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WALKER CORP

55 MACQUARIEDALE RD, APPIN WATER AND SEWER CONCEPT DESIGN & OPTIONS REPORT

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Version	Amendment	BY	Date
A	First Draft	A.K.	02.12.13

1. Introduction

Walker Corporation has engaged Qalchek to carry out a feasibility study for provision of sewer & water services in a future sub division (Endeavour) within Appin. Sewer & water services are a crucial building block of every development and this is no exception. Sewer & water services also tend to be significantly expensive and depending on the complexity of the design can be time consuming, therefore, it is absolutely imperative to explore every available option for sewer and water to find the most economically viable option that will meet the current local and national standards and which can also be constructed in a safe and timely manner.

This report will explore provision of sewer through means of a gravity system or a low pressure system. Water main alignment will also be provided. It should be noted that this is a preliminary study only and will be subject to change once the subdivision layouts are finalized and detailed design is carried out.

2. Background

Appin has recently undergone some major re-zoning resulting in major development, especially within the residential market. Walker Corporation is currently undertaking works for the subdivision which is the primary subject of this report. This subdivision (at the preliminary stage) comprises of 289 lots which are proposed to be built in three stages.

Stage 1 is north of the Gordon Lewis oval along Sports Ground parade. Stage 1 is expected to consist of approximately 42 lots.

Stage 2 is north of Maquariedale rd and south of the Gordon Lewis Oval. Stage 2 is expected to consist of approximately 71 lots.

Stage 3 is immediately south of Maquariedale rd. Stage 3 is expected to consist of approximately 176 lots.

The lot layout's, used at the time of preparation of this report, were provided by the Walker Corporation to Qalchek on the 31.10.13 (Appendix A).

It is also expected that there will be a future subdivision comprising approximately 200 lots by a different developer (Gullotta) immediately south of this development.

These developments will all be east of the future Appin Bypass, which does not have any anticipated construction timeframes.

Construction of the sewage pumping station SPS1175, which is just north of subject subdivision, has recently been completed and the SPS has been taken over by Sydney Water. Regardless of the sewer design selection, this proposed subdivision will be draining into SPS1175. Sydney Water has confirmed that this pumping station has the capacity to accept sewage from the Walker Corporation subdivision. However, this SPS will need to be upgraded for any future developments (including the 200 lots by the Gullotta Group).

For the water supply, there are multiple available points of connection for the different stages. This is detailed in the water design section of this report.

3. Existing site information

The proposed 3 stages of the subject subdivision lie within three super lots.

Stages 1 and 2 lie within Lot 201 of DP749272. Stage 3 lies within Lot 1 of DP209779 and Lot 1 of DP55807.

This subdivision is within a Mine Subsidence Area. The latest survey available at the time of this report's preparation was carried out by 'Lockley Land Title Solutions' on 29.08.06 (Appendix B). There is a riparian corridor within the two super lots and it is anticipated that there will be a major road way construction (the Appin Bypass) in the future. However, the proposed subdivision is clear of these areas.

The existing site has much vegetation that will be affected by this subdivision; however, this is not covered under the scope of this report. The protection or removal of any trees that may be required as a result of sewer and/or water construction will need to be considered and documented at the detailed design stage.

Figure 1: Locality Plan (approximate only) (whereis.com)

4. Design Compliance

The options and concept presented in this report can meet the following Sydney Water's current standards:

- Polyethylene Pipeline Code WSA 01-2004 Third Edition Version 3.1
- Sewerage Code of Australia WSA 02-2002-2.2 SWC Edition Version 2
- Water Supply Code of Australia WSA 03-2011-3.1 Sydney Water Edition 2012
- Sewage Pumping Station Code of Australia WSA 04-2005-2.1 SWC Edition 2012
- Pressure Sewage Code of Australia WSA 07-2007 Version 1.1
- Technical Specification for Low Infiltration Sewers Version 7.0 (14 December 2012)

5. Potable Water service

The existing potable water infrastructure information was obtained from Sydney Water's 'HYDRA' GIS software. This section of the report should be read in conjunction with the concept potable water design (Appendix C)

At this stage it cannot be exactly determined the size or length of lead in water mains required to service the 3 stages of this development. However, taking the existing infrastructure into consideration the anticipated requirements and preliminary cost estimation is provided below.

a. Concept Potable Water Design

At this stage it is anticipated that all new water pipes will be laid at standard depth and in oPVC. No consideration has been given to service or road crossings or any special design which may require different pipe materials.

1. Stage 1

At this stage it is anticipated that the water mains to service Stage 1 will be constructed from DN250 oPVC which is servicing the development at North Appin. The water main would be constructed through Rd No.1 just north of Stage 1.

A total of 875m of DN100 oPVC main would be required to service the 42 Lots of Stage 1.

2. Stage 2

At this stage it is anticipated that the water mains to service Stage 2 will be constructed from the existing DN100 CICL main at the intersection of Sport Ground Pde and Sports Ground Rd and the existing DN300 oPVC main at the intersection of Lewis and Kerr St. It is also anticipated that a lead in main from the DN300 oPVC main at the intersection of Kerr St and Macquariedale Rd will be required; however, this will be shared with Stage 3 of the proposed subdivision.

A total of 740m of DN100 oPVC, 550m of DN150 oPVC and 140m of DN300 oPVC main is anticipated to be constructed to serve 71 lots of Stage 2 of this subdivision.

3. Stage 3

At this stage it is anticipated that the water mains to service Stage 3 will be constructed from the existing DN300 oPVC main at the intersection of Kerr St and Macquariedale Rd (shared with Stage 2),

the existing DN300 oPVC main at the intersection of Appin rd and King St and the DN150 CICL main at the intersection of Appin rd and Church St.

A total of 1585m of DN100 oPVC, 1000m of DN150 oPVC and 225m of DN300 oPVC main is anticipated to be constructed to serve the 176 lots of Stage 3 of this subdivision

b. Potable Water Preliminary Costs

The preliminary cost estimation for the water main construction has been carried out using the sizes and lengths from the concept design. The preliminary costs are indicative only and have been acquired from recent similar projects in the vicinity of the subject subdivision.

Water main size	Cost per meter
DN100 oPVC	$180/m
DN150 oPVC	$230/m
DN300 oPVC	$495/m

Table 1: Lineal meter cost of water mains

	Stage 1	Stage 2	Stage 3	Total required main (per size)
DN100 oPVC	875m	740m	1,585m	3,200m
DN150 oPVC	-	550m	1,000m	1,550m
DN300 oPVC	-	140m	220m	360m
Total mains required (per stage)	875m	1,430m	2,805m	5,110m

Table 2: Length of water mains per stage and per main size (total required for subdivision in green)

	Stage 1	Stage 2	Stage 3	Total cost of main (per size)
DN100 oPVC	$157,500	$133,200	$285,300	$576,000
DN150 oPVC	-	$126,500	$230,000	$356,500
DN300 oPVC	-	$69,300	$108,900	$178,200
Total cost of main (per stage)	$157,500	$329,000	$624,200	$1,110,700

Table 3: Water main costs per stage and per water main size (total required for subdivision in green)

The lengths and costs presented here for the potable water main construction for this subdivision are preliminary and should be used as a guide only. Actual costs are subject to change pending detailed final design and any Sydney Water requirements.

6. Sewer Service

This subdivision as mentioned previously is expected to have approximately 289 lots. As per the current Sewer Code, each lot is assigned with an EP value of 3.5. Total EP of this subdivision is calculated to be 1011.5 EP.

It has been confirmed that the 289 lots of this subdivision can be drained into SPS1175, however, it should be noted that the future Gullota subdivision will require SPS1175 to be upgraded to cater for the additional flows.

For this subdivision there were different options explored for the provision of sewer service to the lots. The options presented in this report are as follows:

Option 1 – Low pressure sewer

Option 2 – Gravity sewer with a pumping station

Option 3 – Gravity and low pressure sewer (without pumping station)

a. Option 1 – Low Pressure sewer

i. Concept Low pressure sewer design

This option has been illustrated in Appendix D and should be referred to in conjunction with this section of the report.

To service the subject subdivision with a low pressure sewer system, an inlet would need to be constructed at the MH (currently being constructed under case number 131108WW), immediately east of the proposed Appin By-pass road in Lot 1154. A ventshaft will need to be installed on this MH.

For the purposes of this report, detailed hydraulic calculations for the sizing of the low pressure mains were not carried out. Pipe sizes were estimated using experience from previous similar projects. Pipe sizes and lengths required are subject to change pending Sydney Water requirements and detailed design. At this stage it is assumed that the low pressure mains would be laid at a standard depth in various sizes of PE pipe. No consideration has been given for special designs or service/road crossings.

1. Stage 1

Stage 1 would require a 160m lead in low pressure main from the existing end of Rd No.1 to the MH which is currently being built under a separate development main draining into SPS1175. This lead in main may be applicable for funding from Sydney Water; however, this would be determined at the application stage of the works. The main sizes and lengths required to service stage 1 are detailed in the cost estimation section below.

2. Stage 2

Stage 2 would require a 410m lead in low pressure main from the north of Stage 2 to south of Stage 1. This main would be laid parallel to the future Appin Bypass within the lot of Gordon Lewis Oval, it should be noted that this lead in main would need to be laid in an easement (easement requirements to be determined at detail design stage). This lead in main may be applicable for funding from Sydney Water; however, this would be determined at the application stage of the works. The main sizes and lengths required to service stage 2 are detailed in the cost estimation section below. A small section of the main in Macquariedale rd between stage 2 and 3 is anticipated to be shared.

3. Stage 3

Stage 3 would not require any lead in mains due to its vicinity to Stage 2. The main sizes and lengths required to service stage 2 are detailed in the cost estimation section below.

ii. Option 1- Preliminary Cost estimation

The preliminary cost estimation for the low pressure main construction has been carried out using the sizes and lengths from the concept design. The preliminary costs are indicative only and have been acquired from recent similar projects.

LP main size	Cost per meter	LP main size	Cost per meter
DN40 PE SDR21	$70/m	DN90 PE SDR21	$150/m
DN50 PE SDR21	$90/m	DN110 PE SDR21	$200/m
DN63 PE SDR21	$110/m	DN160 PE SDR21	$260/m
DN75 PE SDR21	$130/m	DN180 PE SDR21	$340/m

Table 4: Lineal meter cost for Low Pressure mains (Laid)

	Stage 1	Stage 2	Stage 3	Total required main (per size)
DN40 PE SDR21	240m	410m	1,070m	1,720m
DN50 PE SDR21	340m	330m	640m	1,310m
DN63 PE SDR21	205m	230m	575m	1,010m
DN75 PE SDR21	-	200m	460m	660m
DN90 PE SDR21	-	-	190m	190m
DN110 PE SDR21	-	-	410m	410m
DN160 PE SDR21	-	-	220m	220m
DN180 PE SDR21	205m	265m	-	470m
Lead in mains	160m*	410m*	-	570m*
Total Required mains (Per stage)	1,350m	1,845m	3,565m	6,560m

Table 5: Length of LP mains per stage and per main size (total required for subdivision in green)

	Stage 1	Stage 2	Stage 3	Total cost of main (per size)
DN40 PE SDR21	$16,800	$28,700	$74,900	$120,400
DN50 PE SDR21	$30,600	$29,700	$57,600	$117,900
DN63 PE SDR21	$22,550	$25,300	$63,250	$111,100
DN75 PE SDR21	0	$26,000	$59,800	$85,800
DN90 PE SDR21	0	0	$28,500	$28,500
DN110 PE SDR21	0	0	$82,000	$82,000
DN160 PE SDR21	0	0	$57,200	$57,200
DN180 PE SDR21	$69,700	$90,100	0	$159,800
Lead in mains	$54,400*	139,400*	0	$193,800*
Total cost of mains (Per stage)	$194,050	$339,200	$423,250	$762,700(no lead in) $956,500 (Total)

Table 6: LP main costs per stage and per LP main size (total required for subdivision in green)

*These lengths may be partially funded by Sydney Water under lead in main funding. However, the amount of funding (if any) can only be determined at the application stage.

As this would be a low pressure sewer system, each lot would require its own pumping system. These are comprised of a plastic pit (usually 900 liters in volume and 2m deep), a grinder pump and a control/alarm unit. It is anticipated that each pump system and installation would cost approximately $10,000 (installed). The costs of these pump systems is detailed in Table 7. This table does not account for any ongoing operating and maintenance costs

	Quantity required	Cost/unit	Total cost
Pumps systems (Stage 1)	42	$10,000	$420,000
Pumps systems (Stage 2)	71	$10,000	$710,000
Pumps systems (Stage 3)	176	$10,000	$1,760,000
Pump Systems (Subdivision)	289	$10,000	$2,890,000

Table 7: Cost of pump systems (per stage and entire subdivision)

It should be noted that the cost for the pump systems for each individual lot would be the responsibility of the future lot owner. The developer is only responsible for providing a connection point (in the form of a boundary kit) to each lot. However, the cost of these pump systems will affect the land value of each lot as potential owner would need to be notified of this pending cost.

b. Option 2 – Gravity Sewer with a Pump Station

i. Gravity Sewer with a Pump Station concept design

This option has been illustrated in Appendix E and should be referred to in conjunction with this section of the report.

To service the subject subdivision with a gravity sewer, a new MH would need to be constructed over the existing DN300 sewer main, approx. 30m upstream SPS1175. The pipe sizes selected to take into account the Gullotta subdivision south of the subject subdivision, however, the existing pump station does not have the capacity to cater for any future sewage flows. If the Gullotta subdivision is to go ahead, the pump station would need to be upgraded accordingly to suit the additional flows.

In this option, due to the existing surface levels available for the proposed division, a new pumping station would be required just north of stage 2. This pumping station would collect sewage from stages 2 and 3 (and possibly the future Gullotta subdivision).

1. Stage 1

Stage 1 would require a 390m DN300 lead in main from the existing end of Rd No.1 to the new MH which would be constructed over the existing sewer draining into SPS1175. This lead in main may be applicable for funding from Sydney Water; however, this would be determined at the application stage of the works. The deepest MH along this lead in is expected to be approximately 9m deep.

The reticulations lines within stage 1 would need to be DN150 sewer mains. It is expected approx. 675m of DN150 reticulation main would be required. Part of stage 1 would be serviced by approx. 200m of the DN300 main, which will double as a lead in main for Stages 2 and 3. These sizes and lengths are subject to change pending detailed design and Sydney Water requirements.

2. Stage 2

Stage 2 would require a 350m lead in rising main from the north of Stage 2 to south of Stage 1. This main would be laid parallel to the future Appin Bypass within the lot of Gordon Lewis Oval, it should be noted that this lead in main would need to be laid in an easement (easement requirements to be determined at detail design stage). This lead in main would be applicable for funding from Sydney Water; however, this would be determined at the application stage of the works. At this stage the rising main size is anticipated to be a DN150 main, however, this is subject to change pending detailed design and Sydney Water requirements.

At this stage it is anticipated that approximately 1110m of DN150 and 360m of DN225 reticulation main would be required to service stage 2. The DN225 main would however, be treated as a lead in main transferring sewer flows from Stage 2 to the future pumping station.

3. Stage 3

Stage 3 would not require any lead in works due to its vicinity to Stage 2. The DN225 reticulation main in Stage 2 would act as a lead in main for stage 3, transferring the flows from the 176 lots to the future pumping station.

At this stage it is anticipated that 3070m of DN150 and 320m of DN225 reticulation mains would be required to service Stage 3 of this subdivision. It should be noted that the DN225 main within Stage 3 has been sized to accommodate future flows from the Gullotta Subdivision; however, the existing SPS (SPS1175) cannot cater for any future flows. If the Gullotta Subdivision is to proceed in the future, the existing SPS1175 would need to be upgraded to cater for the additional flows.

ii. Option 2 – Preliminary cost estimation

The preliminary cost estimations for this option are carried out using the sizes and lengths from the concept design. The preliminary costs are indicative only and have been acquired from recent similar projects. The amount of excavation required would significantly impact on the construction cost of the gravity sewers required. The concept design has been carried out, laying the sewer as shallow as possible and does not take into account any service crossings which may require the sewer to be deeper. The concept design or the costs do not take into any concrete encasement requirements either. These requirements are likely to be added at the detailed design stage and should be taken into consideration for the overall budgeting process.

The amount of and type of maintenance structures used for the cost estimation are indicative only; these were derived from the absolute minimum spacing. The amount/type/cost of these structures is subject to change pending detailed design and Sydney Water requirements. The following table also provides an indicative cost of maintenance structures. These costs are for structures placed within the subdivision not for the deep MH's which will be required for the lead in from Stage 1 to SPS1175. The prices for the gravity lead in and rising main are provided in a separate section.

Gravity main size	Cost per meter	Type of structure	Cost per structure
DN150 PVC	$340/m	Manhole (<6m)	$8,000
DN225 PVC	$380/m	Maintenance shaft	$5,000
DN300 PVC	$430/m	Terminal shaft	$5,000

Table 8: Lineal meter cost for gravity mains (Laid) and cost per type of structure

	DN150	DN225	DN300	MH	MS	TMS
Stage 1	675m	-	200m	1	14	5
Stage 2	1,110m	360m	-	3	17	10
Stage 3	3,070m	320m	-	7	30	20

Table 9: Amount of pipe and maintenance structures required

	DN150	DN225	DN300	MH	MS	TMS	Total
Stage 1	$229,500	-	$86,000	$8,000	$70,000	$25,000	$418,500
Stage 2	$377,400	$136,800	-	$24,000	$85,000	$50,000	$673,200
Stage 3	$1,043,800	$121,600	-	$56,000	$150,000	$100,000	$1,471,400
Total	$1,650,700	$258,400	$86,000	$88,000	$305,000	$175,000	$2,563,100

Table 10: Cost of pipe and Maintenance structures per stage and per type (total in green)

The lead in main from Stage 1 to SPS1175 would require 7 MH's at varying depths, however, these MH's are anticipated to be of special design due to the required depth (Deepest MH being approx. 9m deep) and are expected to cost $25,000 (nominally). It should be noted that these costs are indicative only and have been derived from previous similar conditions. These costs are subject to change, pending detailed design and market circumstances at time of tendering. The cost of the lead in main is likely to be funded by Sydney Water; however, this will be determined at the time of application.

	Required	Rate	Cost
DN300 PVC	390m	$600/m	$390,000
Manholes	7	$25,000/MH	$175,000
Total	-		$565,000

Table 11: Lead in main costs from Stage 1 to SPS 1175

The pumping station and rising main construction and maintenance costs are broken down below, however, it should be noted that these costs are likely to be funded by Sydney Water, if Sydney Water agrees to the construction and maintenance of this pumping station. This will be determined at the application stage. The pump station specifications are based on transferring flows from Stage 2 and 3 and the Gullotta Subdivision (being approx. 200 lots) based on a total EP of 1565.

Description of item	Quantity	Unit	Rate	Total
Design (Covers the following) REF, Procurement process, Risk Base cost estimate, Design Electrical design, Structural Design, CHAIR workshops, Geo investigations	1	L.S.	$310,000	$310,000
WSC	1	L.S.	$150,000	$150,000
SPS civil cost	1	L.S.	$210,000	$210,000
SPS Wet Well	1	L.S.	$600,000	$600,000
Emergency storage cost	1	L.S.	$300,000	$300,000
Access handle / drive way construction	1	L.S.	$50,000	$50,000
Ventshaft	1	L.S.	$31,000	$31,000
Electrical panel	1	L.S.	$275,000	$275,000
Chemical Dosing Unit cost	1	L.S.	$333,000	$333,000
Pump Cost	2	Each	$41,000	$82,000
DN160 PE SDR21	350	m	$260	$91,000
			Total	$2,432,000

Table 12: SPS construction cost

It should be noted that the maintenance and running costs of the SPS have not been included. These will be a major consideration for Sydney Water, if this option were to be pursued. It is anticipated

that the projected cost of running and maintaining a SPS over 100 years can cost up to $7,000,000 (excluding CPI adjustment and rate increases). The construction, running and maintenance costs of SPS presented in this section are indicative only and have been derived from previous similar projects.

c. Option 3 – Gravity and Low Pressure sewer (without SPS)

i. Gravity and Low Pressure sewer concept design

This option has been illustrated in Appendix F and should be referred to in conjunction with this section of the report.

To service the subject subdivision with option would not require a pumping station, but a combination of gravity and low pressure system. Stage 1 would be serviced using a gravity system with a lead in main to SPS1175 and Stages 2 and 3 would be serviced using a Low pressure system with a lead in pressure main from north of stage 2 to a receiving MH at the south of Stage 1.

The amount/type/size of pipes and structure required are detailed in the preliminary cost section below.

ii. Option 3 - Preliminary cost estimation.

LP main size	Cost per meter	Gravity Main size	Cost per meter
DN40 PE SDR21	$70/m	DN150 PVC	$340/m
DN50 PE SDR21	$90/m	DN300 PVC	$430/m
DN63 PE SDR21	$110/m		
DN75 PE SDR21	$130/m	Structure	Cost per structure
DN90 PE SDR21	$150/m	Manhole (<6m)	$8,000
DN110 PE SDR21	$200/m	Maintenance shaft	$5,000
DN160 PE SDR21	$260/m	Terminal shaft	$5,000

Table 13: Cost of mains and structures

	Stage 1	Stage 2	Stage 3	Total main required (per size)
DN40 PE SDR21	-	410m	1070m	1480m
DN50 PE SDR21	-	330m	640m	970m
DN63 PE SDR21	-	230m	575m	805m
DN75 PE SDR21	-	200m	460m	660m
DN90 PE SDR21	-	-	190m	190m
DN110 PE SDR21	-	-	410m	410m
DN160 PE SDR21	-	250m 390m(lead in)*	240m	880m*
DN150 PVC (Gravity)	675m	-	-	675m
DN300 (Gravity)	200m	-	-	200m
Total Required mains (Per stage)	875m	1810m	3585m	6270m

Table 14: Type/size/amount of mains required per stage

*These lengths may be partially funded by Sydney Water under lead in main funding. However, the amount of funding (if any) can only be determined at the application stage.

	Stage 1	Stage 2	Stage 3	Total cost of main (per size)
DN40 PE SDR21	-	$28,700	$74,900	$103,600
DN50 PE SDR21	-	$29,700	$57,600	$87,300
DN63 PE SDR21	-	$25,300	$63,250	$88,550
DN75 PE SDR21	-	$26,000	$59,800	$85,800
DN90 PE SDR21	-	-	$28,500	$28,500
DN110 PE SDR21	-	-	$82,000	$82,000
DN160 PE SDR21	-	$65,000 $101,400*	$62,400	$228,800*
DN150 PVC (Gravity)	$229,500	-	-	$229,500
DN300 PVC (Gravity)	$86,000	-	-	$86,000
Total cost of mains (Per stage)	$315,000	$276,100	$428,450	(no lead in)$918,150 Subtotal=$1,019,550

Table 15: Cost of mains per stage and per main

Type of structure	Quantity	Total Cost
MH	1	$8,000
MS	14	$70,000
TMS	5	$25,500
	Subtotal	$103,500

Table 16: Cost of maintenance structures for Stage 1

	Required	Rate	Cost
DN300 PVC	390m	$600/m	$390,000
Manholes	7	$25,000/MH	$175,000
Total	-	-	$565,000

Table 17: Lead in cost for main from Stage 1 to SPS1175 (as per option 2)

Total cost to developer for Option 3 would be $1,021,650 (without the lead in mains) and $1,688,050 (with Lead in mains). The cost of the lead in main is likely to be funded by Sydney Water; however, this will be determined at the time of application.

As stages 2 and 3 would be serviced a low pressure sewer system, each lot would require its own pumping system. These are comprised of a plastic pit (usually 900 liters in volume and 2m deep), a grinder pump and a control/alarm unit. It is anticipated that each pump system and installation would cost approximately $10,000 (installed). The costs of these pump systems is detailed in Table 18. This table does not account for any ongoing operating and maintenance costs.

	Quantity required	Cost/unit	Total cost
Pumps systems (Stage 2)	71	$10,000	$710,000
Pumps systems (Stage 3)	176	$10,000	$1,760,000
Pump Systems (Subdivision)	247	$10,000	$2,470,000

Table 18: Cost of pump systems (for stage 2 and 3)

It should be noted that the cost for the pump systems for each individual lot would be the responsibility of the future lot owner. The developer is only responsible for providing a connection point (in the form of a boundary kit) to each lot. However, the cost of these pump systems will affect the land value of each lot as potential owner would need to be notified of this pending cost.

d. Sewer Options Assessment

The three sewer options presented in this report with be assessed and rated against each other based on the following criteria:

Technical Ability to construct the option – This criterion assesses the complexity of the design and construction of the option. For example, a PE pipe requires separate accreditation to a normal plastic sewer, but the design and construction of an SPS is very complex and can be extremely time consuming.

Cost to Developer – This is the total cost of the option for the subdivision that the Developer is anticipated to pay. This does not include any lead in or SPS costs.

Cost to Sydney Water – This is the cost Sydney Water is anticipated to fund i.e. lead in mains and SPS

Cost to Potential Lot owners – This is the cost potential future lot owners would need to pay i.e. cost of pump systems in Low pressure areas.

Social effects – These are effects local communities may have due to the construction each option. Due to the location of the subdivision, no effects are anticipated to the existing communities as majority of the sewer construction would be within the proposed subdivision. Some features of each of the option can be considered unsightly and may therefore be perceived as a negative impact by future residents.

Environmental Issues – These are issues that may arise due to the location of certain sewer structures (SPS, MH's, sewer main alignment) in environmentally sensitive areas. These issues may include (but are not limited to), aboriginal or European significance, Flora and Fauna significance. These issues can only be fully addressed after detailed environmental studies are undertook, for the purposes of this report, the ratings provided are very basic and are indicative only.

Suitability for future extension – This criterion rates the options ability to adapt to future developments; in this case, it would be the possible construction of the Gullotta Subdivision south of the subject subdivision. It should be noted, irrespective of the option chosen, if the Gullotta Subdivision is to go ahead, the existing SPS (SPS1175) would need to be upgraded.

Each option will be rated against the above criteria from 1 to 3, where 1 being the least favorable and 3 being the most favorable. A total tally of this score is provided at the end of the table, where the option with the highest score will be the most preferable.

Assessment Criteria	Option 1	Option 2	Option 3
Technical Ability to construct the option	3	2	2
Cost to Developer	*$762,700* 3	*$2,563,100* 1	*$1,137,550* 2
Cost to Sydney Water	*$193,800* *3*	*$2,997,000(+operating and maintenance costs)* 1	*$666,400* *2*
Cost to potential Lot owners	*$2,890,000(+operating and maintenance costs)* 1	$0 3	*$2,470,000(+operating and maintenance costs)* *2*
Social effects	3	1	2
Environmental Issues	2	1	3
Suitability for future extension	1	3	2
Total	16	12	15

Table 19: Option assessment and Ratings

7. Options Recommendation and Summary

Based on the sewer options provided in this report and the assessment criteria set in the previous section, it is recommended that option 1 (Low pressure sewer only) would be best option to service this subdivision. The advantage of Option 1 over the other two options is that is involved significantly less costs to the developer and Sydney Water, however, all potential lot owners would have to bear the extra cost of the pump systems, and this would also apply to future lot owners of the Gullotta Subdivision. Option 1 is also the least favourable for future extension, as it may require upsizing, even though this may not be a concern to the developer, it will be a significant concern for Sydney Water during the option selection process.

Even though Option 2 has been rated the lowest, it should not be completely ruled out, purely on the basis that Sydney Water may only allow a gravity system in this area, however, this would need to be determined at the application stage.

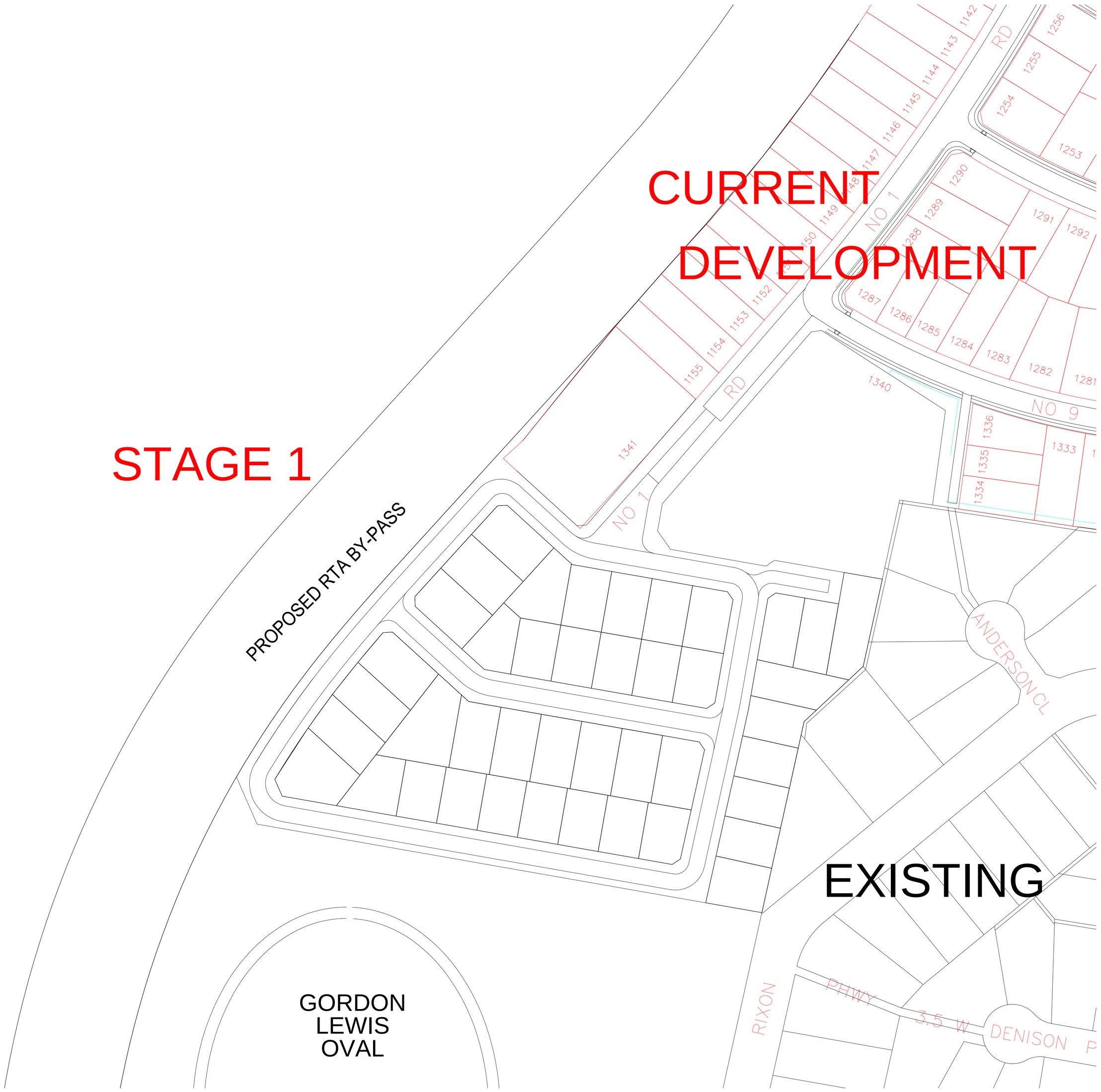
In summary, the Walkers subdivision can be serviced with water infrastructure. There are abundant points of connection available for potable main construction; however, the points of connection and main size would be determined by Sydney Water at application and detailed design stage. The concept design and costs provided for the water in this report have been derived from past experiences and recent similar projects.

With respect to the sewer service provision, three options have been provided and assessed and it is recommended that Option 1 would be most suited, however, pending application to Sydney Water, the other options should not be ruled out at this stage.

APPENDIX A

PROPOSED SUBDIVISON LOT LAYOUT

A1



LOT LAYOUTS PROVIDED BY WALKER CORP ON 31.10.13

DESCRIPTION
APPENDIX A
PROPOSED SUBDIVISION
STAGE 1

SECTION SCALE: HOR:1:– VERT:1:– | DATUM: –
SCALE: 1:1000 | SHEET 01 OF 03 SHEETS | DATE: XX.XX.XX
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FAX: (02) 4722 3155
EMAIL: admin@qalchek.com.au
www.qalchek.com.au

A1

GORDON
LEWIS
OVAL

PROPOSED RTA BY-PASS

STAGE 2

STAGE 3

RD

PERCIVAL

SPORTSGROUND

DARCY

AVE

SPORTSGROUND PDE

LEWIS ST

KERR ST

MACQUARIE

LOT LAYOUTS PROVIDED BY WALKER CORP ON 31.10.13

DESCRIPTION
APPENDIX A
PROPOSED SUBDIVION
STAGE 2

SECTION SCALE: HOR:1:– VERT: 1:– | DATUM: –
SCALE: 1:1000 | SHEET 02 OF 03 SHEETS | DATE: XX.XX.XX
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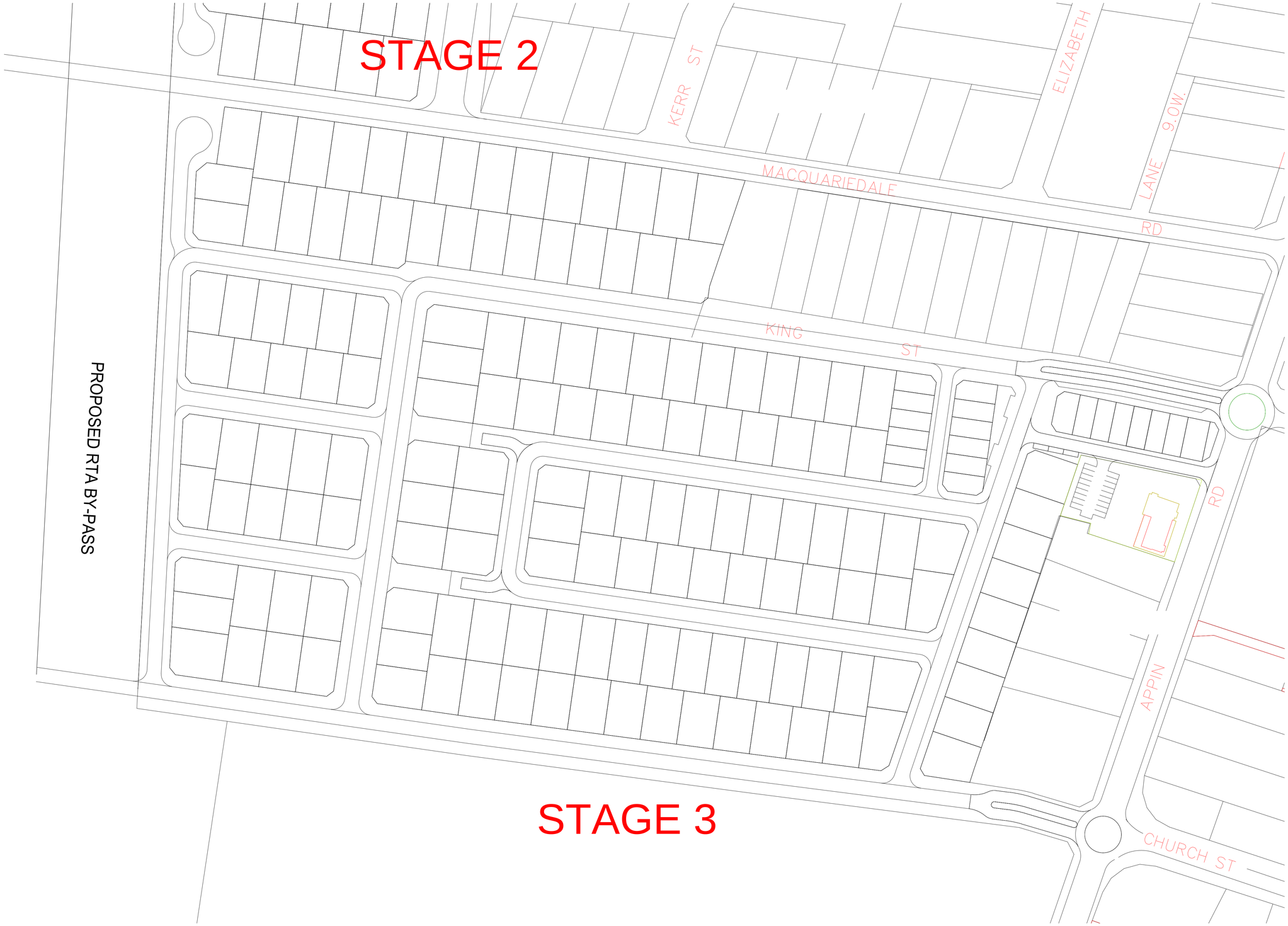
A1



LOT LAYOUTS PROVIDED BY WALKER CORP ON 31.10.13

DESCRIPTION

APPENDIX A
PROPOSED SUBDIVION
STAGE 3

SECTION SCALE: HOR:1:- VERT: 1:- | DATUM: -
SCALE: 1:1000 | SHEET 03 OF 03 SHEETS | DATE: XX.XX.XX
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APPENDIX B

EXISTING SITE SURVEY BY LOCKLEY LAND TITEL SOLUTIONS

MGA

0 50 100 150 200 250

1:2500

(A) EASEMENT FOR TRANSMISSION LINE 18.29 WIDE (VIDE F99082)

(D) EASEMENT FOR TRANSMISSION LINE 18.29 WIDE (VIDE GOV. GAZ No.97 OF 1948)

(E) EXCEPTING LAND BELOW A DEPTH FROM THE SURFACE OF 152.4 METRES (VIDE BK 2416 No.195)

(F) EASEMENT TO DRAIN WATER VARIABLE WIDTH (VIDE DP643722)

(G) EASEMENT FOR SERVICES 10 WIDE (VIDE DP1093666)

(H) EASEMENT FOR SERVICES 10 WIDE (VIDE DP1093666)

(J) EASEMENT TO DRAIN WATER 10 WIDE (VIDE DP1093666)

(L) EXCEPTING LAND BELOW A DEPTH FROM THE SURFACE OF 152.4 METRES (VIDE G793049)

(M) EXCEPTING LAND BELOW A DEPTH FROM THE SURFACE OF 60.96 METRES (VIDE DB2439 No.315)

THIS IS THE PLAN REFERRED TO IN MY LETTER

DATED: -

.....

Registered Surveyor NSW

DATE OF SURVEY: 29-8-06

DATUM: AHD

SITE AREA:

LOCKLEY LAND TITLE SOLUTIONS

Registered Surveyors NSW

19 Massey Street
Gladesville NSW 2111

PO BOX 400
Gladesville NSW 1675

ph:(02) 9879 6077
fax:(02) 9879 7143

CLIENT: WALKER CORPORATION

PLAN OF LOT 101 IN DP 1093666, LOT 201 IN DP 749272, LOT 1 IN DP 209779 & LOT 1 IN DP 558807 AT APPIN ROAD, SPORTSGROUND PARADE & MACQUARIEDALE ROAD, APPIN

LGA: WOLLONDILLY

ORIGINAL PLAN SIZE: A1 1:2500

PROJECT No: 26705

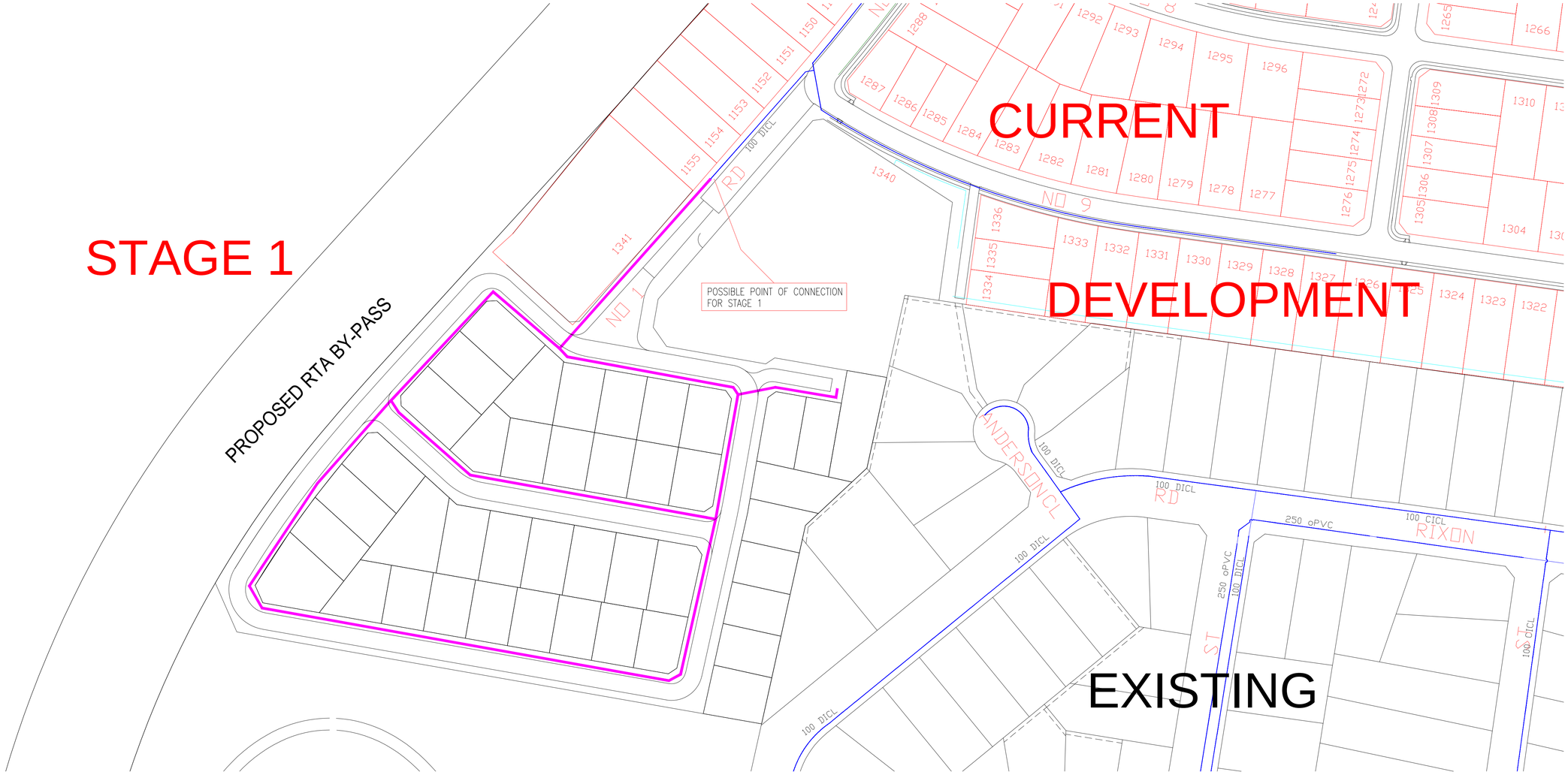
JOB REFERENCE: 29757LOTS

SHEET 1 OF 1 SHEETS

APPENDIX C

CONCEPT WATER DESIGN

A1



EXISTING MAIN (SIZE NOTED ON PLAN)

PROPOSED DN100

PROPOSED DN150

PROPOSED DN300

No.	AMENDMENT DESCRIPTION	BY	DATE
01	FIRST ISSUE	A.K.	28.11.13

DESCRIPTION
APPENDIX C
PROPOSED SUBDIVION
STAGE 1
POTABLE WATER
CONCEPT DESIGN

SECTION SCALE: HOR:1:– VERT: 1:– | DATUM: –
SCALE: 1:1000 | SHEET 01 OF 03 SHEETS | DATE: XX.XX.XX

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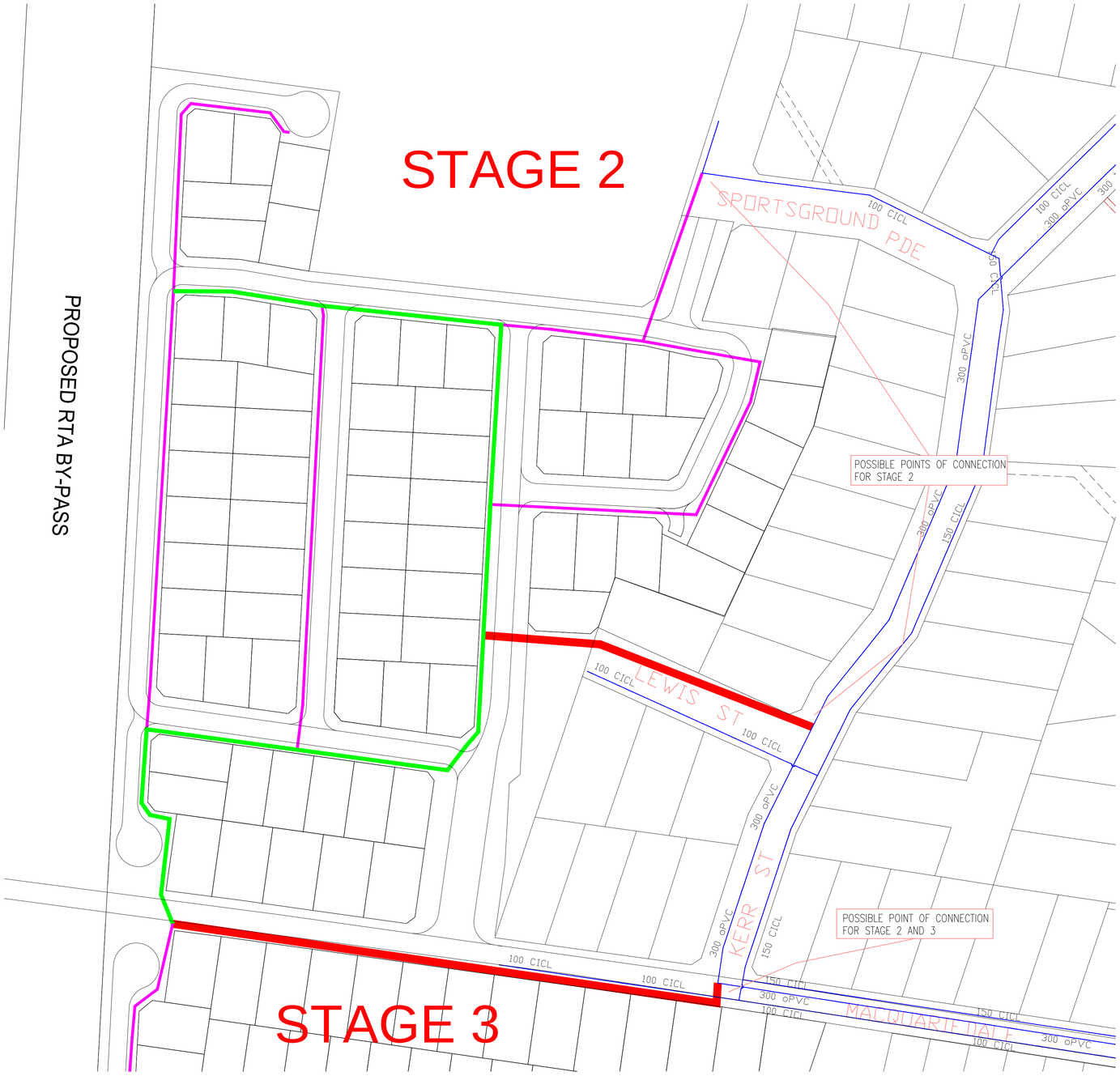
A1



EXISTING MAIN (SIZE NOTED ON PLAN)

PROPOSED DN100

PROPOSED DN150

PROPOSED DN300

No.	AMENDMENT DESCRIPTION	BY	DATE
01	FIRST ISSUE	A.K.	28.11.13

DESCRIPTION

APPENDIX C
PROPOSED SUBDIVION
STAGE 2
POTABLE WATER
CONCEPT DESIGN

SECTION SCALE: HOR:1:– VERT:1:– | DATUM: –
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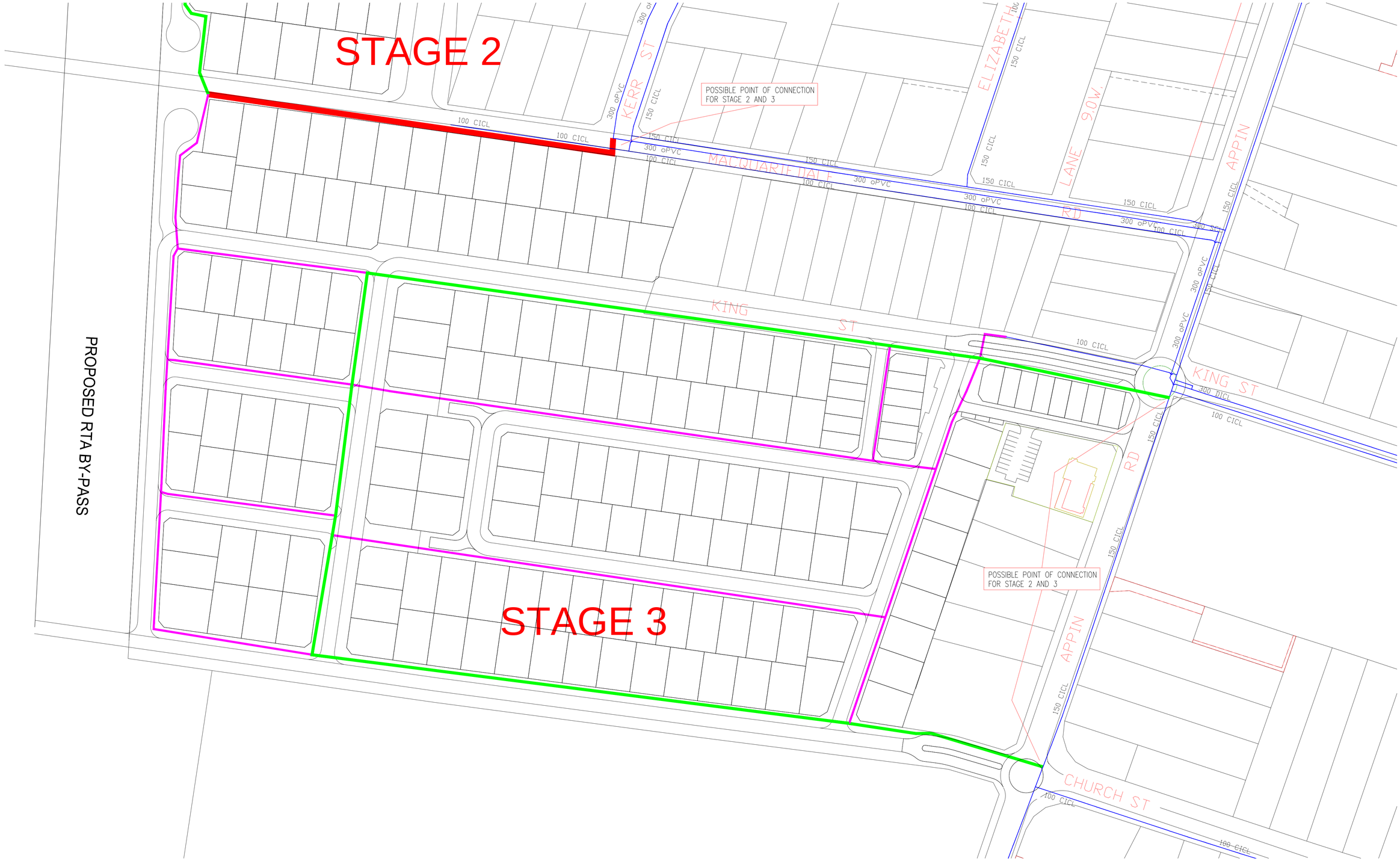
A1



EXISTING MAIN (SIZE NOTED ON PLAN)
PROPOSED DN100
PROPOSED DN150
PROPOSED DN300

No.	AMENDMENT DESCRIPTION	BY	DATE
01	FIRST ISSUE	A.K.	28.11.13

DESCRIPTION
APPENDIX C
PROPOSED SUBDIVION
STAGE 3
POTABLE WATER
CONCEPT DESIGN

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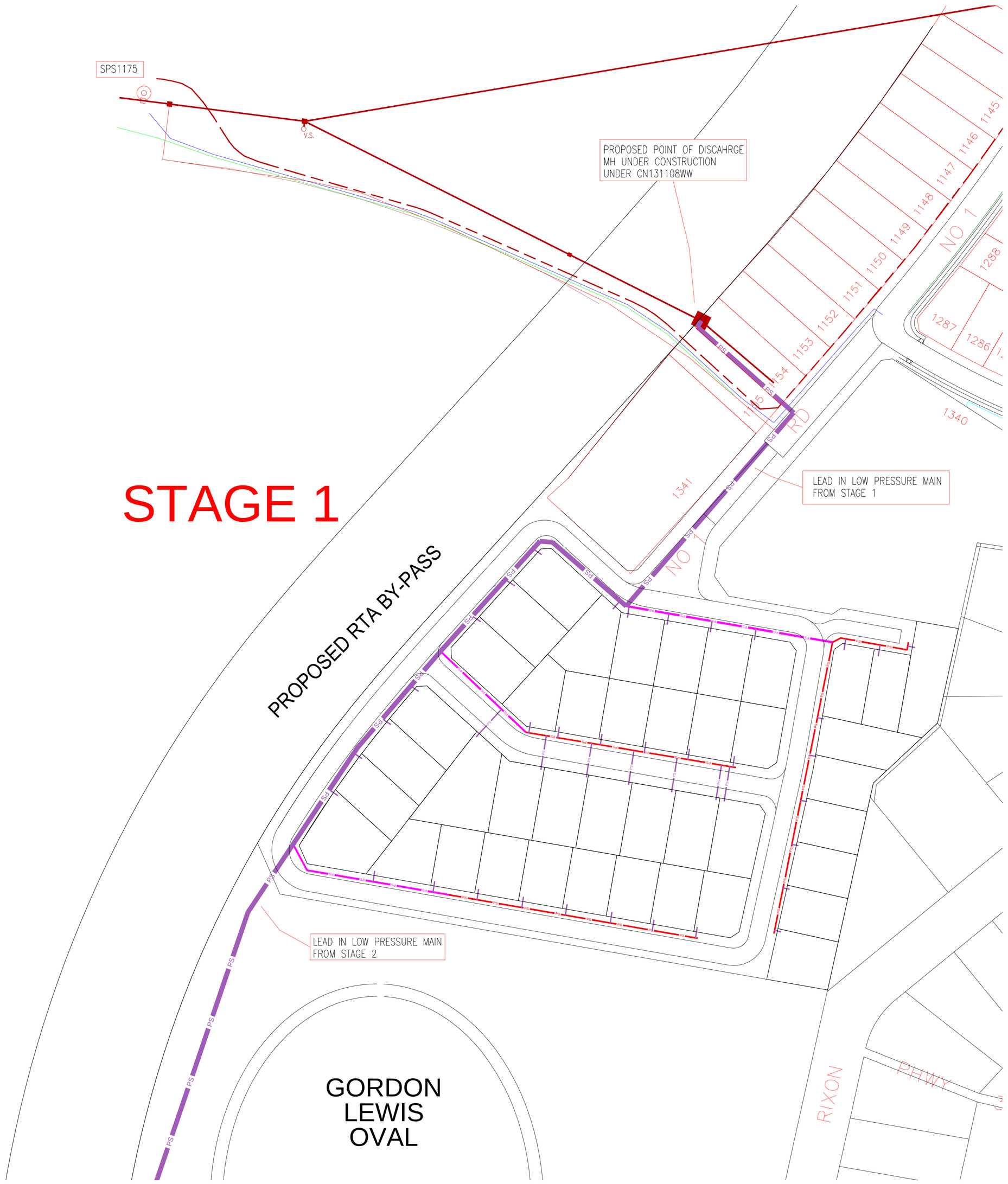
APPENDIX D

CONCEPT LOW PRESSURE SEWER DESIGN

OPTION 1

A1

STAGE 1



PROPOSED DN40 (PROPERTY SERVICE LINES)

PROPOSED DN50

PROPOSED DN63

PROPOSED DN75

PROPOSED DN90

PROPOSED DN110

PROPOSED DN160

PROPOSED DN180

No.	AMENDMENT DESCRIPTION	BY	DATE
01	FIRST ISSUE	A.K.	28.11.13

DESCRIPTION

APPENDIX D
STAGE 1
OPTION 1
LOW PRESSURE SEWER
CONCEPT DESIGN

SECTION SCALE: HOR:1:– VERT:1:– | DATUM: –
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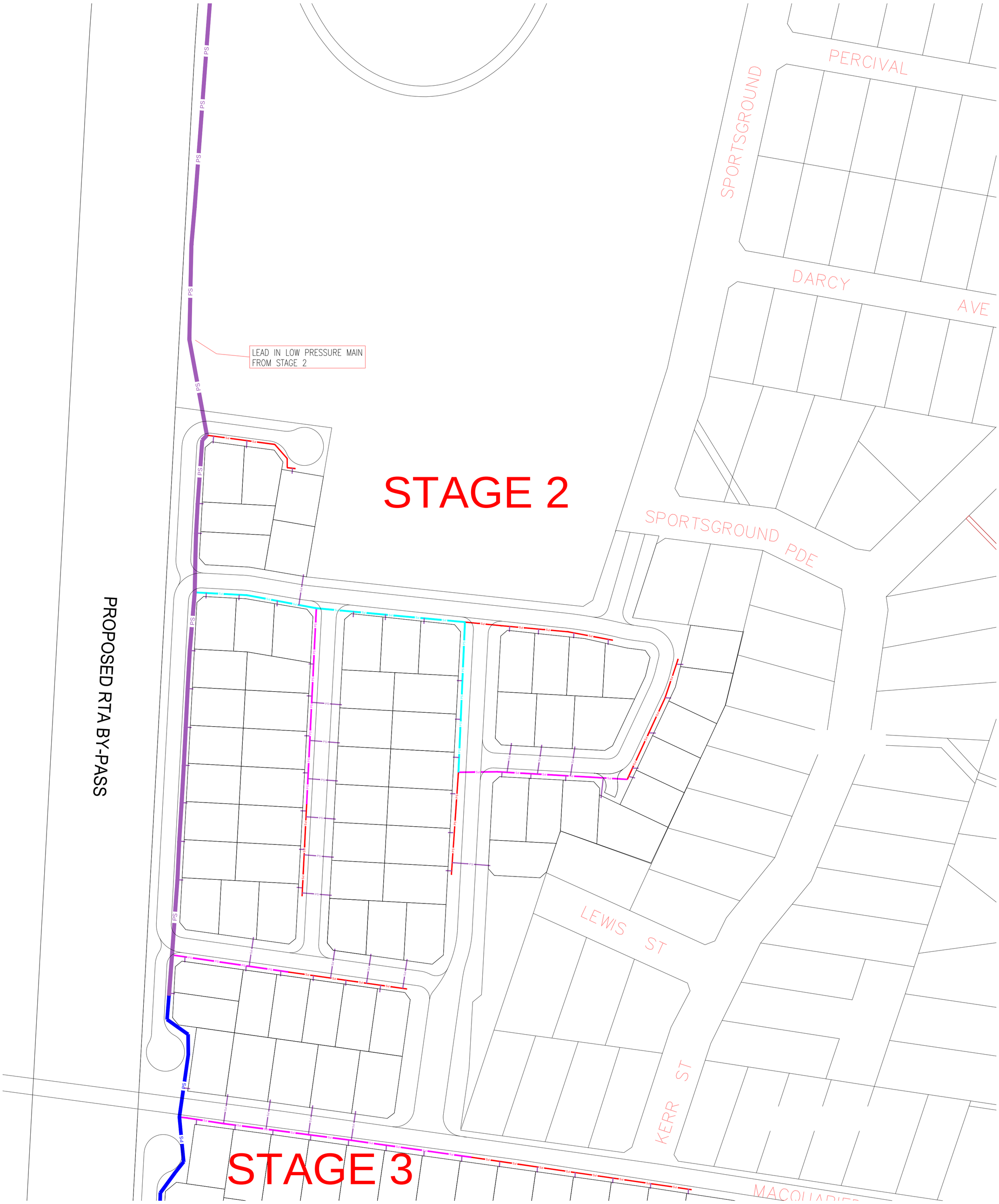
A1



PROPOSED DN40 (PROPERTY SERVICE LINES)

PROPOSED DN50

PROPOSED DN63

PROPOSED DN75

PROPOSED DN90

PROPOSED DN110

PROPOSED DN160

PROPOSED DN180

No.	AMENDMENT DESCRIPTION	BY	DATE
01	FIRST ISSUE	A.K.	28.11.13

DESCRIPTION

APPENDIX D
STAGE 2
OPTION 1
LOW PRESSURE SEWER
CONCEPT DESIGN

SECTION SCALE: HOR:1:– VERT: 1:– | DATUM: –
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A1

PROPOSED DN40 (PROPERTY SERVICE LINES)
PROPOSED DN50
PROPOSED DN63
PROPOSED DN75
PROPOSED DN90
PROPOSED DN110
PROPOSED DN160
PROPOSED DN180

No.	AMENDMENT DESCRIPTION	BY	DATE
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DESCRIPTION

APPENDIX D
STAGE 3
OPTION 1
LOW PRESSURE SEWER
CONCEPT DESIGN

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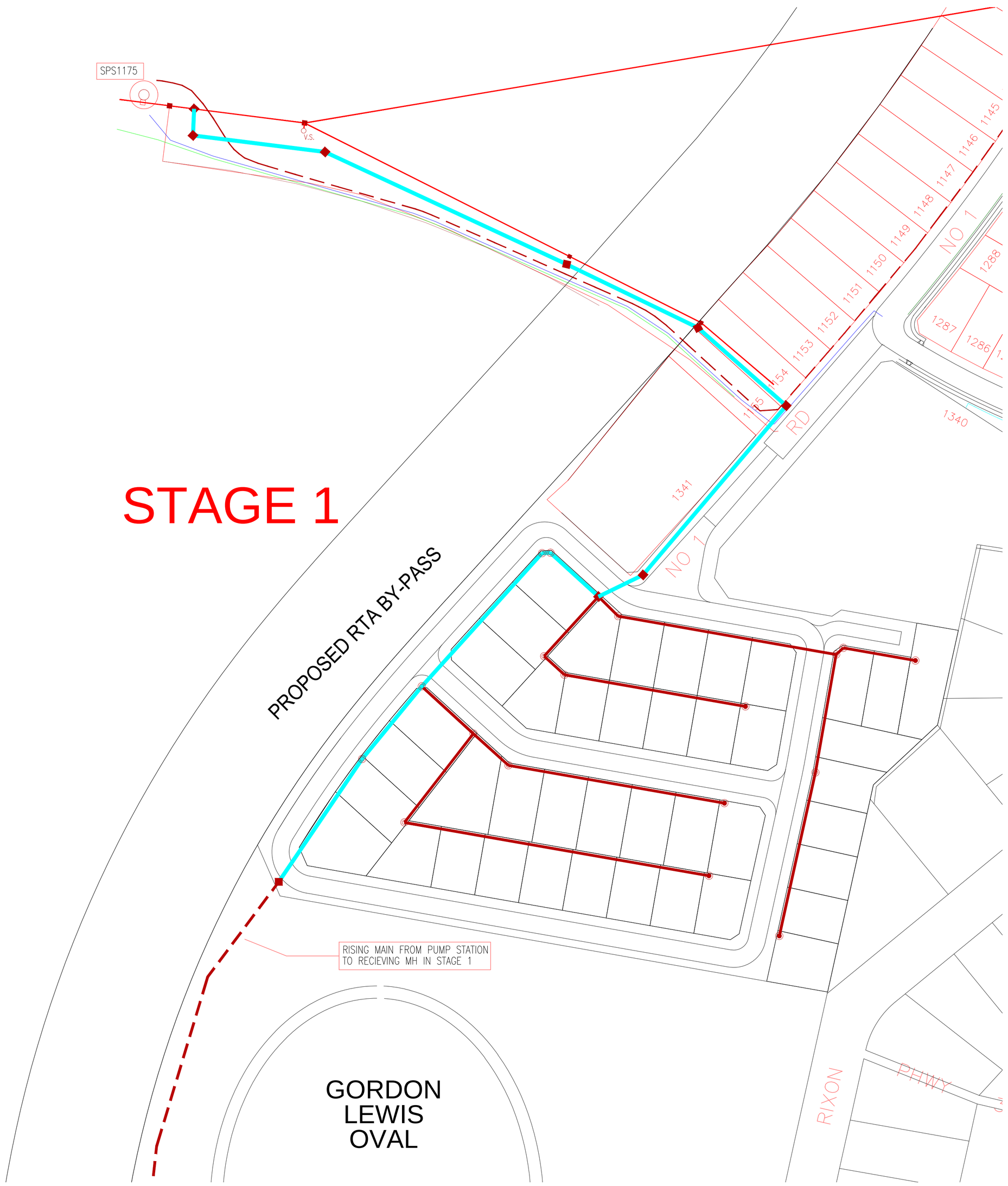
APPENDIX E

CONCPET GRAVITY SEWER WITH SPS

OPTION 2

A1

STAGE 1



PROPOSED DN150

PROPOSED DN225

PROPOSED DN300

PROPOSED MAN HOLE

PROPOSED MAINTENANCE SHAFT

PROPOSED TERMINAL SHAFT

No.	AMENDMENT DESCRIPTION	BY	DATE
01	FIRST ISSUE	A.K.	28.11.13

DESCRIPTION

APPENDIX E
STAGE 1
OPTION 2
GRAVITY SEWER WITH SPS
CONCEPT DESIGN

SECTION SCALE: HOR:1:– VERT:1:– | DATUM: –

SCALE: 1:1000 | SHEET 01 OF 03 SHEETS | DATE: XX.XX.XX

DRAWING No. PM No. 11407 | REVISION: 01

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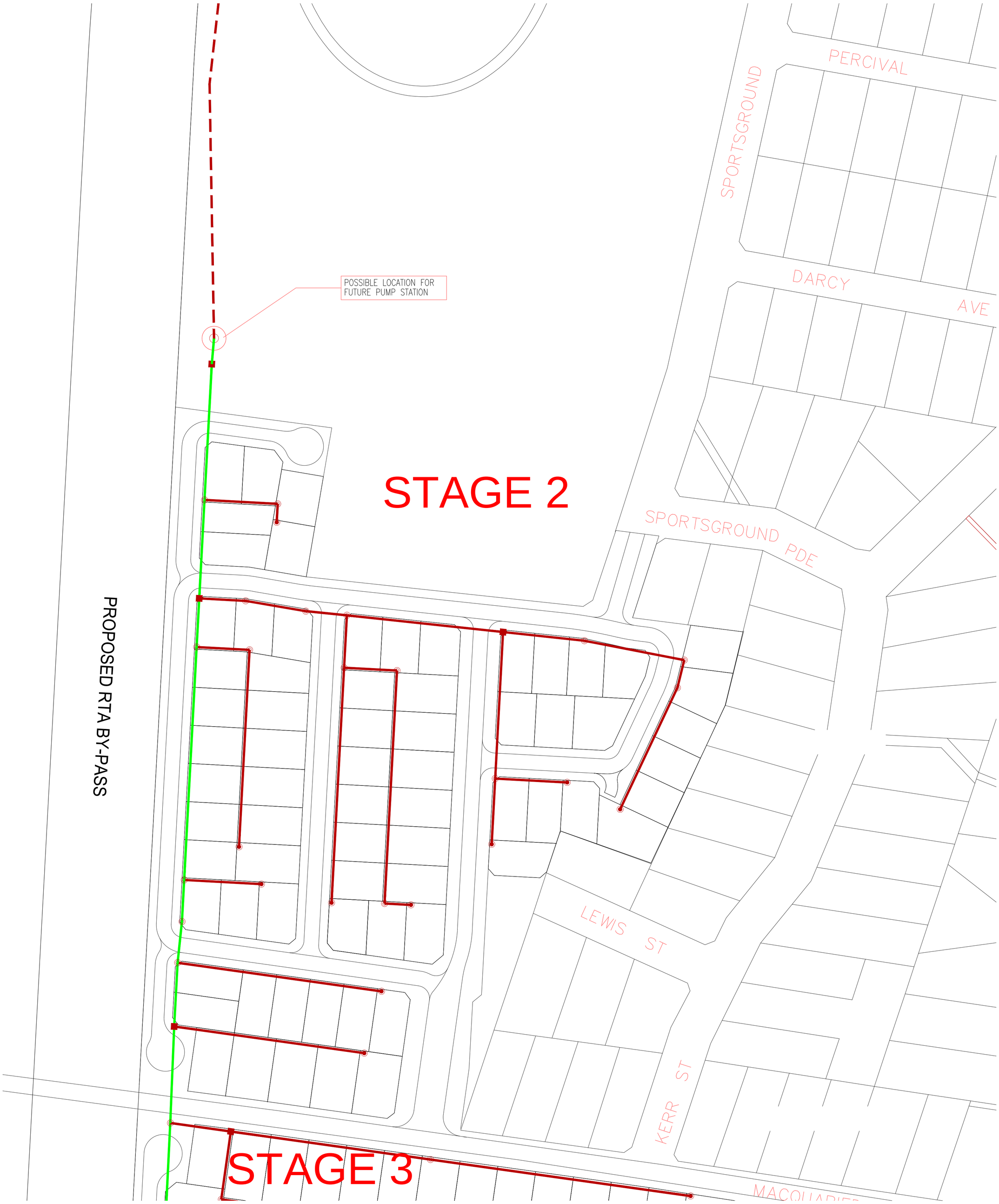

PROPOSED DN150

PROPOSED DN225

PROPOSED DN300

PROPOSED MAN HOLE

PROPOSED MAINTENANCE SHAFT

PROPOSED TERMINAL SHAFT

No.	AMENDMENT DESCRIPTION	BY	DATE
01	FIRST ISSUE	A.K.	28.11.13

DESCRIPTION

APPENDIX E
STAGE 2
OPTION 2
GRAVITY SEWER WITH SPS
CONCEPT DESIGN

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SCALE: 1:1000 | SHEET 02 OF 03 SHEETS | DATE: XX.XX.XX

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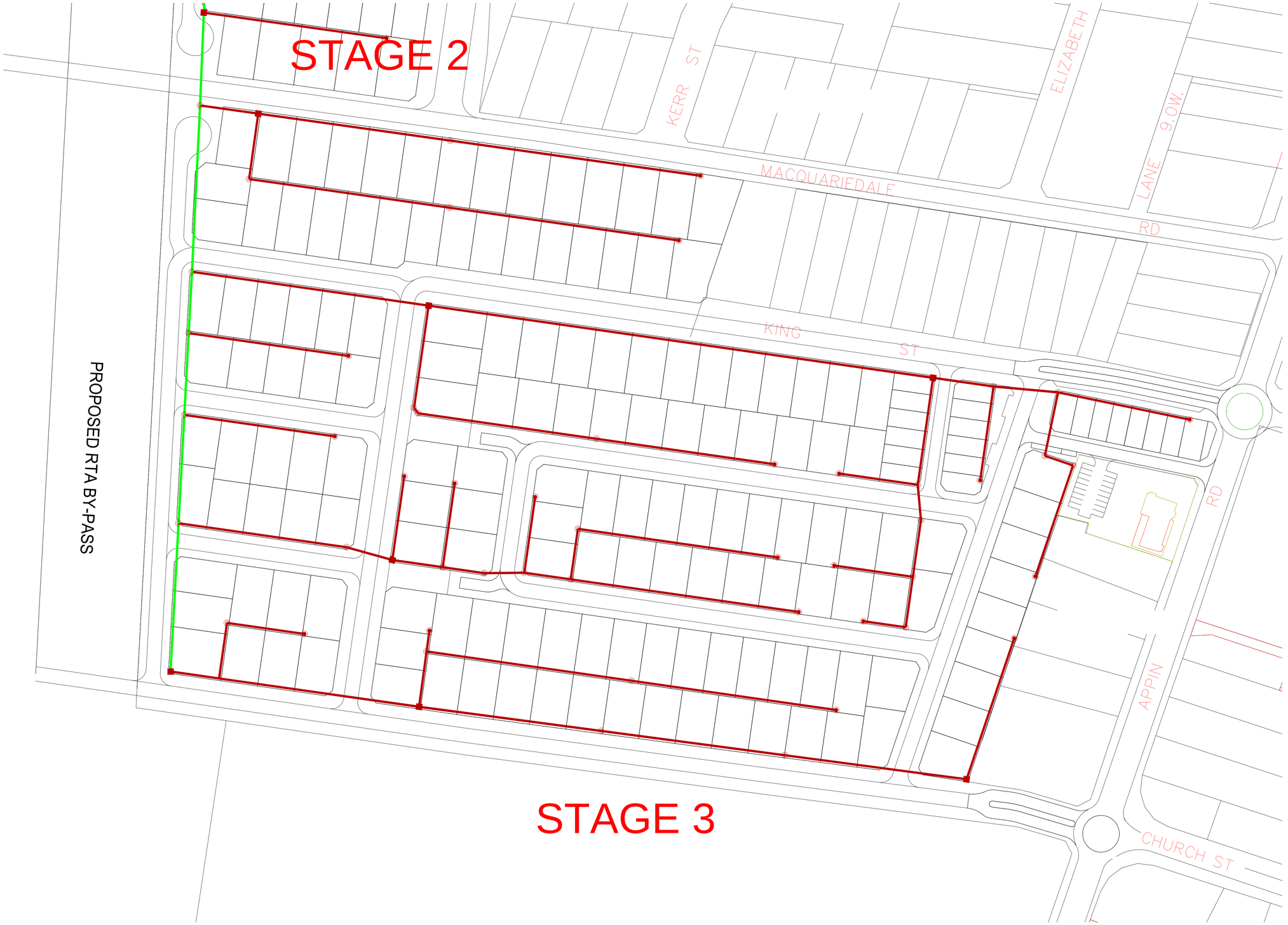
A1



PROPOSED DN150
PROPOSED DN225
PROPOSED DN300

PROPOSED MAN HOLE
PROPOSED MAINTENANCE SHAFT
PROPOSED TERMINAL SHAFT

No.	AMENDMENT DESCRIPTION	BY	DATE
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DESCRIPTION

APPENDIX E
STAGE 3
OPTION 2
GRAVITY SEWER WITH SPS
CONCEPT DESIGN

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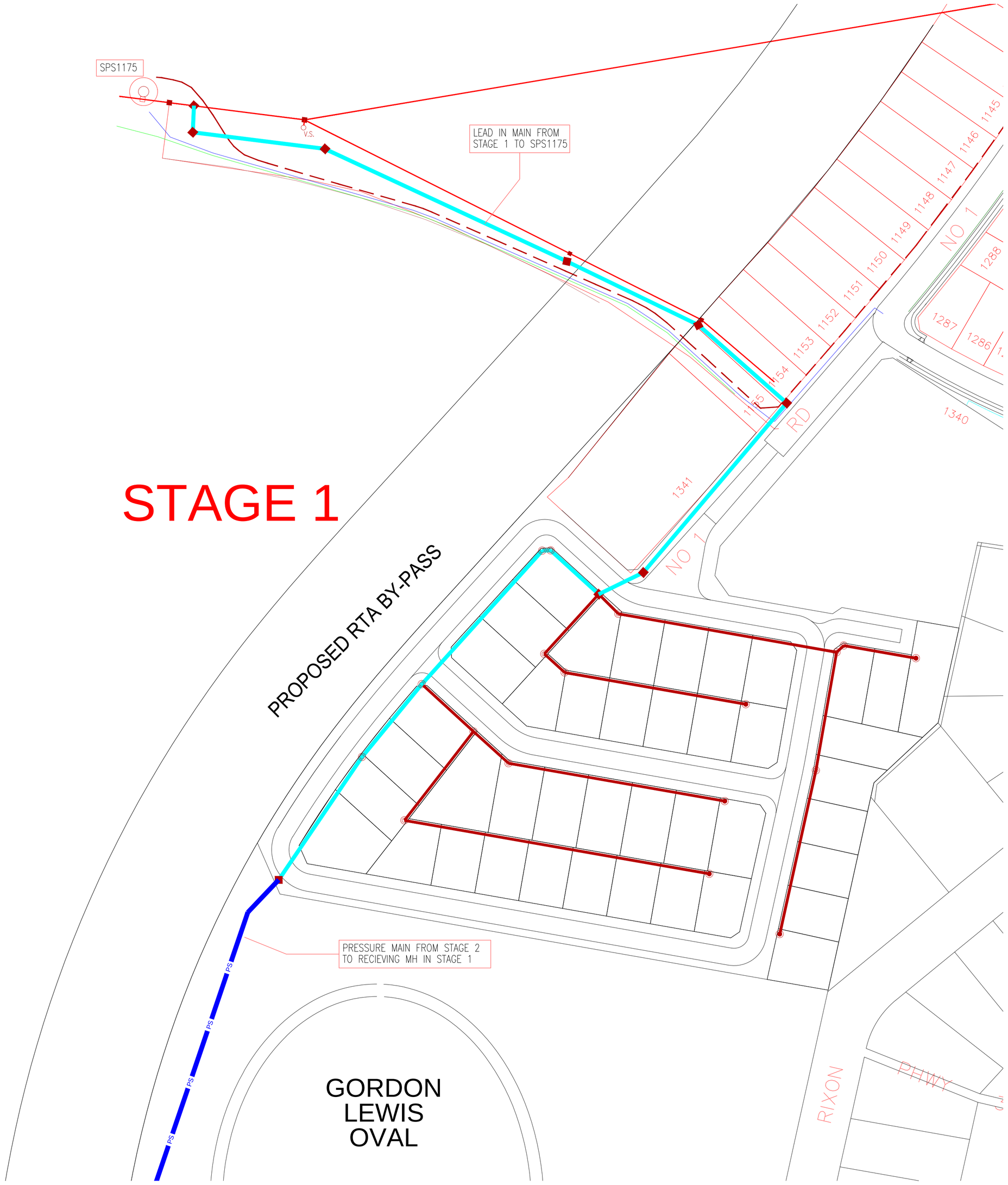
APPENDIX F

CONCEPT LOW PRESSURE AND GRAVITY SEWER

OPTION 3

A1



PROPOSED DN150

PROPOSED DN225

PROPOSED DN300

PROPOSED MAN HOLE

PROPOSED MAINTENANCE SHAFT

PROPOSED TERMINAL SHAFT

No.	AMENDMENT DESCRIPTION	BY	DATE
01	FIRST ISSUE	A.K.	28.11.13

DESCRIPTION

APPENDIX F
STAGE 1
OPTION 3
GRAVITY/LP SEWER
CONCEPT DESIGN

SECTION SCALE: HOR:1:– VERT: 1:– | DATUM: –

SCALE: 1:1000 | SHEET 01 OF 03 SHEETS | DATE: XX.XX.XX

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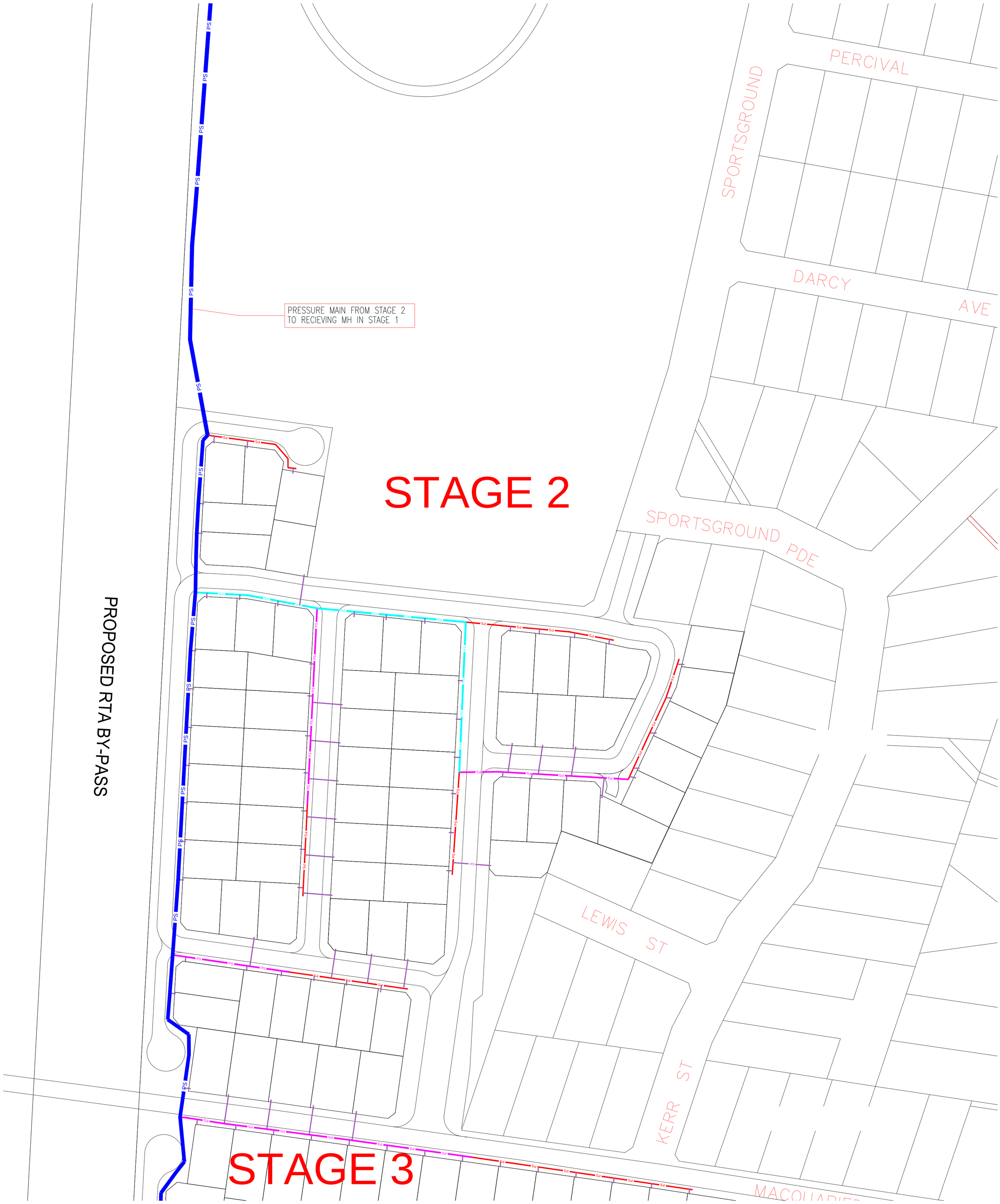
A1



PROPOSED DN40 (PROPERTY SERVICE LINES)

PROPOSED DN50

PROPOSED DN63

PROPOSED DN75

PROPOSED DN90

PROPOSED DN110

PROPOSED DN160

No.	AMENDMENT DESCRIPTION	BY	DATE
01	FIRST ISSUE	A.K.	28.11.13

DESCRIPTION

APPENDIX F
STAGE 2
OPTION 3
GRAVITY/LP SEWER
CONCEPT DESIGN

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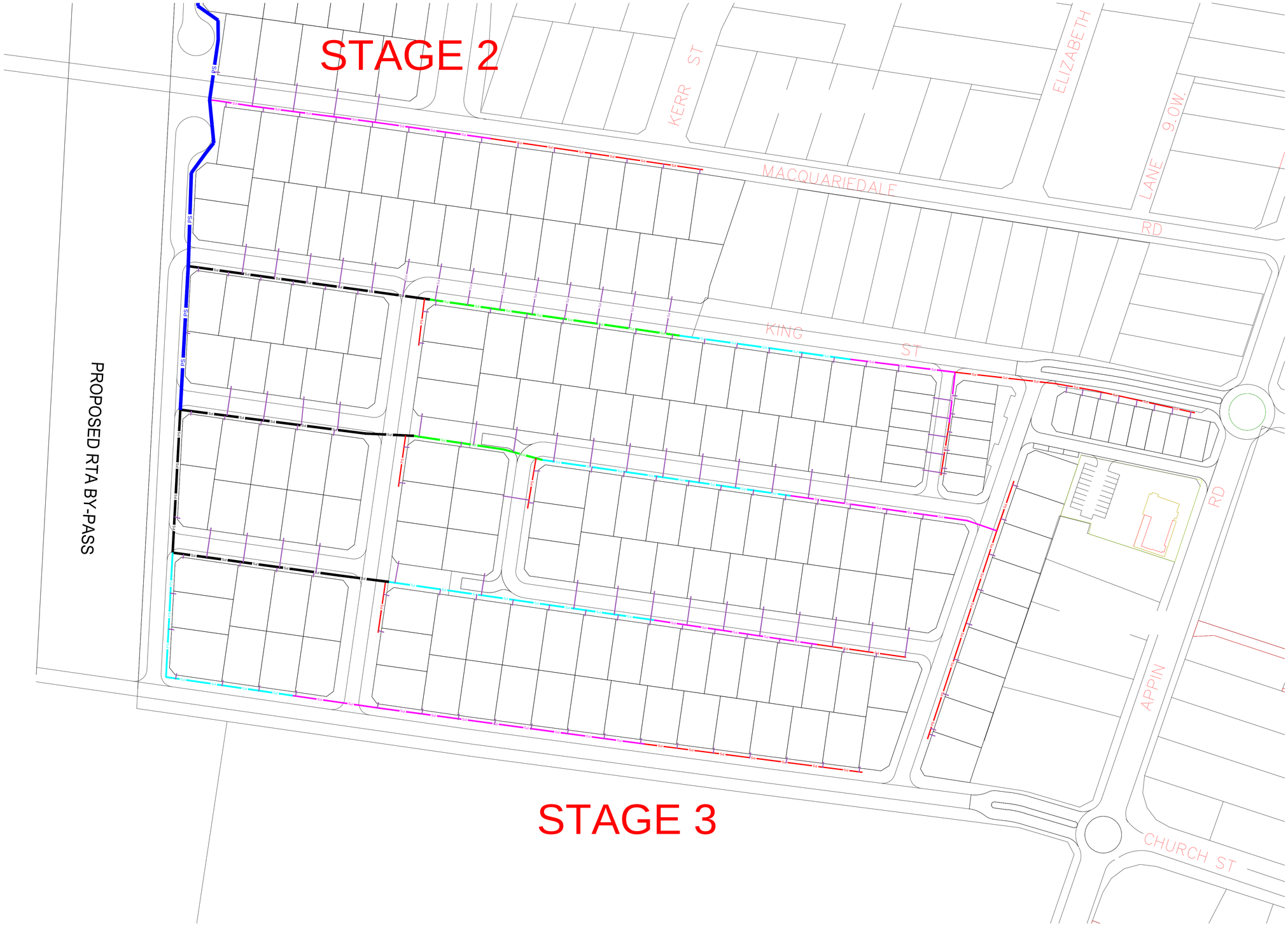
A1



PROPOSED DN40 (PROPERTY SERVICE LINES)
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PROPOSED DN63
PROPOSED DN75
PROPOSED DN90
PROPOSED DN110
PROPOSED DN160

No.	AMENDMENT DESCRIPTION	BY	DATE
01	FIRST ISSUE	A.K.	28.11.13

DESCRIPTION

APPENDIX F
STAGE 3
OPTION 3
GRAVITY/LP SEWER
CONCEPT DESIGN

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