GISBORNE WASTEWATER NETWORK – OVERFLOW DISCHARGES: REGULATORY REF: DW-2020-109732-00/WD-2020-109733-00

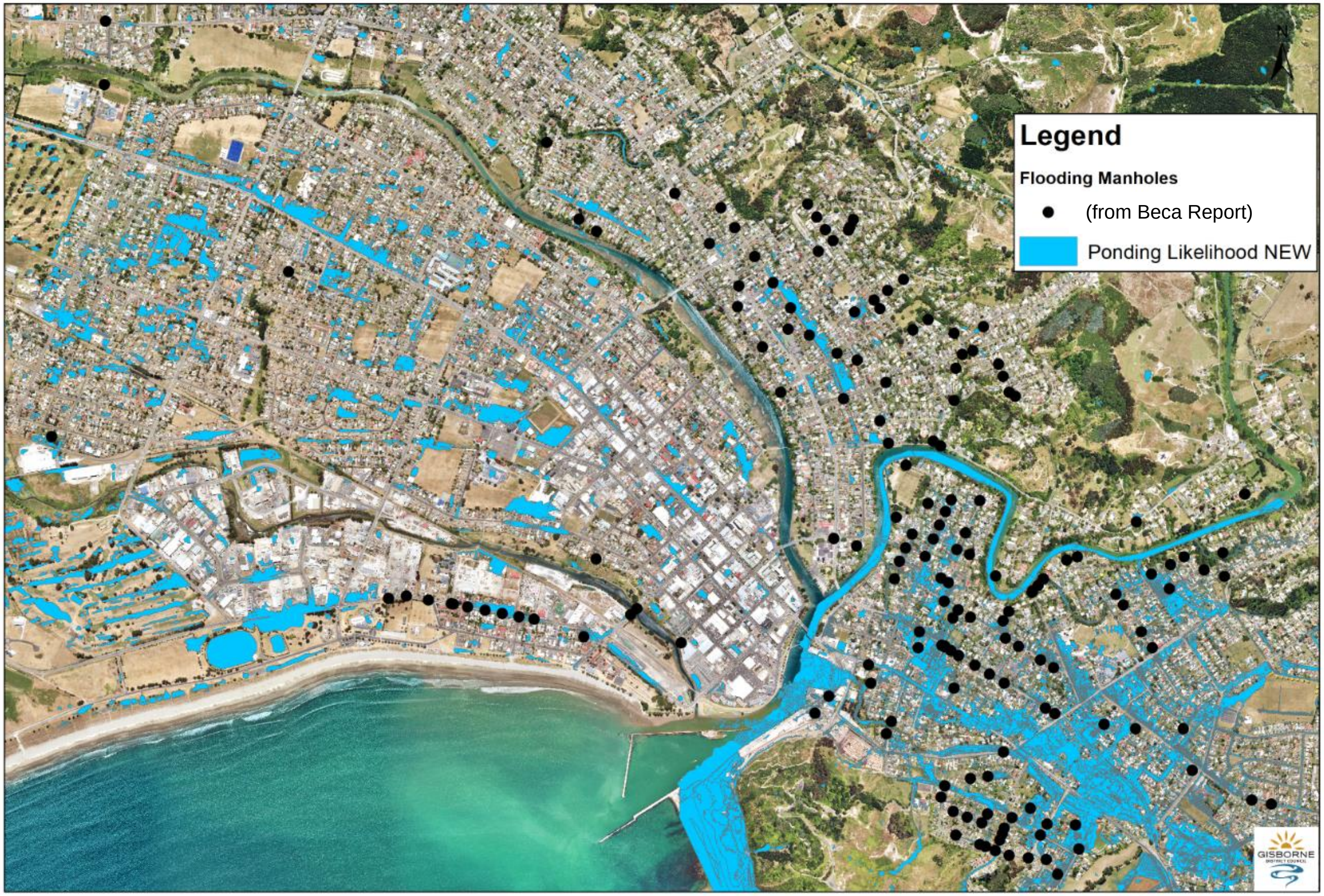
Further S92 Response 21 April 2021

Topic/Question	Actions
(i) In the response BECA reference HIRDS v4 RCP6.0 – is there a locally applicable reference available that justifies from the choice of RCP6.0, rather than RCP 8.5 (i.e. a stormwater modelling specification or engineering design standard) alternatively what is the difference between RCP6.0 and RCP8.5?	We are not aware of any guidelines stating which RCP should be used. RCP6.0 was used as it is the most consistent with previous work and is not overly conservative. Where required RCP8.5 can be used for sensitivity checks. RCP6.0 is the closest (but slightly lower) to the A1B Mid scenario used in HIRDSv3. However, it is the more conservative of the two RCP that assume some stabilisation in atmospheric CO_2. Tables 5 to 7 of MfE(2018)[1] provide the average °C increases associated with RCP6.0 and the other RCPs for all regions of New Zealand. RCP6.0 is the most consistent with previous MfE advice of allowing for 2°C of warming through to 2090. A comparison of the 2-year ARI rainfall depths for RCPs 6.0 and 8.5 against HIRDSv3) is provided in the attached Table 1 (below). While the HIRDSv4 RCP 6.0 to 2050 rainfall is very similar (0% to 3% difference) to the modelled rainfall for the 2-12 hour range, the HIRDSv4 rainfall is lower than that modelled for the durations of less than 2 hours and for the 24 hour total. The 10-minute HIRDSv4 rainfall is 11% less than modelled, while the 24-hour rainfall is 6% less.
(ii) In the response BECA refer to the following "The flow monitoring undertaken for model calibration provided flow/time graphs which show that the network is dealing with significant direct inflow (fast response), then rain derived infiltration followed by groundwater infiltration - which are consistent with the Water NZ manual":	
a. Can the applicant provide a map/schematic showing the location of the gauging points and associated	Maps showing the locations of the monitoring points, together with the contributing catchment and network are provided as Attachment A.

[1] Ministry for the Environment 2018. Climate Change Projections for New Zealand: Atmosphere Projections Based on Simulations from the IPCC Fifth Assessment, 2nd Edition. Wellington: Ministry for the Environment.

	upstream wastewater network including pump stations and reference (from the Mott Macdonald gauging report) which locations/hydrographs one(s) show the fast response to direct inflow?	We have also extracted flow monitoring information from the Mott Macdonald report for June 2014 (Attachment B) to facilitate review of the network flow monitoring across the monitoring sites. As can be seen from this extract, all of the monitoring sites show rapid response to heavy rainfall. Some sites to the south of the Taruheru River (eg APNISM135, DISRSM125 and LYTTSM075) also show the influence of overflow valves being opened from 11 to 12 June 2014.
b.	Can the applicant provide a map/schematic that show areas of known property flooding referenced in the original application, page 223, see Figure 3-2 from the CH2M Beca Modelling Report, 2017. How does this compare to the nodes identified as flooding in the 2yr-ARI map (Figure B2) in the Beca modelling report.	A map showing indicative property ponding is provided below. The 'Ponding Likelihood' layer predicts where water is likely to pond on a property, based on a number of GIS layers that have been aggregated through a weighting process. These GIS layers include our stormwater flood model, depressions layer, and a Rain on Grid model. Ponding can be affected by many factors, e.g. fences on a property may divert flows, private stormwater sumps and pipes may drain areas, and soil conditions may allow for water to seep into the soil quicker than modelled. The data is also relevant to information available at a specific point in time, and things may have changed over time. Therefore, this layer is viewed as a guide only, as site conditions could be different. The modelled information is based on geospatial modelling, is for indicative purposes only. Council also uses records of actual flooding (surveys and Requests for Service received) and undertakes property inspections / investigations to validate whether or not there are actual effects, and whether or not stormwater drainage improvements (public or private) are required to mitigate the risk of ponding. The nodes identified in Figure B2 have been overlain on the Ponding Likelihood' layer. However, the location of property flooding in heavy rainfall will not necessarily correlate to the location of wastewater overflows from manholes. While property flooding is considered a primary cause of rainwater entering the wastewater system, properties that experience wastewater overflows will not necessarily also be the properties that experience rainwater flooding. Property

	overflows are a result of being below the hydraulic grade line in the adjacent surcharged sewer main. In other words, the rainwater gets into the wastewater network as a result of on-property flooding, but the effects are often experienced 'downstream' in the wastewater network (at the point at which the wastewater network capacity is eventually exceeded, once surface water from multiple properties has managed to enter the wastewater network e.g. through gully traps). For this reason, there is no definitive correlation between properties that experience flooding and wastewater overflows. However, we would expect the modelled overflow nodes to be in the same general areas as the known private property flooding, ordinarily downstream of properties that flood. Note however, that overflows from the network are managed to avoid these uncontrolled overflows occurring.



Land Information

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Path: X:\Projects\drainwise.mxd
Date: 12/04/2021
User: mdc

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Gisborne District Council

Scale 1:15,000

c.	Can the applicant please provide a model calibration report. This should include a comparison between predicted/modelled flows and gauged data and demonstrate how well the model performs. This is required to determine the level of confidence in the modelling results (and subsequent conclusions).	No specific calibration report was produced. The flow gauge data and model graphs were part of the calibration process as is standard practice. The model aims to reflect the AWT flow gauging report that shows rainfall and the resultant wastewater flows that occur very quickly afterwards. As indicated in our previous response, the flow gauging sites were selected with a key aim of calibrating the model to predict overflow performance. The flow records show rapid and substantial increases in wastewater network flows associated with rainfall events and this is a clear demonstration of the result of direct stormwater inflow (Fast Response), which is replicated in the wastewater model.
d.	How does the applicant reconcile the conclusion on page 9 of the GDC 'Analysis of rainfall and scour events 2014-2019' "that most overflows occur at elevated groundwater levels or where groundwater levels are increasing (rather than decreasing), i.e. when the shallow aquifer is recharging rather than declining. Rainfall is seasonal and as the autumn and winter progress, there is more rainfall and aquifers are recharging" with the private network being the principal source of the inflow?	The analysis of rainfall and scour events was undertaken to assess the correlation of heavy rainfall and overflow events. It also briefly considered groundwater levels, but did not assess the contribution of groundwater flows/infiltration to flows in the piped network. The conclusion that most overflows occur at elevated groundwater levels or where groundwater levels are increasing (rather than decreasing) is not surprising given that overflows predominantly occur in winter when both rainfall and groundwater levels are generally higher. However, this does not mean that the groundwater contribution is a significant driver of overflows. The flow gauging and associated monitoring clearly shows a substantial 'fast response' during and immediately following heavy rain – which then returns to 'normal' flows relatively quickly after the rainfall event. It is this substantial direct inflow that causes surcharging of the network and hence the requirement to open overflow valves to avoid uncontrolled overflows through manholes and on private property. It is expected that groundwater levels will naturally be higher in winter, when heavy rainfall events cause wastewater overflows. This is not evidence that groundwater causes overflows. From other evidence provided in this s92 response, it is clear that overflows are caused primarily by fast response inflow.

	Infiltration will be dependent on a range of factors, including groundwater levels, pipe levels, pipe condition and ground permeability. In terms of the relative contribution of inflow and infiltration into the wastewater network from the private and public components of the network: ▪ Private properties have at minimum three potential access points within close proximity of the land surface where rainwater can get into the wastewater system (gully traps and inspection points). These are all within relative close proximity of each other, and can be in areas of on-property ponding. ▪ Inflow from private properties, as the key source of rainwater getting into the wastewater network, has been validated through property inspections where we have found more than half of gully traps are broken and potentially allowing rainwater in, there has been reported overtopping of gully traps, and inspection points are often also leaky. We have also identified more than 50 private stormwater cross connections with private wastewater infrastructure. ▪ In contrast, the public network is only connected to the land surface via sealed manholes which are predominantly in the road crown (centre) where ponding is unlikely to occur, and are spaced generally 40m to 80m apart. Council also inspects its manholes. The likelihood of inflow from the public network is therefore very low. ▪ Council implements public asset inspection, maintenance and renewal programmes to ensure that the integrity and performance of the public network. There is therefore a much greater likelihood of substantial inflow originating from private property.
(iii) Can the applicant please clarify the 2-year ARI containment objective. At what location(s) in the network will	The identified performance target is not a containment standard (although that term is used in the Beca report) but rather 'no wet weather overflows in events up to and including a 50% AEP event'. It is a network wide overflow target –

	containment be achieved? And for what storm event duration? Is it for each manhole identified to flood in the 2-yr ARI or for individual sluice valves/overflow points?	that is, no overflow from any part of the network during such rainfall events. This aligns to the standard specified in Policy C6.2.2 (9) of the Tairawhiti Resource Management Plan. At this stage, the overflow target relates to all storm durations for the 50% AEP event. As per Table 14 in the application, Council will continue to analyse overflow events to refine the critical rainfall events that lead to overflows. While the wet weather overflow target is for the entire network, in a practical sense it relates to the opening of the overflow valves. That is the network is managed, and overflow valves are opened only as necessary, to avoid wet weather overflows occurring from manholes (and other informal points such as gully traps) in the network. The aim is to achieve this overflow target within the first ten years of the term of the resource consent. At that point (or before), the consent targets and the approach to resolving overflows will be refined to continue to seek improvements. The initial primary objective is to achieve an 85% reduction of direct inflow (fast response) in combination with minor network upgrades. However, Council also requested additional modelling scenarios if lesser (75% and 65%) reductions in inflow were achieved. These identified additional public network upgrades would enable Council to achieve the target of no wet weather overflows in events up to and including a 50% AEP event, however at an increasing network upgrade cost. This affirmed that there are 'fall back' positions and practical solutions should the objective of 85% reduction in inflow not be achieved in practice.
(iv)	Can the applicant confirm that the population growth assumptions used in the 2017 modelling are still consistent with the 2021 LTP process.	The Beca model assumed a population of 41,288 in 2051. GDC commissioned an assessment from Malcolm Thomas Consultants[2] which has identified a population of 48,164 for 2051 based on a medium growth projection. However, this projection is for the General Urban Area (GUA) which is based on Statistic NZ mesh blocks which covers an area larger than the area

[2] Provided to Council 1/10/2020

	serviced within Council's Reticulated Services Boundary – so the serviced population will be lower. This is the first time that GDC has projected a population increase and planning has now started to determine the impact of this for the 2024 LTP. However, we do not consider this is significant for modelling purposes given the increase is over a 30 year period. Additionally, the increase in wastewater flows associated with this population increase is minor when compared to the increase in wastewater/stormwater flows that occur during wet weather.
(v) Is it feasible to install any form of "treatment" on overflow locations? i.e scum boards or debris screen.	Treatment such as scum boards or debris screens are potentially possible, but not necessarily practicable. For example, the main overflow location with highest frequency of use is the Wainui Rd overflow. It is located in a confined area with high public access and limited vehicle access for debris removal. The implementation of screens or similar devices in this location would be very difficult and would potentially give rise to a range of other issues.
(vi) Is the applicant proposing to limit the number of dry weather overflows per annum?	The application has set the following DWO targets (Table 14) of: ▪ ≤1 dry weather overflow per 1,000 connections (no more than 15 in total) per year (from Day 1) and ▪ ≤0.6 dry weather overflows per 1,000 connections (no more than 9 in total) per year (from Year 2). As the occurrence of DWOs is beyond Council's direct control, achieving these targets requires a multi-faceted approach that includes public education and network maintenance and management. As Council cannot control this directly, the above are targets rather than 'not to be exceeded' limits. Council has a proactive programme of jet cleaning known trouble spots to reduce the risk and has increased its jet cleaning budget to further mitigate risks. The increased use of wet wipes has resulted in an increase in blockages, which is a recognised national and international problem. To address this known problem, Council has introduced cutter pumps, supported by an education programme, in an attempt to reduce the risk of blockages.

(vii) Is it possible to quantify how direct inflow drives overflow performance, not other forms of I&I for each overflow point/sluice valve in the network?	Under the I/I Manual 2015 direct inflow is also referred to as fast response (section 1.3). It includes: ▪ roof downpipe connections (gully traps or sewer laterals); ▪ low gullies that act as low drainage points; ▪ damaged or improperly constructed gullies; ▪ surface area-drainage cross-connections; ▪ catchpit drainage cross-connections; ▪ at-surface manhole defects such as holes in the lid or rim, particularly where surface ponding occurs; ▪ shallow defects in private sewers permitting direct stormwater entry; and ▪ inspection openings with loose or missing caps The relative contribution of these potential sources to overflows, both individually and in combination, will vary from location to location across the network. Whilst there is evidence of indirect inflow or slow response to rainfall within the network, direct inflow or fast response dominates. Accordingly, the DrainWise programme seeks to identify and resolve all of these potential fast response sources as far as possible. Additionally, as provided for in the application, Council has built regular reviews into the draft consent conditions to enable progress and the approach to reducing overflows to be reviewed and refined/altered if necessary to ensure the consent outcomes of reducing overflows are achieved.
(viii) Is there any additional quantitative data to support the qualitative assessment that ascribes responsibility to the private network due to age and type of material across the entire wastewater network.	The quantitative data is based on Council's Asset Management System which records the age of the sewer main and material type. Wastewater pipeline materials used in private property are generally similar to that used when the adjacent public network was constructed. From age banding we have a high confidence level of the pipe type used on private property generally being brittle pipe (earthenware) and 3 to 4ft lengths resulting in high frequency of jointing which are high risk failure points that allow RDII and GWI intrusion. This has

		been confirmed by CCTV and discussions with plumbers. The brittle pipe is also susceptible to pipe cracking due to earthquakes. The DrainWise plan prioritises private laterals as medium but still requires Council to take action and this is an essential component of achieving the required reduction levels on an aggregated basis. The I/I Manual 2015 quotes the Watercare model, "The study also found that the maximum number of properties within a catchment with defective drainage is typically 60-70%". This aligns with what GDC has found through property inspections and CCTV.
(ix)	Any additional information on the modelling work and/or model calibration to support the assessment of direct inflow (fast response) driving the overflow performance and that removal of 85% of direct inflows will result in a 2yr-ARI containment.	Refer to (ii)c & (iii) above. The model results indicate that removal of 85% of direct stormwater inflow plus three network upgrades results in a 2 year ARI containment standard (no wet weather overflows in events up to and including a 50% AEP event) being achieved. However, as discussed above, an assessment of additional network upgrades was made to address the situation if a lesser level of inflow reduction was achieved. Should this be required, then Council has the option of implementing additional network upgrades – albeit at increasing cost.
(x)	The constant wind fields give extreme examples where the flow tends to stick to the edges of Tūranganui-a-Kiwa/Poverty Bay and would bracket the response for the sites on the edges of the Bay. However, a varying wind field would move some of this plume into the middle of the Bay, influencing the sites that were not directly affected by the modelled extreme plume. Whilst we appreciate that it isn't feasible to run every scenario, it would be instructive to	Variable wind fields could be expected to result in greater dilution of any contaminants, so it is expected that the dilutions would potentially be greater along the shoreline, and there could possibly be some areas in other parts of the bay that could be exposed to contaminants. However these areas would have relatively greater dilutions due to the variable winds and the increased water depth.

	have a comment on how mixing and diffusion would affect water quality values given at sites that were not directly affected by the plume during the given modelled extreme events.	
(xi)	We understand that NIWA completed a report for GDC and HBRC late last year (through the Envirolink fund) that assessed the effects of climate change on the East Coast. We note that commentary on climate change impacts in MetOcean's response were drawn from earlier reports and it would be appropriate to have some assessment on whether there are any changes to the assessments of inflow based on the latest NIWA findings.	In respect of rainfall, the NIWA report[3] concluded: ▪ Projected changes in rainfall show variability across the two regions. By 2040 under both medium and high greenhouse gas concentration pathways, annual rainfall is expected to decrease by a small amount for the majority of both regions, generally in the 0-5% range. By 2090, larger and more extensive decreases to annual rainfall are projected, decreasing by up to 10% under the medium concentration pathway, and up to 15% under high concentrations. ▪ Extreme, rare rainfall events are projected to become more severe in the future. Short duration rainfall events have the largest relative increases compared with longer duration rainfall events. For the selected locations analysed in this report, rainfall depths for 1-in-50-year and 1-in-100-year events are projected to increase across the greenhouse gas concentration scenarios and future time periods. ▪ The annual maximum 1-day rainfall total is generally projected to increase or decrease by 0-5 mm across the two regions by 2040 under the medium greenhouse gas concentration pathway. Under high greenhouse gas concentrations and further into the future, larger and more widespread increases are projected. It is noted that these are longer term changes that do not affect current predictions of overflow volumes and, as for new growth projections, the potential impacts of climate change will be part of Council's wastewater network

[3] Climate change projections and impacts for Tairāwhiti and Hawke's Bay. Prepared for Envirolink, Gisborne District Council and Hawke's Bay Regional Council, November 2020

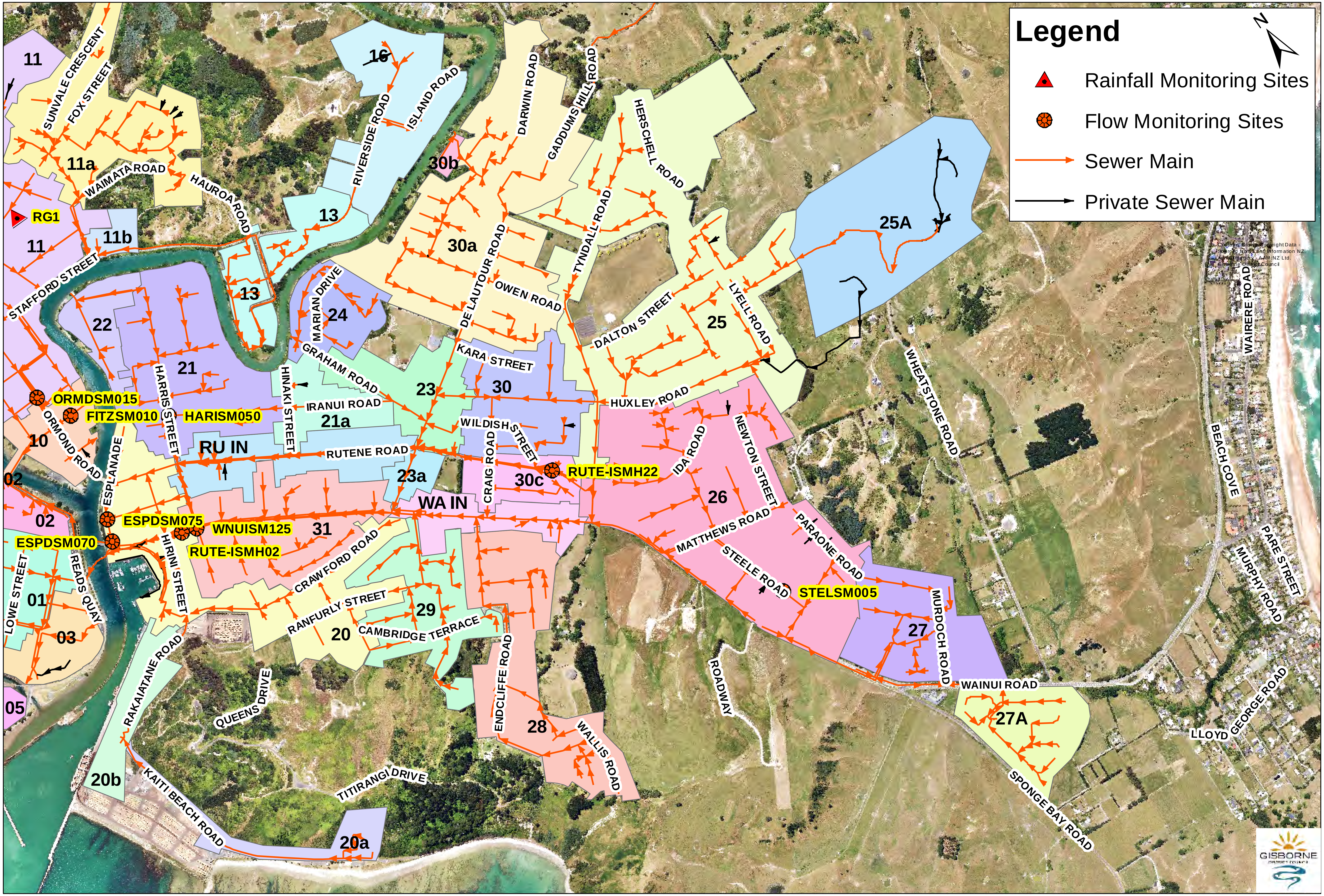
	asset management and upgrade programme moving forward. However, Council considers that the predicted increase in severity of extreme rainfall events over time reinforces the need to focus on removing direct inflow into the network as a priority.
The general issue that our technical reviewers have, and are seeking to clarify, is whether there is sufficient technical data to substantiate the anticipated 85% reduction of direct inflows and the level of confidence that can be afforded to this assumption. We are seeking to provide a comprehensive and robust technical review to support the S.42A report and the more clarity that can be achieved at this stage will lead to less equivocal reviews and assessment. For example, the model may be well calibrated for the gauged locations and be reliable for assessing overflow performance at those locations but may be less reliable in the small sub-catchments at the top of the network extents (which is where the applicant is seeking to make improvements). If the model is out by X percent then achieving the required volume reductions may not be achievable (in the worst case).	The removal of 85% of direct stormwater inflow is a target of Council's DrainWise programme. The wastewater modelling has shown that if this achieved, in conjunction with relatively minor network upgrades (which are programmed for this financial year), then the overflow target of 'no wet weather overflows in events up to and including a 50% AEP event' will be met. While the calibration of the model is likely to be most accurate at the overflow locations, as this is where the flow monitoring was undertaken, the upper catchments were tested under 6 x average dry weather flow and did not overflow under these theoretical capacity conditions. However, it is important to stress that it is the overflow target of 'no wet weather overflows in events up to and including a 50% AEP event' that Council is working to achieve in the first ten years of the consent. If the 85% direct inflow reduction is not achieved, then Council has the backup option of implementing additional network upgrades. As indicated above, and in the application, Council has investigated what upgrades are required if only 75% and 65% removal of direct inflow is achieved – noting that the less direct inflow removal achieved, the more network upgrades are required to achieve the overflow target. Regular reviews have been built into the consent conditions to enable the effectiveness of the DrainWise programme to be assessed and changes in approach made as necessary. Council also notes that once the overflow target has been met, it intends to reset the consent targets to continue to improve performance and further reduce overflows. We are currently working on a condition of consent to make this more explicit.

Table 1 (see response to question (i))

The table below shows the difference in 2-year ARI rainfall depths for RCPs 6.0 and 8.5 out to 2050, and a comparison to the HIRDSv3 rainfall used previously. It shows that the RCP8.5 rainfall depths are 2.2% to 3.6% higher than the RCP6.0 depths.

Comparison of modelled HIRDSv3 rainfall and HIRDS v4 for 2-year ARI storm		Storm duration							
		10m	**20m**	**30m**	**1h**	**2h**	**6h**	**12h**	**24h**
HIRDSv3 depth in Wastewater model	***mm***	7.7	11.4	14.3	21.1	29.1	48.8	67.5	93.3
HIRDSv4 RCP 6.0 to 2050 (interpolated)	***mm***	6.8	10.4	13.3	19.8	29.0	50.0	67.6	87.8
	HIRDS v4/v3	89%	91%	93%	94%	100%	103%	100%	94%
HIRDSv4 RCP 8.5 to 2050 (interpolated)	***mm***	7.1	10.8	13.7	20.6	30.1	51.5	69.3	89.8
	HIRDS v4/v3	92%	95%	96%	97%	103%	105%	103%	96%

Attachment A: Flow Monitoring Points and Network Maps



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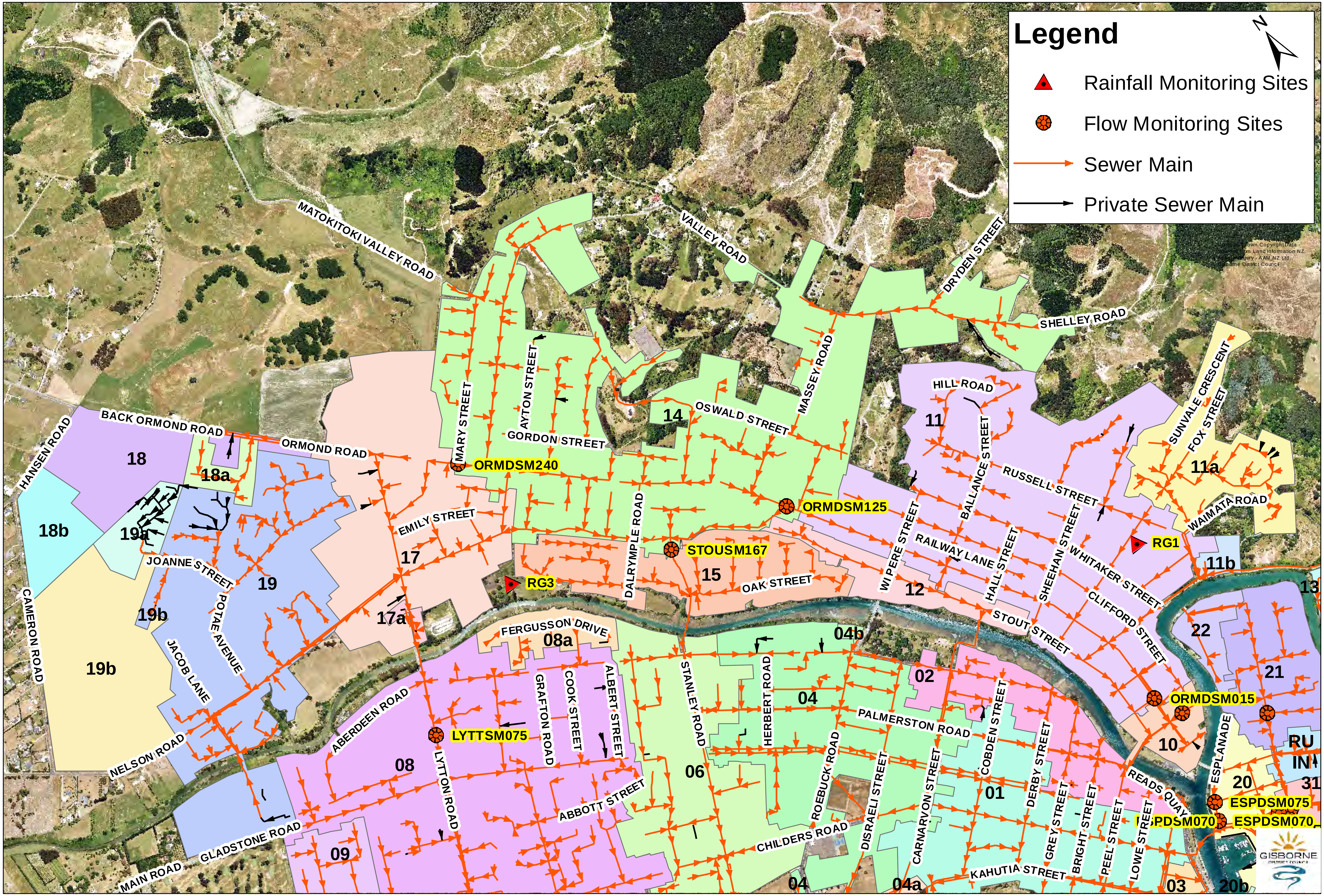

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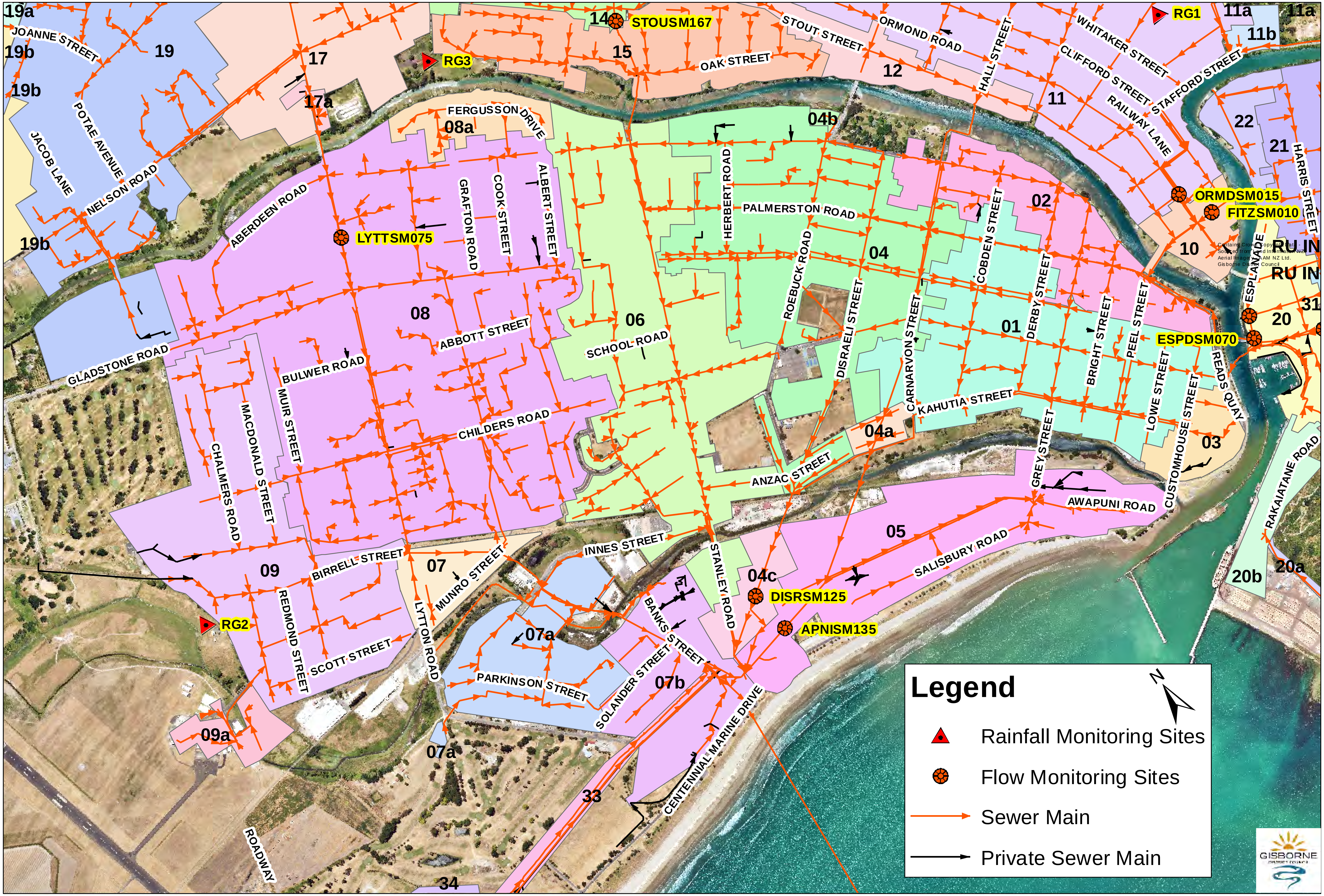

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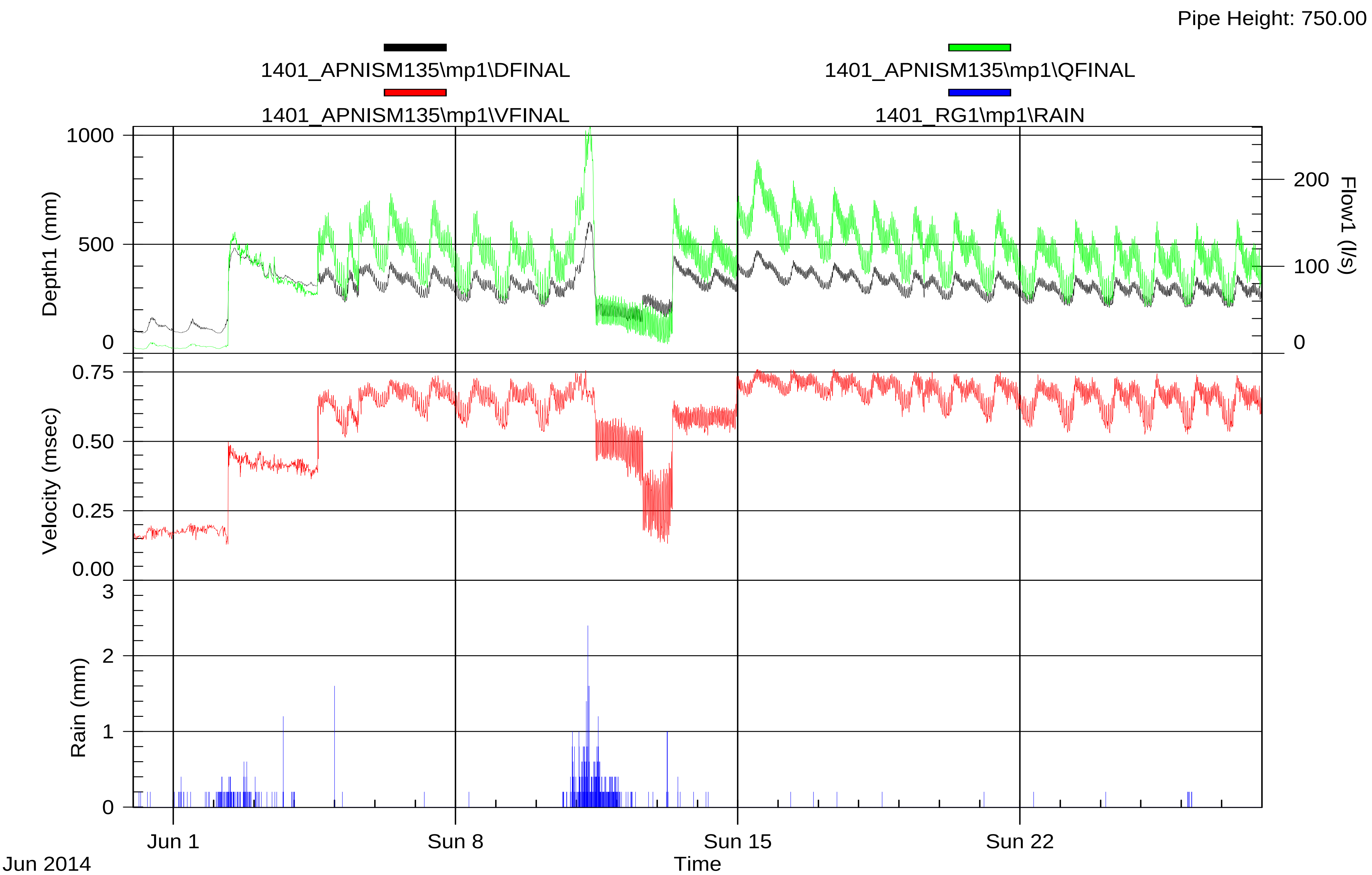
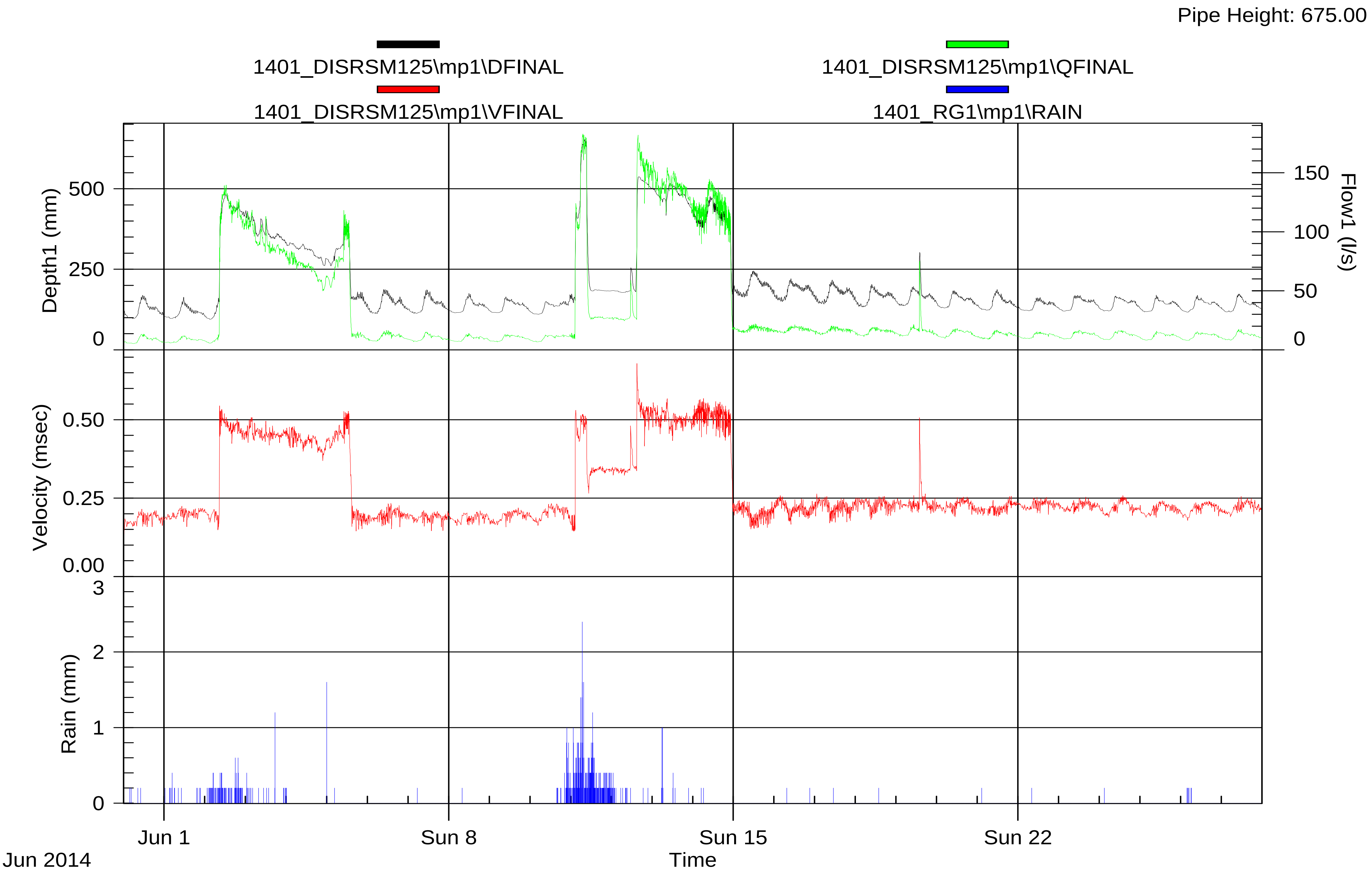
Attachment B: Flow Monitoring Records, June 2014

Mott MacDonald - Gisborne



Mott MacDonald - Gisborne



Mott MacDonald - Gisborne

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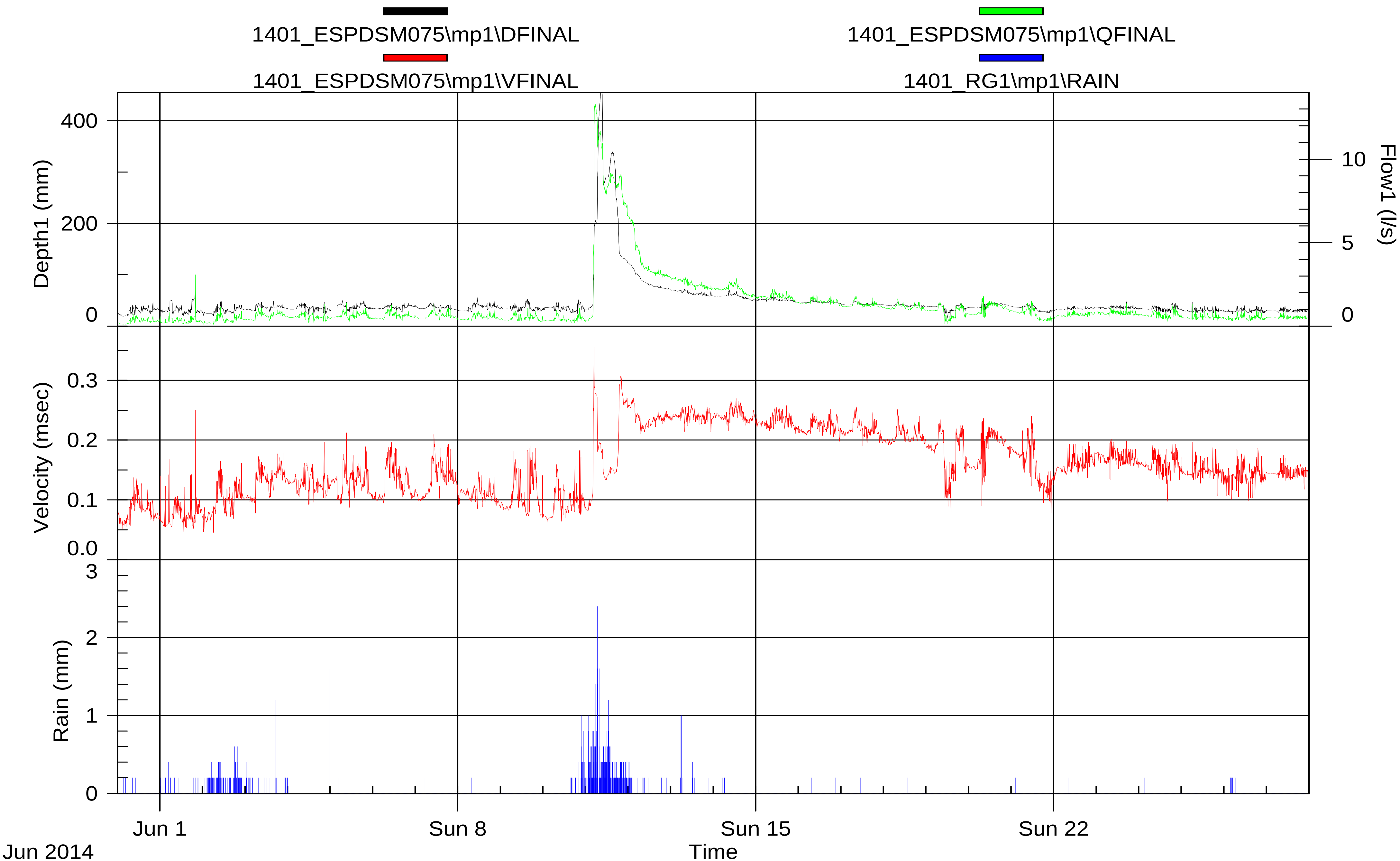

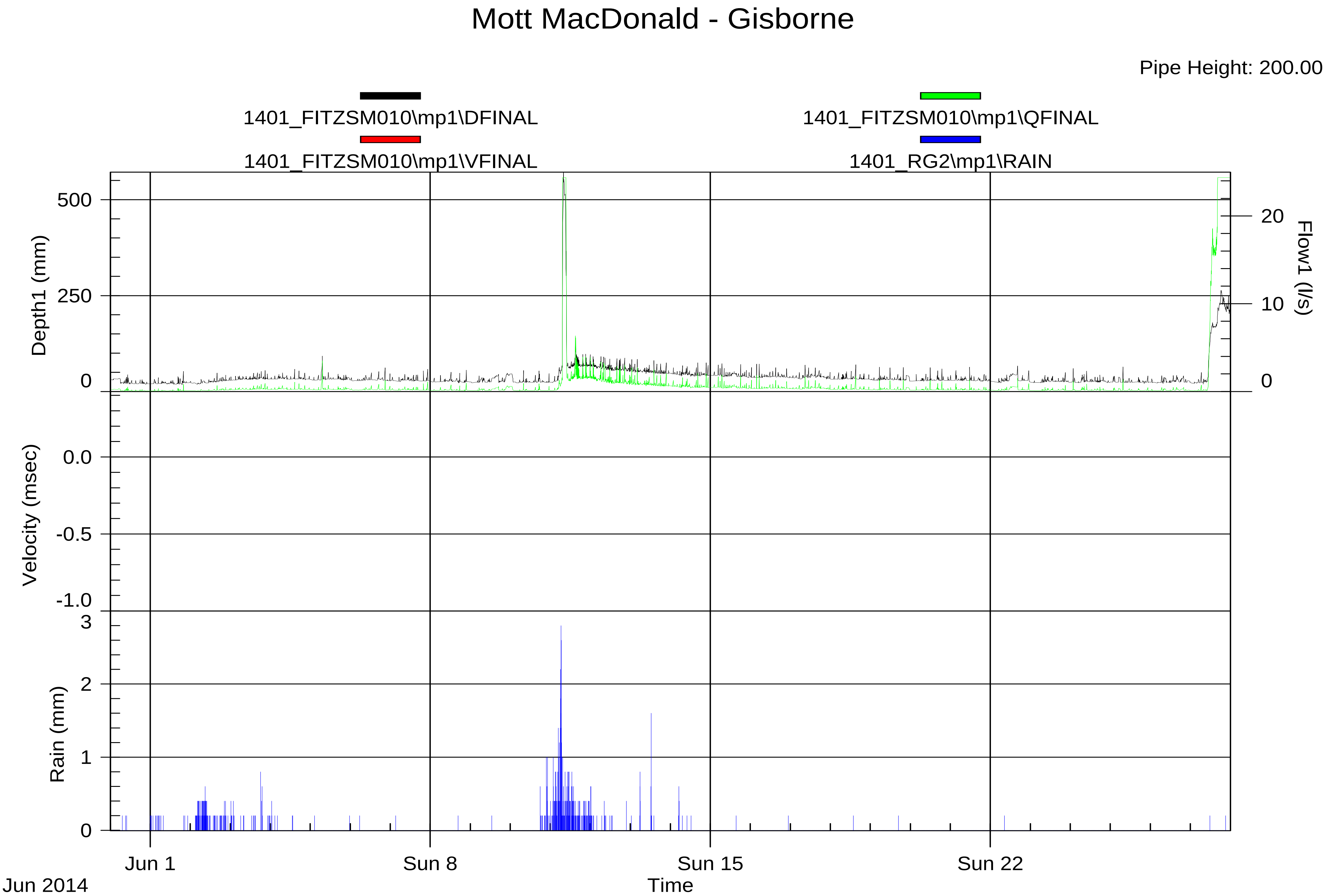
Mott MacDonald - Gisborne
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1401_RG2\mp1\RAIN
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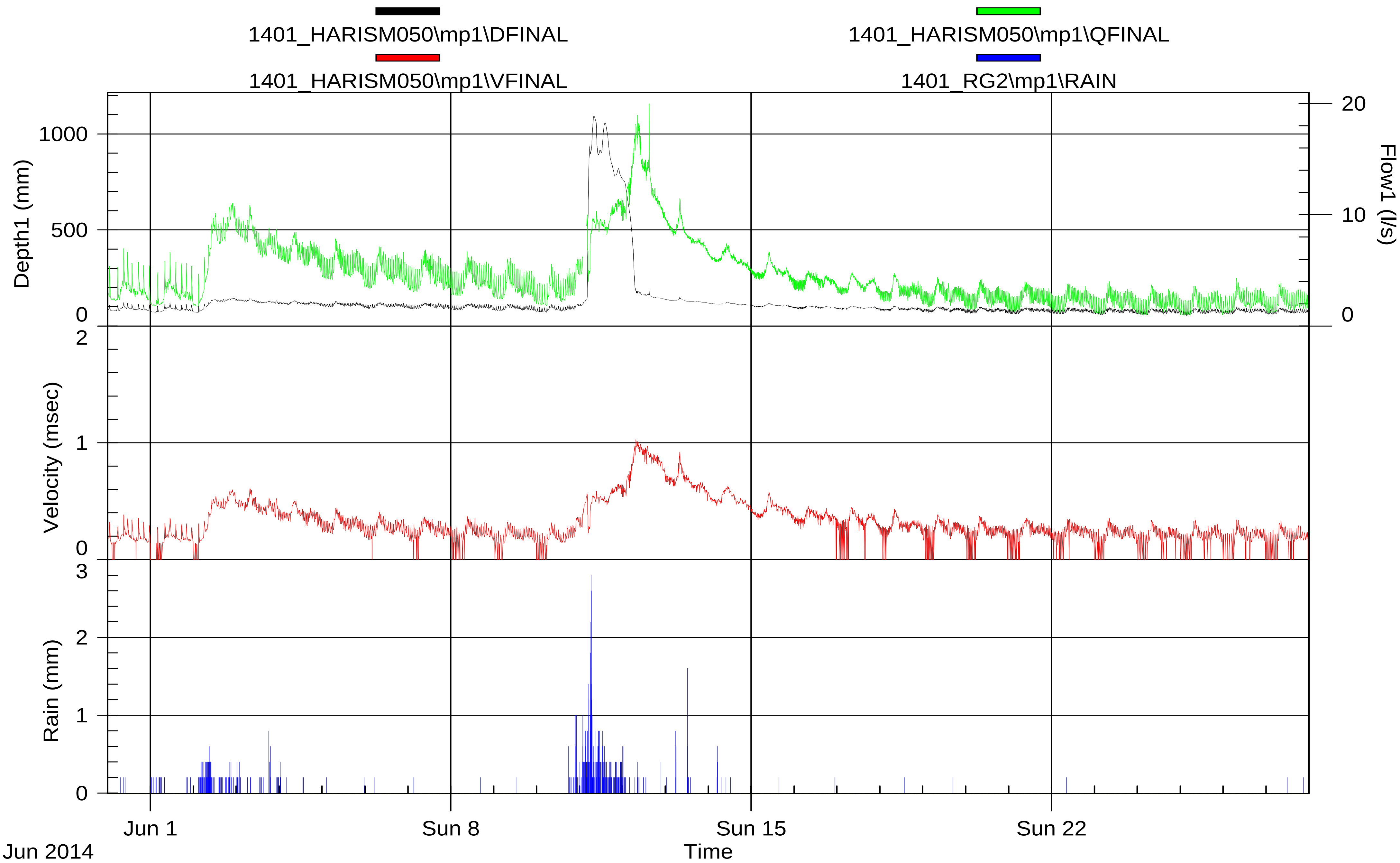
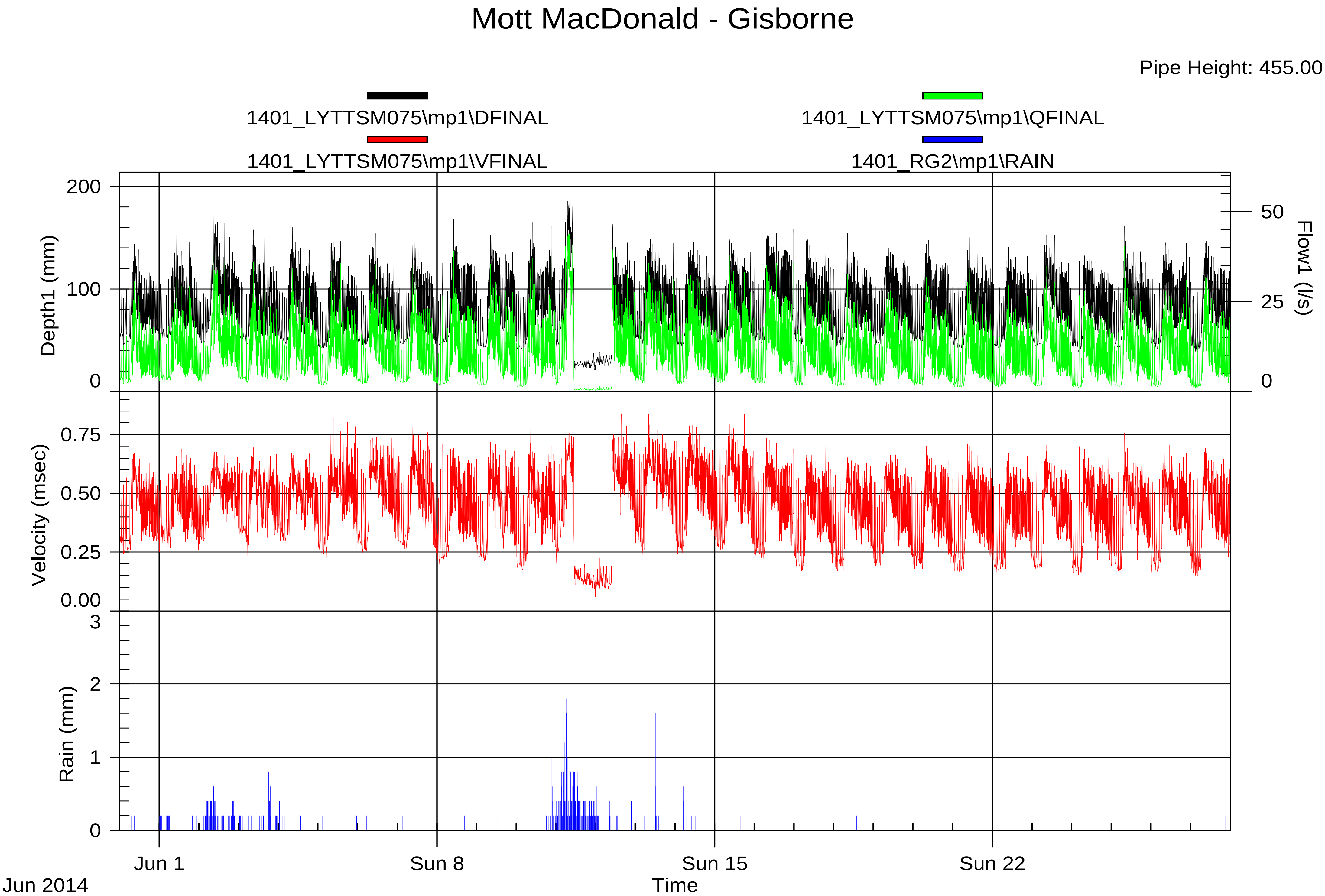
250
0
Flow1 (l/s)
20
10
0
Velocity (msec)
0.0
-0.5
-1.0
Rain (mm)
3
2
1
0
Jun 1
Sun 8
Sun 15
Sun 22
Jun 2014
Time

Mott MacDonald - Gisborne

Pipe Height: 200.00

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Flow1 (l/s)
50
25
0
Velocity (msec)
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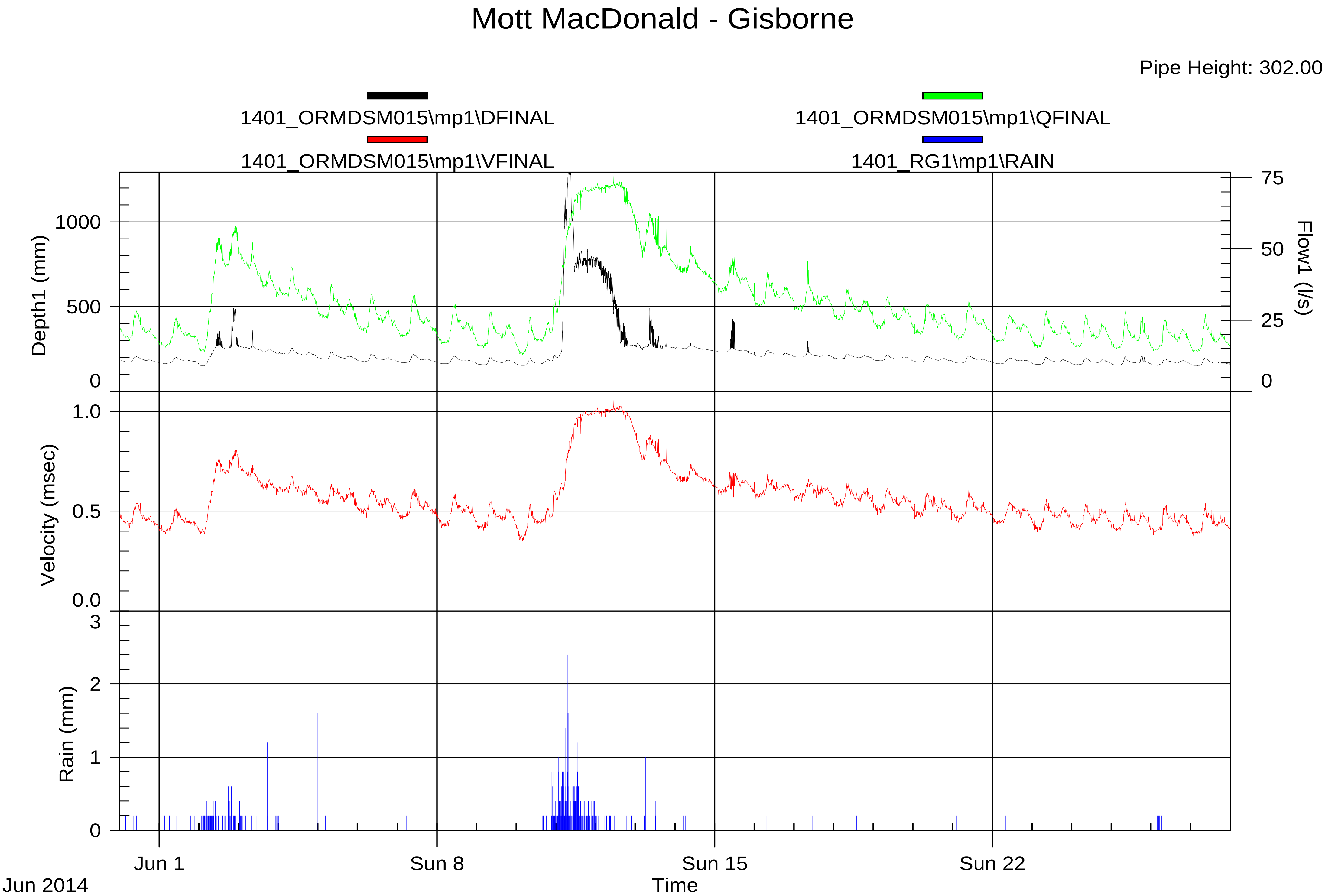
Sun 8
Sun 15
Sun 22
Jun 2014
Time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Velocity (msec)
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Mott MacDonald - Gisborne

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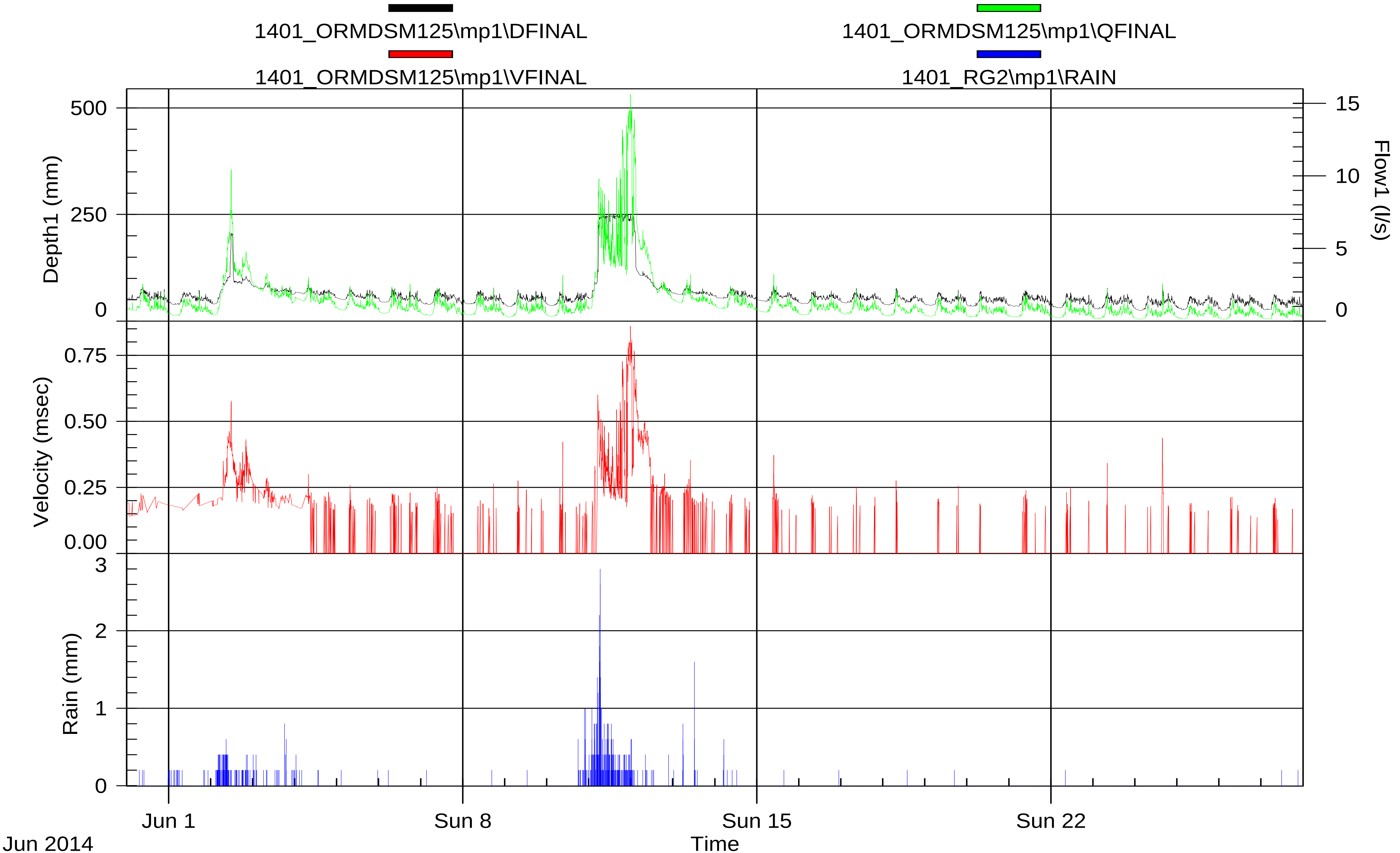

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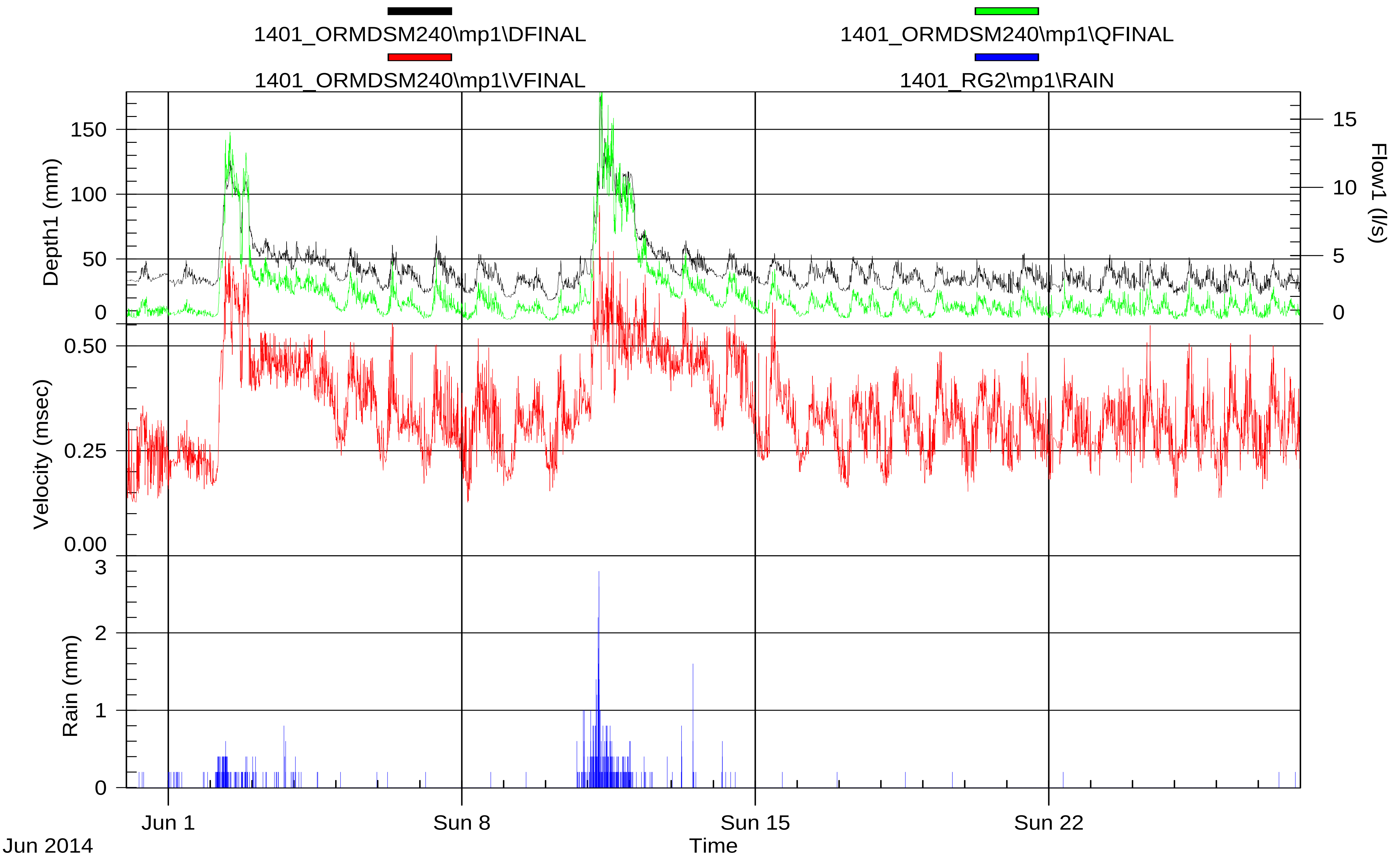

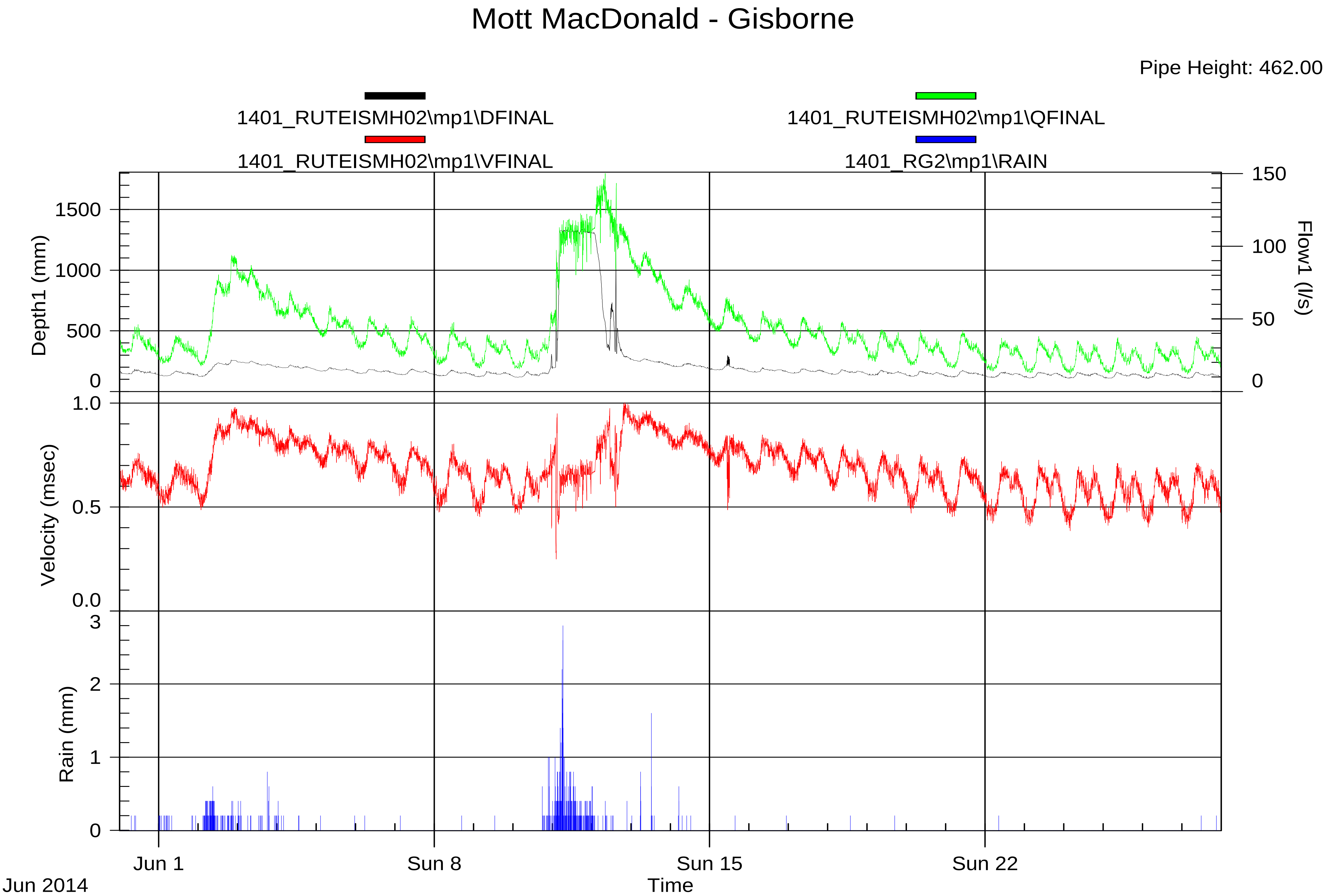
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500
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Flow1 (l/s)
150
100
50
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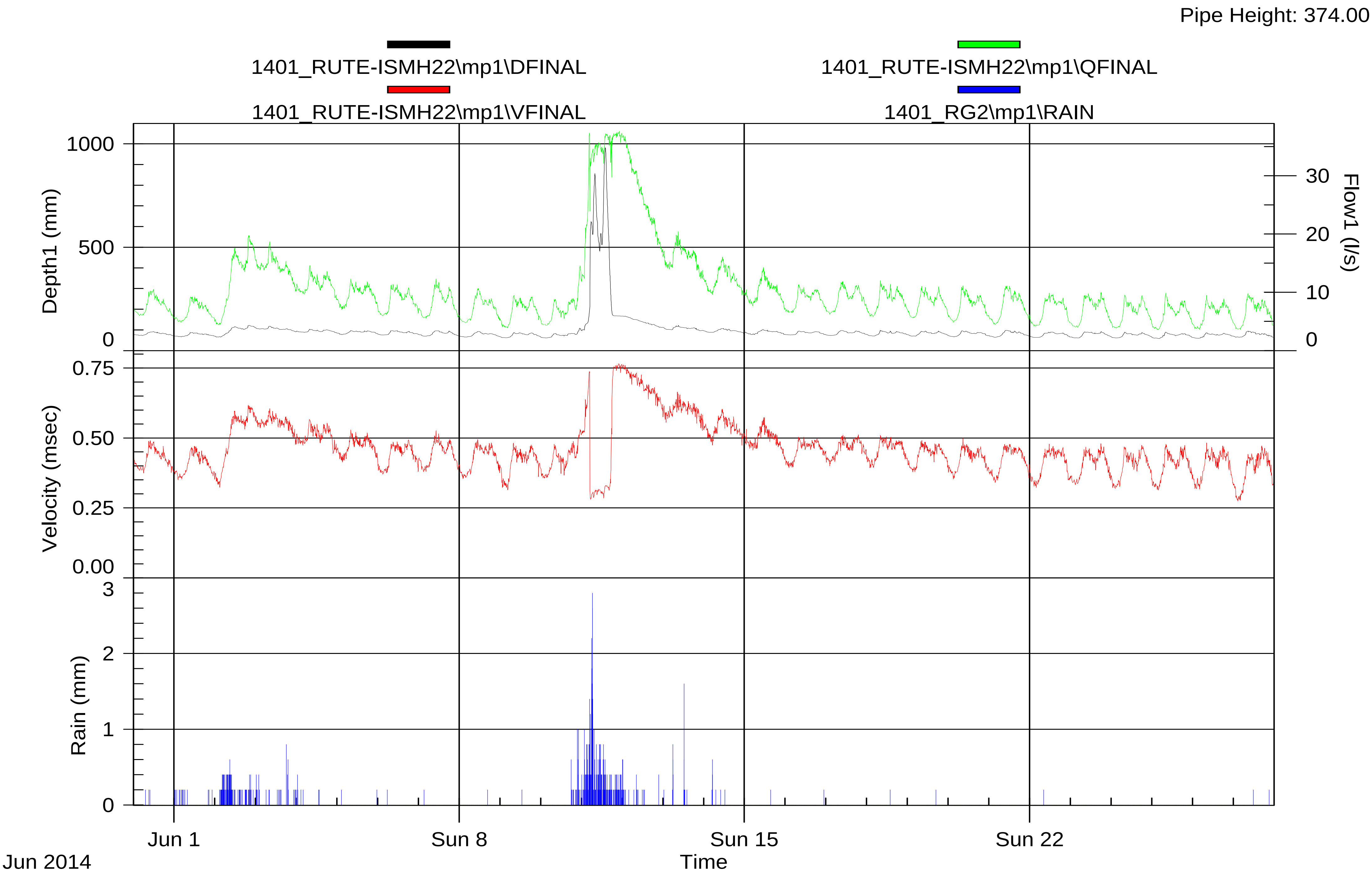
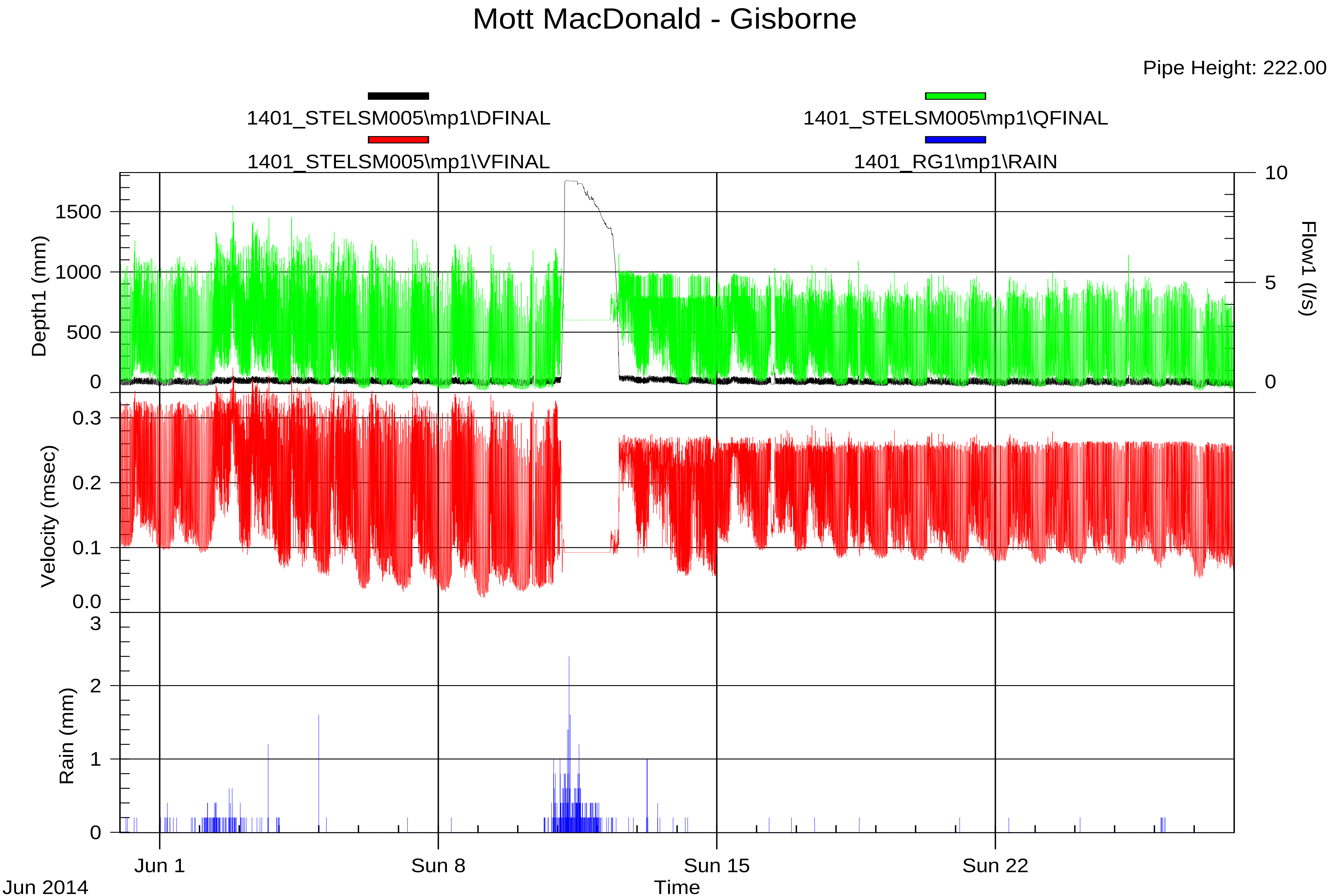
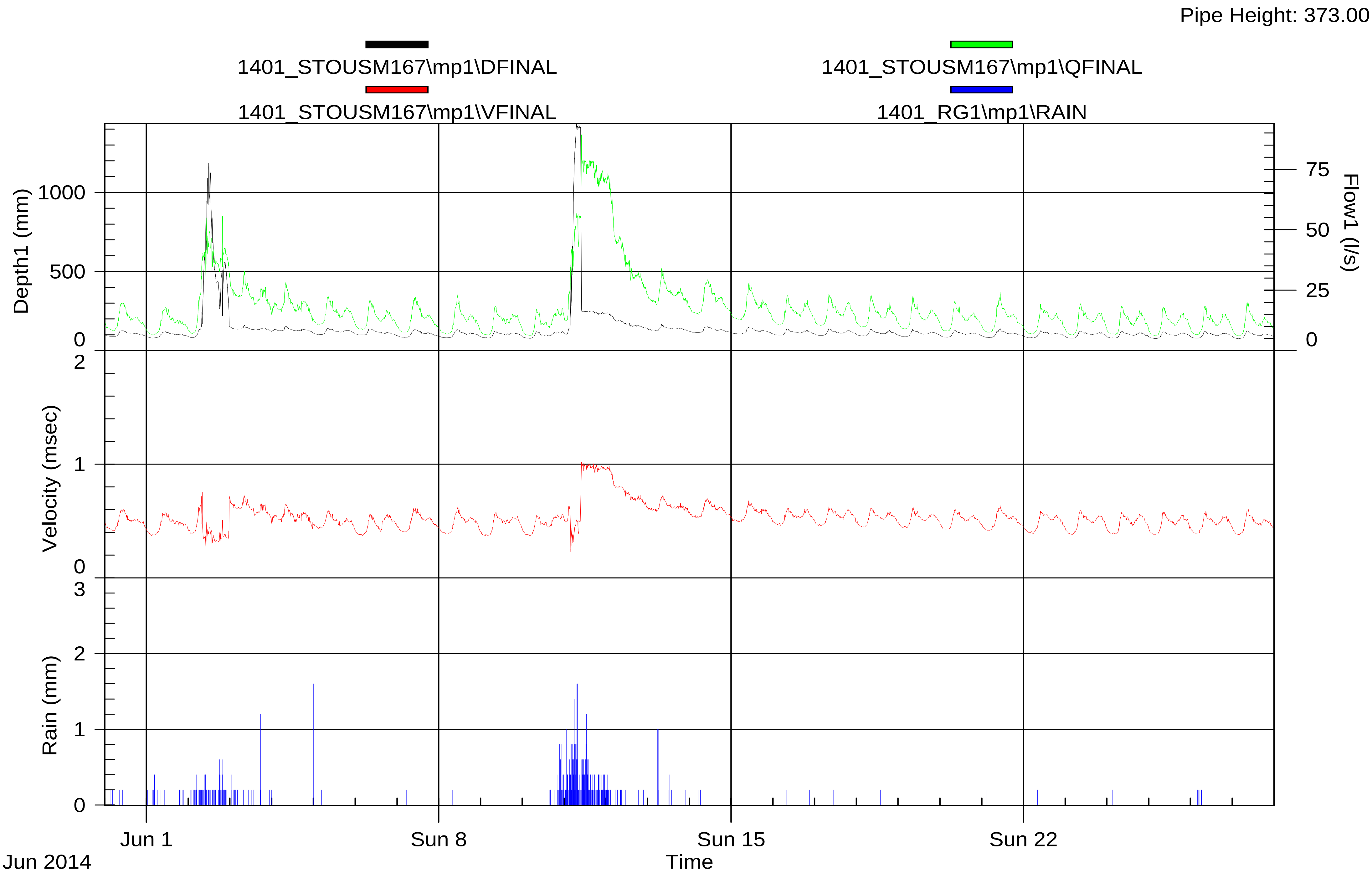
Velocity (msec)
1.0
0.5
0.0
Rain (mm)
3
2
1
0
Jun 1
Sun 8
Sun 15
Sun 22
Jun 2014
Time

Mott MacDonald - Gisborne



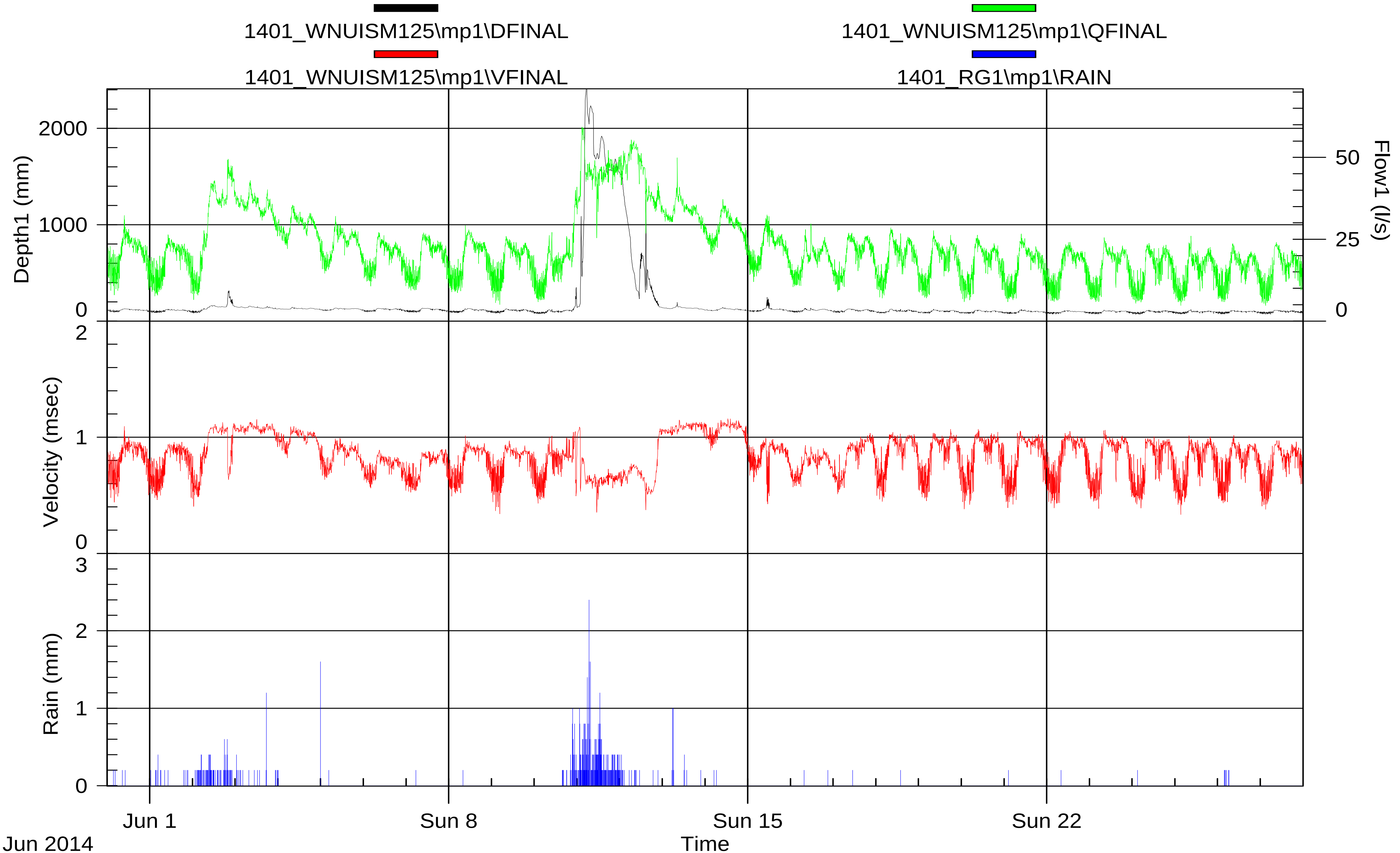

Mott MacDonald - Gisborne
Pipe Height: 222.00
1401_STELSM005\mp1\DFINAL
1401_STELSM005\mp1\QFINAL
1401_STELSM005\mp1\VFINAL
1401_RG1\mp1\RAIN
Depth1 (mm)
1500
1000
500
0
Flow1 (l/s)
10
5
0
Velocity (msec)
0.3
0.2
0.1
0.0
Rain (mm)
3
2
1
0
Jun 1
Sun 8
Sun 15
Sun 22
Jun 2014
Time

Mott MacDonald - Gisborne



Mott MacDonald - Gisborne

Pipe Height: 301.00



Mott MacDonald - Gisborne

Pipe Height: 232.00