sludge disposal.	Probably immaterial	Space required for decommissioning		Minimum road width suitable for two cars Full road access around DAF/BAC/Ozone process units, other units required at least one face road facing
3	Access	Permanent Access (distance between structures)	'Drive through' required for chemical delivery	Could an in/out facility be used?	Reduced footprint	Noted that reversing of chemical tankers from delivery bay is not permitted under AS 3780	Minimum road widths and no large paved areas means impractical to have B-train delivery vehicles reversing			May exclude the use of future larger B-train vehicles	Probably immaterial			Drive through' chemical delivery facility
4	Access	Permanent Access (distance between structures)	Footpath required on all roads (HSE requirement)	Could staff use the road instead? Could vehicles on-site have priority?	Reduced footprint		Staff will regularly be walking around site - best practise to separate staff from traffic for safety purposes Inconsistent with other Watercare sites if vehicles have priority Public tours to be taken through the plant -	Staff will regularly be walking around site - best practise to separate staff from traffic for safety purposes Inconsistent with other Watercare sites if vehicles have priority			Probably immaterial			Footpath required on all roads
5	Access	Permanent Access (distance between structures)	Sufficient space required for truck to back into sludge press	'Drive through' option? Alterantives to truck movements?	Reduced footprint	Future Disposal location currently unknown, but expected to be many Kilometers away. Truck typical way solids disposed of from Water and Wastewater plants in New Zealand (incl. existing Huia WTP) Unknown if 'Drive through' options will be possible, and will be dependent on process design and sludge treatment technology selected Nearest known sludge disposal facility would be Puketutu Island - approx. 26km, and would be impractical to pump this distance. Possibility that, with Kauri Dieback, won't be permitted to dispose of sludge to this location, and may need to be taken further afield Possibility of disposal to wastewater sewer, but feasibility of this still being confirmed as there are capacity issues in the existing wastewater network in the area. This would be the preferred option, but Watercare are not yet in a position to	Sludge movements will be frequent and on-going for the life of the plant Possible to use hook bins, but truck movements (and associated space) still required to transport these bins for disposal 'Drive through' option preferred by Operations, but can only be determined as part of sludge treatment technology selected			Having sufficient footprint will allow for larger trucks to be used future (which would mean fewer truck trips)	Probably material		Drive through' option would require an over height structure for sludge handling i.e. ground floor truck access, second floor sludge storage, third floor sludge thickeners. Visual impact would be increased, potential for noise to travel further also increased	Allow space for truck to be backed in to sludge press facility, noting Operations preference for a 'Drive through' facility Feasibility of sludge disposal to the existing wastewater network still being confirmed (WSL)
6	Access	Temporary Access (Dist between structures)	2m wide footpath around all equipment without road access for access purposes	Could this access be eliminated?	Reduced footprint		Required to access all parts of a structure as part of routine plant inspections	Required to access all parts of a structure as part of routine plant inspections Required for access to the structure during peroids of maintenance. Noted that erection of scaffolding will likely be required for any maintenance activities, so needs to be sufficient plant to install this	Access will be required around the structure as part of the construction of the facility		Probably immaterial	Access will be required around the structure to allow for decommissioning of the facility		2m wide footpath adopted around all equipment
7	Access	Entry/Exit to Site	Two-way primary entry and exit to the facility for heavy vehicles, Secondary emergency exit for heavy vehicles	Could only a single two-way primary entry/exit be provided?	Reduced footprint/One location for traffic	Primary entryway will need to be large to accommodate heavy vehicle access in a safe manner	Primary access provides key means for meeting Operational requirements. Provision of a secondary access means that, in the unlikely event the primary access is blocked, an emergency secondary access is available to allow plant operations to continue and access for service vehicles Two lane secondary access would be preferable, but may be impractical given site constraints	A secondary access allows for maintenance vehicles entry separate to operations entrance. This also allows any maintenance activites on the Primary access (e.g. resealing of road, repair or replacement of gate) to be conducted without affecting plant operations	Multiple access points, if available for construction activities, will assist in construction vehicle movements		Probably immaterial	A secondary access allows for decommissioning vehicles to enter separate to operations entrance, allowing this to be conducted without affecting plant operations	Noted that the secondary access is expected to be used rarely	Provide two-way primary entry and exit access point, and single lane secondary access point
8	Access	Entry/Exit to Site	Heavy vehicle entering onto the site must be wholly off Woodlands Park Road for safety reasons	Could the truck remain partly/in full within the road?	Reduced footprint	Watercare may be liable for any injury or death accidents caused by vehicles entering their site - not acceptable to Watercare to accept this risk Opportunity to 'eliminate' the hazard which is in the best interests of the community and Watercare	Truck movementsrequired for chemical deliveries and for sludge removal Operational preference for multiple trucks to be removed from the road, but this may not be practical given the space contraints on site	Truck movements required for maintenance activities	Same/similar access method may be able to be used during construction, providing safety benefits		Probably immaterial			Adopt requirements for vehicles to be wholly off Woodland Park Road when entering site
9	Access	Road Gradients	Flat areas in front of Chemical Delivery facility and Filter press facility entry/exit. Remainder of roads within site to ATCOP. Entry/exit gradients need to accommodate heavy vehicles	Could we not reduce earthworks by choosing steeper/shallower gradients?	Reduced earthworks footprint	Access through the site will be impaired/impossible if slopes are too steep - heavy vehicle access must be all-weather. Noted that trucks struggle with navigating existing facility in wet Within gradient limits, optimisation will take place as part of the design as bulk earthworks are expensive, and minimising these will assit in	Chemical Delivery facility must be flat to facilitate chemical deliveries Filter Press facility must be flat to facility heavy vehicle turning/reversing Essential that traffic movement is maintained at all times/in all weather as facility must be operate 24/7	Vehicle access to site required at all times for emergency maintenance activities	Minimising cut/fill will be provide cost benefits and reduced construction timeframes	Probably material, however earthworks will be a function of the required road gradients	Risk of ground contamination		Flat areas in front of Chemical Delivery facility and Filter press facility entry/exit. Remainder of roads within site to ATCOP.
10	Construction	Laydown/site office area	Construction duration must meet project timeframes - essential this project is online by 2023 to service the people of Auckland	Could no laydown area be provided?	Reduced temporary construction footprint		Overall construction timeframes must be met. Construction of the new Huia Water Treatment plant provides a significant risk mitigation to the overall water supply of Auckland, in that the existing Huia facility is at the end of it's service life.		It would be common for a construction project to provide a site larger than required for the physical works to allow the Contractor to establish a laydown area. The Waikato Water Treatment plant (of a similar size to the Huia plant) had a purpose-built laydown area of around 5,000m2. To meet construction timeframes, not providing a laydown area may require 24 hour construction and/or additional truck movements to service site.	Probably material		24 hour and/or additional truck movements will have an impact on local residents during the construction phase	(Specalist input to be sought from Alta on construction impact of not providing dedicated construction laydown area - to be carried out once earthworks requirements determined)
11	Ancillary Structures	Administration Building	Required as per Basis of Design. Must be located at front of facility	Could we put it elsewhere?	Avoids high ecological value areas		Operations requirement to locate at the front of the facility, as this provides for oversight of vehicle movments at the site. It's also provides Health and Safety advantages as visitors or contractors must pass through the facility and sign in before being granted to site. Regular issues occur with Watercare's other sites where the administration building is not located at the entry to plant Controlling access to site is a key requirement for emergency management, particularly given the risk of chlorine leak and other emergencies. Locating this at the front of the facility also allows for a single emergency response location to be set				Probably immaterial			Admin building required, and to be located at entry to site
12	Ancillary Structures	Carparking	Minimum requirement for 25 carparks as per Basis of Design	Can we put the carpark elsewhere/underground?	Reduced footprint	Some additional design complexity locating the carpark below another facility	An operating treatment plant site will need staff and visitors to be on site. Given the remoteness of the facility the only practicable option is to provide carparking facilities In the event of an emergency, vehciles will need rapid access to site, and a carpark provides the only practicable option for this. Acceess will be needed quickly to the administration building in such events for meetings/plans/health and safety briefing etc Parking on Woodland Park Road or other nearby roads is not safe or practicable No objection from an Operations perspective to locate the facility underground or under a	Rapid access to site is required in the event of emergency maintenance - vehicles are therefore required to be parked on site, and are best parked in a dedicated facility to maintain operations (e.g. chemical delivery trucks)			Probably immaterial		Provision of carparking reduces external impacts e.g. on-road parking	Some or all carparking to be provided underneath the Administration Building. Facility for parking of larger vehicles within the site will be required.
13	Ancillary Structures	Fencing	Electric fence, 1m clear distance either side	Could no fencing be used? Could no clear space be provided?	Reduced footprint		Security fencing required for a facility of regional importance. Electric fencing deemed the minimum level of security required at such facilities, and is consitent with other Water and Wastewater Treatment Plants in the region Not providing clear space will mean vegetation will contact the fence, eliminating the	Clear space required for personnel access to clear vegetation touching the fence			Probably immaterial			Electric fence, 1m clear distance either side

14	Ancillary Structures	Electrical	Required as per Basis of Design. Need to include space for transportable standby generator. Truck access required for fuel/genset maintenance	Could we not remove generator?	Reduced footprint		Full Redundancy, incl. generator required for a water treatment plant of regional significance that must be fully operational at all times. Transportable generator space required to provide operational flexibility if major generator failure occurs e.g. genset fire	Vehicle access required to maintain genset and fuel storage to enable 'always ready' standby			Insignificant			Required as per Basis of Design. Need to include space for transportable standby generator. Truck access required for fuel/genset maintenance
15	Ancillary Structures	Stacking - Chemical Facility	Chemical facility on site	Could the Chemical facility be underground?	Reduced footprint (would be contained under road)	Designing a facility to meet current checmical storage regulations would be significantly more difficult and costly.	Having a chemical facility underground represents a risk to the plant, as it could be impacted by flooding events or damage from vehciles above. It would not be possible to run the treatment plant facility without access to large quantities of chemicals provided by the chemical storage facility An undergound facility will introduce a confined space to the site - a serious Health and Safety consideration which make all works undertaken	An undergound facility will introduce a confined space to the site - a serious Health and Safety consideration which make all works undertaken at this facility much more risky Maintenance becomes more difficult as access is constrained by the facility being underground. May require 'lid' remove or similar which will impact of accessibility through the site, which is untenable	Requires more cut on site for installation of the facility Underground structures are inherently less constructable than their on-ground peers Introduces confined spaces risk during construction	Will limit the ability to upgrade/expand this facility in future if require. Will also limit the ability to upgrade this facility to meet future Chemical Storage regulations, and/or may simply be non-compliant with future Chemical Storage regulations leading to a difficult Health and Safety issue to manage	Probably material	Risk of surrounding ground becoming contaminated during the facilities operation. Likely to require more extensive remedation during decommissioning		Not adopted to underground facility on basis of cost, risk and health and safety (accessibility)
16	Ancillary Structures	Stacking - Other tanks	Minimimum pumping, no stacking	Can they be stacked?	Reduced footprint	Deisgn is more difficult with stacked tankage Hydraulic profile is likely to mean that stacked tanks require additional pumping in order to use this storage	Introduces additional health and safety risks working in empty tanks below full tanks	Introduces additional health and safety risks working in empty tanks below full tanks	Stacked tanks are significantly more difficult to construct due to the sizes of component parts	Eliminates installaing equipment ontop of tanks in future	Probably material	Unable to decommission tanks underneath existing tanks	Likley to increase height, which will impact on visual elements	Not adopted to stack tanks
17	Ancillary Structures	Other process	No risk of leakage into processes	Can they be stacked?	Reduced footprint	All process units must be discrete and operationally independent to provide for a reliable, maintainable and operable plant of regional significane with a high uptime	From a water safety perspective, it is not acceptable for any external leaking into the process element. Any such leakage would require a full plant shut down and cleaning For example, it is not acceptable for fuel (with storage or in vehicles) to be stacked upon process vessels. Similarly waste discharges on the process cannot be stacked upon process vessels				Probably material		Likley to increase height, which will impact on visual elements	Not adopted to stack processes
18	Ancillary Structures	Sludge Thicknerner	Gravity thicknerner	What about using a plate settler process?	Smaller footprint	Not a proven technology on Waitakere water - the existing site uses gravity thickerner techology	Risk of plant being non-operational if the technology proves unsuccessful. This is not an acceptable risk for a regional facility				Probably immaterial			Not adopted
19	Ancillary Structures	Balance tanks	Separate, on-ground tanks	What if we put these underground?	Smaller footprint	All process units must be discrete and operationally independent to provide for a reliable, maintainable and operable plant of regional significane with a high uptime	Underground tanks cause confined spaces. Additional pumping energy costs. Unable to spot process issues.	An undergound facility will introduce a confined space to the site - a serious Health and Safety consideration which make all works undertaken at this facility much more risky Maintenance becomes more difficult as access is constrained by the facility being underground. May require 'lid' remove or similar which will impact of accessibility through the site, which is			Probably material			Not adopted
20	Process Structures	Stacking DAF	Not stacked	Can these be stacked?	Smaller footprint		A building is located overtop of the facility - it would therefore not be possible to stack another process on top	Need to access mechanical equipment from the top of the facility (e.g. gantry crane) for maintenance purposes - won't be possible with an additional process stacked on top	Stacking another process on top will significnatly reduce the constructability		Probably material		Likley to increase height, which will impact on visual elements	Not adopted
21	Process Structures	Stacking BAC	Upwash tanks stacked underneath facility	Can we stack something on top?	Smaller footprint	Upwash and washwater tanks already located underneath the BAC process.	A building is located overtop of the facility - it would therefore not be possible to stack another prrocess on top Upwash tanks already located underneath the facility to save space and provide process advantages	Need to access mechanical equipment from the top of the facility (e.g. gantry crane) for maintenance purposes - won't be possible with an additional process stacked on top Media will need to be replaced regularly, and this is access through the top of the process unit	Stacking another process on top will significnatly reduce the constructability		Probably material		Likley to increase height, which will impact on visual elements	Not adopted
22	Process Structures	Stacking Chlorine Contact	No stacking	Can we stack something on top	Smaller footprint	Due to chlorine dosing, tank (and any structures above) need to be designed to be chloride resistant.	From a water safety perspective, it is not acceptable for any external leaking into the process element. Any such leakage would require a full plant shut down and cleaning. Note that the chlorine contact tank is the very last facility before water leaves the plant, so any contamination cannot be later removed		Stacking another process on top will significnatly reduce the constructability		Probably material		Likley to increase height, which will impact on visual elements	Not adopted
23	Process Structures	Chlorine Contact	Contact time of 20 min	Can contact time be reduced from 20 minutes?	Reduced footprint	Reduced chlorine contact tank size DWSNZ requirement of 30 minutes contact time, WSL have aproval for 20 minute contact time subject to achieving Ct = 6	Not possible under current water safety regulations to futher reduce this 20 minute contact time			Contact time unlikley to be increase in future, but may be further reduced	Probably material			20 min chlorine contact time adopted
24	Earthworks	Tanks	Part-buried tanks	Can tanks be smaller/deeper/alternative aspect ration?	Reduced footprint	Can be optimised in the design phase, a practicable aspect ratio has been adopted at this stage			Tanks already 8m deep - around the practicable maximum depth for construction. Deeper tanks will be significantly less constructable/more expensive to construct		Probably material			Adopt aspect ratios shown
25	Earthworks	Batter Slopes/Retaining Walls	Batter slopes	Could we have retaining walls instead?	Reduced footprint	More complex to design. Risk of retaining vs batter slopes to be considered i.e. vehicles leaving carriageways	Introduces risk of vehicles driving over retaining walls causing damage to plant and injury/death	Additional on-going maintenance required to maintain retaing walls for life of facility	Constructability reduced compared with batter slopes as retaining requires heavy civils		Probably material			Batter slopes adopted
26	Stormwater	Treatment/Storage												(Tonkin and Taylor to provide stormwater advice)
27	Ancillary Structures	Raw water Pump Station	To be located on the new site - building required over top/vehicle access required to site	Could it be located elsewhere?	No change to footprint, only located elsewhere	Will be deeper on new site compares to locating it on the old site Locating it on the old site requires distributed electrical and control systems	Operational preference to have the raw water pump station to be located on the same site for ease of inspection		Due to depth means less constructable on new site Reduces construction traffic generally if located on one site		Probably material			Watercare preference for new site, but flexible on location
28	Chemical Storage	Chlorine Facility	Dedicated facility min. 10m away from parking and administration building	Could it be located next to/on top of another facility?	Reduced footprint		Chlorine gas is a hazardous substance. It is important the the facility is well managed because of this hazard Chlorine gas is the most economical way of providing residual treatment to water supplies, and when well managed is safe for the surrounding communities. Most water treatment plants in New Zealand, including the existing Huia Water Treatment Plant, use Chlorine Gas Emergency management procedures typically require specially trained operators utilising breathing appartus to respond to emergencies such as chlorine leaks. It is therefore critical that this facility is located a small distance away from where these responders are located Given the extreme risk during a leak, it would not be accentable to stack this facility on other				Probably immaterial			Independent facility adopted

Appendix D Layout Development Drawings

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
2	UPDATED WITH REVISED RESERVOIRS		AB	AB	PF	05/19
1	FOR CONSENT		AB	CG	PF	11/18
0	FOR CONSENT		AB	CG	PF	10/18

0 10 20 30 40 50m
SCALE 1:1000 AT ORIGINAL SIZE

Watercare

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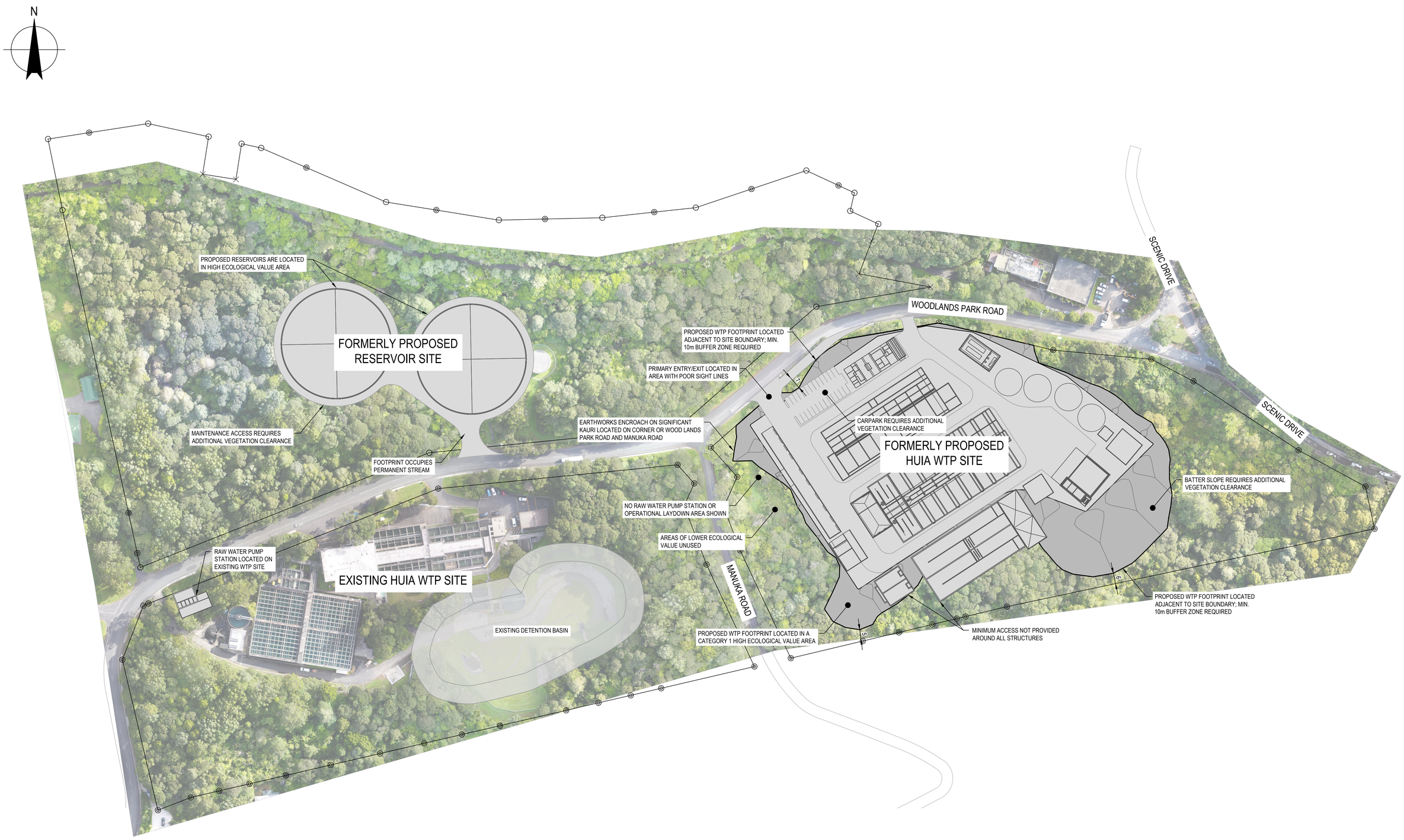
Drawn	A. BLOW	Designer	A. BLOW
Drafting Check	C. GAMST	Design Check	C. GAMST
Approved (Project Director)	P. FREE		
Date	10/2018		
Scale	1:1000	This Drawing must not be used for Construction unless signed as Approved	

Client **WATERCARE SERVICES LTD**
Project **HUIA REPLACEMENT WATER TREATMENT PLANT**
Title **GENERAL OVERVIEW PLAN**

Original Size **A1**
Drawing No: **51-3357505-G001**
Rev: **2**

Plot Date: 21 May 2019 - 3:19 PM
Plotted by: Andrew Blow
Cad File No: G:\51\3357505\CADD\Drawings\51-3357505-G001.dwg



No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
1	FOR CONSENT		AB	CG	PF	11/18
0	FOR CONSENT		AB	CG	PF	10/18

0 10 20 30 40 50m
SCALE 1:1000 AT ORIGINAL SIZE

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Drawn	A. BLOW	Designer	A. BLOW
Drafting Check	C. GAMST	Design Check	C. GAMST
Approved (Project Director)	P. FREE		
Date	10/2018		
Scale	1:1000	This Drawing must not be used for Construction unless signed as Approved	

Client **WATERCARE SERVICES LTD**
Project **HUIA REPLACEMENT WATER TREATMENT PLANT**
Title **FORMERLY PROPOSED SITE LAYOUT SUMMARY OF ISSUES**

Original Size **A1** Drawing No: **51-3357505-G002** Rev: **1**

Plot Date: 21 May 2019 - 1:22 PM Plotted by: Andrew Blow Cad File No: G:\51\3357505\CADD\Drawings\51-3357505-G002.dwg

KEY		
COLOUR	CONSTRUCTABILITY	GUIDEANCE
	POOR	AVOID, WILL RESULT IN SIGNIFICANT COSTS TO CONSTRUCT IN THESE AREAS
	MEDIUM	AVOID WHERE PRACTICABLE, WILL INCREASE COSTS TO CONSTRUCT IN THESE AREAS

NOTE:

1. PURPOSE OF DRAWING IS, FOR THE PURPOSES OF IDENTIFYING AREAS OF LOW CONSTRUCTABILITY FROM A TOPOGRAPHICAL PERSPECTIVE.

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
2	FOR CONSENT		AB	AB	PF	05/19
1	FOR CONSENT		AB	CG	PF	11/18
0	FOR CONSENT		AB	CG	PF	10/18

0 10 20 30 40 50m
SCALE 1:1000 AT ORIGINAL SIZE

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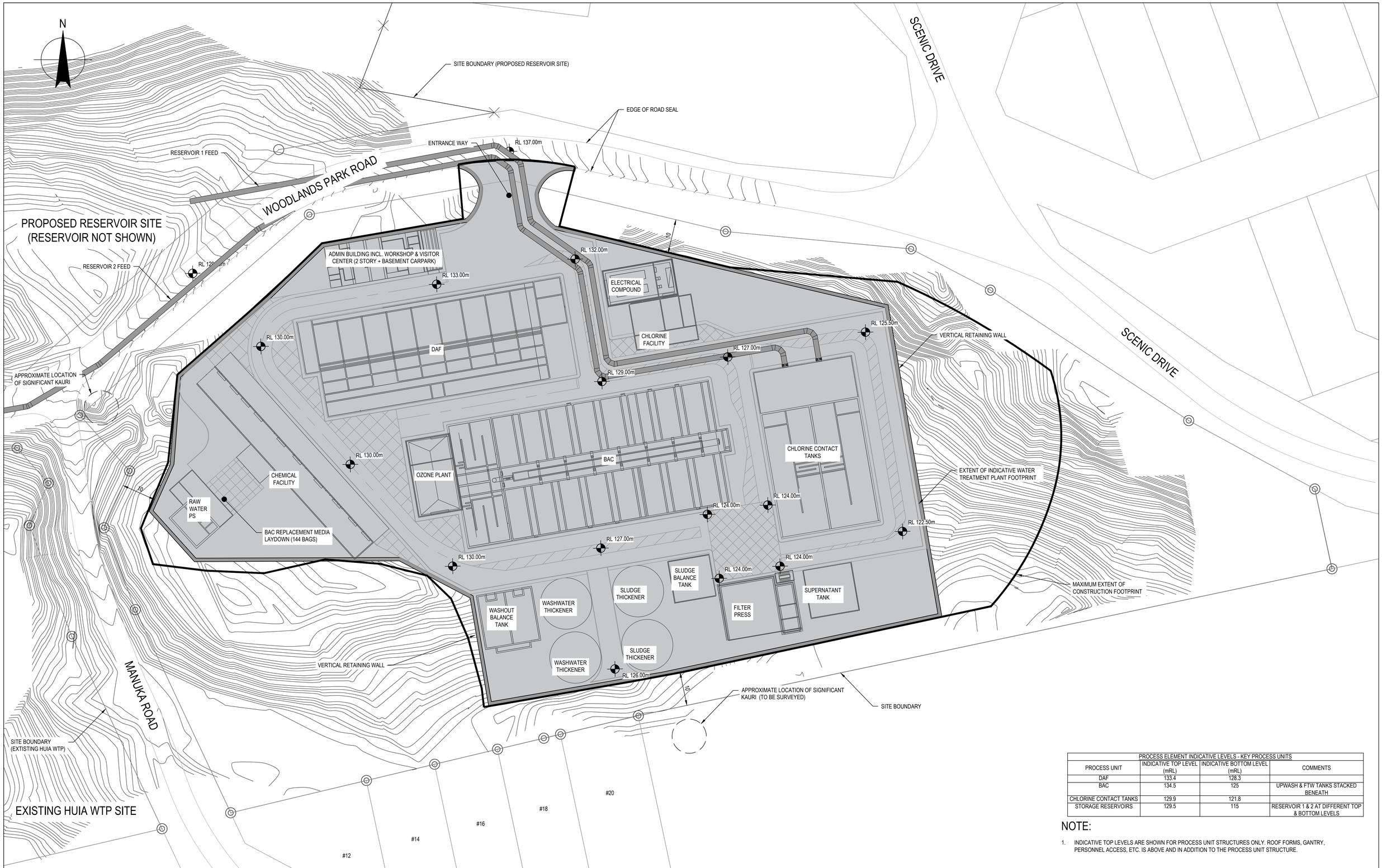
Drawn	A BLOW	Designer	A BLOW
Drafting Check	C. GAMST	Design Check	C. GAMST
Approved (Project Director)	P. FREE		
Date	10/2018		
Scale	1:1000	This Drawing must not be used for Construction unless signed as Approved	

Client WATERCARE SERVICES LTD
Project HUIA REPLACEMENT WATER TREATMENT PLANT
Title CONSTRUCTABILITY ASSESSMENT OVERVIEW PLAN

Original Size **A1**
Drawing No: 51-3357505-G003
Rev: 2

Plot Date: 21 May 2019 - 3:21 PM Plotted by: Andrew Blow Cad File No: G:\51\3357505\CADD\Drawings\51-3357505-G003.dwg



PROCESS ELEMENT INDICATIVE LEVELS - KEY PROCESS UNITS			
PROCESS UNIT	INDICATIVE TOP LEVEL (mRL)	INDICATIVE BOTTOM LEVEL (mRL)	COMMENTS
DAF	133.4	128.3	
BAC	134.5	125	UPWASH & FTW TANKS STACKED BENEATH
CHLORINE CONTACT TANKS	129.9	121.8	
STORAGE RESERVOIRS	129.5	115	RESERVOIR 1 & 2 AT DIFFERENT TOP & BOTTOM LEVELS

NOTE:

1. INDICATIVE TOP LEVELS ARE SHOWN FOR PROCESS UNIT STRUCTURES ONLY. ROOF FORMS, GANTRY, PERSONNEL ACCESS, ETC. IS ABOVE AND IN ADDITION TO THE PROCESS UNIT STRUCTURE.

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
2	FOR CONSENT		EG	AB	PF	05/19
1	FOR CONSENT		AB	CG	PF	11/18
0	FOR CONSENT		AB	CG	PF	10/18

0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

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Drawn	J. ALCASID	Designer	C. GAMST
Drafting Check	J. ROSS	Design Check	C GAMST
Approved (Project Director)	P FREE		
Date	10/2018		
Scale	1:500	This Drawing must not be used for Construction unless signed as Approved	

Client **WATERCARE SERVICES LTD**
Project **HUIA REPLACEMENT WATER TREATMENT PLANT**
Title **PLANT SITE LAYOUT**

Original Size **A1**
Drawing No: **51-3357505-C001**
Rev: **2**

Plot Date: 21 May 2019 - 10:05 PM
Plotted by: Andrew Blow
Cad File No: G:\51\3357505\CADD\Drawings\51-3357505-C001.dwg

N

KEY	
COLOUR	ECOLOGICAL INTEGRITY
	1 - HIGHEST
	2
	3
	4
	5 - LOWEST
	10M STREAM BUFFER

NOTES:
1. TO BE READ IN CONJUNCTION WITH DRAWING 51-3357505-C001
2. DRAWING ILLUSTRATIVE ONLY FOR COORDINATION PURPOSES ONLY - REFER TO ORIGINAL MATERIALS IN ALL INSTANCES
3. ECOLOGICAL SURVEY SHOWN PROVIDED BY BOFFA MISKELL

No	Revision Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
2	UPDATED ECOLOGICAL CLASSIFICATION	EG	AB	PF	05/19
1	FOR CONSENT	JA	CG	PF	11/18
0	FOR CONSENT	JA	CG	PF	10/18

0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

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Drawn	J. ALCASID	Designer	C. GAMST
Drafting Check	J. ROSS	Design Check	A. BLOW
Approved (Project Director)	P. FREE		
Date	10/2018		
Scale	1:500	This Drawing must not be used for Construction unless signed as Approved	

Client: WATERCARE SERVICES LTD
Project: HUIA REPLACEMENT WATER TREATMENT PLANT
Title: WTP SITE LAYOUT PLAN OVERLAID WITH ECOLOGICAL CONSTRAINTS

Original Size A1 | Drawing No: 51-3357505-C002 | Rev: 2

Plot Date: 21 May 2019 - 1:24 PM | Plotted by: Andrew Blow | Cad File No: G:\51\3357505\CADD\Drawings\51-3357505-C002.dwg

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
2	UPDATED WITH REVISED RESERVOIRS		EG	AB	PF	05/19
1	FOR CONSENT		AB	CG	PF	11/18
0	FOR CONSENT		AB	CG	PF	10/18

0 5 10 15 20 25m

SCALE 1:500 AT ORIGINAL SIZE

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Drawn	A. BLOW	Designer	A. BLOW
Drafting Check	G.DIAO	Design Check	C. GAMST
Approved (Project Director)	P. FREE		
Date	10/2018		
Scale	1:500	This Drawing must not be used for Construction unless signed as Approved	

Client WATERCARE SERVICES LTD
Project HUIA REPLACEMENT WATER TREATMENT PLANT
Title RESERVOIR SITE LAYOUT

Original Size **A1** Drawing No: **51-3357505-C003** Rev: **2**

Plot Date: 21 May 2019 - 10:07 PM Plotted by: Andrew Blow Cad File No: G:\51\3357505\CADD\Drawings\51-3357505-C003.dwg

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
2	UPDATED ECOLOGICAL CLASSICATION		EG	AB	PF	05/19
1	FOR CONSENT		JA	CG	PF	11/18
0	FOR CONSENT		JA	CG	PF	10/18

0 5 10 15 20 25m

SCALE 1:500 AT ORIGINAL SIZE

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Drawn	J. ALCASID	Designer	C. GAMST
Drafting Check	J. ROSS	Design Check	C. GAMST
Approved (Project Director)	P. FREE		
Date	10/2018		
Scale	1:500	This Drawing must not be used for Construction unless signed as Approved	

Client WATERCARE SERVICES LTD
Project HUIA REPLACEMENT WATER TREATMENT PLANT
Title RESERVOIR LAYOUT PLAN OVERLAID WITH ECOLOGICAL CONSTRAINTS

Original Size **A1** Drawing No: **51-3357505-C004** Rev: **2**

Plot Date: 21 May 2019 - 1:24 PM Plotted by: Andrew Blow Cad File No: G:\51\3357505\CADD\Drawings\51-3357505-C004 OPT2.dwg

PLAN
SCALE 1:500

CUT FILL VOLUMES

TOTAL CUT VOLUME: 9,300m³
TOTAL FILL VOLUME: 34,800m³

EARTH WORKS CUT / FILL DEPTH			
CUT / FILL DEPTH			DEPTH COLOUR
-10	to	-9	
-9	to	-8	
-8	to	-7	
-7	to	-6	
-6	to	-5	
-5	to	-4	
-4	to	-3	
-3	to	-2	
-2	to	-1	
-1	to	0	
0	to	1	
1	to	2	
2	to	3	
3	to	4	
4	to	5	
5	to	6	
6	to	7	
7	to	8	
8	to	9	
9	to	10	

NOTES:
1. EARTHWORKS SHOWN ARE TO ESTABLISH FINAL WTP PLATFORM ONLY.
2. STAGING AND POSSIBLE ENABLING EARTHWORKS REQUIRED NOT SHOWN

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
1	FOR CONSENT		EP	CG	PF	11/18
0	FOR CONSENT		EP	CG	PF	10/18

0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

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Approved (Project Director)	P.FREE		
Date	10/2018		
Scale	1:500	This Drawing must not be used for Construction unless signed as Approved	

Client WATERCARE SERVICES LTD
Project HUIA WATER TREATMENT PLANT
Title CUT AND FILL THEMATIC MAP EARTHWORKS PLATFORM ONLY

Original Size A1
Drawing No: 51-3357505-C005
Rev: 1

Plot Date: 21 May 2019 - 3:27 PM
Plotted by: Andrew Blow
Cad File No: G:\51\3357505\CADD\Drawings\51-3357505-C005.dwg

N

PROPOSED RESERVOIR SITE
(RESERVOIR NOT SHOWN)

WOODLANDS PARK ROAD AD

SCENIC DRIVE

SCENIC DRIVE

ENTRANCE WAY

EDGE OF ROAD SEAL

ADMIN BUILDING INCL. WORKSHOP & VISITOR CENTER (2 STORY + BASEMENT CARPARK)

ELECTRICAL COMPOUND

CHLORINE FACILITY

DAF

VERTICAL RETAINING WALL

CHLORINE CONTACT TANKS

CHEMICAL FACILITY

OZONE PLANT

BAC

RW PS

BAC REPLACEMENT MEDIA LAYDOWN (144 BAGS)

WASHOUT BALANCE TANK

WASHWATER THICKENER

SLUDGE THICKENER

SLUDGE BALANCE TANK

FILTER PRESS

SUPERNATANT TANK

WASHWATER THICKENER

SLUDGE THICKENER

VERTICAL RETAINING WALL

MAXIMUM EXTENT OF CONSTRUCTION FOOTPRINT

MANUKA ROAD

SITE BOUNDARY

EXISTING HUIA WTP SITE ' SITE

CUT FILL VOLUMES

TOTAL CUT VOLUME: 41,460m³
TOTAL FILL VOLUME: 30,400m³

TOTAL DISTURBED AREA: 27,200m²

EARTH WORKS CUT / FILL DEPTH			
CUT / FILL DEPTH			DEPTH COLOUR
-13	to	-12	
-12	to	-11	
-11	to	-10	
-10	to	-9	
-9	to	-8	
-8	to	-7	
-7	to	-6	
-6	to	-5	
-5	to	-4	
-4	to	-3	
-3	to	-2	
-2	to	-1	
-1	to	0	
0	to	1	
1	to	2	
2	to	3	
3	to	4	
4	to	5	
5	to	6	
6	to	7	
7	to	8	
8	to	9	
9	to	10	

NOTES:
1. EARTHWORKS SHOWN ARE TO ESTABLISH FINAL WTP PLATFORM ONLY.
2. STAGING AND POSSIBLE ENABLING EARTHWORKS REQUIRED NOT SHOWN

PLAN
SCALE 1:500

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
1	FOE CONSENT		EP	CG	PF	11/18
0	FOR CONSENT		EP	CG	PF	10/18

0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

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Drawn	E. PARCIA	Designer	A.BLOW
Drafting Check	C.GAMST	Design Check	C.GAMST
Approved (Project Director)	P.FREE		
Date	10/2018		
Scale	1:500	This Drawing must not be used for Construction unless signed as Approved	

Client **WATERCARE SERVICES LTD**
Project **HUIA REPLACEMENT WATER TREATMENT PLANT**
Title **EARTHWORKS CUT/FILL DEPTHS WATER TREATMENT PLANT SITE**

Original Size **A1**
Drawing No: **51-3357505-C006**
Rev: **1**

Plot Date: 21 May 2019 - 11:44 AM
Plotted by: Ella Genn Parcia
Cad File No: \\ghdnet\ghd\NZ\Auckland\Projects\51\3357505\CADD\Drawings\51-3357505-C006.dwg

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
1	FOR CONSENT		RB	CG	PF	11/18
0	FOR CONSENT		RB	CG	PF	10/18

0 5 10 15 20 25m

SCALE 1:500 AT ORIGINAL SIZE

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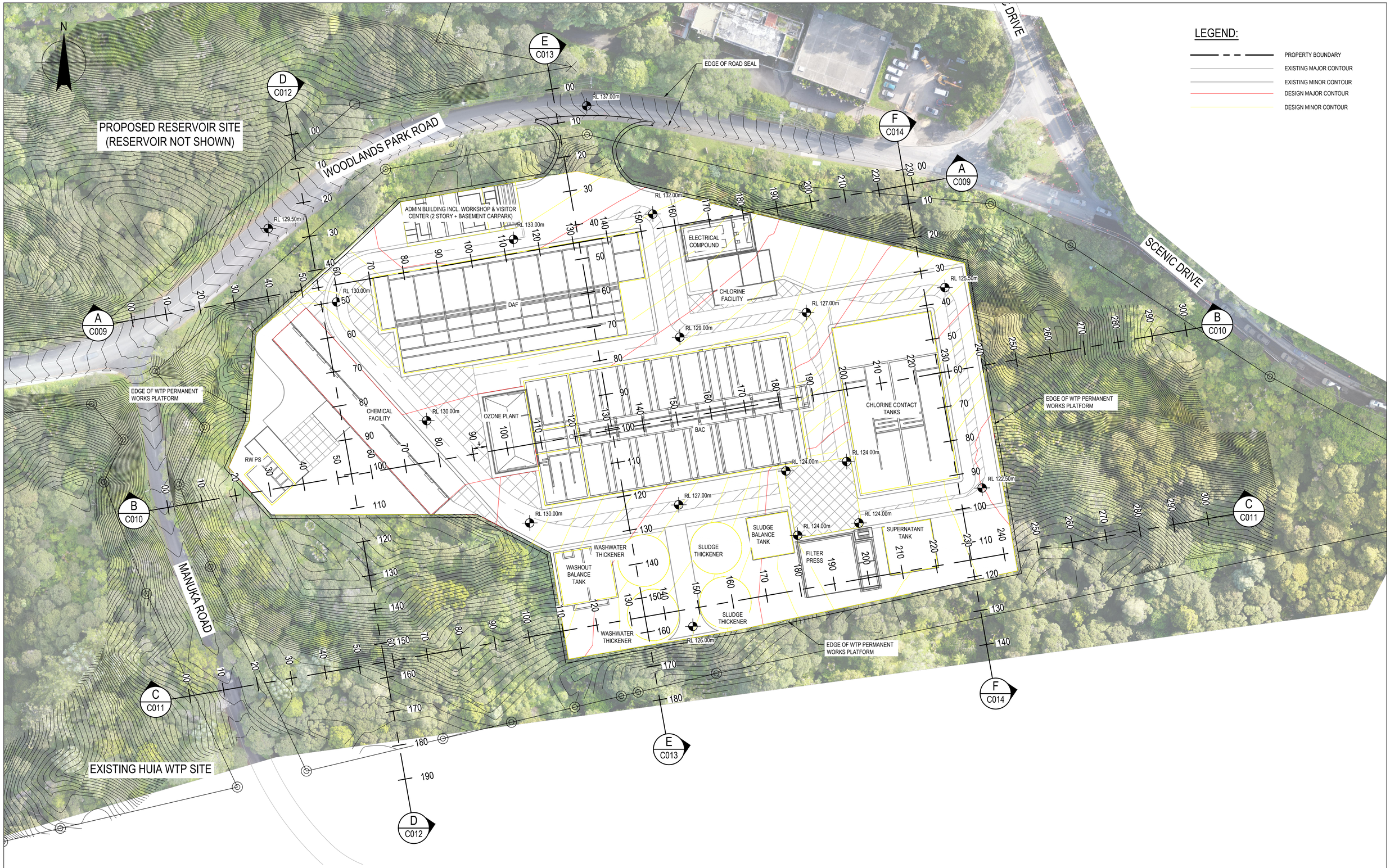
DO NOT SCALE

Drawn	R. BAILEY	Designer	A. BLOW
Drafting Check	A. BLOW	Design Check	C. GAMST
Approved (Project Director)	P. FREE		
Date	10/2018		
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client **WATERCARE SERVICES LTD**
Project **HUIA REPLACEMENT WATER TREATMENT PLANT**
Title **EARTHWORKS CUT/FILL DEPTHS RESERVOIR SITE**

Original Size **A1**
Drawing No: 51-3357505-C007
Rev: 1

Plot Date: 21 May 2019 - 1:25 PM
Plotted by: Andrew Blow
Cad File No: G:\51\3357505\CADD\Drawings\51-3357505-C007.dwg



No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
1	FOR CONSENT		RG	CG	PF	11/18
0	FOR CONSENT		RG	CG	PF	10/18

SCALE 1:500 AT ORIGINAL SIZE

0 5 10 15 20 25m

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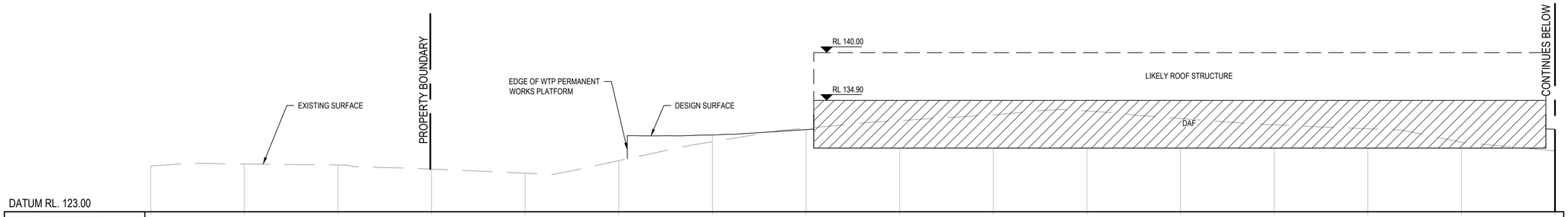
DO NOT SCALE

Drawn	R.GUEVARRA	Designer	A.BLOW
Drafting Check	C.GAMST	Design Check	C.GAMST
Approved (Project Director)	P.FREE		
Date	10/2018		
Scale	1:500	This Drawing must not be used for Construction unless signed as Approved	

Client WATERCARE SERVICES LTD
Project HUIA REPLACEMENT WATER TREATMENT PLANT
Title WTP PLAN OF SECTIONS

Original Size **A1**
Drawing No: **51-3357505-C008**
Rev: **1**

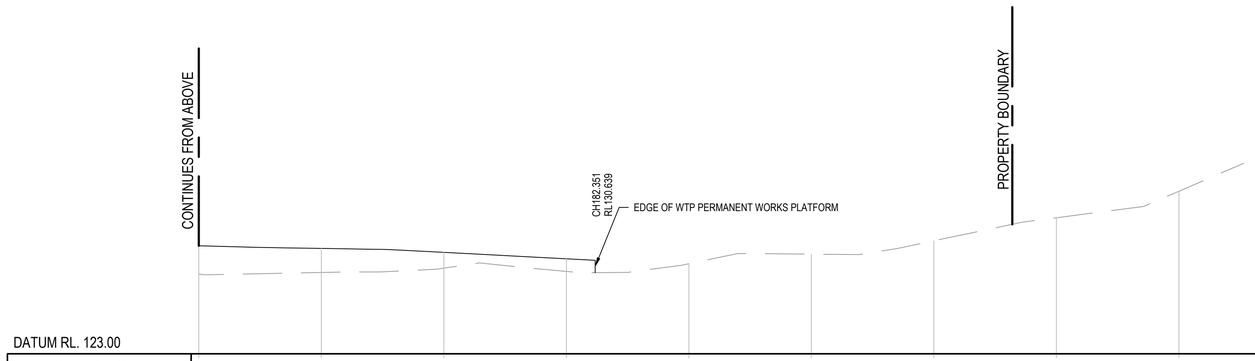
Plot Date: 21 May 2019 - 1:30 PM Plotted by: Andrew Blow Cad File No: G:\51\3357505\CADD\Drawings\51-3357505-C008.dwg



DATUM RL. 123.00

LEVEL DIFFERENCE CUT - / FILL +	0.00	0.00	0.00	0.00	0.00	0.00	0.71	-0.15	-4.43	-5.05	-5.46	-4.65	-3.99	-3.57	-2.13	2.31
DESIGN SURFACE LEVEL	127.892	128.103	127.997	127.563	127.122	128.462	131.199	131.779	129.800	129.800	129.800	129.800	129.800	129.800	129.800	131.817
EXISTING GROUND LEVEL	127.89	128.10	128.00	127.56	127.12	128.46	130.49	131.93	132.73	133.35	133.76	132.95	132.29	131.87	130.43	129.51
CHAINAGE	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00

A SECTION
C008 SCALE 1 : 250



DATUM RL. 123.00

LEVEL DIFFERENCE CUT - / FILL +	2.31	1.96	1.29	1.03	0.00	0.00	0.00	0.00	0.00																			
DESIGN SURFACE LEVEL	131.817	131.602	131.277	130.760	130.357	131.134	132.226	134.106	136.271																			
EXISTING GROUND LEVEL	129.51	129.64	129.99	129.73	130.36	131.13	132.23	134.11	136.27																			
CHAINAGE	150.00	160.00	170.00	180.00	190.00	200.00	210.00	220.00	230.00	240.00	250.00	260.00	270.00	280.00	283.29													

A SECTION
C008 SCALE 1 : 250

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
1	FOR CONSENT		RG	CG	PF	11/18
0	FOR CONSENT		RG	CG	PF	10/18

0 2.5 5 7.5 10 12.5m
SCALE 1:250 AT ORIGINAL SIZE

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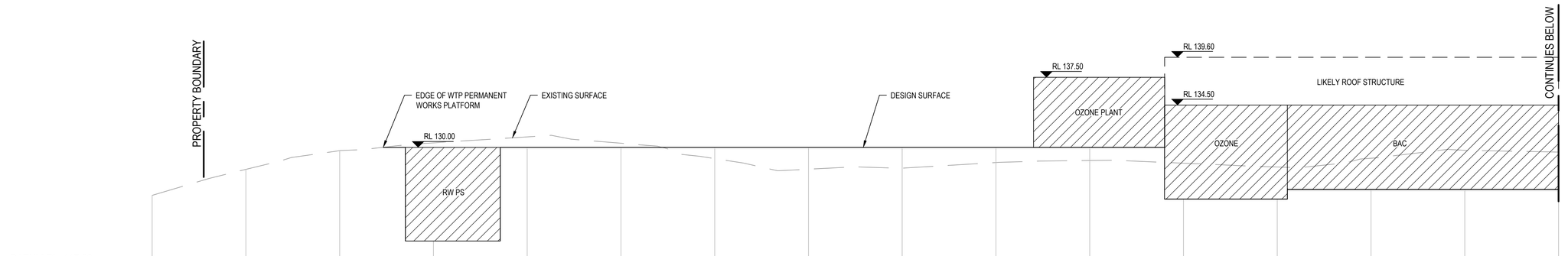
Drawn	R.GUEVARRA	Designer	A.BLOW
Drafting Check	C.GAMST	Design Check	C.GAMST
Approved (Project Director)	P.FREE		
Date	10/2018		
Scale	1:250	This Drawing must not be used for Construction unless signed as Approved	

Client **WATERCARE SERVICES LTD**
Project **HUIA REPLACEMENT WATER TREATMENT PLANT**
Title **WATER TREATMENT PLANT SECTIONS, SHEET 1 OF 6**

Original Size **A1** Drawing No: **51-3357505-C009** Rev: **1**

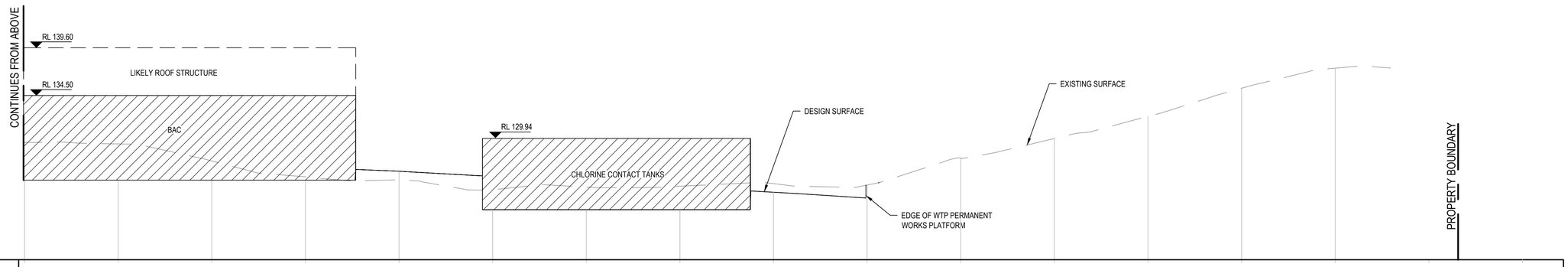
Plot Date: 21 May 2019 - 1:31 PM Plotted by: Andrew Blow Cad File No: G:\51\3357505\CADD\Drawings\51-3357505-C009.dwg



DATUM RL. 117.00

LEVEL DIFFERENCE CUT - / FILL +	0.00	0.00	0.00	-5.49	-1.12	-0.44	1.20	2.33	2.22	1.62	1.40	-6.66	-6.26	-3.34	-4.19	-4.01
DESIGN SURFACE LEVEL	124.881	127.649	129.658	120.000	130.000	130.000	130.000	130.000	130.000	130.000	130.000	124.500	124.500	125.500	125.500	125.500
EXISTING GROUND LEVEL	124.88	127.65	129.66	130.49	131.12	130.44	128.80	127.67	127.78	128.38	128.60	128.31	127.91	128.84	129.69	129.51
CHAINAGE	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00

B C008 SECTION
SCALE 1 : 250



DATUM RL. 117.00

LEVEL DIFFERENCE CUT - / FILL +	-4.01	-3.86	-2.07	-0.36	0.92	-2.14	-2.42	-2.50	-0.93	0.00	0.00	0.00	0.00	0.00	0.00			
DESIGN SURFACE LEVEL	125.500	125.500	125.500	125.500	126.443	122.340	122.340	122.340	124.212	124.951	127.894	129.915	132.265	135.271	137.435			
EXISTING GROUND LEVEL	129.51	129.36	127.57	125.86	125.52	124.48	124.76	124.84	125.14	124.95	127.89	129.91	132.26	135.27	137.43			
CHAINAGE	150.00	160.00	170.00	180.00	190.00	200.00	210.00	220.00	230.00	240.00	250.00	260.00	270.00	280.00	290.00	300.00	310.00	

B C008 SECTION
SCALE 1 : 250

No	Revision	Drawn	Job Manager	Project Director	Date
1	FOR CONSENT	RG	CG	PF	11/18
0	FOR CONSENT	RG	CG	PF	10/18

Note: * indicates signatures on original issue of drawing or last revision of drawing

0 2.5 5 7.5 10 12.5m
SCALE 1:250 AT ORIGINAL SIZE

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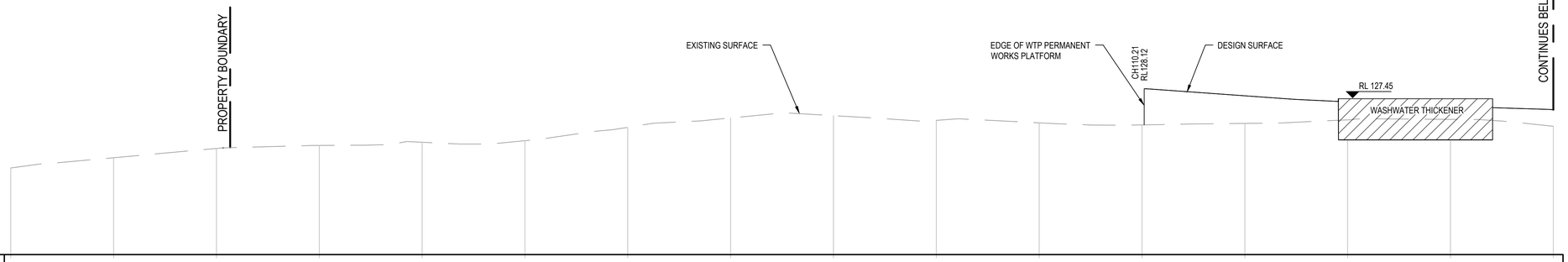
Drawn	R.GUEVARRA	Designer	A.BLOW
Drafting Check	C.GAMST	Design Check	C.GAMST
Approved (Project Director)	P.FREE		
Date	10/2018		
Scale	1:250	This Drawing must not be used for Construction unless signed as Approved	

Client **WATERCARE SERVICES LTD**
Project **HUIA REPLACEMENT WATER TREATMENT PLANT**
Title **WATER TREATMENT PLANT SECTIONS, SHEET 2 OF 6**

Original Size **A1** Drawing No: **51-3357505-C010** Rev: **1**

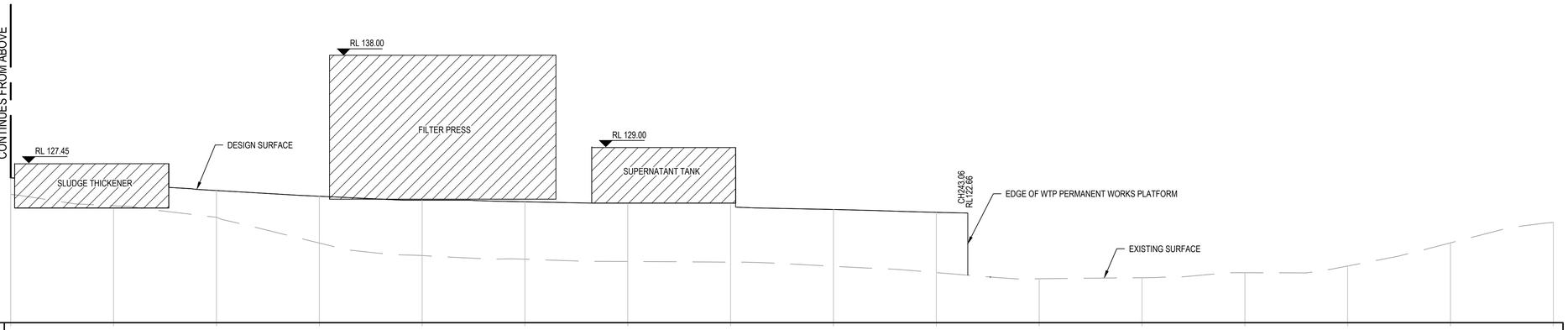
Plot Date: 21 May 2019 - 1:31 PM Plotted by: Andrew Blow Cad File No: G:\51\3357505\CADD\Drawings\51-3357505-C010.dwg



DATUM RL. 112.00

LEVEL DIFFERENCE CUT - / FILL +	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.68	-1.94	-1.99	1.61
DESIGN SURFACE LEVEL	120.41	121.41	122.31	122.61	122.92	123.07	124.37	125.28	125.51	125.05	124.81	124.60	127.43	123.15	123.15	126.08
EXISTING GROUND LEVEL	120.41	121.41	122.32	122.61	122.92	123.07	124.37	125.28	125.51	125.05	124.81	124.60	124.75	125.09	125.14	124.47
CHAINAGE	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00

C C008 SECTION
SCALE 1 : 250



DATUM RL. 112.00

LEVEL DIFFERENCE CUT - / FILL +	1.61	-0.22	2.60	4.54	5.38	5.58	7.85	7.91	5.52	5.85	0.00	0.00	0.00	0.00	0.00	0.00
DESIGN SURFACE LEVEL	126.08	123.15	124.85	124.29	123.91	123.75	123.60	123.60	123.00	122.73	116.27	116.38	116.86	117.51	119.76	121.75
EXISTING GROUND LEVEL	124.47	123.37	122.25	119.75	118.53	118.17	117.95	117.89	117.49	116.87	116.27	116.38	116.86	117.51	119.76	121.75
CHAINAGE	150.00	160.00	170.00	180.00	190.00	200.00	210.00	220.00	230.00	240.00	250.00	260.00	270.00	280.00	290.00	300.00

C C008 SECTION
SCALE 1 : 250

No	Revision	Drawn	Job Manager	Project Director	Date
1	FOR CONSENT	RG	CG	PF	11/18
0	FOR CONSENT	RG	CG	PF	10/18

Note: * indicates signatures on original issue of drawing or last revision of drawing

0 2.5 5 7.5 10 12.5m
SCALE 1:250 AT ORIGINAL SIZE

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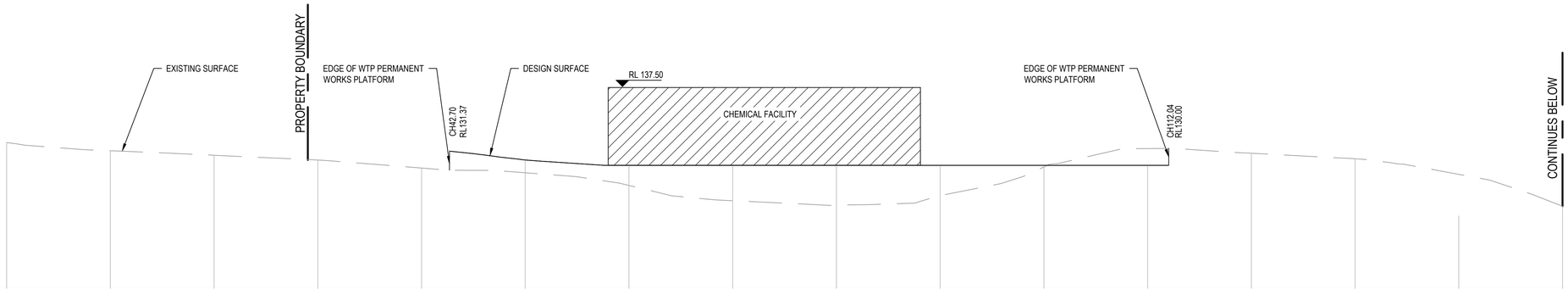
Drafting Check	C.GAMST	Design Check	C.GAMST
Approved (Project Director)	P.FREE		
Date	10/2018		
Scale	1:250	This Drawing must not be used for Construction unless signed as Approved	

Client WATERCARE SERVICES LTD
Project HUIA REPLACEMENT WATER TREATMENT PLANT
Title WATER TREATMENT PLANT SECTIONS, SHEET 3 OF 6

Original Size A1
Drawing No: 51-3357505-C011
Rev: 1

Plot Date: 21 May 2019 - 10:12 PM
Plotted by: Andrew Blow
Cad File No: G:\51\3357505\CADD\Drawings\51-3357505-C011.dwg

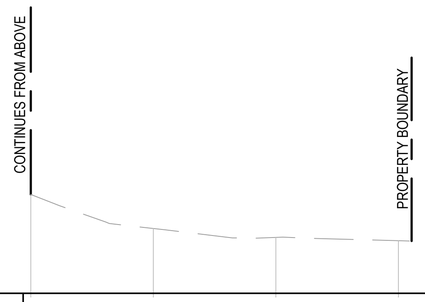


DATUM RL. 118.00

LEVEL DIFFERENCE CUT - / FILL +	0.00	0.00	0.00	0.00	0.00	1.23	1.93	3.40	3.84	2.91	0.15	-1.62	0.00	0.00	0.00	0.00
DESIGN SURFACE LEVEL	132.20	131.41	130.98	130.51	129.74	130.52	130.00	130.00	130.00	130.00	130.00	130.00	131.17	130.64	129.13	126.07
EXISTING GROUND LEVEL	132.20	131.41	130.98	130.51	129.74	129.29	128.07	126.60	126.16	127.09	129.85	131.62	131.17	130.64	129.13	126.07
CHAINAGE	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00

D C008 SECTION

SCALE 1 : 250



DATUM RL. 118.00

LEVEL DIFFERENCE CUT - / FILL +	0.00	0.00	0.00	0.00		
DESIGN SURFACE LEVEL	126.07	123.29	122.56	122.30		
EXISTING GROUND LEVEL	126.07	123.29	122.56	122.30		
CHAINAGE	150.00	160.00	170.00	180.00	190.00	194.44

D C008 SECTION

SCALE 1 : 250

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
1	FOR CONSENT		RG	CG	PF	11/18
0	FOR CONSENT		RG	CG	PF	10/18

0 2.5 5 7.5 10 12.5m

SCALE 1:250 AT ORIGINAL SIZE

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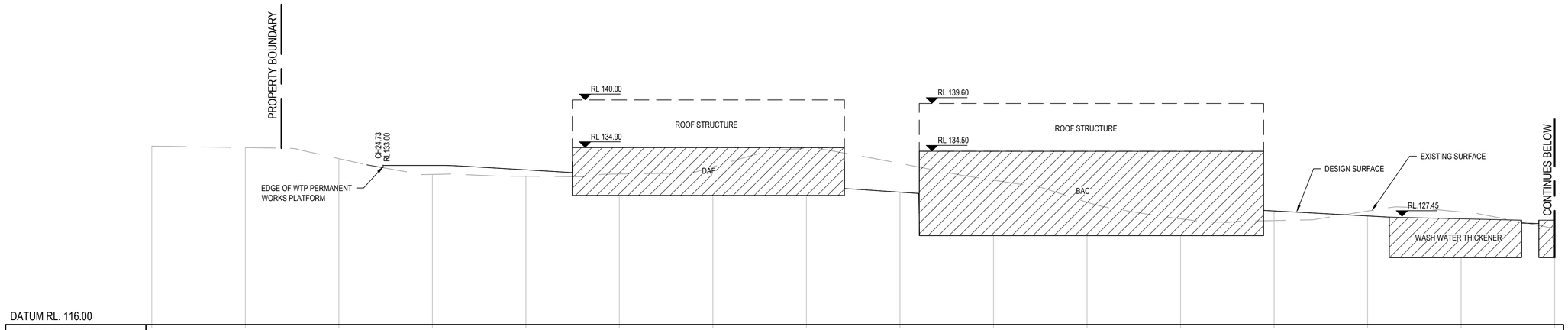
Drawn	R.GUEVARRA	Designer	A.BLOW
Drafting Check	C.GAMST	Design Check	C.GAMST
Approved (Project Director)	P.FREE		
Date	10/2018		
Scale	1:250	This Drawing must not be used for Construction unless signed as Approved	

Client **WATERCARE SERVICES LTD**
Project **HUIA REPLACEMENT WATER TREATMENT PLANT**
Title **WATER TREATMENT PLANT SECTIONS, SHEET 4 OF 6**

Original Size **A1** Drawing No: **51-3357505-C012** Rev: **1**

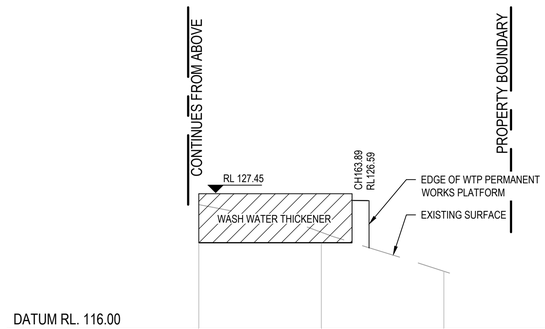
Plot Date: 21 May 2019 - 10:14 PM Plotted by: Andrew Blow Cad File No: G:\51\3357505\CADD\Drawings\51-3357505-C012.dwg



DATUM RL. 116.00

LEVEL DIFFERENCE CUT - / FILL +	0.00	0.00	0.00	0.95	0.68	-3.79	-4.55	-6.54	-3.07	-5.93	-3.57	-1.80	1.03	-0.52	-4.88	-3.11
DESIGN SURFACE LEVEL	135.06	134.90	133.74	133.00	132.53	129.80	129.80	129.80	130.15	125.50	125.50	125.50	128.15	127.61	123.15	123.15
EXISTING GROUND LEVEL	135.06	134.90	133.74	132.05	131.85	132.09	132.85	134.84	133.22	131.43	129.07	127.30	127.11	128.13	128.03	126.26
CHAINAGE	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00

E C008 SECTION
SCALE 1 : 250



DATUM RL. 116.00

LEVEL DIFFERENCE CUT - / FILL +	-3.11	-0.85	0.00			
DESIGN SURFACE LEVEL	123.15	123.15	120.82			
EXISTING GROUND LEVEL	126.26	124.00	120.82			
CHAINAGE	150.00	160.00	170.00	180.00	190.00	194.44

E C008 SECTION
SCALE 1 : 250

No	Revision	Drawn	Job Manager	Project Director	Date
1	FOR CONSENT	RG	CG	PF	11/18
0	FOR CONSENT	RG	CG	PF	10/18

Note: * indicates signatures on original issue of drawing or last revision of drawing

0 2.5 5 7.5 10 12.5m
SCALE 1:250 AT ORIGINAL SIZE

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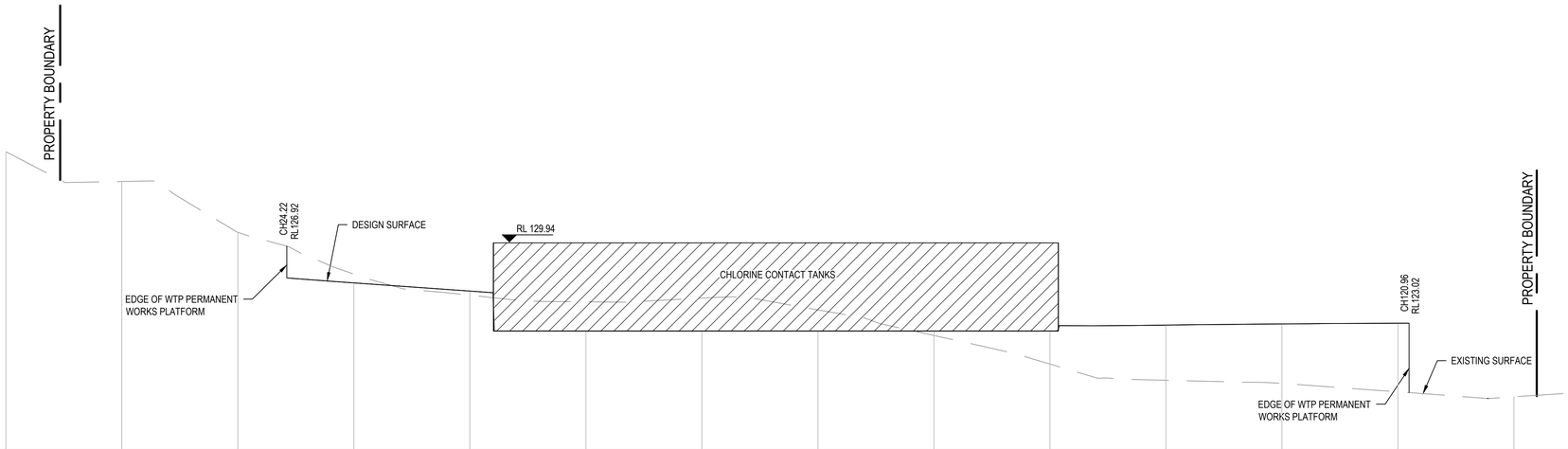
Drawn	R.GUEVARRA	Designer	A.BLOW
Drafting Check	C.GAMST	Design Check	C.GAMST
Approved (Project Director)	P.FREE		
Date	10/2018		
Scale	1:250	This Drawing must not be used for Construction unless signed as Approved	

Client **WATERCARE SERVICES LTD**
Project **HUIA REPLACEMENT WATER TREATMENT PLANT**
Title **WATER TREATMENT PLANT SECTIONS, SHEET 5 OF 6**

Original Size **A1** Drawing No: **51-3357505-C013** Rev: **1**

Plot Date: 21 May 2019 - 10:17 PM Plotted by: Andrew Blow Cad File No: G:\51\3357505\CADD\Drawings\51-3357505-C013.dwg



DATUM RL. 112.00

LEVEL DIFFERENCE CUT - / FILL +	0.00	0.00	0.00	-0.76	0.36	-2.52	-2.84	-1.83	0.38	2.84	4.76	5.12	5.91	0.00	
DESIGN SURFACE LEVEL	137.79	135.23	130.85	126.49	125.79	122.34	122.34	122.34	122.34	122.34	122.86	122.96	123.02	116.68	
EXISTING GROUND LEVEL	137.79	135.23	130.85	127.25	125.43	124.86	125.18	124.17	121.96	119.50	118.10	117.84	117.11	116.68	
CHAINAGE	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00

F C008 SECTION
SCALE 1 : 250

No	Revision	Drawn	Job Manager	Project Director	Date
1	FOR CONSENT	RG	CG	PF	11/18
0	FOR CONSENT	RG	CG	PF	10/18

Note: * indicates signatures on original issue of drawing or last revision of drawing

0 2.5 5 7.5 10 12.5m
SCALE 1:250 AT ORIGINAL SIZE

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Drawn	R.GUEVARRA	Designer	A.BLOW
Drafting Check	C.GAMST	Design Check	C.GAMST
Approved (Project Director)	P.FREE		
Date	10/2018		
Scale	1:250	This Drawing must not be used for Construction unless signed as Approved	

Client **WATERCARE SERVICES LTD**
Project **HUIA REPLACEMENT WATER TREATMENT PLANT**
Title **WATER TREATMENT PLANT SECTIONS, SHEET 6 OF 6**

Original Size **A1**
Drawing No: **51-3357505-C014**
Rev: **1**

Plot Date: 21 May 2019 - 10:19 PM
Plotted by: Andrew Blow
Cad File No: G:\51\3357505\CADD\Drawings\51-3357505-C014.dwg

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
0	FOR CONSENT		RG	CG	PF	10/18

0 5 10 15 20 25m

SCALE 1:500 AT ORIGINAL SIZE

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DO NOT SCALE

Drawn	R. GUEVARRA	Designer	A.BLOW
Drafting Check	C.GAMST	Design Check	C.GAMST
Approved (Project Director)	P.FREE		
Date	10/2018		
Scale	1:500	This Drawing must not be used for Construction unless signed as Approved	

Client **WATERCARE SERVICES LTD**
Project **HUIA REPLACEMENT WATER TREATMENT PLANT**
Title **RESERVOIR PLAN OF SECTIONS**

Original Size **A1**
Drawing No: 51-3357505-C015 **Rev: 0**

Plot Date: 21 May 2019 - 1:25 PM Plotted by: Andrew Blow Cad File No: G:\51\3357505\CADD\Drawings\51-3357505-C015.dwg

No	Revision	Note: * indicates signatures on original issue of drawing	Drawn	Job Manager	Project Director	Date
1	FOR CONSENT		RG	CG	PF	11/18
0	FOR CONSENT		RG	CG	PF	10/18

0 2.5 5 7.5 10 12.5m

SCALE 1:250 AT ORIGINAL SIZE

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DO NOT SCALE

Drawn	R. GUEVARRA	Designer	A.BLOW
Drafting Check	C.GAMST	Design Check	C.GAMST
Approved (Project Director)	P.FREE		
Date	10/2018		
Scale	1:250	This Drawing must not be used for Construction unless signed as Approved	

Client WATERCARE SERVICES LTD
Project HUIA REPLACEMENT WATER TREATMENT PLANT
Title RESERVOIR SITE
SECTIONS SHEET 1 OF 1

Original Size **A1**

Drawing No: 51-3357505-C016 **Rev: 1**

Plot Date: 21 May 2019 - 1:25 PM Plotted by: Andrew Blow Cad File No: G:\51\3357505\CADD\Drawings\51-3357505-C016.dwg

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G:\51\3357505\WP\01. Consenting Site Layout Report\513357505-REP_Huia Water Treatment Plant Consenting Phase Site Layout Development - Rev 2.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	A. Blow	P. Free	P J Free	P. Free	P J Free	21/05/19

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