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CIVIL DESIGN REPORT

SDP Assessment

Porirua Northern Growth Area

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1.0 EXECUTIVE SUMMARY

INTRODUCTION

This report is intended to provide support to Kainga Ora in their Specific Development Project (SDP) Assessment of the Porirua Northern Growth Area (NGA). It aims to identify opportunities, constraints, gaps, risks, and recommendations associated with the development and required infrastructure. The process has been guided by the Proposed project objectives and collaboration with various consultants. The focus of this report is on civil design constraints and opportunities within the project area to achieve residential development within the NGA.

DEVELOPABLE AREA

Calculating the developable area is crucial for assessing the expected residential yield and infrastructure requirements. We have defined developable area as flat, suitable for land development including residential, commercial, educational, recreational, stormwater management, and transport. While preliminary designs have been undertaken with other consultant constraint input, further detailed design will refine this area to match the evolving project requirements.

EARTHWORKS

Significant earthworks are required for residential development in the Northern Growth Area, driven by the need to create land suitable for residential development. The site's hilly and steep terrain, along with ecological constraints, present challenges. Earthwork modelling has been vital for developing a suitable design, utilizing a design approach that maintains a cut/fill balance and minimizes environmental impacts. Collaboration among geotechnical, ecological, and urban design teams have informed our earthworks approach. Additional geotechnical and ecological investigations are required to ensure the feasibility of the earthworks activities required in achieving development outcomes.

ROADING

The concept road network design for the Northern Growth Area is closely aligned with the site's natural features and has been developed concurrently with earthworks modelling. Roads running north to south follow the land's contours, while those running east to west often require steeper gradients. A primary north-south road connection that links the land blocks has been highlighted as an important requirement in achieving the project objectives. A concept design has been completed and supports its feasibility and ability to support a multi-modal transport corridor. Efforts are made to ensure pedestrian friendly access across the development, despite the challenging terrain.

STORMWATER

The stormwater management strategy for the Northern Growth Area (NGA) is critical as the downstream receiving environment for much of the NGA is sensitive. Conversion of the current pervious surface into impervious surfaces, will result in increased stormwater flows and volumes. To address this, the stormwater design focuses on mitigating post-development stormwater impacts using underground pipes and centralized attenuation ponds.

The NGA is divided into four major catchments with an opportunity for an integrated catchment approach for better stormwater alignment to match existing discharge locations.

Stormwater constraints can be mitigated through stormwater design methods and a site-specific stormwater management plan for the Porirua Northern Growth Area.



WATER SENSITIVE DESIGN

Water-sensitive design needs to be integrated within the stormwater management approach. An integrated catchment approach should be employed along with best utilising existing gullies as centralised stormwater devices where feasible. At-source treatment of stormwater through raingardens and swales may prove challenging due to the steep nature, driveway density, and limited soakage present with the NGA.

Close collaboration with the ecology team will be required to ensure receiving environments are protected. A site-specific stormwater plan should be developed at later stages.

WASTEWATER

Wastewater management in the NGA will be defined by the requirement of peak flow detention for all new development runoffs that are conveyed to the current bulk main within SH59. The advantage of the sloping terrain generally allows for a conventional gravity-based wastewater network. A series of tanks and pump stations will be required at some locations to pump discharge from low points with unsuitable gravity connections to SH59. The requirement to provide peak flow detention before discharge into the existing network will also increase the need tank requirements. Catchment wide design considerations should aim to best reduce the number of storage and pumping facilities. Recommendations include bulk wastewater network modelling to assess the effects on the existing network in line with growth assumptions.

WATER SUPPLY

New bulk water supply infrastructure in the NGA is an immediate requirement to enable development. While a bulk water supply exists along SH59, additional local storage is required to supply new development demands. New pump stations along SH59 will be required to transfer water to elevated reservoirs, which will, in turn, distribute water through domestic mains suitable for residential use. A collaborative approach should be taken to optimize new enabling water infrastructure to ensure all development can be serviced.

The presence of undeveloped terrain between the development areas complicates the establishment of a north-south domestic supply main without utilising the existing SH59 corridor. Isolated reservoirs will require transmission of water through a domestic main to provide for development areas that are located at a distance from the reservoir source.

Assessing the bulk water supply's capacity to meet the demands of the new development is a key risk and will require further bulk network modelling.

EXISTING TRAIN STATIONS AND ACCESS

Development activities will impact both Pukerua Bay and Plimmerton train stations. Upgrades to the surrounding areas are required to enhance pedestrian safety and accommodate increased traffic from the new development areas to the existing train stations. Further studies are required to understand current and future capacity constraints at each train station.



2.0 INTRODUCTION

The purpose of this report is to support Kainga Ora with the Porirua Northern Growth Area SDP assessment. This report intends to identify gaps, risks, constraints, and opportunities relating to the development and associated infrastructure for the underlying Concept Plan. Our process has been guided by the proposed project objectives and collaboration with other consultants during the assessment process.

This memo addresses the constraints and opportunities of the civil design and methodology to achieve residential development of the NGA. The development is expected to comprise of:

- Approximately 5000-7000 residential dwellings.
- Commercial, educational, recreational areas and activities ancillary to residential development in accordance with SDP objectives.
- Associated proposed infrastructure to support the development.
- Associated upgrades to existing infrastructure to support the development.

2.1 PROJECT AREA

The NGA SDP project area is most accurately delineated by the seven landowner blocks, State Highway 59 (formerly known as State Highway 1), and two train stations.

- Plimmerton Farm
- Kakaho Block
- Skaiffe Block
- Mt Welcome
- Lucas Block
- Muri Block
- Carrod Block

In addition to the landowner blocks, the area also includes the existing areas outlined below that will be directly impacted by the proposed development.

- State Highway 59
- Plimmerton Train Station and linking access
- Pukerua Bay Train Station and linking access

2.2 OPPORTUNITIES AND CONSTRAINTS SCOPE

Our scope involves assessing any opportunities or constraints that are present with developing the project area for residential use and meet the project objectives outlined by the SDP assessment team. Additionally, we have included any key risks, information gaps, and recommendations to ensure that the design objectives can be met. Our report aims to cover the below items involved in design and constructing civil infrastructure to enable the development:

- Earthworks
- Roading
- Stormwater
- Water Sensitive Design
- Wastewater
- Water Supply
- Developable Area Methodology
- Existing Train Stations Constraints

3.0 DEVELOPABLE AREA



3.1 OVERVIEW

Calculating the developable area is a key factor in assessing the expected residential yield and the infrastructure required for the project. We define developable land as area that is generally flat and suitable for various development, including residential and commercial, schools, parks, stormwater management, and roads.

In the case of the NGA project, we heavily rely on earthwork operations to make the land suitable for development in addition to considering various constraints provided by other consultants. These constraints cover a wide range of areas, including geotechnical, ecological, and cultural. Areas of land that are excessively steep or present substantial challenges are currently designated as unsuitable for development and are not factored into our calculations for potential yield and infrastructure requirements. Our developable land assumptions and plans can be found in Appendix 1. Concept Developable Areas.

It's important to note that these assessments are preliminary because they're conducted at the desktop level. As the project advances and more detailed design stages occur, we expect these areas and the definition of developable land to be refined to match the project's evolving requirements and objectives.

When calculating the residential yield for the NGA, it is important to consider the requirements for batters on residential lots as it can impact density calculations. When developing steep land, a larger lot size is typically needed since only half of the lot can be suitable for building and living space, while the other half is designated for planted batters. The effects of this can be further illustrated in the examples provided below and within Appendix 1: Concept Developable Area

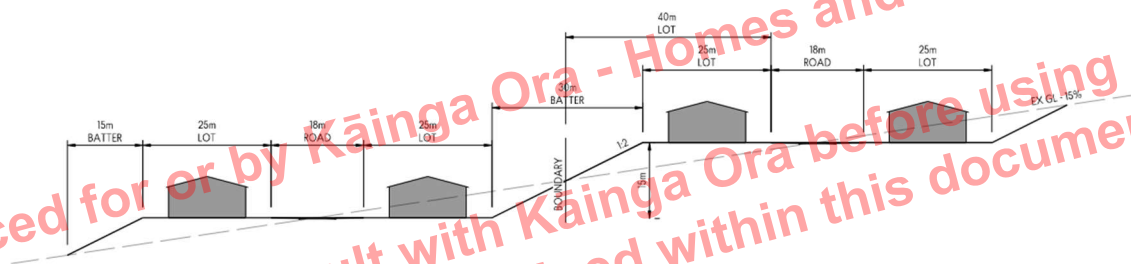


IMAGE 1: Terrain effects on lot size

4.0 EARTHWORKS

4.1 OVERVIEW

Significant earthworks are required for supporting residential development in the Northern Growth Area. Earthwork modelling has played a crucial role in informing our civil design during the SDP process, particularly in calculating the extent of developable land and the anticipated project yield.

The site comprises of mostly hilly land with significant areas of steep topography (i.e. steeper than 1 in 5 slopes). There are numerous gullies across the site including some streams and wetlands. The site rises generally west to east from around RL 50 to RL 300.

Geotechnical investigations have been carried out by PDP and their recommendations and observations have been considered in the earthworks design. To briefly summarise, the project area contains a variety of soil types, including silt, clay, sand, gravel, and loess, layered over greywacke sandstone-mudstone. Groundwater levels are typically deep throughout the site, except in low-lying areas along the western and southwestern boundaries of the NGA, near streams, and at the base of gullies, where groundwater may be closer to the surface. Some areas of the site are likely to contain softer, possibly organic material mainly located at the bases of gullies and other low-lying areas.

As a general practice, we have adopted a 2H:1V slope ratio as the maximum allowable batter slope for these soil types. Additionally, these slopes batters generally do not require any engineered reinforcement at these grades and can be re-vegetated.



4.2 OPPORTUNITIES

- Generally, the NGA has a geotechnically stable landform, with soils suitable for bulk earthworks. This observation is further detailed in the geotechnical report prepared by PDP. Through a collaborative approach involving geotechnical, ecological, and urban design inputs, we have identified specific areas of the site that can be earthworked to achieve optimal urban development yield, favourable road gradients, and efficient land utilization. These areas have ultimately informed the developable area and corresponding land use assumptions in collaboration with the urban design team at Boffa Miskell.
- Bulk earthworks will need to facilitate a balanced approach between cut and fill, ensuring there is no excess material requiring removal or additional material import. This will also minimise the need for secondary earthworks, retaining requirements and encourage batter slopes to be designed at grades to minimise the time required for rehabilitation and revegetation post earthworks.
- There are fundamental elements of good practice, such as minimising extent of areas earthworked at any one time and stabilising areas as soon as practicable, that should be common to all sites. These limit the opportunity for erosion, however even with best practice, there will always be the risk of some sediment being mobilised during and immediately after rainfall events. Therefore, it is equally important to put in place control measures to contain, collect, and manage any sediment that is generated before it can leave the site. The GWRC guideline document *"Erosion and Sediment Control Guide for Land Disturbing Activities in the Wellington Region"* details control measures and is widely used as the appropriate standard for management of erosion and sediment control in the Wellington Region. It is our view that the erosion and sediment control design can be adequately addressed. Ultimately, any large-scale earthworks within the NGA will require regional consent and compliance with GWRC rules in line with the principles described above.

4.3 CONSTRAINTS

- Large scale earthworks are required to obtain acceptable residential yield and use of land.
- To achieve a cut/fill balance, certain gullies and low-lying areas will be utilized for placement of fill material. However, it is crucial to manage this process carefully to ensure compliance with ecological constraints. Through close collaboration with the ecology team, we have identified areas that are suitable for earthworks, as well as areas that must be avoided to protect ecologically sensitive areas.
- We have investigated a low earthworks development approach for parts of the site. Those concept designs indicated roads at unacceptable widths and gradients, SED house design requirements, and poor yield on both a dwelling/hectare basis and dwelling/development cost basis.
- Parts of the site are within a sensitive receiving environment (Taupō catchment) so very high standards are required for erosion and sediment control. This includes implementing an increased sizing of erosion and sediment controls such as sediment retention ponds and decanting earth bunds that exceed the minimum recommendations outlined in Greater Wellington Regional Council: Erosion and Sediment Control Guideline for Land Disturbing Activities in the Wellington Region
- Any disturbance to the existing ground removes the existing vegetative cover and potentially allows erosion of the bare ground to occur. Hilly sites are particularly prone to this during high rainfall events and without adequate controls in place sediment can be mobilised. This sediment can damage the environment downstream of the site by covering the ground surface including streams beds with silt and clay and directly damaging aquatic life. The risk of generating erosion is proportional to the surface area exposed, the duration of earthworks, and the rainfall occurrences during the earthworks process.
- Our earthwork modeling relies on ecological constraints obtained through the SDP assessment desktop studies. The ecology team has contributed their insights, and we have also endeavored to identify wetland vegetation areas using aerial imagery along with stream corridors identified within public GIS maps. Our goal is to avoid areas identified as a high ecological constraint with



no offsetting pathway. In certain cases, earthworks may still be necessary in areas categorized as medium or lower ecological value or within the higher reaches of stream corridors. However, as there are no well-defined ecological constraint boundaries, we may need to make further adjustments to the earthwork areas to address newly identified ecological limitations.

4.4 KEY RISKS AND RECOMMENDATIONS

Ecological constraints pose a key risk to the earthworks and feasibility of development within the NGA. Further guidance from the ecology team to provide well defined parameters and ecological constraint boundaries to inform our earthworks modelling and corresponding yield of the NGA.

Additional geotechnical investigations are necessary to gain a better understanding of soil conditions, with a primary focus on the Skaiffe block. Given its history as a fill site, it is important to conduct further investigations to determine the soil's suitability.

5.0 ROADING

5.1 OVERVIEW

The concept road network takes its form from the existing land features, which have been identified during the SDP assessment phase by various consultants, including those focused on ecological considerations. Our roading design was developed concurrently with the earthworks modelling adopting similar constraints.

In general, roads running from south to north can be constructed with more modest slopes, as they follow the natural contours of the land. Conversely, roads running from east to west often require steeper grades, as they need to navigate hilly terrain that goes against the natural contours. We have identified key routes that potentially connect the development and can be found in Appendix 3. Concept Roding Layout.

State Highway 59 serves as a crucial link for the NGA development. Additionally, we have explored the possibility of establishing a secondary north-south connection to further improve accessibility within the NGA area that does not rely as heavily on SH59. This connection route has been identified to meet multi modal transportation needs and has been designed to meet those specific requirements. A concept design of this can be found in Appendix 8, Concept North – South Roding Connection. This concept design has been done without employing a site wide bulk earthworks approach. We would expect volume quantities and batter heights to be reduced once the road corridor is incorporated into a site wide earthworks design.

5.2 OPPORTUNITIES

- The incorporation of bulk earthworks is essential to establish a road network that is suitable for public transport. Without integrating bulk earthworks, it would be challenging to achieve a roading design with acceptable grades.
- Opportunities to develop a north/south roading connection throughout the development with the addition of the Scaife block. Ultimately, this road could serve as the primary north-south transport connection for the development, while also offering additional earthworked land that is suitable for development. The establishment of this roading connection will require significant earthworks and the construction of stream crossing infrastructure. It is important to recognize that despite considerable design and construction efforts, certain sections of the road may still be limited by steep grades and potentially reduced cross sections. Ongoing assessment in conjunction with ecological and geotechnical considerations is necessary to ensure the feasibility of the road connection extent.
- By adopting an integrated design approach, it becomes possible to access certain areas of the site through neighbouring properties, where previously these areas would not have a suitable roading connection to allow development.



- Aligning bulk three 3 waters services with the proposed roading network. Given the significant need for new bulk infrastructure in wastewater, stormwater, and water supply, these services are generally designed to fit within road reserves. The SDP process could provide an opportunity for improved alignment and future planning in this regard.
- Integrated upgrades within SH59, including new intersections, underground infrastructure and multi modal transport options. Undertaking these upgrades will reduce disruption to existing traffic flow and better align construction outcomes.
- Design primary roading cross sections to align with development across the NGA rather than a site-specific approach. This approach facilitates the alignment of development road connection points and ensures uniform road cross sections throughout the NGA. An illustration of this is maintaining a consistent width for bike pathways on a nominated right- or left-hand side of a road.

5.3 CONSTRAINTS

- To access areas of development, roads may feature steep gradients in specific locations. We generally target a maximum 10% grades for key connection routes, with limited sections at 12% where required.
- The selection of development and housing typologies should be approached with careful consideration, taking into account the grades of the roads they face. For instance, it may be advisable to reduce density in sections where roads are steep, while utilizing flatter sections of the site for higher-density development. Further considerations in collaboration with the urban design team are required and ongoing.
- Pedestrian friendly access will be challenging on many roads due to the steep nature of the terrain, but we will strive to minimize these challenges wherever possible.
- A higher number of driveway crossing associated with higher yield developments and ensuring the pedestrian routes are not conflicting.

5.4 KEY RISKS AND RECOMMENDATIONS

Further design to ensure an appropriate geometric roading design allows for a multi-modal transport link within the constraints of the steep terrain.

Intersection design and connectivity to SH59 has not been developed yet, but it plays a fundamental role in enabling the development within the NGA.

6.0 STORMWATER

6.1 OVERVIEW

The stormwater management strategy for the NGA is a critical design consideration to allow development. New hard impervious surface will replace the pastoral hill sides and create additional peak flows in large rain fall events, along with additional runoff volume in frequent rain fall events.

Our design strategy is to mitigate these post development stormwater flows and volumes to ensure no downstream effects and to best match the existing hydrology discharges to the receiving environments. A network of underground pipes will be used to convey stormwater to centralised attenuation and treatment areas. These stormwater management areas will most commonly be designed as ponds to attenuation post-development stormwater flows and release at a controlled pre-development rate. Additionally, they will be designed to mitigate low flow volumes to best ensure a frequency of discharges is mitigated.

The project area's existing stormwater catchments are delineated into four major catchments: Pukerua Bay, Horokiro Stream, Taupo Swamp, and Taupo Stream. Comprehensive catchment analysis and maps are provided in Appendix 4. Concept Stormwater Catchments. The post-development stormwater design should aim to keep discharges to there corresponding existing catchment.



6.2 OPPORTUNITIES

- Numerous gullies and the overall slope of the land allows for an efficient, environmentally sustainable stormwater design to be realised.
- Most of the NGA is elevated with no flood risk.
- Possibility for development of the site to incorporate stormwater management measures that help alleviate current downstream flood hazards.
- Adopting an integrated catchment approach offers improved alignment for stormwater solutions, as opposed to focusing solely on individual development pockets. Often, stormwater catchments encompass multiple landowners and aren't confined to a single land development project. Maintaining incoming flows from upstream catchment and aligning them with existing hydrological outflows can pose challenges in land development projects, especially when these existing flows can change based on the development programme. Utilising an integrated stormwater design approach allows us to anticipate these flow patterns and creates a more robust stormwater strategy that aligns better with the natural hydrology and catchment characteristics of the land.
- Adopting a stormwater water management plan that is consistent for the NGA to ensure outcomes are consistently met.

6.3 CONSTRAINTS

- Sensitive receiving environment (particularly the Taupō catchment) means best practice stormwater management is required to develop the land without adverse effects on downstream catchment.
- Stringent requirements to manage stormwater flows and volumes within the Plimmerton Farm specific chapter (PC18) in the Porirua City Council (PCC) district plan. These requirements for managing stormwater are more rigorous compared to the typical standards in the region, necessitating further investigation. This investigation is currently ongoing.
- The steep terrain, location of stormwater management areas and numerous discharge locations can potentially pose issues with access and maintenance requirements. These areas need to be carefully designed with those considerations early in the design process.
- Undersized culverts under SH59. Existing stormwater catchments within the NGA discharge to low points generally along SH59. Those flows are then conveyed through a series of culverts under the highway. Preliminary investigations demonstrate that these culverts are generally undersized for the existing catchment. Further investigations are required to fully understand the upstream and downstream effects of any potential upgrades of these culverts.
- Flood prone land has been identified within Plimmerton Farms. This can potentially be mitigated through the used of upstream attenuation devices that will ideally be constructed with the development.
- Limited allowance for soakage devices. This will result in a further consideration when designing stormwater ponds and treatment devices to ensure a larger allowance for volume mitigation can be achieved. Additionally, a re-vegetation scheme will likely be required to help mitigate these effects.
- Requirement of on-lot rainwater re-use tanks that are required to be plumbed into the houses for dirty water re-use may be required if other volume mitigation measure cannot be met.

6.4 KEY RISKS AND RECOMMENDATIONS

Stormwater volume retention requirements remain the key risk but can be mitigated through various stormwater design methods. Additionally, utilising existing gullies for stormwater management will be subject to ecological constraints.

Implementing a project specific stormwater management plan that allows good residential greenfield development outcomes and focuses on centralised stormwater management devices where achievable.



7.0 WATER SENSITIVE DESIGN

7.1 OVERVIEW

Water sensitive design will play a key role in development of the NGA and has been designed concurrently with the stormwater design approach. Treatment of stormwater should be required throughout the development with a focus on contaminants being produced from specific surface treatments and uses. These containments should be designed for within treatment devices to ensure stormwater discharges are matching pre-development runoffs.

7.2 OPPORTUNITIES:

- There is an opportunity to utilize existing gullies for stormwater treatment, which can lead to reduced earthworks, retention of stormwater, and potential enhancement of these receiving environments. Careful consideration in collaboration with the ecology team is necessary and ongoing.
- Integrated catchment approach will allow centralised stormwater treatment devices to become integrated within public spaces and reserves. Considering the steep terrain in certain areas of the development, centralized management may be considered as a preferable treatment option.
- Adopt a project wide stormwater management strategy to create stormwater design principles that are bespoke for the greenfield development of this nature and the specific receiving environment of the NGA.

7.3 CONSTRAINTS:

- The presence of multiple gullies and sub-catchments necessitates the use of numerous treatment and retention devices to manage and retain hydrology to each location, ultimately increasing the number of bioretention devices required. Additional efforts will be needed to identify these points of discharge, flow/volume requirements and develop appropriate strategies in collaboration with hapū, ecology and geotechnical inputs.
- Generally due to the steeper grades of the roading network and density of residential development, roadside bioretention devices may not be the most effective solution in treating stormwater.
- Volume retention within treatment devices may be limited when located on earth worked areas and batters. Devices that can provide this retention are best utilised in existing gullies but will be subject to further ecological investigations.

7.4 KEY RISKS AND RECOMMENDATIONS

Implementing a project specific stormwater management plan.

Ecological constraints discharging to the sensitive receiving environments.

Locating unlined bioretention devices within earth worked areas, and specifically fill batters is generally not acceptable. This can generally be mitigated by utilising existing gullies where earthworks activities have not occurred.

8.0 WASTEWATER

8.1 OVERVIEW

We have completed a preliminary wastewater catchments analysis. Due to bulk infrastructure constraints all peak flows will require detention. Although much of the site could be serviced by a gravity-based system, due to the site topography, we expect a number of required pressure systems to convey wastewater to suitable gravity discharge locations. A concept layout of this network is provided in Appendix 5. Concept Wastewater Catchments.



8.2 OPPORTUNITIES

- The moderately sloping site means that most of the site can be designed with a gravity-based wastewater network. This will result in low ongoing operational and maintenance costs.
- An integrated catchment approach will allow for better alignment of wastewater solutions as opposed to singular pockets of development.

8.3 CONSTRAINTS

- There are downstream capacity constraints in the bulk networks and treatment plant. We are aware of ongoing investigations and considerations of upgrades to these facilities currently envisaged in the Porirua Long-Term Plan. A new storage tank north of the Plimmerton train station is currently under construction and will help alleviate downstream effects. There are options available to mitigate this and enable development of the site prior to completion of downstream works. This could be achieved by providing control of peak flows, through providing detention storage with delayed discharge to the existing gravity networks adjacent to the site. Storage would be via a series of tanks which would be placed to suit the topography and would be installed progressively to suit the development.
- Landform consisting of gullies and ecological constraints could limit utilising gravity to the bottom of the development area. Once flows are conveyed to the low point of a specific catchment, there may be a requirement to pump back to a suitable gravity network that can convey back to SH59 and clear of any constraints that exist in the gully low points.

8.4 KEY RISKS AND RECOMMENDATIONS

Wastewater network modelling with the proposed network and growth assumptions within the NGA to confirm effects on the bulk network.

9.0 WATER SUPPLY

9.1 OVERVIEW

Bulk water infrastructure will be required to service development within the NGA SDP area. This infrastructure will be required to enable the majority of the development and therefore is a vital piece of enabling works.

A bulk supply exists along the NGA but needs extra local storage due to the elevation. This bulk water supply from the bulk network is supplied by Te Marua Water Treatment plant and the Haywards Hill pump station. This bulk network runs along SH59 and is the primary supply to Porirua. To supply the development additional pump stations along SH59 will be required to pump water to new reservoirs located at higher elevations. Water would then be distributed through a domestic main at a pressure suitable for residential connection and use.

A concept layout of the proposed water supply network is provided in Appendix 6. Concept Water Supply Layout. This plan outlines the necessary reservoir elevations and the associated minimum and maximum pressure limits that will serve the development area. In general, the domestic water supply network must have a minimum pressure of 25m and a maximum of 90m at the residential lot boundary connection point. However, in the lower catchment areas, pressure reducing valves may be necessary.

9.2 OPPORTUNITIES

- There are several elevated locations across the NGA suitable for placement of new reservoirs that would enable conventional gravity-based supply of potable water to the new dwellings. The reservoirs would be fed by connection from the existing public water reticulation in State Highway 59.
- Align Multiple developments and landowners to better develop shared water infrastructure that can better supply the development. This is especially required for the various elevations development will occur at, and subsequent elevation of any new reservoirs.
- Explore the potential for new water infrastructure along SH59. Consider the installation of a reticulation main along SH59 that could potentially serve all developments. This approach



eliminates the need for constructing water mains through undeveloped land, which can pose complications for future earthworks and civil activities when dealing with existing water infrastructure that must be accommodated or adjusted. SH59 presents an opportunity to establish a development water supply route using an existing corridor during the early development stages.

- Reevaluate the domestic water demand associated with medium density development and design accordingly.

9.3 CONSTRAINTS

- New reservoirs are required almost immediately to enable early stages of development due to the elevation of the existing reservoirs relative to the site elevations and the current storage volumes available.
- Earthworks are required to for access roads to new reservoir locations.
- The presence undeveloped terrain between the developable areas limits the establishment of north-south bulk supply infrastructure connections.
- Isolated reservoirs will require significant domestic main infrastructure to provide a water connection suitable for residential use. Conveying this through future development areas could cause design issues aligning with earthworks and civil infrastructure. Primarily these domestic mains should be aligned along vested roads and will likely have to be realigned to these locations unless the roading infrastructure is construction tandemly.
- Reservoir construction is required in areas of steep terrain and limited access. Construction methodology and safety in design must be considered.

9.4 KEY RISKS AND RECOMMENDATIONS

Unknown bulk water supply capacity from the Haywards Hill pump station. Through preliminary discussions with the supply asset manager, Wellington Water, we know that there is enough supply to service a significant proportion of the site. However, water network modelling with the proposed network and growth assumptions within the NGA is required to confirm the effects of full development across the NGA on the bulk network.

Resilience considerations of proposed bulk mains and reservoirs. The elevation requirements of the reservoirs created limited access.

10.0 PUKERUA BAY & PLIMMERTON TRAIN STATIONS & ACCESS

10.1 OVERVIEW

During the SDP assessment process, it became evident that the development activities would have an impact on the existing Pukerua Bay and Plimmerton train stations. As a result, it was deemed necessary to incorporate them within the SDP project assessment area. Our initial evaluation indicated that accessing either train station would necessitate substantial improvements to facilitate pedestrian and bus movements effectively. Moreover, the train stations themselves would require upgrades to accommodate the increased traffic, which warrants further investigation.

10.2 OPPORTUNITIES:

- Opportunities for upgrades exist at both train stations to enhance pedestrian safety and improve access for vehicles and buses.

10.3 PUKERUA BAY TRAIN STATION CONSTRAINTS

- There is limited pedestrian access to proposed residential development within project area. To address this issue, the construction of a pedestrian route along SH59 or Muri Road is required.
- Vehicular access and space for bus movements at the Pukerua Bay train station are limited.



- There is limited available land for potential upgrades. Enabling bus movements through upgrades would necessitate a significant scope of civil construction and would likely involve land acquisition. It is advisable to conduct a thorough feasibility study and explore alternative options to address this issue in the future.
- SH59 is additionally constrained by an existing bridge connecting to western side of the train station. Accessing the eastern requires turning onto Gray street, and then onto Muri Road. Both intersections would require upgrades to improve the layout and sightlines.
- Creating a multi-modal transport route through Muri Road and into the Muri Road Block is heavily constrained and would unlikely be feasible without private land acquisition to accommodate a wider road reserve. The existing road reserve has a 20m width that requires significant retaining to be fully utilised. Due to these constraints, we have identified that SH59 could provide a better connection to the train station. A photo of this cross section can be found below.



IMAGE 2: Existing Muri Road Cross Section

10.4 PLIMMERTON TRAIN STATION CONSTRAINTS

- The current pedestrian access at the Plimmerton train station offers limited pedestrian accessibility. While a pedestrian bridge exists to the south, it does not adequately accommodate pedestrians approaching from the north. Therefore, there is a requirement to establish a new crossing across SH59. This could involve the installation of a new pedestrian traffic light or, more likely, a pedestrian bridge. The aim is to improve pedestrian safety and maintain smooth traffic flow. Two potential crossing locations have been suggested, and these can be found in Appendix 7 Train Station Constraint Assessment.

10.5 KEY RISKS AND RECOMMENDATIONS

Further studies are required to understand current and future capacity constraints at each train station.

11.0 CONCLUSIONS

Based on our ongoing assessment in collaboration with other expert consultants including ecology, geotechnical, transportation, urban design, and infrastructure. We are satisfied that the development enabled via a potential SDP can be adequately serviced in terms of roading, stormwater, wastewater, and potable water. Significant design works have been undertaken on some parcels of land within the NGA. This has demonstrated that there are workable solutions to the identified constraints. Furthermore, the adoption of an integrated design approach for the entirety of NGA will allow for better opportunities and workable solutions to the identified constraints. However, further comprehensive engineering assessments are still required to ensure the feasibility and effectiveness of these services if progressed through to an SDP.



12.0 LIMITATIONS

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APPENDICES & DRAWINGS

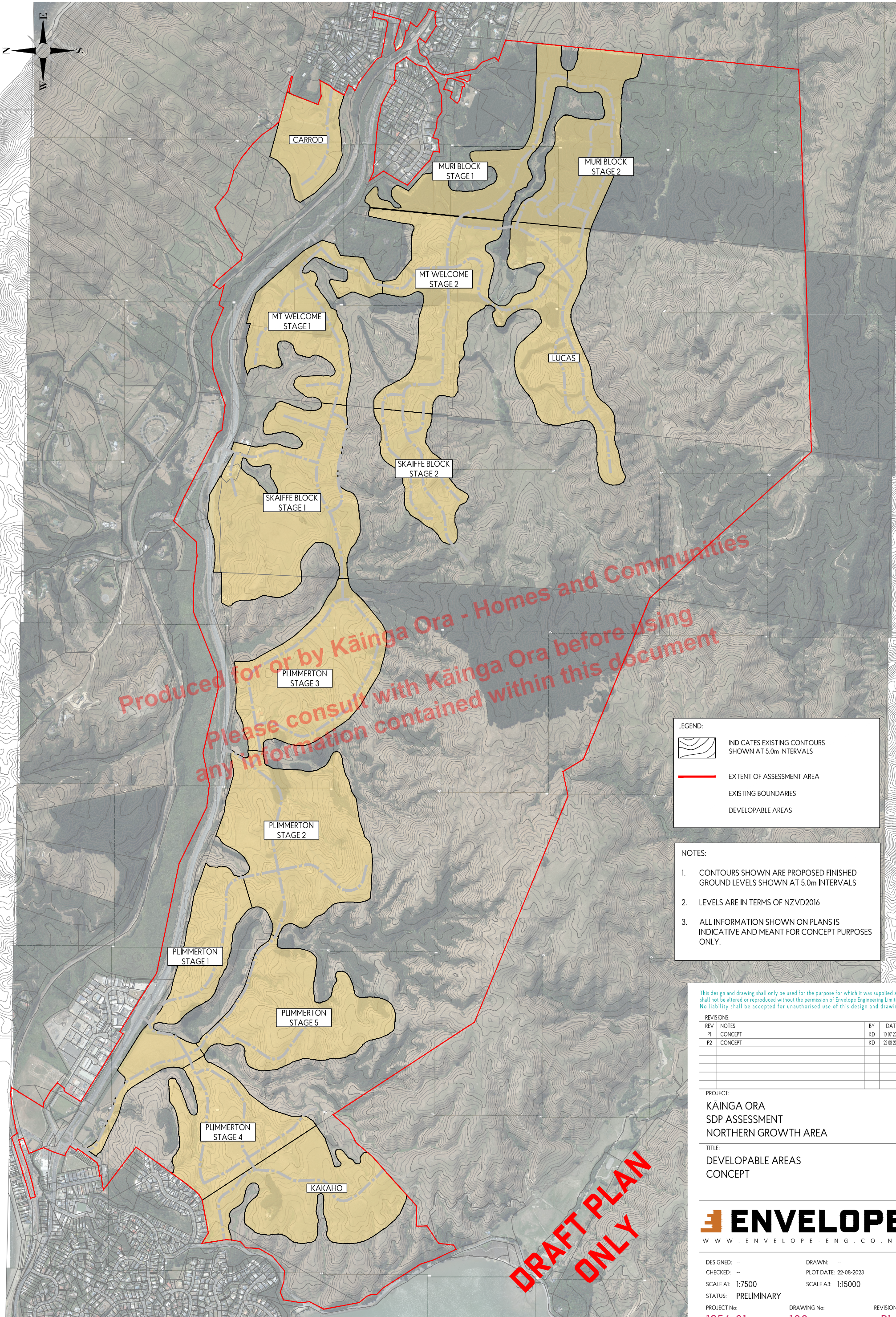
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APPENDIX 1

CONCEPT DEVELOPABLE AREAS

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LEGEND:



INDICATES EXISTING CONTOURS
SHOWN AT 5.0m INTERVALS



EXTENT OF ASSESSMENT AREA



EXISTING BOUNDARIES



DEVELOPABLE AREAS

NOTES:

1. CONTOURS SHOWN ARE PROPOSED FINISHED GROUND LEVELS SHOWN AT 5.0m INTERVALS
2. LEVELS ARE IN TERMS OF NZVD2016
3. ALL INFORMATION SHOWN ON PLANS IS INDICATIVE AND MEANT FOR CONCEPT PURPOSES ONLY.

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REV	NOTES		
P1	CONCEPT	KD	10-07-2023
P2	CONCEPT	KD	22-08-2023

PROJECT:
KĀINGA ORA
SDP ASSESSMENT
NORTHERN GROWTH AREA

TITLE:
DEVELOPABLE AREAS
CONCEPT



DESIGNED: --	DRAWN: --	REVISION:
CHECKED: --	PLOT DATE: 22-08-2023	
SCALE A1: 1:7500	SCALE A3: 1:15000	
STATUS: PRELIMINARY		
PROJECT No: 1956-01	DRAWING No: 100	REVISION: P1

DRAFT PLAN
ONLY

Client
Project
Reference Number
Date

Kāinga Ora
Northern Growth Area - SDP Assessment
1956-01
25/09/2023



NGA - DEVELOPABLE AREAS									40 PER HA	
ID	Name	Developable Area (ha)	Commercial (ha)	School (ha)	Open Space (ha)	Drainage (ha)	Roads (ha)	Residential (ha)	Dwellings per ha	Yield (lots)
1	Kakaho Block	27.8	0.834	0.834	4.17	2.78	5.282	13.9	40	556
2	Plimmertion Stage 1	20.9	0.627	0.627	3.135	2.09	3.971	10.45	40	418
3	Plimmertion Stage 2	38.5	1.155	1.155	5.775	3.85	7.315	19.25	40	770
4	Plimmertion Stage 3	30.6	0.918	0.918	4.59	3.06	5.814	15.3	40	612
5	Plimmertion Stage 4	21	0.63	0.63	3.15	2.1	3.99	10.5	40	420
6	Plimmertion Stage 5	27.6	0.828	0.828	4.14	2.76	5.244	13.8	40	552
7	Skafe Stage 1	40.2	1.206	1.206	6.03	4.02	7.638	20.1	40	804
8	Skafe Stage 2	12.3	0.369	0.369	1.845	1.23	2.337	6.15	40	246
9	Mt Welcome Stage 1	21.5	0.645	0.645	3.225	2.15	4.085	10.75	40	430
10	Mt Welcome Stage 2	27.8	0.8334	0.8334	4.167	2.778	5.2782	13.89	40	556
11	Lucas Block	28.4	0.852	0.852	4.26	2.84	5.396	14.2	40	568
12	Muri Stage 1	15.4	0.462	0.462	2.31	1.54	2.926	7.7	40	308
13	Muri Stage 2	21.5	0.645	0.645	3.225	2.15	4.085	10.75	40	430
14	Carrod	11.2	0.336	0.336	1.68	1.12	2.128	5.6	40	224
Total		344.68	10.3404	10.3404	51.702	34.468	65.4892	172.34		6894

Land Use	%
Commercial (ha)	3%
School (ha)	3%
Open Space (ha)	15%
Drainage (ha)	10%
Roads (ha)	19%
Residential (ha)	50%
Total	100%

Dwellings/ha	40
--------------	----

Scenario - Internal lots with batters incl

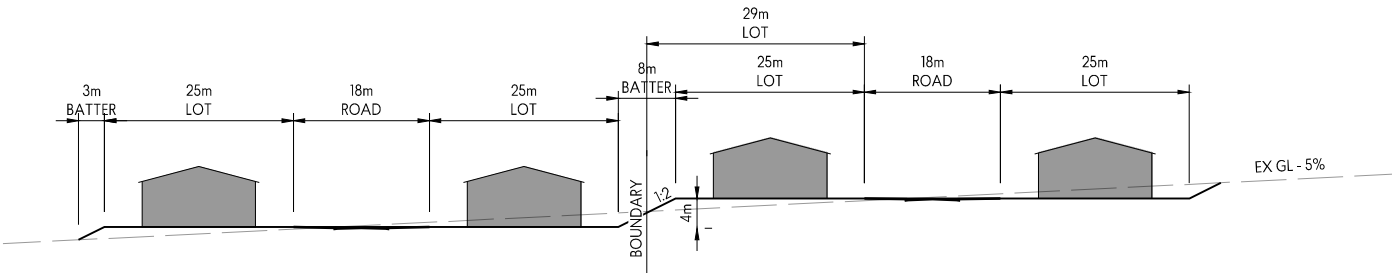
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Lot Size	232	264	320	
Depth	29	33	40	
Width	8	8	8	
Per ha	43	38	31	
				37

Scenario - Batters excl

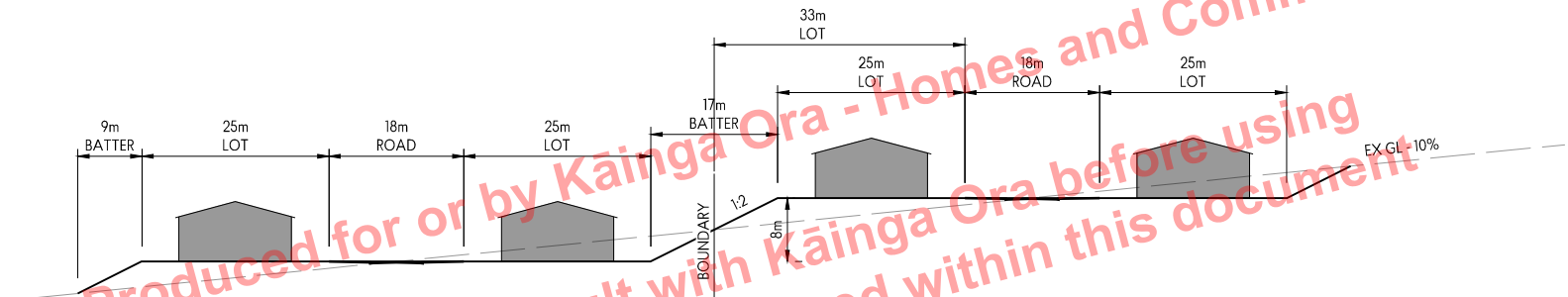
Grades	5%	10%	15%	Average
Lot Size	200	200	200	
Depth	25	25	25	
Width	8	8	8	
Per ha	50	50	50	
				50

Average
44

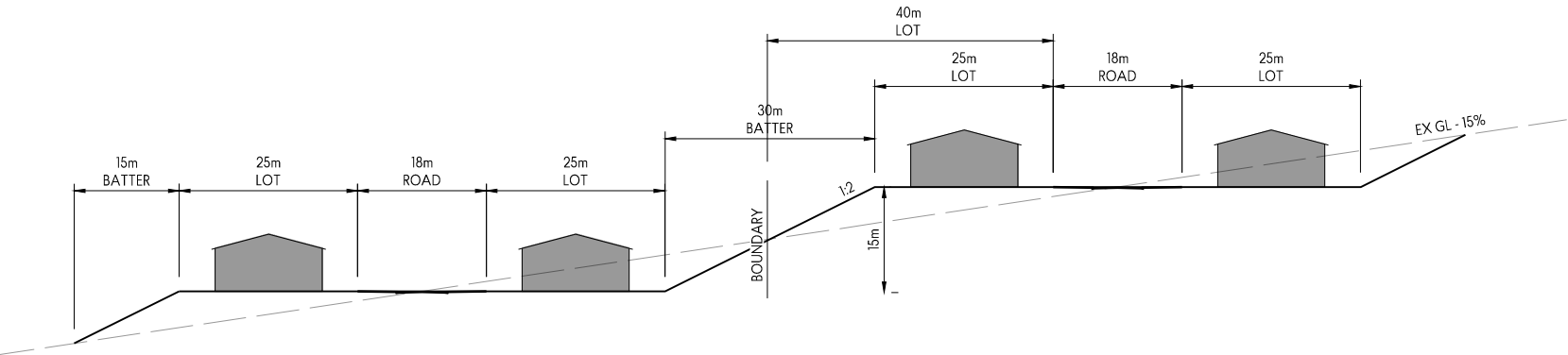
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SCALE: 1:50-A1
1:100-A3



TYPICAL CROSS-SECTION - 10%
SCALE: 1:50-A1
1:100-A3



TYPICAL CROSS-SECTION - 15%
SCALE: 1:50-A1
1:100-A3



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REV	NOTES	BY	DATE
--			

PROJECT:
KĀINGA ORA
SDP ASSESSMENT
NORTHERN GROWTH AREA

TITLE:
TYPICAL SECTIONS
CONCEPT



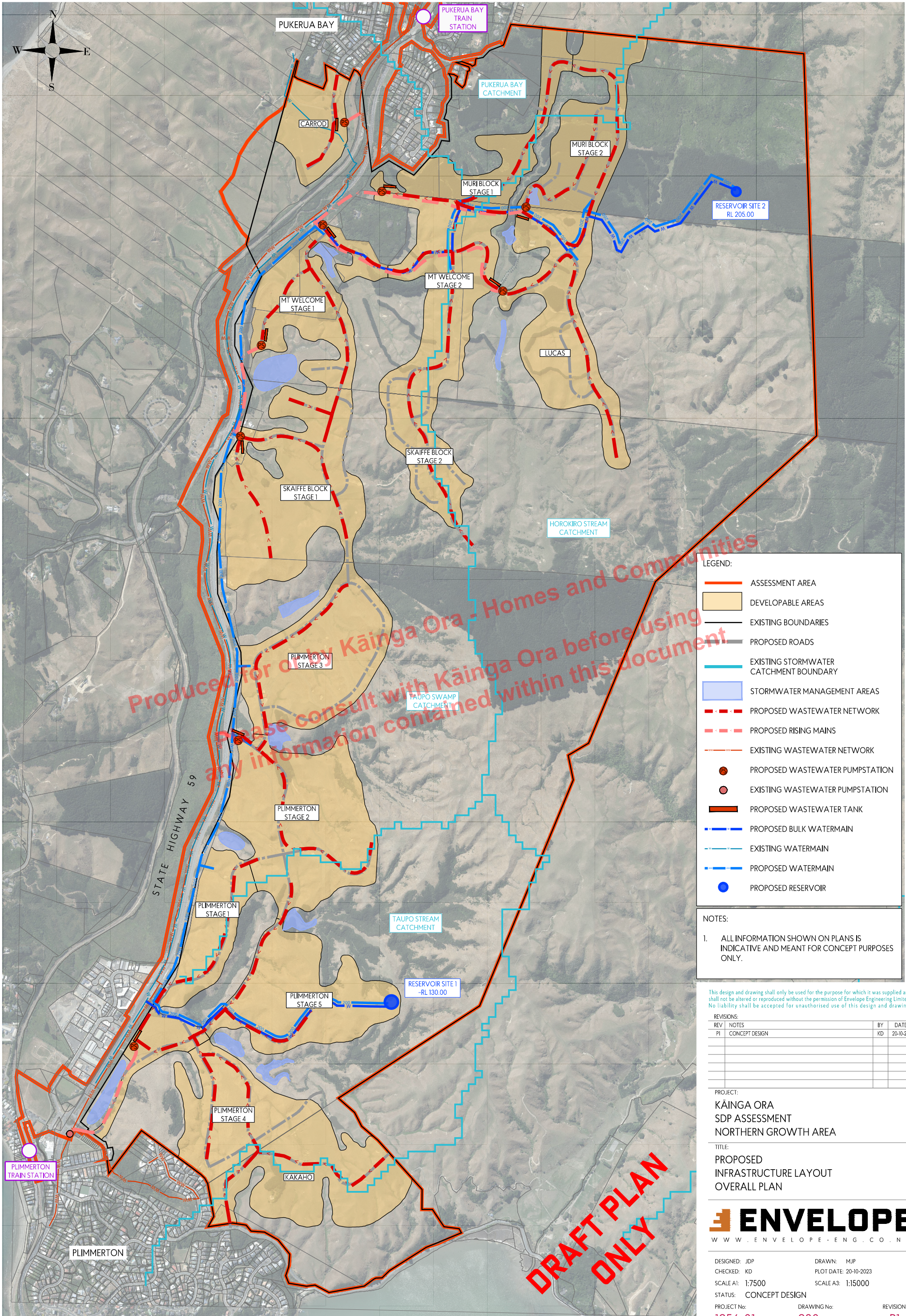
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CHECKED: --	PLOT DATE: 07-06-2023
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STATUS: CONCEPT	
PROJECT No: 1956-01	DRAWING No: SK930
	REVISION: P1

APPENDIX 2

CONCEPT INFRASTRUCTURE OVERALL LAYOUT

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LEGEND:

- ASSESSMENT AREA
- DEVELOPABLE AREAS
- EXISTING BOUNDARIES
- PROPOSED ROADS
- EXISTING STORMWATER CATCHMENT BOUNDARY
- STORMWATER MANAGEMENT AREAS
- PROPOSED WASTEWATER NETWORK
- PROPOSED RISING MAINS
- EXISTING WASTEWATER NETWORK
- PROPOSED WASTEWATER PUMPSTATION
- EXISTING WASTEWATER PUMPSTATION
- PROPOSED WASTEWATER TANK
- PROPOSED BULK WATERMAIN
- EXISTING WATERMAIN
- PROPOSED WATERMAIN
- PROPOSED RESERVOIR

NOTES:

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REVISIONS:			
REV	NOTES	BY	DATE
P1	CONCEPT DESIGN	KD	20-10-23

PROJECT:
KAINGA ORA
SDP ASSESSMENT
NORTHERN GROWTH AREA

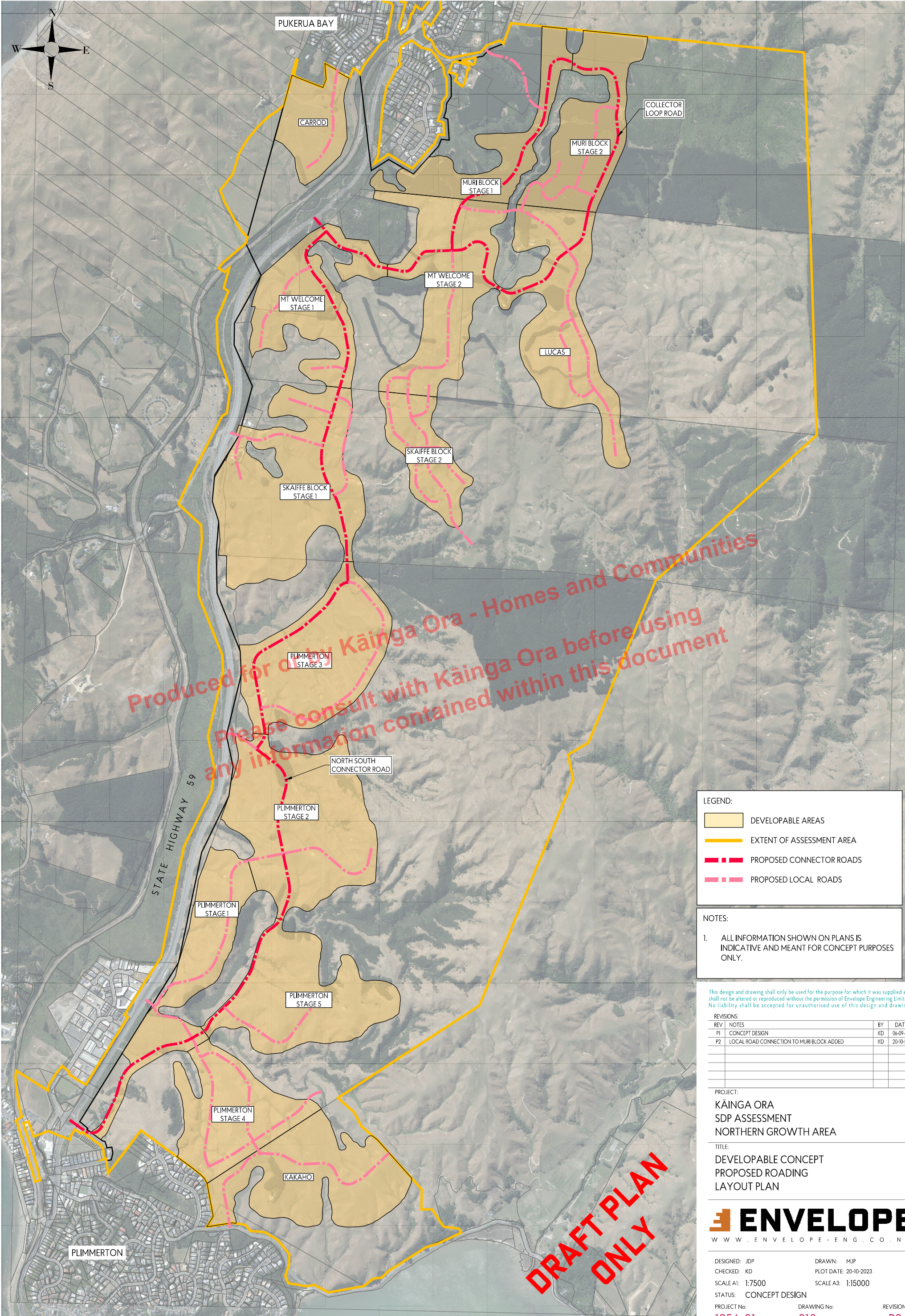
TITLE:
PROPOSED
INFRASTRUCTURE LAYOUT
OVERALL PLAN



DESIGNED: JDP	DRAWN: MJP
CHECKED: KD	PLOT DATE: 20-10-2023
SCALE A1: 1:7500	SCALE A3: 1:15000
STATUS: CONCEPT DESIGN	
PROJECT No: 1956-01	DRAWING No: 930
	REVISION: P1

APPENDIX 3
CONCEPT ROADING LAYOUT

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LEGEND:

- DEVELOPABLE AREAS
- EXTENT OF ASSESSMENT AREA
- PROPOSED CONNECTOR ROADS
- PROPOSED LOCAL ROADS

NOTES:

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REVISIONS:			
REV	NOTES	BY	DATE
P1	CONCEPT DESIGN	KD	06-09-23
P2	LOCAL ROAD CONNECTION TO MURI BLOCK ADDED	KD	20-10-23

PROJECT:
KAINGA ORA
SDP ASSESSMENT
NORTHERN GROWTH AREA

TITLE:
DEVELOPABLE CONCEPT
PROPOSED ROADING
LAYOUT PLAN



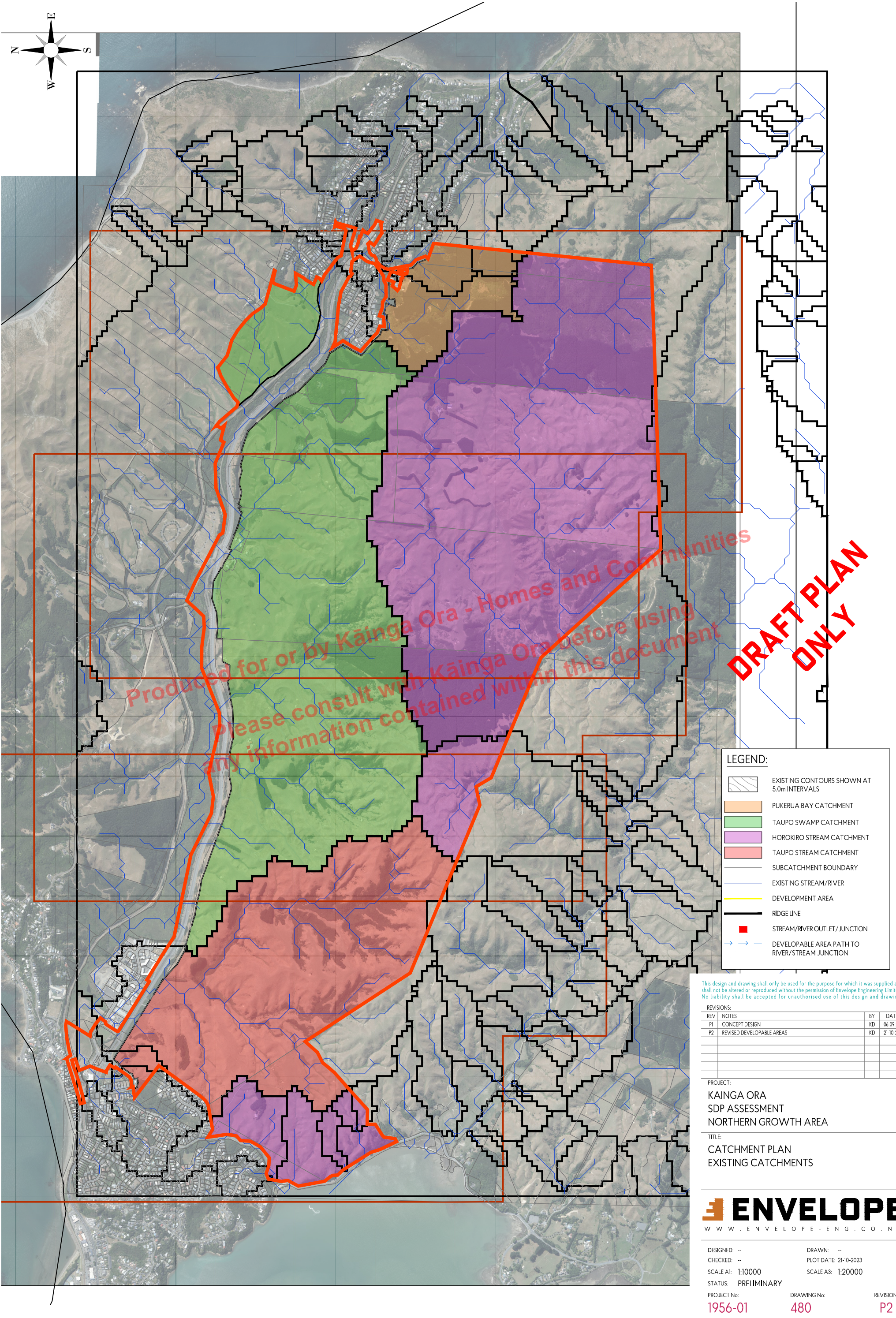
DESIGNED: JDP	DRAWN: MJP
CHECKED: KD	PLOT DATE: 20-10-2023
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STATUS: CONCEPT DESIGN	
PROJECT No: 1956-01	DRAWING No: 310
	REVISION: P2

APPENDIX 4

CONCEPT STORMWATER CATCHMENTS

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LEGEND:

- EXISTING CONTOURS SHOWN AT 5.0m INTERVALS
- PUKERUA BAY CATCHMENT
- TAUPO SWAMP CATCHMENT
- HOROKIRO STREAM CATCHMENT
- TAUPO STREAM CATCHMENT
- SUBCATCHMENT BOUNDARY
- EXISTING STREAM/RIVER
- DEVELOPMENT AREA
- RIDGE LINE
- STREAM/RIVER OUTLET/JUNCTION
- DEVELOPABLE AREA PATH TO RIVER/STREAM JUNCTION

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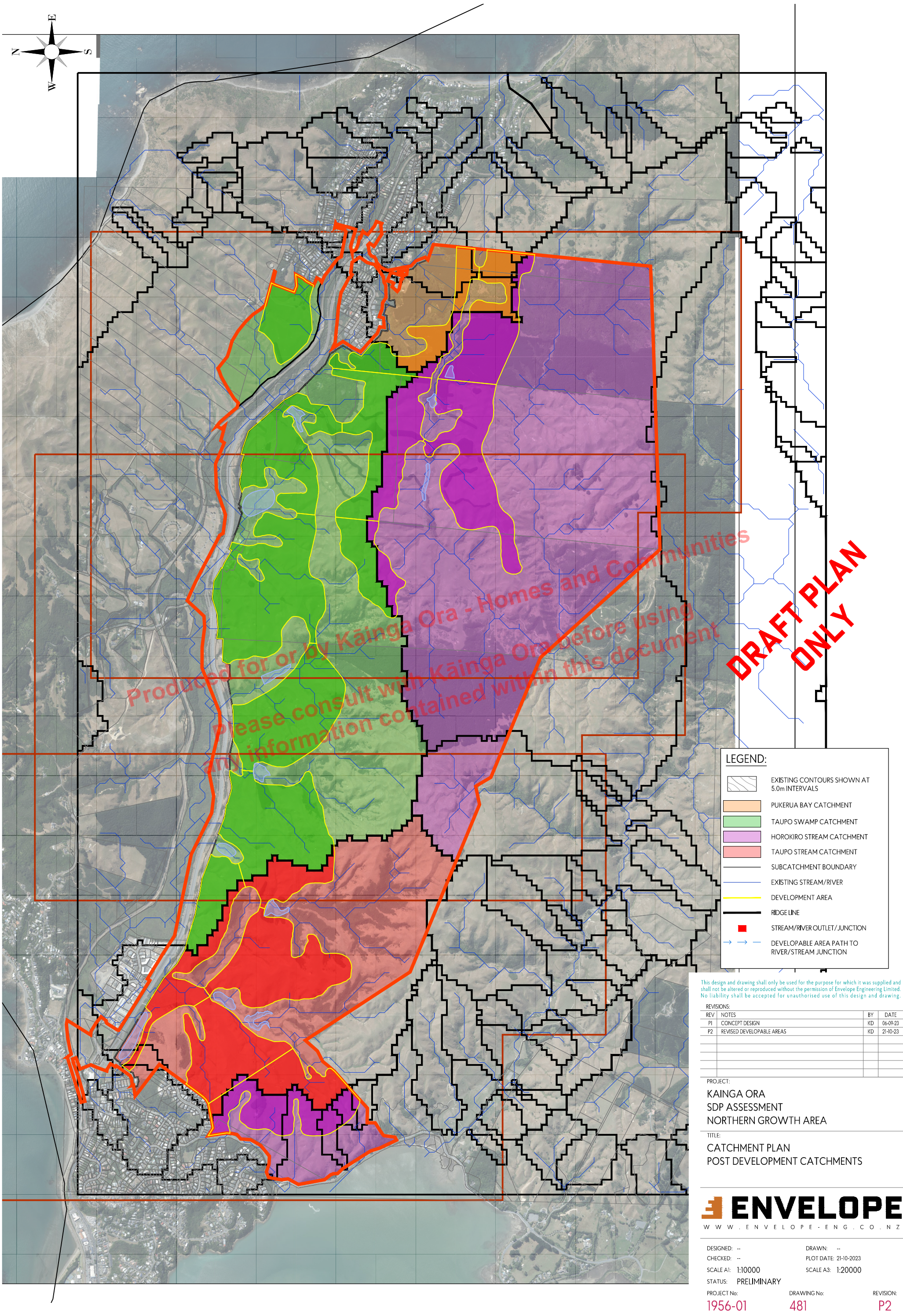
REVISIONS:			
REV	NOTES	BY	DATE
P1	CONCEPT DESIGN	KD	06-09-23
P2	REVISED DEVELOPABLE AREAS	KD	21-10-23

PROJECT:
KAINGA ORA
SDP ASSESSMENT
NORTHERN GROWTH AREA

TITLE:
CATCHMENT PLAN
EXISTING CATCHMENTS



DESIGNED: --	DRAWN: --
CHECKED: --	PLOT DATE: 21-10-2023
SCALE A1: 1:10000	SCALE A3: 1:20000
STATUS: PRELIMINARY	
PROJECT No: 1956-01	DRAWING No: 480
	REVISION: P2



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LEGEND:

- EXISTING CONTOURS SHOWN AT 5.0m INTERVALS
- PUKERUA BAY CATCHMENT
- TAUPO SWAMP CATCHMENT
- HOROKIRO STREAM CATCHMENT
- TAUPO STREAM CATCHMENT
- SUBCATCHMENT BOUNDARY
- EXISTING STREAM/RIVER
- DEVELOPMENT AREA
- RIDGE LINE
- STREAM/RIVER OUTLET/JUNCTION
- DEVELOPABLE AREA PATH TO RIVER/STREAM JUNCTION

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REVISIONS:			
REV	NOTES	BY	DATE
P1	CONCEPT DESIGN	KD	06-09-23
P2	REVISED DEVELOPABLE AREAS	KD	21-10-23

PROJECT:
KAINGA ORA
SDP ASSESSMENT
NORTHERN GROWTH AREA

TITLE:
CATCHMENT PLAN
POST DEVELOPMENT CATCHMENTS



DESIGNED: --	DRAWN: --
CHECKED: --	PLOT DATE: 21-10-2023
SCALE A1: 1:10000	SCALE A3: 1:20000
STATUS: PRELIMINARY	
PROJECT No: 1956-01	DRAWING No: 481
	REVISION: P2



NGA - PRE/POST STORMWATER CATCHEMENT SCENARIOS					
Catchment ID	Development Block	Pre-Development (ha)	Post-Development (ha)	Post-Development Impervious (ha)	Pre/Post
Pukerua Bay		37.5948	15.20	9.1	24%
	Muri Block		15.20		
Horokiro Stream		427.0512	79.62	47.8	11%
	Muri Block		16.68		
	Lucas Block		41.86		
	Scaiffe Block		3.78		
	Kakaho Block		17.30		
Taupo swamp		321.6894	171.49	102.9	32%
	Carrod Block		11.25		
	Muri Block		5.00		
	Mt Welcome		35.96		
	Scaiffe Block		48.76		
	Plimmerton Farm		70.53		
Taupo Stream		183.736	78.66	47.2	26%
	Plimmerton Farm		67.81		
	Kakaho Block		10.86		

Catchment	
Pukerua Bay	
Taupo Swamp	
Horokiro Stream	
Taupo Catchment	

Impervious Assumption	60%
-----------------------	-----

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APPENDIX 5

CONCEPT WASTEWATER CATCHMENTS

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