

Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Previous Overview for Johnstone WTL 2015

Johnstone River – mostly perennial

Reach	Natural terrain			Natural hydrological		Modifications		Sediment and water quality issues	Sufficient riverine vegetation	Other	
	Slopes	High rainfall areas	Land zone surrounding channels	Geology and significant natural features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use				Weirs, dams, infrastructure
Data source	HR–state layer	LZ-state layer	G-state layer SNF – research, attendees	attendees	SW-state layer	LU-state layer	W&D-state layer	attendees	attendees	attendees	
Upper-mid catchment	Granites steep	Between 1501mm and 3201mm p.a.	- 8 - Basalt plains and hills	- Northern side has more topography – remnant patch of granite – forms catchment divide (to the south of the north Johnstone).	- Overall very incised system	<u>Upper Catchment</u> - Some GW present - Major diffuse spring discharge (due to elevation changes) - No significant features – minor volumes - Aquifers are ‘clogged’	<u>Overall:</u> - 55% natural / minimal use lands - 16% grazing - 12% sugarcane - 6% dairy (in upper catchment) - 3% bananas - 1% other crops - 2% urban - 4% other land uses.	<u>Malanda water supply</u> - From North Johnstone River - Bores used as back up	- The area has experienced tin and gold mining and so there are a number of abandoned mines to the north of Cowley Falls, and south of Guilfoyle Falls and Mungalli Falls.	- Riparian vegetation in headwaters	- Wet tropics area
North Johnstone	<u>Milla Milla</u> - High elevation - Steep gradient		- 11 - hills and lowlands on metamorphic rocks - 12 - hills and lowlands on granitic rocks	- North Johnstone River misrepresented - main channel on map - Bulgaru swamp <u>Upper Catchment</u> - In the upper reaches of the sub-basin, near Malanda, the dominant geology consists of a layer of basalts and volcanics on granites and sandstone-mudrocks. - Headwaters in old, well weathered basalts. - Basalts thick in those areas (100m) - Underlain by metamorphics and granites. - Highway is on basalt ridge. - Lots of waterfalls - Perennial <u>Beatrice River</u> - Lesser major channel - Perennial - Low during dry years Then: - Beatrice and north Johnstone River run into granites - Erosion not a big issue - Reasonable pasture	- The North Johnstone River is a very incised, permanently flowing, confined system that is supported by groundwater discharge throughout its upper reaches. - The river’s sharp change in trajectory from north-east to south-east relates to the fault line. - The next change in trajectory from south-east to north-east may relate to confinement by metamorphics. - The upper catchment is recognised for its large number of waterfalls, which attracts tourism to this area.	- Incised landscapes include smaller springs - Spring discharge in Upper system - Metamorphics fill up and drain quickly - GW level variation is 20m - Steps, waterfalls (edges of basalt flows) <u>Milla Milla</u> - Quick run off	-Grazing and dairy production occurs in the areas surrounding Malanda, Jaggan, Tarzali, and Minbun – on the rich, young, basalt soils The majority of intensive agriculture – sugarcane and irrigated tree fruits – occurs on the alluvial flats east of Mount Poorka. Intensive agriculture is supported by good alluvial aquifers in down-catchment of Harts Gully. - Agricultural production on the basalt takes place in form of tea plantations near Mamu and Cowley Falls. - Logging (some)	<u>Atherton Tablelands</u> - Farm dams present	<u>Overall</u> <u>Vast amounts of sediment tied up in often weed infested point and lateral bars and small islands. Unless they are permitted to be removed they pose threats to the bank stability and long term threats of more sediment in the GBR.</u> <u>Source Catchments modelling suggests that since European settlement (c1860) loads have increased:</u> - 3.0 fold for SS - 2.7 fold for DIN - 3.4 fold for PN - 1.7 fold for DIP - 4.4 fold for PP - Calculated using ‘Base’ load scenario - The Johnstone basin generates the highest proportion of the anthropogenic pollutant loads to the Wet Tropics load for DIN (45%) and DIP	- Degraded in some areas - partially cleared in the upper North Johnstone - Ok on the Johnstone itself. <u>Beatrice River</u> - Riparian vegetation good due to National Park reach however minimal riparian above the National Park through the dairy farms	- Johnstone Basin area: 2,326 km ² - Highly modified system in upper catchment, pristine in mid catchments (National Park), modified in coastal zone - Overly committed water allocations in upper tributaries of catchment not all currently being used (a lot was used for dairy) <u>Atherton Tablelands</u> - Bromfield swamp - Series of perched peat swamps - Volcanic craters <u>Milla Milla</u>

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- Rafting from Beatrice down
- Waterfall circuit is the edge of the basins
 - Possible fault line (ID: 2030301 - Fault Approximate): running north-south from approximately 3km south-west of Topaz (in Russell sub-basin) to approximately 5km north-east of Mungalli.
 - North Johnstone River runs parallel to the fault line.
 - Granites create areas where water runs off rapidly into nearby rivers and creeks.
 - In the lower reaches of the sub-basin, the North Johnstone River flows through basalts on sandstone-mudrocks. It then flow through alluvium, on sandstone-mudrocks and metamorphics, and joins the South Johnstone River in the coastal zone of Innisfail. From this point onwards, the coastal zone is part of the South Johnstone sub-catchment.
 - The coastal zone is confined by a ridge of metamorphic rocks which stretches along the coastline and confines the Johnstone River mouth.

- Historically
- Tin mining
 - Gold mining

- Upper reaches
- Malanda
 - Milla Milla

- **National Parks:** Herberton Range, Maalan, Tully Gorge, Wooroonooran, Palmerston Rocks, Ella Bay.
- **Forest Reserves:** Mount Fisher.
- **Regional Parks:** Warrina, Carello Palm Swamp
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- Warrina – Wetlands/Tropical Froggerly proposed project to filter agricultural, industrial waters)

- (23%), and the second highest regional contributions for TSS (20%), PN (33%), PP (35%) and PSII herbicides (20%).
- The greatest anthropogenic loads of DIN and PSII herbicides are sourced from sugarcane.
 - The Source Catchments analysis suggests that 56% of the total DIN load is sourced from sugarcane land use while bananas contribute 9% of the total DIN load from the Johnstone Basin. The model suggests that sugarcane in this basin contributes 80% of the anthropogenic DIN load exported from the basin.
 - Sugarcane contributes 96% of the PSII herbicide loads from the basin.

- Cultural tourism values significant
- A very high number of nique microcosms in waterfalls

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<p>Mid-lower catchment</p> <p>North Johnstone</p>	<p>Floodplain</p>	<p>Between 3201mm and 4001mm p.a.</p>	<ul style="list-style-type: none"> - 3 - Alluvium (river and creek flats) - 8 - Basalt plains and hills - 11 - hills and lowlands on metamorphic rocks 	<p><u>Northern side of Johnstone catchment</u></p> <ul style="list-style-type: none"> - Floodplain - Mixture of geologies and sediments - Quite clayey (not sandy) substrate - Depth of alluvium up to 40m - Underlain by basalts, granites and metamorphics - Still undulating relative to other areas <p><u>Coastal areas</u></p> <ul style="list-style-type: none"> - Flooding significant / extensive - Johnstone River has narrow outlet - Confined area out to sea - Gorge section above Nerada flattens out below 	<ul style="list-style-type: none"> - Very incised - Sand within the Johnstone River bed - Some sand beds are more silty - Stony riffles near mouth 	<p><u>East Palmerston area</u></p> <ul style="list-style-type: none"> - Dynamic system - Lots of spring discharge because of changes in elevation. - High ridges fill in wet season - Drain out in dry season - Up to 60m change in GW <p><u>Mid reaches to coast</u></p> <ul style="list-style-type: none"> - Some GW present - Not a sandy aquifer 	<p><u>Mid reaches to Innisfail / coastal areas</u></p> <ul style="list-style-type: none"> - Bananas - Mixed crops (some) - Sugarcane (hilliest cane district in region) - Fruits - Tea <p><u>Coastal areas</u></p> <ul style="list-style-type: none"> - ~50% sugarcane - ~50% bananas 	<ul style="list-style-type: none"> - Bores in the Wangan into weathered metamorphics - more topography, draining onto the flat lands <p><u>Innisfail water supply</u></p> <ul style="list-style-type: none"> - Supply gained from North Johnstone - Bores in Palmerston East 	<ul style="list-style-type: none"> - North and South Johnstone and Liverpool 11% of the total area - 2% of the Wet Tropics TSS - 30% DIN (high –not from the uplands, probably 80% from cane, 12% bananas, 5% urban) - 21% of the PS2 - Weeds are present in this sub-basin – varying densities / distributions. 	<ul style="list-style-type: none"> - Riparian vegetation limited in more developed areas - Lower reaches in poor condition / extent - Improves near mouth 	<ul style="list-style-type: none"> - Good swamp forming systems - River improvement trust
<p>Upper-mid catchment</p> <p>South Johnstone</p>	<p>Steep</p>	<p>Between 2801mm and 4001mm p.a.</p>	<ul style="list-style-type: none"> - 8 - Basalt plains and hills - 12 - hills and lowlands on granitic rocks 	<p>- Shallow basin.</p> <p>- Higher proportion of granites in headwaters</p> <p>First:</p> <ul style="list-style-type: none"> - Basalt along main river channel, and some metamorphic rock. - Sheer zone running north/south – valley from Cairns south. - Results in limited catchment extent. <p>- Not same reliability of flow as North Johnstone River Steep while holds water, drains out quickly</p> <p>Then:</p> <ul style="list-style-type: none"> - Metamorphics - Alluvial development similar to Russell River - A lot of fine sediments - River loses energy rapidly in flatter coastal plain 	<ul style="list-style-type: none"> - Very incised 	<ul style="list-style-type: none"> - Water available but not in good supply - Some contribution of GW from granites - Not a large aquifer system 	<p>-</p>	<p>Sediment from banana farms</p>	<p>-</p>	<p>-</p>	

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<p>Mid-lower catchment South Johnstone</p>	<p>Floodplain</p>	<p>Between 2801mm and 4001mm p.a.</p>	<ul style="list-style-type: none"> - 11 - hills and lowlands on metamorphic rocks - 12 - hills and lowlands on granitic rocks <p><u>Coastal:</u></p> <ul style="list-style-type: none"> - 1 - Tidal flats and beaches - 2 - Coastal dunes - 3 - Alluvium (river and creek flats) 	<ul style="list-style-type: none"> - River caught between mountains before reaching the floodplain - Granites - Basalts (lower porosity, quite thin except for in the valley itself) - Depth of alluvium 40 m - Underlying metamorphics <p><u>Innisfail area</u></p> <ul style="list-style-type: none"> - Very prone to flooding <p><u>Southern areas</u></p> <ul style="list-style-type: none"> - Hydrosols - Good vegetation to the south runs around to east. - All creeks run into estuarine system and Bingil Bay. 	<ul style="list-style-type: none"> - Very incised throughout <p><u>Mouth of River:</u></p> <ul style="list-style-type: none"> - Well defined, deep channels - Good flood terraces - Bypass and overflow channels 	<ul style="list-style-type: none"> - Metamorphics don't produce good aquifer development (unsuitable sediment) 	<ul style="list-style-type: none"> - Mourilyan Harbour and prawn farms on coast. - Innisfail <p><u>Southern areas</u></p> <ul style="list-style-type: none"> - Fertilised grazing - Sugarcane <p><u>Innisfail area</u></p> <ul style="list-style-type: none"> - Residences putting in drainage works on palustrine system draining north, just north of sand geology 	<p><u>-The bores get more salty – and saltwater perch and extensive mangrove and melaleuca forests.</u></p>	<ul style="list-style-type: none"> - North and South Johnstone and Liverpool 11% of the total area - 2% of the Wet Tropics TSS - 30% DIN (high –not from the uplands, probably 80% from cane, 12% bananas, 5% urban) - 21%of the PS2 	<p><u>Southern areas</u></p> <ul style="list-style-type: none"> - Good vegetation 	<ul style="list-style-type: none"> - Granite area in upper catchment is in WHA - Have to come down right to the coastal plain before development - WHA also on basalt <p><u>Innisfail area</u></p> <ul style="list-style-type: none"> - Hotspot for cyclone - Vine forest is indicative of cyclone activity - Alluvial vegetation is lowland swamps, melaleuca swamps, palm swamps, <i>eleocharis</i> - Stacked dune swales with good vegetation - Palustrine wetland to north of Mourilyan Harbour Road – drains north
<p>Moresby & Upper Moresby</p>		<p>3201 mm p.a.</p>	<ul style="list-style-type: none"> - 11 - hills and lowlands on metamorphic rocks <p><u>Coastal:</u></p> <ul style="list-style-type: none"> - 1 - Tidal flats and beaches - 2 - Coastal dunes - 3 - Alluvium (river and creek flats) 	<p><u>Moresby & Upper Moresby</u></p> <ul style="list-style-type: none"> - Unique - Own small catchment - Highly modified system - Extensive drainage modification. - Metamorphics and sand build up on the southern side - Bulk of 'river' runs through sandy system - Shear zone running north isolating it off 	<ul style="list-style-type: none"> - Very high water table - Finely balanced in terms of saltwater wedge - Sand extraction could create saltwater issues 	<p><u>Moresby & Upper Moresby</u></p> <ul style="list-style-type: none"> - Very high water table - Finely balanced in terms of saltwater wedge - Sand extraction could create saltwater issues 	<p><u>Moresby & Upper Moresby</u></p> <ul style="list-style-type: none"> - Upper catchment of the Moresby is highly modified - Sugarcane - Port area - Aquaculture (prawn farms) <p>The majority of intensive agriculture – sugarcane and irrigated tree fruits – occurs on the alluvial flats east of Basilisk Ranges towards the coast.</p>	<p><u>Upper Moresby</u></p> <ul style="list-style-type: none"> - ASS soils and sands common - Oxidise very quickly - Typical with shallow basin (has created issues with aquaculture). 	<p><u>Moresby & Upper Moresby</u></p> <ul style="list-style-type: none"> - Pond Apple a serious issue - Saltwater wedge area has a lot of mangroves 	<p><u>Moresby & Upper Moresby</u></p> <ul style="list-style-type: none"> - Stacked dune swale carries littoral rainforest - Seagrass collapsed 	

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										This is a highly modified system, with intensive agriculture being supported by irrigation and drainage channels.
Liverpool Creek, Silkwood area, Kurrimine Beach	- Lower elevation	Between 2801mm and 4001mm p.a. Little bit of rain shadow effect	- 11 - hills and lowlands on metamorphic rocks - 12 - hills and lowlands on granitic rocks <u>Coastal:</u> - 1 - Tidal flats and beaches - 2 - Coastal dunes - 3 - Alluvium (river and creek flats)	<u>Liverpool Creek</u> - Shorter catchment - Headwaters in granites and metamorphics - Larger amount of alluvial floodplain <u>Silkwood tributary</u> - Perennial - Rain driven, distinct pattern from wet season to dry season - Clay sediments initially - Sandy sediments closer to coast - Holds a lot of water	<u>Silkwood tributary</u> - Deep channel <u>Liverpool Creek</u> - Well defined - Steep banks - Square, deep channel - Fair bit of sand in creek itself <u>Kurrimine Beach</u> - Steep banks	<u>Liverpool Creek (lower section)</u> - Bananas - Sugarcane - Prawn farms on little Liverpool creek - Sand extraction in bottom end of Liverpool Creek <u>Kurrimine Beach</u> - Defence land at Cowley Beach	<u>Kurrimine Beach</u> - High rates of erosion.	<u>Liverpool Creek</u> - Upper reaches of catchment good veg coverage - High weed diversity <u>Silkwood</u> - Remnant patches of vegetation through Silkwood - <u>Liverpool Creek</u> - Used to be Melaleuca's through the palustrine, saturated at depth		
Maria Creek	Floodplain	2801 mm p.a.	<u>Coastal:</u> - 1 - Tidal flats and beaches - 2 - Coastal dunes - 3 - Alluvium (river and creek flats)	<u>Maria Creek</u> - Dominant drainage system - Lots of creeks - Running down to Bingil Bay - Feed back into estuarine area - Surface water flooding Maria Creek annually.	<u>Maria Creek</u> - Deep channel	<u>Maria Creek National Park</u> <u>Maria Creek</u> - Mission Beach (Tully catchment, but proximate) - Grazing area south - High fertiliser use - Sugarcane basin up behind on hydrosols, wall to wall	<u>Maria Creek</u> - Mission Beach water supply comes from Liverpool and Tully tributaries.	<u>Maria Creek</u> - Lots of drainage modification	<u>Maria Creek</u> - Heavily degraded upstream - Heavily degraded upstream - Good vegetation to the south to the national park. - Large wetlands in the National Park - <u>Maria Creek (east of highway)</u>	

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- Vegetated metamorphic hill
- Nature refuge
- *Melaleuca viridiflora* swamp at base of hill.

Overview for Lower Johnstone WTL November 2016

- The Johnstone Basin is situated in the Wet Tropics region; this region receives the highest rainfalls in Australia. Rainfall totals are typically concentrated in the 'wet season' months (December – April) and are influenced by the monsoon and tropical lows/depressions, although the region also receives regular rain throughout the year in comparison to the Dry Tropics.
- Parts of the Johnstone River catchment can receive in excess of 5900 mm annual rainfall (The Johnstone River Management Plan 2013).
- The Johnstone River catchment has three distinct areas: the upper (tablelands or hinterland) area, the middle (the Range or World Heritage) and the lower (coastal or floodplain) area (The Johnstone River Management Plan 2013).
- North Johnstone River Catchment 1089sq km, South Johnstone River Catchment 591 sq km, Moresby River Catchment 147 sq km, Liverpool Creek Catchment 311 sq km and Maria Creek Catchment 243 sq km.
- The National Park is at the top of the catchment the water flowing through is modified by the trees and many waterfalls slowing the water down.
- The catchment has a range of different geologies however; the predominant geology consists of sandstone-mudrocks on weathered granites. The upper catchment has quite a lot of erosive material coming down the river from the upper catchment. The granites throughout the upper part break down into sand. The old metamorphics break down into fine clay materials which create large basalt flows and provide rich fertile soils in the floodplain and valued by the agricultural industry in the region. These basalts, while very productive, are very erosive.
- Most of the dominant rock is marine sediments that have been pushed up and washed up onto land.
- The Atherton Basalt is fairly recent, around fifty million years ago.
- Granites are intrusive; pushing up over time. They usually have very fast run off areas whereas basalts usually have a lot of infiltration and older basalts have less infiltration. The metamorphics usually have fast run off areas but are fractured creating springs in them. The underlying metamorphics have tin and silver and other metals in them making them attractive for mining. In the north there is a significant local sandstone aquifer, which receives recharge from rainfall percolating through the porous basalt, and has a water table which fluctuates by up to 60m in depth.
- The metamorphics are under the coastal area with sand on top, these large sand deposits affect the way that water flows. Rivers normally find their way around these sand areas, and do not go through them. However, the Liverpool Creek is an exception to this rule
- Where the old paleo channels are, there is a difference in the transmissivity of the underlying aquifers, this creates a lot of local variability. A lot of the paleo channels come out as 'wonky holes'. A wonky hole is an old channel where freshwater comes out in the ocean underneath. Fishermen know where they are located and are associated with high fish productivity. They can be located by temperature changes in the water and are important from a nutrient point of view.
- There are big sand ridge sequences on the coastal area and swamp areas. Old rock is present on the coast such as the Hodgkinson's sandstone. Every time there is a different pattern of geology it indicates a different geological timing. It has been a very active geology in this region for a long time.
- The Johnstone has very incised lines running along the faults. There are fault lines at 45 degree angles taking the rivers to the coast. The whole system is dictated by these underlying fault lines that cause the river to jump around in very angular manner. There is also a little tiny fault which has uplifted and exposed old rock around 50 – 80 million years ago.
- In the lower part of the catchment, there is a large sheer zone with a massive amount of movement. The rocks are pulverised in this particular area and it runs from the Tully catchment all the way up to the Russell and Mulgrave and is called the 'Mulgrave Sheer Line'. The sheer zone is found right up through the alluvium and has quite a large impact on how the catchment flows.
- At the top of the upper Johnstone rainforest occurs with untouched National Park. One single river flows through the National Park and out the other side, capturing the water from all of the Upper Johnstone. This could provide a great opportunity for monitoring water quality as the water flows into the rainforest, as the water flows out of the rainforest and below.
- The Johnstone was primarily pastoral (dairy and beef) development on the tablelands and agriculture (sugar and bananas) on the coast (The Johnstone River Management Plan 2013).

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- The vegetation is representative of the high biodiversity of vegetation both natural and exotic that characterises most Wet Tropics catchments. However, remnant areas become sparser closer to Innisfail (The Johnstone River Management Plan 2013).
- North Liverpool is clean compared to the Johnstone because of its granite catchment. The fines that are coming out of the basalt are most likely making the Johnstone look unclean.
- Turbidity due to fine sediments suspended in flow is frequently very high even in minor floods and the river and tributaries often “run red” rather than milky white or brown colour that is typical of rainforest discharges in the region (The Johnstone River Management Plan 2013).
- The Johnstone basin generates the highest proportion of the anthropogenic pollutant loads to the Wet Tropics load for DIN (45%) and DIP (23%), and the second highest regional contributions for TSS (20%), PN (33%), PP (35%) and PSII herbicides (20%).
- The greatest anthropogenic loads of DIN and PSII herbicides are sourced from sugarcane
- A suite of pesticides has been detected in the sediments and the leaf tissue of mangroves in the lower North Johnstone River although there is no recommended guideline level for these habitat in the ANZECC (2000) guidelines in which to assess the condition of this lower section of river. These pesticides include diuron, atrazine, simazine, hexazinone, tebuthiuron, ametryn, metolachlor, pendimethalin, chlorpyrifos, protiphos, diazinon and chlorfenvinphos. (Godfrey, P.C. and R.G. Pearson 2012).
- The potentially impacted areas of the Johnstone River are habitat to populations of Lake Eacham rainbowfish listed as ‘Endangered’ under the EPBC (1999), the recently described rainbowfish, *M. utcheensis*, other strains of rainbowfish, a new, but as-yet-undescribed, species of hardyhead (Pusey pers. comm.) and at least five frog species presumed extinct or listed as “Endangered’ under the EPBC (1999) (Richards et al. 1993).
- The Johnstone catchment contains many banana areas with slope in excess of 3% (Sing, N., Barron, F. 2014).
- Coarse sand 0.2µm, fine sand = 9µm, Silt 75µm and clay 15µm (Brodie et al 2014).
- The Johnstone has the second largest area of sugar cane (16%) in the region.
- The Johnstone basin includes 10% of the regional grazing area (including dairy).
- Bananas are mainly grown in the Johnstone (66km²)

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Map 01

Overview Upper Johnstone


This is a high rainfall area matched only to Tasmania. This particular area comes out as a hotspot due to the rainfall and the added advantage of basalts. The extra rainfall and permanently flowing rivers create very important areas.

An important note is not to use technologies and solutions that are designed for temperate climates. North Queensland technologies are needed and the solutions for Liverpool Creek will be different from the Johnstone River.


CSIRO Research (NERC funded) by Helen Murphy has looked at the persistence and effect of bramble and the mapping of it and how long it persists, if it is growing or shrinking. Currently there is no solution on how to deal with it, currently QPWS is in the planning stage of trials.

UPPER JOHNSTONE										
Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
240 Douglas Creek Djallan Creek Rosina Creek Jordan Creek Henrietta Creek Goldern Creek Wenginianie Creek	<p>Slopes</p> <p>Up to 604m at the highest peak and several other peaks.</p> <p>Land Zones</p> <p>Mostly at upper slopes and headwaters:</p> <p>- 8 (Basalt plains and hills)</p> <p>Some</p> <p>- 12 (Hills and lowlands on Granite rocks) around Rosina, Goldern, Wenginianie and Jordan Creek</p> <p>Headwaters of Douglas Creek area:</p> <p>- 11 (Hills and lowlands on metamorphic rocks).</p> <p><u>Upper</u></p> <p>Steep.</p> <p>Two main creeks Henrietta (more undulating) and Douglas Creek (steep with gorges) – both have a lot of waterfalls they join together just before they enter the Johnstone below Crawford's lookout.</p>	<p>In the upper slopes and headwaters:</p> <p>Mainly:</p> <p>Large areas of:</p> <p>- Granite (at top of sub catchment in head waters of Henrietta Creek)</p> <p>Some:</p> <p>Metamorphics</p> <p>Mudrock (bottom of sub catchment near Douglas Creek)</p> <p>Little bit of basalt in the upper part with fractured rocks.</p> <p>A little bit of alluvial development but most are washed clean.</p> <p>These systems do not have a lot of alluvium.</p> <p>No sand and silt build up.</p>	<p>2801 – 4001 mm/yr</p> <p>Henrietta has waterfalls just before it hits the Douglas</p>	<p><u>Upper</u></p> <p>Fast run off</p> <p>Two main creeks are permanent – some of the tributaries disappear.</p> <p>The channel is bedrock confined and very incised – initially flowing through granites and then basalts on sandstone-mudrocks.</p> <p>Some areas have boulders quite a few rock bars</p> <p>Minimal alluvium.</p> <p>Few paleo channels underneath basalts.</p> <p>Quite a few rock bars.</p>	<p>A lot of infiltration - surface to groundwater connection.</p> <p>Some of creeks will disappear underground in dry season. While there is permanent flow in the system, not always on the surface.</p> <p>South of the Johnstone Gorge. Creeks on the metamorphics have a fair bit of fracturing.</p>	<p>Land use:</p> <p>All:</p> <p>- Nature conservation = 99.6%</p> <p>(Wooroonooran National Park)</p> <p>Previous logging – fairly selective in that area, some old tracks.</p> <p>Ex goldfields were quite extensive throughout creeks and tributaries in the 1900s and has modified the landscape.</p> <p>Mining in the creeks (Jordan Creek) mostly for alluvial gold.</p> <p>Logging selectively also occurred in the area.</p>	<p>- Old powerline corridor straight through the middle.</p> <p>- The Palmerston highway through the middle on a ridge.</p> <p>- Road little impact on water flow</p> <p>- All this area was logged and has an extensive mining history, primarily gold</p>	<p>- no distinct riparian – naturally occurring.</p> <p>The water hits then and runs straight of and not sand can develop – so no riparian.</p> <p>Main channel - Well vegetated.</p>	<p>- Cyclone damage can be seen.</p> <p>- Rare fish around the waterfalls.</p> <p>- No connectivity for catadromous fish.</p> <p>- Chinese headstones present and old steel and mining equipment is still there – potential tourism feature here</p> <p>- .Large feral pig population</p>	



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	<p>Basalt breaks down into colluvium.</p> <p>Water cascades down under the colluvium and slips. This is very common. This can cause a major source of sediment from National Parks.</p> <p>It is unusual to have such large areas of basalt in protected areas.</p> <p>Picture of the area below:</p> 			Limited connectivity because of the waterfalls, stops fish passage.						
Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
238 Several unnamed creeks	<p>Slopes Up to 690m (Mount Poorka) towards the bottom of the catchment. A couple of other peaks found. Approx. 200m – 400m above sea level on the main channel.</p> <p>Land Zones</p> <p>Mostly</p> <ul style="list-style-type: none"> - 11 (Hills and lowlands on metamorphic rocks). <p>Some:</p> <p>At the headwaters and upper catchment:</p> <ul style="list-style-type: none"> - 8 Basalt (plains and hills) 	<p>Mostly:</p> <ul style="list-style-type: none"> - Mudrock - Basalt (around ¼ at top of sub catchment) - Metamorphic 	2801 - 3201mm/yr	<ul style="list-style-type: none"> - Fast flowing and fast run off. - smaller creeks - Ill-defined channels. - Mainly ephemeral creek. - Not same permanency as 240 as not much 	<ul style="list-style-type: none"> - Little infiltration - Some small springs 	<p>Land use:</p> <ul style="list-style-type: none"> - Nature conservation = 99.7% <p>(Wooroonooran National Park)</p>			<ul style="list-style-type: none"> - Vegetation heavily cyclone damaged 	<ul style="list-style-type: none"> - Highest altitude recordings for crocodiles in the gorge - Barramundi and Turtles present. - Pig inundation


Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

				<p>basalt to retain.</p> <ul style="list-style-type: none"> - Johnstone river between 240 and 238 is the gorge, fast, permanent, completely incised. - Big stretches joined by rapids. 						
<p>237</p> <p>Several unnamed creeks</p>	<p>Slopes Up to 500m towards the top of the catchment. Several other peaks found.</p> <p>Not as steep as 238</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 11 (Hills and lowlands on metamorphic rocks). <p>Smaller area of :</p> <ul style="list-style-type: none"> - 8 (Basalt plains and hills) towards east of catchment 	<p>Mostly:</p> <ul style="list-style-type: none"> - Mudrock - Basalt - Metamorphics 	<p>2801 – 4001mm/yr</p>	<ul style="list-style-type: none"> - The main tributary is permanent. - Waterfall near where it runs into the Johnstone (Jones falls). - Not as deep, short or sharp. - Faster run off. - One major channel permanent. - Slips in the north. 	<p>Little bit of surface to groundwater interaction</p>	<p>Land use:</p> <ul style="list-style-type: none"> - Nature conservation = 99.23% <p>(Wooroonooran National Park)</p>			<ul style="list-style-type: none"> - Well vegetated 	<p>Plenty of fish and crocodiles throughout this reach.</p>


Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
<p>218</p> <p>Bridal Veil Creek</p> <p>Brewer Creek</p> <p>Oro Creek</p> <p>Badgery Creek</p> <p>Barong Creek</p> <p>Sandy Creek</p> <p>Duffer Creek</p> <p>Big sub catchment</p>  	<p>Slopes Up to 761m above sea level at headwaters of Badger Creek. Several other peaks.</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 11 (Hills and lowlands on metamorphic rocks). - 8 (Basalt plains and hills) mostly down the centre of the catchment on Badgery Creek. <p>Some</p> <ul style="list-style-type: none"> - 3 (Alluvium) found in small patches on Badgery Creek. 	<p>Large areas of:</p> <ul style="list-style-type: none"> - Mudrock (Large amount of mudstone all the way down and basalt down to the main channel). - Basalt (down main channel) - Metamorphics - Naturally no alluvium 	<p>2401 – 4001mm/yr</p>	<ul style="list-style-type: none"> - Badgery Creek – permanent flowing. - Channel is incised and a lot of bedrock controls. - Slips along the main channel itself. Two large slips on the Johnstone main channel, natural slips – and no obvious cause. River cobble at the top. - Deep into the Johnstone around 3-4m deep in places e.g. at the 	<ul style="list-style-type: none"> - Ground water to surface water interaction – driven by the basalts. - There may be paleo channels running through it. 	<p>Land use:</p> <ul style="list-style-type: none"> - Nature conservation = 99.8% - (Wooroonooran National Park) - Late 1980's logging tracks. - Gold on Badgery Creek and Sandy Creek. 		<ul style="list-style-type: none"> - Water quality – good and clean on Badgery Creek. - Fines occur in flood events. - Godfrey assessment: HEV Most of streams in division 13 possess high land-use scores as their catchments are located in rainforest areas within protected reserve on the southern and central slopes of the Francis and Walter Hill ranges. (Godfrey report and GIS data). - Feral pigs have visual impacts on the water clarity of streams in protected sub- 	<ul style="list-style-type: none"> - Well vegetated - Cyclone damage or slips enable the areas to be colonised by giant brambles. - Brambles originally brought in for gardens and dispersed by birds. - Naturally not much riparian. - Giant Bramble has colonised large disturbed areas throughout this section 	<ul style="list-style-type: none"> - Fish above the falls. Jungle perch and sooty grunter above it and Barramundi at the mouth = connected.


Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)		SW-GW, recharge areas	Land use	Weirs, dams, infrastructure		
<p>238, 237, 218 (all together) Bagery, Barong, Sandy</p> 	<p>Mostly:</p> <ul style="list-style-type: none"> - 11 (Hills and lowlands on metamorphic rocks). - 8 (Basalt plains and hills) towards east of catchment <p>Small amount of</p> <ul style="list-style-type: none"> - 3 (Alluvium) found in small patches on Badgery Creek. 	<p>Mudstone – metamorphics material. Little bit of basalts but more metamorphics.</p>	<ul style="list-style-type: none"> - This whole area holds a lot of water. 	<ul style="list-style-type: none"> - Fast flowing - Smaller creeks - Ill-defined channels. - Sharper as there is not as much basalt as 240. - The water hits and runs straight out. - Ephemeral water holes. - Waterfalls into the gorge. - <u>Johnstone River Gorge area.</u> - Fast permanent incised. - Waterholes flow permanently joined by rapids. - Impressive good flows all year round and good connectivity way up. 		<ul style="list-style-type: none"> - All National Park - (Wooroonooran National Park) 		<ul style="list-style-type: none"> - No infrastructure or previous gold mining. 	<ul style="list-style-type: none"> - Vegetation highly effected by cyclones. 	<ul style="list-style-type: none"> - Stream crocodiles have been found all the way up (highest recordings for crocodiles). - Pythons come out in winter time aggregate in the rocks.


Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Reach name, polygon number	Natural terrain	Natural hydrological	Modifications	Sediment and water quality issues	Riverine vegetation condition	Other			
231 – Overview Wadda Creek Chunga Creek Bora Creek Western Creek Fisher Creek Kay Creek Banana Creek Eleven Mile Creek Rankin Creek	<p>Slopes Up to 367m towards Jones Falls rapids. Several other peaks. 200m above sea level on the main channel.</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 8 (Basalt plains and hills) <p>Some</p> <ul style="list-style-type: none"> - 11 (Hills and lowlands on metamorphic rocks). - 3 (Alluvium) 	<p>Large areas of:</p> <p>Mostly:</p> <ul style="list-style-type: none"> - Basalt <p>Some</p> <ul style="list-style-type: none"> - Mudrock (around Rankin Creek, Eleven Mile Creek) and Western Creek. <p>Metamorphic, similar to the above.</p>	2401 – 4001mm/yr	<ul style="list-style-type: none"> - Creek lines off the ridge. - fast runoff - not permanent 	- Chunga Creek fed from spring	<p>Land use:</p> <p><u>Upper</u></p> <ul style="list-style-type: none"> - Nature conservation = 10.3% <p>(Wooroonooran National Park)</p> <ul style="list-style-type: none"> - Grazing native vegetation = 39.3% <p><u>Lower</u></p> <ul style="list-style-type: none"> - Irrigated perennial horticulture = 22.37% - Other minimal use 18.82% - Cropping- sugar = 5.4% - Irrigated cropping = 1.14% - (Others less than 1%). - Near the National Park area and across into Rankin Creek area – paddocks are sloping and around 800 acres are grazing. - Towards East Palmerston, agricultural production takes form of irrigated tree fruits (bananas), cropping 		<ul style="list-style-type: none"> - Scouring and sedimentation - Milkiness is coming into Rankin Creek and Bora Creek from the top soil that has been lost over the years and worn down to clays. This causes gully erosion. 	<ul style="list-style-type: none"> - No or little riparian vegetation. - Vegetation - what is there is covered by vines and strangled out. - Trees falling over (smaller trees with little roots). - No trees to shade Creeks - No fencing of river increased water weeds - Revegetation occurring up the top, was previously well vegetated now cleared - No designated cattle crossings cause erosion on slopes. 	<ul style="list-style-type: none"> - More development - Crustaceans disappearing - Massive pig populations - Used to have turtle and platypus populations down to two turtles and not see platypus in the last couple of years.


Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

						(sugarcane), and some grazing (beef). Bananas grown here are the highest elevation on undulating hills				
						- Most of the streams in this division have low land-use scores as their catchments are used extensively for cropping and cattle grazing while some also have residential areas. (Godfrey, P.C. and R.G. Pearson 2012).				
Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
231 – (a) (near to main river)	<p>Mostly</p> <ul style="list-style-type: none"> - 8 (Basalt plains and hills) <p>Some</p> <ul style="list-style-type: none"> - 11 (Hills and lowlands on metamorphic rocks). <p>Small amount of:</p> <ul style="list-style-type: none"> - 3 (Alluvium) 	<p>Large areas of:</p> <p>Mostly:</p> <ul style="list-style-type: none"> - Basalt <p>Some</p> <ul style="list-style-type: none"> - Mudrock 	2401 – 4001mm/yr	Fast run off – metamorphics not permanent.		<p>Land use:</p> <p>Mostly:</p> <p><u>Upper</u></p> <ul style="list-style-type: none"> - Nature conservation (Wooroonooran National Park) - Irrigated perennial horticulture - Other minimal use - Grazing on native vegetation - Other minimal use <p><u>Lower</u></p> <p>Some</p> <ul style="list-style-type: none"> - Irrigated cropping - Irrigated tree fruits - Irrigated perennial horticulture 				



Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
231 (b) Chunga Creek	<p>Mostly - 8 (Basalt plains and hills)</p> <p>Some - 11 (Hills and lowlands on metamorphic rocks).</p> <p>- Small amount of:</p> <p>- 3 (Alluvium)</p> 	<p>Large areas of:</p> <p>Mostly:</p> <p>- Basalt</p> <p>Some</p> <p>- Mudrock</p>	2401 – 4001mm/yr	<p>- Permanent system</p> <p>- Not connected to National Park.</p>	<p>- Good ground water surface water interaction with a spring coming out of basalt.</p> <p>- Gully erosion – side gully's cleared completely – head cut similar to Atherton tablelands.</p>	<p>Land use</p> <p>Mostly:</p> <p><u>Upper</u></p> <p>- Grazing on native vegetation</p> <p>- Irrigated perennial horticulture</p> <p>- Other minimal use</p> <p><u>Lower</u></p> <p>Some:</p> <p>- Cropping sugar</p> <p>- Some of this area was used for bananas.</p> <p>- Major stock route all the way to the tablelands.</p>	<p>- A road crossing small section causing erosion.</p>	<p>- Clear waters.</p>	<p>- At the top re vegetation occurring.</p> <p>- Minimal riparian vegetation – (micro climate)</p> <p>- No vegetation in surrounding area.</p> <p>- Nuns road is forested.</p> <p>- cleared section</p>	<p>- Micro climate is special and found in this area (microclimate for frogs).</p>
231 (c) Rankin Creek Bora Creek Banana Creek	<p>Mostly - 8 (Basalt plains and hills)</p> <p>Some - 11 (Hills and lowlands on metamorphic rocks).</p> <p><u>Rankin Creek</u> Minimal alluvium Elevated, rocky areas</p> <p><u>Bora Creek</u></p> <p>Comes from North down – joins to Rankin. Flows to the east – due to contours.</p>	<p>Large areas of:</p> <p>Mostly:</p> <p>- Basalt</p> <p>Some</p> <p>- Mudrock</p>	2401 – 4001mm/yr	<p><u>Rankin creek</u> –</p> <p>- Incised channel</p> <p>- Incised deep banks all the way down, a lot of rock bars.</p> <p>- Permanently flowing down in this area.</p> <p>- Mouth of Rankin Creek, not</p>	<p><u>Bora Creek</u></p> <p>- Good surface to ground water interaction (through the basalt).</p>	<p>Mostly:</p> <p>- Grazing on native vegetation</p> <p>- Irrigated perennial horticulture</p> <p>- Other minimal use</p> <p>Some:</p> <p>- Irrigated tree fruits</p> <p>- Other minimal use</p> <p>- Cropping sugar</p> <p>- Irrigated cropping</p> <p><u>Rankin Creek</u> – Mixtures of grazing</p>	<p><u>Rankin Creek</u></p> <p>- Dams</p> <p>- Weirs and extraction for bananas – Not just extraction out of channel but also bores. This effects the water table and effects the flow of the stream.</p>		<p><u>Rankin Creek</u> –</p> <p>- Minimum riparian</p> <p>- Vegetation within the stream bed in good condition.</p> <p>- Could be a priority spot for riparian restoration.</p> <p><u>Bora Creek</u></p>	<p><u>Rankin Creek</u></p> <p>- No connections – stocking the rivers with fish – sooty grunter.</p> <p>- Tilapia found here</p> <p>- Bottom of the second falls there is a big indigenous</p>


Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

			<p>barriers to connections.</p> <ul style="list-style-type: none"> - Waterways are the main connections between remanent bits of vegetation. 	<p>deep, stable, rocky, bedrock controlled, confined</p> <ul style="list-style-type: none"> - Middle reaches of Rankin creek have Paleo channels. - Creeks connected back into the foothills in most of the area, these waterway are the main avenue for connection to national park for a range of species. - Meanders increasing in the lower reaches. - <u>Bora creek</u> – - Gully erosion. - Channel more incised further down. - Near Banana Creek the creek runs dry. - Connections across from Bora Creek. - A connecting system. - Quite deep. 		<p>Lime on paddock (seen as a white patch on picture opposite).</p> <p>Bananas in lower areas, a small amount of cane, some grazing to the west in the higher areas.</p> <p><u>Bora Creek</u> – Banana packing shed washes discharge back into the creek, bananas are on elevation so the runoff comes down.</p> <p>Motorbike track</p>	<p>Gauging station</p>		<ul style="list-style-type: none"> - Minimum to no riparian until the lower end. 	<p>cave that has lots of history. The falls are 50 meters apart and area both in council reserve. The bottom falls has a cave.</p>
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Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
231 (d) Rankin Creek	<p>Mostly - 8 (Basalt plains and hills)</p> <p>Some - 11 (Hills and lowlands on metamorphic rocks).</p> <p>Picture showing the location where the colour of the creek changes to milky and the location of the banana shed.</p> 	<p>Mostly:</p> <ul style="list-style-type: none"> - Basalt <p>Some:</p> <ul style="list-style-type: none"> - Mud rock <p>No alluvium</p>	2401 - 2801mm/yr	<ul style="list-style-type: none"> - A deep creek - bedrock confined - The channel has cut through the basalt and runs the whole way through colluvium soils from breakdown of basalt. 		<p>Land use:</p> <p>Mostly:</p> <ul style="list-style-type: none"> - Cropping sugar - Other minimal use - Grazing on native vegetation 		<p><u>Rankin Creek</u></p> <ul style="list-style-type: none"> - Clear to milky – colour go through a clay deposit. See it crossing the bridge at Rankin Creek - Cayland clays (see picture) 	<ul style="list-style-type: none"> - Riparian thin to thick. - Vegetation in stream bed in good condition – has buffer at top of the bank and infill. 	
231, 237, 218 (main channel)		<p>Mostly:</p> <ul style="list-style-type: none"> - Basalt and Mudrock <p>No alluvial</p> <p>Gorgy</p>	<p>2801-3201mm/yr</p> <ul style="list-style-type: none"> - In big floods it flows out. - Some little areas of wetland development associated, lagoons and backwater, natural. 	<ul style="list-style-type: none"> - Confined channel - Rock bars all the way through - High flow paths 	<ul style="list-style-type: none"> - Good SW-GW recharge 	<p>Mostly:</p> <ul style="list-style-type: none"> - Nature conservation (Wooroonooran National Park) - <p>Some:</p> <ul style="list-style-type: none"> - Other minimal use - Irrigated tree fruits - Grazing on native vegetation - Small area of other minimal use (residual native cover) 			<ul style="list-style-type: none"> - Change in vegetation. - Some 'island' high flow paths vegetated, guinea grass, Singapore daisy, hymenachne near Rankin Creek. 	



Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
220 Mirinjo Creek Waraker Creek Deep Creek Hoodoo Creek Harts Gully Culla Creek	<p>Up to 439 (Cooroo Peak) several other peaks.</p> <p>Slopes</p> <p>Land Zones</p> <p>Mostly</p> <ul style="list-style-type: none"> - 8 (Basalt plains and hills) - 11 (Hills and lowlands on metamorphic rocks). <p>Some</p> <ul style="list-style-type: none"> - 3 (Alluvium) on main channel - <p>Basalt running all the way through – fracturing in the old metamorphics</p> 	<p>Large areas of:</p> <ul style="list-style-type: none"> - Mudrock around the top of sub – catchment. - Basalt (around centre and along main channel). <p>Mostly metamorphic with a little bit of fracturing.</p>	2401 – 4001mm/yr	<ul style="list-style-type: none"> - Waraker Creek prone to slips - Permanent - Bedrock controlled and incised. - High flow channel near Cooroo lands. - Waraka Creek – no waterfalls. - Connections back to reef. 	- Good SW_ GW recharge	<p>Land use:</p> <p><u>Upper</u></p> <ul style="list-style-type: none"> - Nature conservation = 70.23% (Wooroonoo ran National Park) - Relatively recent addition to the National Park. - Cocolh – reserve – camping and recreation. <p><u>Lower</u></p> <ul style="list-style-type: none"> - Irrigated perennial horticulture = 4.67% - Grazing native vegetation = 2.23% (at the south of the sub catchment). <p>Previously logged heavily</p> <p>Alluvial goldmining in the 1950's. No current day impacts.</p>	<ul style="list-style-type: none"> - Gaging station put in to see what came off the rainforest areas which has been discontinued (started in 1991). - Fish passage through (a council run causeway) which gets drowned when it floods so connections are maintained 	<ul style="list-style-type: none"> - Waraker Creek – milky not clear. - Highly disturbed rainforest turbidity - Areas of the basin that was once logged (e.g., Waraker sub-catchment) has on-going water quality issues similar to those identified in the upper Mulgrave. (Godfrey, P.C. and R.G. Pearson 2012 and GIS data). - Feral pigs have visual impacts on the water clarity of streams in protected sub-catchments Mystery, Poorka, Lower Badgery, Badgery, Waraker and unprotected areas. (Godfrey, P.C. and R.G. Pearson 2012 and GIS data). 	<ul style="list-style-type: none"> - Giant bramble – disturbed from the past – a recent addition. - A riparian gap identified in the management plan. - Riparian present 	


Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
234 (upper) Martin Creek Berner Creek Fisher Creek Dunkinju Creek Borton Creek Twelve Mile Creek Gordon Creek	<p>Slopes Up to 240m on Fisher Creek. Several other Creeks 200m on the main channel.</p> <p>130m 110m 20m hills present in this area</p> <p>Steep</p> <p>Land Zones</p> <p>Mostly</p> <ul style="list-style-type: none"> - 8 (Basalt plains and hills) some - 11 (Hills and lowlands on metamorphic rocks). - 3 (Alluvium) on main channel and small areas in the centre of sub catchment <p>- Bank erosion in Fisher Creek, - 2-3m high banks in the red dirt, - Erosion as a result of bank clearing, banks undercut.</p> <p>Undulating nature – 100m – 10m from the top.</p> 	<p>Large areas of:</p> <ul style="list-style-type: none"> - Basalt <p>Small area of:</p> <ul style="list-style-type: none"> - Mudrock (around Dunkinju Creek and Borton Creek). <p>Upper end all basalt.</p> <p>Alluvium highly erodible and areas slump.</p> <p>Alluvium highly erodible – due to it being from basalt particularly in these areas. Very fine material can't get back out of suspension</p> <p>Little floodplain or alluvium.</p>	2401 – 4001mm/yr Gregory falls – 5-10 m (natural barrier to aquatic biota)	<ul style="list-style-type: none"> - Incised system past the falls - runoff very rapid - Fishers largest tributary - Gully erosion - Bank erosion, subsiding & undercutting common in cleared areas along Fishers Creek - Permanent flowing system - Basalt – feeding the stream might be dry at times at the top. - Fisher Creek is the biggest tributary – with an impressive waterfall in a quarry at Berner Creek. - Fisher creek into main channel – river changes below Palmerston Rocks National Parks as it start to get alluvium and ox bows and a unconfined system. - In the alluvial area – start to run into problems by keeping the river in its place as it naturally bounces around. 	<ul style="list-style-type: none"> - Good surface to ground water interaction. - Fisher Creek and rainfall flow into alluvium recharging it which creates a wet area. - Springs from basalt – lower in catchment. 	<p>Land use:</p> <ul style="list-style-type: none"> - Grazing native vegetation = 50.4% - Cropping = 20.5% - Irrigated perennial horticulture =10.48% - Other minimal use = 10.66% - Residential = 2% - Nature conservation = 1.62% <p>(Japoon National Park and Palmerston Rocks National Park)</p> <p>At the end of Fisher Creek into the cane area there is a nature refuge as well as National Park and council reserve.</p> <p>Tea plantation in upper (see picture opposite).</p> <p>All grazing with some bananas and tea at the tip</p> <p>Area below Palmerston Rocks National Park is bananas and sugar cane.</p> <p>Quarry (Basalt – blue metal).</p>	<p>Weirs causeway above Gregory Falls.</p> <p>Development close to channel in alluvial area.</p> <p>400ft above sea level – quarry at 100m.</p> <p>Fisher Creek – Ridgeline and road all the way down through on the south side.</p> <p>Straightening of the channel (artificial).</p>	<ul style="list-style-type: none"> - Sediment coming out of the quarry - Bauxite causing aluminium issues. - DPI – found alluvium associated with this area. - Lots of sediment. 	<p><u>Upper</u> Riparian minimal and disconnected.</p> <p><u>Lower</u> Riparian – minimal– erosion causes the river to run red in high flow events.</p>	<ul style="list-style-type: none"> - Remnant endangered area. - An endemic species of turtle to Johnston River called the Johnstone River snapping turtle <i>Eseya irwini</i>. - Rehabilitai on potential, however issues with alluvium.


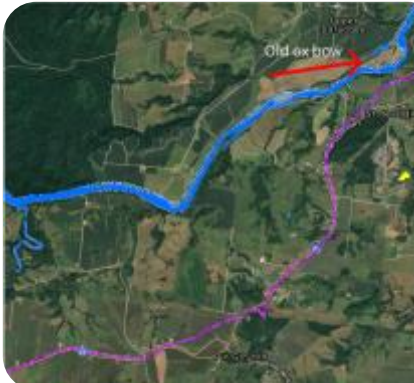

Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

				<ul style="list-style-type: none"> - Will jump around quite a lot. Big rock bar where the roads are built on - outcrop of Hodgkinson's formation – small amount is exposed. - Main channel with lots of feeder systems. - Meanders in creek getting broader so a faster flowing creek. - Berner Creek complex on western side of ridge from Fisher and then joins Fisher down the system. 						
										
Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
234 (lower) Martin Creek Berner Creek Fisher Creek Dunkinju Creek Borton Creek Twelve Mile Creek Gordon Creek	<p>Slopes Up to 240m on Fisher Creek. Several other Creeks 200m on the main channel.</p> <p>Land Zones</p> <p>Mostly</p> <ul style="list-style-type: none"> - 8 (Basalt plains and hills) some - 11 (Hills and lowlands on metamorphic rocks). - 3 (Alluvium) on main channel and small areas in the centre of sub catchment <p>Steep contours slow the water. Very steep area to have cane.</p> <p><u>Lower</u></p>	<p>Large areas of:</p> <ul style="list-style-type: none"> - Basalt <p>Small area of:</p> <ul style="list-style-type: none"> - Mudrock (around Dunkinju Creek and Borton Creek). <p><u>Lower main channel</u></p> <p>Metamorphic – basalt rock bar.</p>	<ul style="list-style-type: none"> - 2401 – 4001mm/yr - Waterfalls right in the quarry – major disconnection to the stream. 	<ul style="list-style-type: none"> - The river is migrating as there is no riparian slowing it down. - <u>Lower main channel</u> - Pool and riffle to the tidal section in stone island. - Well incised and confined. - Permanent Creek. 	<ul style="list-style-type: none"> - Surface to groundwater interaction - Water coming from basalt either side. 	<p>Land use:</p> <ul style="list-style-type: none"> - Grazing native vegetation = 50.4% - Cropping = 20.5% - Irrigated perennial horticulture = 10.48% - Other minimal use = 10.66% - Residential = 2% 	<ul style="list-style-type: none"> - Cross drains in some paddocks to slow the water down. - Some land levelling away from the red soils. 	<ul style="list-style-type: none"> - The creek is milky in colour. - Straight from cane into the creek 	<ul style="list-style-type: none"> - Through the cane very minimal riparian - Thunbergia and Kudzu (weed/vine) is found in Fishers and Berner Creek. 	<ul style="list-style-type: none"> - Bull sharks (5ft 60 pounds) and stonefish present. - No packing shed with cane

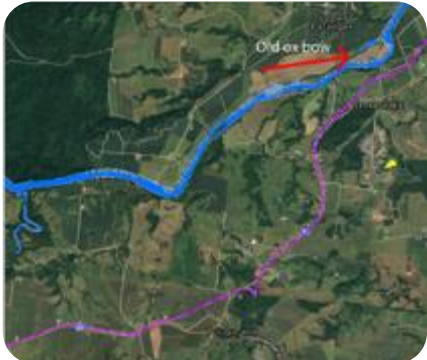
Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

	<p>Banks – various 5-6m deep terracing (natural).</p> 			<ul style="list-style-type: none"> - No paleo creeks in Hodgkinson formation. 		<ul style="list-style-type: none"> - Nature conservation = 1.62% - Japoon National Park - Palmerston Rocks National Park <p>Grazing most the way down and at the end sugar cane and bananas very similar to Fisher Creek.</p> <p>No irrigation on cane only on banana's and no natural drainage.</p>				
Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
233	<p>Slopes Up to 80m</p> <p>not much steepness</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 8 (Basalt plains and hills) <p>Some</p> <ul style="list-style-type: none"> - 3 (Alluvium) on main channel - 11 (Hills and lowlands on metamorphic rocks). Small area top of sub catchment. <p>Gully erosion</p>	<p>Large areas of:</p> <ul style="list-style-type: none"> - Basalt <p>Small area:</p> <ul style="list-style-type: none"> - Mudrock (small area) - Alluvium (on main channel) <p>The creek parallel to north Johnstone is on an alluvial terrace surrounded by basalt.</p>	2401 – 4001mm/yr	<ul style="list-style-type: none"> - flashy, gullies, - not much catchment so ephemeral, - High flow channel in foot of basalt. - Ox bow by fisher creek <p>Lower floodplain – unconfined system – erosion and breakthrough in ox bows. Risk of a breakthrough of a flood.</p> <p>Smaller creek lines, short, underlain by basalt.</p> <p>Often on the high flow channel that</p>		<p>Land use:</p> <ul style="list-style-type: none"> - Grazing native vegetation = 42.67% - Cropping – sugar = 19.3% - Irrigated perennial horticulture = 17.3% - Other minimal use = 10.8% - Residential = 6.58% - Irrigated cropping = 1.97% <p>Lots of crops – cane or bananas more and more as</p>			<ul style="list-style-type: none"> - patchy to no riparian 	<ul style="list-style-type: none"> - Flashy system - not a lot of catchment - Old ox bow – bananas drain into ox bow – acting as a bit of a treatment – if it wasn't there would be anything between main channel and bananas. - no significant hydrological features




Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

	 			<p>is higher than the river itself, areas of gully erosion</p>		<p>you go further down. Bananas right close to the bank and drain back into the lowland area – natural levees.</p> <p>Bananas in the alluvium along the river that drains back into an old oxbow area on the river.</p>				
<p>Main channel between 234, 220 and fisher creek</p>	<ul style="list-style-type: none"> - 8 (Basalt plains and hills) - 11 (Hills and lowlands on metamorphic rocks). Small area top of sub catchment - 3 (Alluvium) on main channel 	<ul style="list-style-type: none"> - Metamorphics driving direction of flow, - Basalt rock bar. - Basalt ridge to the south 	<p>2401 - 4001 mm/yr</p>	<ul style="list-style-type: none"> - Pool riffle system down to tidal area (stone islands) - Confined channel - 5-6m banks - Terracing - If close to basalt vent, you tend to get palaeochannels but no evidence that this is occurring here but not really investigated 	<ul style="list-style-type: none"> - Water coming from basalt and baseflow 				<ul style="list-style-type: none"> - No riparian 	<ul style="list-style-type: none"> - Bull sharks - Stonefish - Bull sharks




Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
224 Tregothanaan Creek (main Creek) Joongoon Creek	<p>Slopes Up to 270m at headwaters of Tregothanaan Creek. Several other peaks.</p> <p>By the river fairly flat then terraced up into a plateau</p> <p>Flat with some metamorphic hills</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 8 (Basalt plains and hills) - 11 (Hills and lowlands on metamorphic rocks). At headwaters of Joongoon Creek <p>Some</p> <ul style="list-style-type: none"> - 3 (Alluvium) main channel <p>Tongue of basalt, hold for eroding area</p> 	<p>Large areas of:</p> <ul style="list-style-type: none"> - Basalt (headwaters of Tregothanaan Creek - Alluvium (along main channel) - Mudrock <p>Basalts in the west.</p> <p><u>East</u></p> <p>Shallow Alluvium in the east and as you move down.</p> <p>Mainly clay in this area and not moving that fast.</p> <p>Creek systems in basalt</p>	<p>2401 – 4001mm/yr</p> <p>River terrace – flood out area (see picture).</p> <p><u>Lower</u></p> <p>Pool riffle to Stone Island then tidal.</p> <p>Last rapids – tidal limit in straight stretch – estuarine.</p>	<ul style="list-style-type: none"> - Main creek permanent - Permanent bed rock controlled – until the lower part. - In the alluvium the river flips over to the other side. - Waterhole - Well connected system. <p><u>East –</u></p> <ul style="list-style-type: none"> - There is some basalt that comes down holding the water and not letting it erode. - No defined creeks systems. - Straight banks getting into stiffer clays on the bend and clays in the river acting as bars in this area where 224 ends - 20 m high eroding bank, mainly clay. - There was a time when the river was really low. 	<ul style="list-style-type: none"> - Irrigated from Johnstone River. - Good surface to ground water interaction. 	<p>Land use:</p> <p>Mostly:</p> <p><u>Upper:</u></p> <ul style="list-style-type: none"> - Nature conservation = 25.15% <p>Headwaters in National Park</p> <p>Wooroonooran National Park</p> <ul style="list-style-type: none"> - Grazing native vegetation = 37.44% <p><u>Lower</u></p> <ul style="list-style-type: none"> - Other minimal use = 17% - Irrigated perennial horticulture = 15.24% <p>Grazing in the middle as you get down to the Johnstone – alluvial areas – bananas no cane.</p> <p><u>East</u> - all bananas and little bits of cane (used to be cane).</p>	<ul style="list-style-type: none"> - No dams or weirs. - Pumping station – water intake for the town of Innisfail. - If the river takes a different route wouldn't run past the water intake for the town – so needs to stabilise this areas - Few drainage to the east. 	<ul style="list-style-type: none"> - Issues with the gravel roads and sedimentation. 	<ul style="list-style-type: none"> - Minimal riparian – patchy in the Johnstone. - Highly disturbed weed infested – bramble, Siam weed and lantana. <p><u>East –</u></p> <ul style="list-style-type: none"> - Little riparian. 	<ul style="list-style-type: none"> - Coming straight out the natural flow – no impoundment. - <u>East</u> - A crocodiles lives here on Stone Island (see picture for location). - Out of riffle into estuarine Stone Island is the cut off between the two and becomes tidal. During low flows the salt water has been known to come up but is generally not the case. - Few landholders and lots of rural residential – all on septic systems.

Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

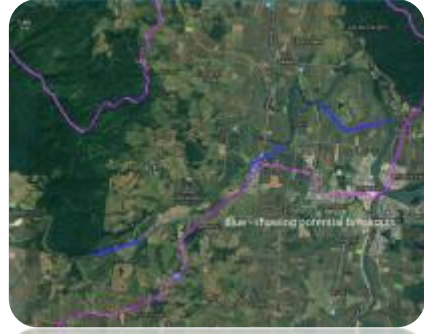
  										
<p>211 Fitzgerald Creek Victory Creek Daradgee ck</p>	<p>Slopes Up to 44m in height.</p> <p>Very flat</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 11 (Hills and lowlands on metamorphic rocks). - 8 (Basalt plains and hills) 	<p>Large areas of:</p> <ul style="list-style-type: none"> - Alluvium - mudrock <p>Small area of:</p> <ul style="list-style-type: none"> - Basalt 	<p>2801 – 4001mm/yr</p> <ul style="list-style-type: none"> - Rainshadow - Previously wetlands. It used to be palm swamps. Soupy when 	<p><u>Fitzgerald creek</u>– Permanent system. Incised in the floodplain not a confined system –</p>	<ul style="list-style-type: none"> - Good ground water interactions in alluvial areas. - Victory Creek - Doesn't have the same sinuosity 	<p>Land use:</p> <ul style="list-style-type: none"> - Cropping – Sugar = 52% - Grazing Native vegetation = 19.43% 	<ul style="list-style-type: none"> - Drained - <u>Victory Creek</u> modified and straightened in places. 	<ul style="list-style-type: none"> - Disturbed creeks - <u>Fitzgerald</u> - Pollution – looks like wash from banana packing sheds – sudy water. Also seen sediment occasionally. Water 	<p><u>Fitzgerald Creek</u></p> <ul style="list-style-type: none"> - No riparian at all. - Some revegetation (narrow) 	<ul style="list-style-type: none"> - Great opportunity for wetland treatment – already has constructed wetlands. - Located on the other side

Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)


<p>- 3 (Alluvium)</p> <p>Quite a large catchment.</p> <p>Fitzgerald Creek</p>  <p>Picture below showing where the palm swamps used to be and the straightness of Victory Creek.</p>  <p>Picture below showing artificial wetlands</p> 	<p>Alluvium and basalts (do not let water out).</p> <p>Not a lot of sand in the system.</p>	<p>wet rock when dry.</p> <ul style="list-style-type: none"> - Water logging from water in adjacent creek – levee near creek – cane roots in water table – perched water table. - The whole creek is a filtering treatment - A small constructed wetland is found here. - <u>Victory Creek</u> - Areas to the east goes underwater on high flow events – - Used to be palm forest swamps (see picture). 	<p>can jump around in the future.</p> <p>Can see paleo channels running all the way through the alluvial.</p> <p><u>Victory Creek</u></p> <ul style="list-style-type: none"> - Straightened (fault line) very flat and deep drain and incised and modified. - Slow flow, lack of elevation. - Less energy, low elevation, high water table. Lot of water close to system. - Low flow system - Permanent. - Good connectivity through the system. 	<p>probably because the soil has more clay – so holds it in place.</p> <ul style="list-style-type: none"> - Low transmissivity soils 	<ul style="list-style-type: none"> - Irrigated perennial horticulture = 10.85% - Other minimal use = 8.21% - Residential = 7.74% <p>Palm swamp which is grazed most of the time</p> <p>Limited value in agricultural area.</p>		<p>quality issues but not yet well defined.</p> <ul style="list-style-type: none"> - WQ issues but not well defines and not good info on this. - A lot of significant weeds, highest concentration of national, state and local weeds - <u>Victory Creek</u> Limnocharis present in Victory Creek - water weed in highest concentration of national and state declared weed in this area. - Water quality monitoring just downstream of stone island 	<p>further down the system.</p> <ul style="list-style-type: none"> - Palm swamp – full of pond apple - Small patch of high value forest. - <u>Victory Creek</u> – mixed riparian – 	<p>from Eubanangee – so most likely an old wetland area.</p> <p><u>Victory Creek</u></p> <ul style="list-style-type: none"> - Good aquatic connectivity, crocodiles up near vasta view
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Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)


Picture below showing potential breakout areas.



Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
214 Stone Creek Polly Creek Catelan Creek Sandfly Creek	<p>Slopes</p> <p>Up to 294m (Seymour Range) at the headwaters of Sandfly Creek. Several other peaks in the range - One at headwaters of Polly Creek (274m).</p> <p>Land Zones</p> <p>Mostly</p> <ul style="list-style-type: none"> - 11 (Hills and lowlands on metamorphic rocks). - 3 (Alluvium) main channel <p>Some</p> <ul style="list-style-type: none"> - 8 (Basalt plains and hills) - 1 (Tidal flats and beaches) - 2 (coastal sand dunes) at coast <p>Eastern side – low lying naturally inundated.</p> <p>Not a big catchment</p> <p>Summary</p> <p>Flat area on the eastern side – wetter as it gets lower – potential of reinstatement of wetland areas. The estuarine area has mangroves and impeded flood gate stops the estuarine flowing into it.</p> 	<p>Large areas of:</p> <ul style="list-style-type: none"> - Metamorphic rock - Alluvium <p>Small area of :</p> <ul style="list-style-type: none"> - Basalt (at headwaters of Stone creek) <p>Metamorphic – ancient – same range that runs all the way down to Liverpool Creek and has the bar on the Russel.</p>	<p>2401 – 4001mm/yr</p> <ul style="list-style-type: none"> - Lots of water holes. - Not a lot of airflow the area in rain shadow used to be a wetland. - Bigger tides go backwards here. - Small estuarine area for the size of the river and the catchment. - Rain shadow 	<p>Fast and flashy</p> <ul style="list-style-type: none"> - permanent water from fractured rock - aquifers, - spring fed - Bedrock controlled - Small and confined until you get to the end. - Connection through that has the reef value. - Creeks are not big enough for Innisfail to get its water from here. 	<p>No major water sources – fractures not high yielding.</p>	<p>Land use (whole of 214)</p> <p><u>Upper</u></p> <ul style="list-style-type: none"> - Nature conservation = 11.15% (Ella Bay National Park) - Other minimal use= 34.5% - Cropping sugar = 23.77% (near Stone Creek) - Grazing native vegetation = 8.31% <p><u>Middle and Lower</u></p> <ul style="list-style-type: none"> - Residential = 6.39% - Irrigated perennial horticulture = 5.84% - Marsh/wetland = 5.02% - Grazing modified pastures = 1.3% - Services = 1.57% <p>Free hold and crown forest.</p>	<p>Stone creek – straightened.</p> <p>No major drains only artificial levee in southern bank.</p>	<p>Clear water.</p>	<ul style="list-style-type: none"> - Good vegetation. - Previously been logged all 7-11 - 1 – best RE in the Wet Tropics. - Mangrove along banks. 	<ul style="list-style-type: none"> - Endemic fish – rainbows and blue eyes. - Pitcher plants. - Important area for cassowaries up to Russell Heads. - Rural residential in the hills. - Wetland opportunity here.

Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
214 (Lower section in more detail)	<p>Slopes Up to 294m (Seymour Range) at the headwaters of Sandfly Creek. 12m at lowest peak.</p> <p>Summary Flat area on the eastern side.</p> <p>Land Zones</p> <p>Mostly:</p> <ul style="list-style-type: none"> - 11 (Hills and lowlands on metamorphic rocks) at top of lower channel at headwaters of Sandfly Creek. - 3 (Alluvium) towards btoom of sub catchment and main channel <p>Some:</p> <ul style="list-style-type: none"> - 1 (Tidal flats and beaches) - 2 (coastal sand dunes) at coast 	<p>Mostly:</p> <ul style="list-style-type: none"> - Metamorphic rock - Alluvium 	<p>2401 – 2801mm/yr</p> <p>It area gets wetter as it gets lower – potential of reinstatement of wetland areas.</p> <p>Main channel tidal</p>	<ul style="list-style-type: none"> - Potential for break out at Eaton across out to the mangrove – could cut the southern area across. - High flow - The river at the mouth drops a 1m. - A rock bar deep water after this and can be shallow around this areas where mangroves - Potential for breakout around Eaton (see picture). 		<p>Landuse:</p> <p>Mostly:</p> <p><u>Upper</u></p> <ul style="list-style-type: none"> - Other minimal use - Grazing on native vegetation <p>Some:</p> <p><u>Upper</u></p> <ul style="list-style-type: none"> - Nature conservation (Ella Bay National Park) <p>Lower</p> <ul style="list-style-type: none"> - Residential services - Carello Palm Swamp Conservation Park <p>Estuarine area – unsuitable for agriculture.</p>	<ul style="list-style-type: none"> - Flood gate stops the estuarine flowing into it (see picture opposite) - <u>Flying Fish point</u> - Levee at the end of the system that was built before 1972. This is a bottle neck causing massive flooding to the area (see picture opposite). - Innisfail estate – sewage – pipeline proposal nearly in line with the bridge for future. - Innisfail estate – sewage (cannot handle the area to the north more as than 50 lots) This is part of the town plan. - Cane might be sub divided in the future. 	<p>- ASS soils in this area</p>	<ul style="list-style-type: none"> - Not many mangroves at the bottom end. There is too much push from the freshwater for them to survive. - Lots of Pond Apple infestation in fresh reaches - Johnstone River die back due to competition for views of the river. The mangroves are being taken out. - <u>Flying fish point</u> - Innisfail estate – estuarine area – vegetation to east is mapped as mangrove with a bit of freshwater on the back of it (right hand side of Eaton). - Small amount of mangrove for a vast system. - No riparian 	<ul style="list-style-type: none"> - Tilapia on upstream side of the floodgate present

Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

South Johnstone


MAP 01 Grid 2 Upper Johnstone (264 - 243)

Overview



- Fine, silty, fertile alluvium can be found from Hart's Gully to the coast.
- Alluvium is derived from basalt parent materials, and is underlain by sandstone-mudrocks and metamorphics.
- There is significant alluvial groundwater development in this area, at the eastern limits of the basalt flows, but this water is difficult to extract due to the low transmissivity of fine silty alluvial soils.
- Domestic water supplies for Innisfail are gained from weirs.
- Flying Fish Point is based on the coastal metamorphic formation, and domestic water is supplied from reservoirs.
- There may be a hydrological connection with Russell Basin to the north through the top layers of alluvium between Vasa Views and Garradunga – but this connection is superficial as indicated by the outline of Eubenagee Swamp.
- There is little riparian vegetation and wetlands are limited.
- The North Johnstone River flows through a wide, flat, deep alluvial plain and joins the South Johnstone River in the coastal zone downstream of Innisfail. From this point onwards, the coastal zone is part of the South Johnstone sub-catchment.
- The Johnstone River flows out into the sea through a very narrow outlet between two ridges of metamorphics.
- Flooding in this confined alluvial plain can be significant and extensive

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
264 Downey Creek	<p>Slopes Up to 932m at headwaters of Downey Creek. Several other peaks.</p> <p>Land Zones</p> <p>Mostly</p> <ul style="list-style-type: none"> - 12 (Hills and lowlands on Granite rocks) at headwaters of Downey Creek - 11 (Hills and lowlands on metamorphic rocks).at bottom of sub catchment <p>Some</p> <ul style="list-style-type: none"> - 8 (Basalt plains and hills) through centre of sub catchment - 3 Alluvium (small area through centre on 8 land zone. <p>Reasonable steep and big sides of flat.</p>	<p>Large areas of:</p> <ul style="list-style-type: none"> - Granite (at headwaters of Downey Creek) - Basalt (through the centre of sub catchment) - Mudrock (at bottom of sub catchment) <p>Jarra Creek and Tully fault lines. Classic fault lines with two different geologies.</p> <p>Just upstream from an area of interesting geological feature where the river drops into a fault line and does a 90 degree turns (see picture opposite).</p>	<p>2801 – 4801mm/yr</p> <ul style="list-style-type: none"> - Camellia Falls – two thirds of the way down. - Set of falls below Downey Creek at Binda Falls limiting connectivity through to this area. - Lots of water in the system that runs off into basalts. 	<p>Permanent flow</p> <p>The creek itself is more of a u-shaped valley rather than v-shaped</p> <p>The Johnstone has no connectivity</p>		<p>Land use:</p> <ul style="list-style-type: none"> - Nature conservation = 100% (Wooroonooran National Park) - Department of Defence have lease over some of the area, near to the headwaters of Jarra through to Downey Creek causeway. - Agricultural production on the basalt takes place 	<p>- Light rock bars across creeks.</p>		<ul style="list-style-type: none"> - Fertile and more riparian with redistricted access. 	<ul style="list-style-type: none"> - Downey creek no large fish above main falls but endemic small fish. - Social values - Burials - Cultural significance in this area. - Fish, frog's and aquatic plants including endemic plants. - New Fish species discovered in Downey Jan 2017.


Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

	<p>Where logging tracks closed down there is erosion, along road and where culverts washing out.</p> 					<p>in form of tea plantations near Mamu and Cowley Falls.</p> <ul style="list-style-type: none"> - Fertile land and set aside as a scientific area – never logged so good standard of forest. - Previously lots of gold mining - Cultural significance from gold mining (Jordan Creek) 				
Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
<p>256</p> <p>Egan Creek</p> <p>Weekenah Creek</p> <p>South Johnstone River main channel</p>	<p>Slopes Up to 546m near headwaters of Egan Creek. Other peaks of 360m and 380m.</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 8 (Basalt plains and hills) <p>Some</p> <ul style="list-style-type: none"> - 12 (Hills and lowlands on Granite rocks) at headwaters and main channel - 11 (Hills and lowlands on metamorphic rocks).at bottom of sub catchment and main channel. 	<p>Large area of:</p> <ul style="list-style-type: none"> - Basalt <p>Small amount of</p> <ul style="list-style-type: none"> - Granite in headwaters of Egan Creek 	<p>2801 – 3201mm/yr</p>	<p>Fast run off</p>	<p>Good SW – GW</p>	<p>Land use:</p> <ul style="list-style-type: none"> - Nature conservation =100% (Wooroonooran National Park) 		<p>The pesticide 2,4-D was detected in this middle section of the South Johnstone although the levels did not breach the ANZECC (2000) guideline value (Table 33). The water quality of the streams situated exclusively in the protected reserve of division 16 is likely to be excellent as these streams are located in undeveloped catchments. (Godfrey, P.C. and R.G. Pearson 2012).Godfrey,</p>		


Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
 <p>258 Unnamed creeks</p> <p>Slopes Up to 400m</p> <p>Land zones Mostly</p> <ul style="list-style-type: none"> - 11 (Hills and lowlands on metamorphic rocks).at bottom of sub catchment and main channel - 8 (Basalt plains and hills) <p>Some</p> <ul style="list-style-type: none"> - 12 (Hills and lowlands on Granite rocks) at headwaters and main channel 	<p>Mostly</p> <ul style="list-style-type: none"> - Basalt <p>Some</p> <ul style="list-style-type: none"> - Arenite – mudrock - Granite (top of sub catchment). 	2801-4801mm/yr			<p>Land use</p> <ul style="list-style-type: none"> - Nature conservation =100% (Wooroonooran National Park) 			<ul style="list-style-type: none"> - Fertile and more riparian than we have had and restricted in its access. 	<ul style="list-style-type: none"> - Burials - Lots of previous gold mining - Cultural significance in this area. 	


Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
254 Mitcha Creek Mitchaburra Creek South Johnstone River main channel	<p>Slopes Up to 73m near Cowley falls</p> <p>Steep catchment</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 8 (Basalt plains and hills) <p>Some</p> <ul style="list-style-type: none"> - 11 (Hills and lowlands on metamorphic rocks). Small area on main channel at bottom of sub catchment. <p>Not a big catchment.</p> 	<ul style="list-style-type: none"> - Large area of Basalt - Basalt is quite old - Permanently confined and big granite boulders underneath. - Not a lot of sediment 	2801 - 4001mm/yr Mitcha Creek has Cowley Falls with a 100m drop Told by a cane farmer in the 60's South Johnstone was reduced to pools.	<ul style="list-style-type: none"> - In the main channel – South Johnstone has near permanent flows and is incised - Not frequent that it dries up - Connections above waterfall are minimal. 	Surface flow may continue	Land use: - Nature conservation = 99.8% (Wooroonooran National Park).		<ul style="list-style-type: none"> - Very clear water - The pesticide 2,4-D was detected in this middle section of the South Johnstone although the levels did not breach the ANZECC (2000) guideline value (Table 33). The water quality of the streams situated exclusively in the protected reserve of division 16 is likely to be excellent as these streams are located in undeveloped catchments. (Godfrey, P.C. and R.G. Pearson 2012). 	Well vegetated Around the falls – an area of fern land from the spray of the water. - Most of the streams in division 16 have excellent riparian habitats as the majority of the sub-catchments are entirely protected forest reserve while the reaches of three streams which extend beyond the protected estate display some fragmentation and thinning along their banks (Table 33). Overall, the condition of the streams in division 16 was classified HEV, HEV or SDa. (Godfrey report and GIS data).	<ul style="list-style-type: none"> - Important cultural values in Mitcha Creek - Offtake for Innisfail (north Johnstone only).


Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
262 Several unnamed creeks	<p>Slopes Up to 706m other heights of 444m and 200m.</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 11 (Hills and lowlands on metamorphic rocks). <p>Some</p> <ul style="list-style-type: none"> - 8 (Basalt plains and hills) <p>Everything to south of the causeway flat, north of causeway gorges.</p> <p>Similar to Downey but not the same volume of water and not on a fault line.</p> 	<p>Mostly:</p> <ul style="list-style-type: none"> - Mudrock - Basalt (top of catchment in the gorge). 	4000 – 4801mm/yr	<ul style="list-style-type: none"> - Permanent - Waterfalls - Disconnected from the South Johnstone 		<ul style="list-style-type: none"> - Nature conservation = 99.8% (Wooroonooran NP and Japoon NP) - Area was heavily logged. 			<ul style="list-style-type: none"> - Riparian in bottom half 	<ul style="list-style-type: none"> - Endemics – fish and frogs - Aquatic plants
259 McNamee Creek	<p>Slopes Up to 375m at headwaters of McNamee Creek.</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 11 (Hills and lowlands on metamorphic rocks). <p>Some</p> <ul style="list-style-type: none"> - 8 (Basalt plains and hills) <p>Not on a fault line in its own range. Metamorphic and basalts down through it basalt flow.</p>	<p>Large area of:</p> <ul style="list-style-type: none"> - Mudrock - Basalt (mainly through McNamee Creek). 	<p>3201 – 4801mm/yr</p> <p>Similar to Downey but not the same volume of water.</p>	<ul style="list-style-type: none"> - Permanent - Very gorgy in lower McNamee 	<ul style="list-style-type: none"> - Waterfalls downstream – disconnected from South Johnstone. 	<p>Land use:</p> <ul style="list-style-type: none"> - Nature conservation = 100% <p>Wooroonooran National Park Japoon National Park</p> <p>Area was heavily logged.</p>		<ul style="list-style-type: none"> - The pesticide 2,4-D was detected in this middle section of the South Johnstone although the levels did not breach the ANZECC (2000) guideline value (Table 33). The water quality of the streams situated exclusively in the protected reserve of division 16 is likely to be excellent as these 	<ul style="list-style-type: none"> - Good quality water - Riparian in bottom half – acting as a good headwater to slow the water down in the top of the catchment. - Most of the streams in division 16 have excellent riparian habitats as the majority of the sub-catchments are entirely 	<ul style="list-style-type: none"> - Big eels in McNamee.Creek - The catchments of the tributaries are mostly in protected forest areas on the south-eastern slopes of the Walter Hill Range or western slopes of Mount Utchee so most


Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

	<p>At causeway everything is flat. Upstream valley – below drops quickly.</p> <p>Gorges present</p> 							<p>streams are located in undeveloped catchments. (Godfrey, P.C. and R.G. Pearson 2012).</p>	<p>protected forest reserve while the reaches of three streams which extend beyond the protected estate display some fragmentation and thinning along their banks (Table 33). Overall, the condition of the streams in division 16 was classified HEV, HEV or SDa. (Godfrey report and GIS data).</p>	<p>of the streams in division 16 possess high land-use scores. (Godfrey, P.C. and R.G. Pearson 2012).</p>
Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
246	<p>Slopes Up to 100m on the main channel of the South Johnstone River.</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 11 (Hills and lowlands on metamorphic rocks). <p>Some</p> <ul style="list-style-type: none"> - 8 (Basalt plains and hills) (at top and bottom of main channel). - 3 (alluvium) main on channel <p>Very steep in that bottom area (northern) – landholder maintained and with lots of erosion in this area.</p> <p>Not a big catchment</p>	<p>Large area of:</p> <ul style="list-style-type: none"> - Mudrock <p>Small area of</p> <ul style="list-style-type: none"> - Basalt (mainly around the top and bottom of main channel). <p>Hodgkinson formation – no springs in (not like coast).</p> <p>Not much basalt</p> <p>Small amount of alluvium at bottom of sub catchment.</p>	3201 – 4001mm/yr	<ul style="list-style-type: none"> - Nothing permanent. - Smaller creek systems - Fast runoff from Hodgkinson formation - Ephemeral - Rivers cobbles and boulders 	Small amount SW-GW	<p>Nature conservation = 92% (Japoon National Park)</p> <p><u>Lower</u></p> <ul style="list-style-type: none"> - Grazing native vegetation = 2.25% - Other minimal use = 1.98% - Irrigated perennial horticulture = 1% <p>Grazing with small area of bananas at the end of it.</p> <p>Steep pinch down to bananas and erosion in the grazing part.</p>		<ul style="list-style-type: none"> - The bramble has stopped the succession of the trees coming through which are shallow rooted and creates slips. - Forest with Bramble – patches have doubled/tripled in size and slip scare in aerial photography. - Biggest threat to wet tropics vegetation. Brambles are changing the hydrological situation. 	<ul style="list-style-type: none"> - Cyclone damage - Small amount of riparian. Riparian would have been present in the past. - Bramble is cutting the edges of the forest and is allowed to grow. - Fire can help to get rid of the bramble in the rainforest but no burning into the rainforest. 	<ul style="list-style-type: none"> - The catchments tributaries are mostly in protected forest areas on the south-eastern slopes of the Walter Hill Range or western slopes of Mount Utchee so most of the streams in division 16 possess high land-use scores. (Godfrey, P.C. and R.G. Pearson 2012).



Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

	<p>- Looks like a similar landscape at the bottom to 245.</p> 					<p>Previously Logged</p>		<p>- The pesticide 2,4-D was detected in this middle section of the South Johnstone although the levels did not breach the ANZECC (2000) guideline value (Table 33). The water quality of the streams situated exclusively in the protected reserve of division 16 is likely to be excellent as these streams are located in undeveloped catchments. (Godfrey, P.C. and R.G. Pearson 2012).</p>	<p>- Giant Bramble is killed by fire and fire stimulates tree recruitment though some scorching of surrounding Rainforest will occur. QPWS in planning stage of small trials.</p> <p>- Most of the streams in division 16 have excellent riparian habitats as the majority of the sub-catchments are entirely protected forest reserve while the reaches of three streams which extend beyond the protected estate display some fragmentation and thinning along their banks (Table 33). Overall, the condition of the streams in division 16 was classified HEV, HEV or SDa. (Godfrey report and GIS data).</p>	
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Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
244 no names of creeks	<p>Slopes Up to 252m. Several other peaks from 60-220m. Main South Johnstone channel on approx. 200m.</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 8 (Basalt plains and hills) - 11 (Hills and lowlands on metamorphic rocks). <p>Some</p> <ul style="list-style-type: none"> - 3 (alluvium) main channel - Steep - Confined - Gorge <p>Picture below showing area:</p>  <p>Picture showing national park:</p>	<p>Large area of:</p> <ul style="list-style-type: none"> - Basalt <p>Small area of:</p> <ul style="list-style-type: none"> - Mudrock - Very small area of Alluvium on main channel <p>Mixture – near mamoo – basalt as it gets further down into metamorphic</p>	3201 – 4001mm/yr	<ul style="list-style-type: none"> - Ephemeral small systems. - Rocks and boulders - Sharp ridge into river itself. - Boulder fields and the end and gravel beds. - A lot of rock controls – incised and deep. - Gravel when the river disappears. - River semi-permanent – but water holes are permanent. - Short sharp catchment. 	<ul style="list-style-type: none"> - Little to surface to groundwater to the west and straight into the South Johnstone. 	<p>Land use:</p> <ul style="list-style-type: none"> - Nature conservation = 62% - Wooroonooran National Park - Japoon National Park - Virtually all National Park - Other minimal use = 16.3% - Grazing native vegetation = 15.5% - Irrigated perennial horticulture = 3% - Clearing at the top of the gorge then straight. - Smaller banana farm – which will be expanded. 	<ul style="list-style-type: none"> - Terracing work done. 	<ul style="list-style-type: none"> - The pesticide 2,4-D was detected in this middle section of the South Johnstone although the levels did not breach the ANZECC (2000) guideline value (Table 33). The water quality of the streams situated exclusively in the protected reserve of division 16 is likely to be excellent as these streams are located in undeveloped catchments. (Godfrey, P.C. and R.G. Pearson 2012). 	<p>Scattered riparian species but no riparian zone as such</p> <ul style="list-style-type: none"> - Most of the streams in division 16 have excellent riparian habitats as the majority of the sub-catchments are entirely protected forest reserve while the reaches of three streams which extend beyond the protected estate display some fragmentation and thinning along their banks (Table 33). Overall, the condition of the streams in division 16 was classified HEV, HEV or SDa. (Godfrey report and GIS data). 	<ul style="list-style-type: none"> - Rarely seen crocodiles – not as prevalent as Johnstone. Crocodiles prefer alluvium area/sandy areas.

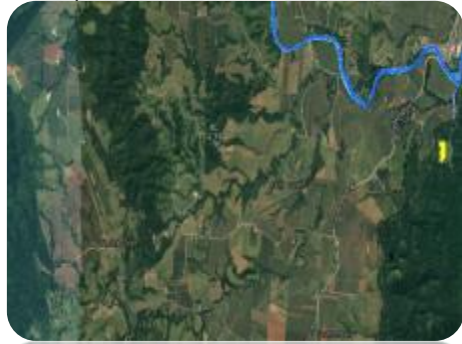
Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
 <p>Main Channel (244 & 246)</p>	<p>Main channel runs through:</p> <ul style="list-style-type: none"> - 8 (Basalt plains and hills) - 11 (Hills and lowlands on metamorphic rocks). 	<p>Large area of:</p> <p>Basalt and mudrock</p>	<p>3201 – 4001mm/yr</p>	<ul style="list-style-type: none"> - Steep, confined system – totally incised. - Bedrock controlled - Deposition on corner. - Smaller boulders - Rock controls - Deep Gravel - River near permanent - Waterholes permanent 	<p>Little to surface to groundwater</p>	<ul style="list-style-type: none"> - Main channel runs through National Park 		<p>Scattered riparian species but no riparian zone.</p>	<ul style="list-style-type: none"> - Some flood runners here and there – depositional areas. - Crocodiles not as prevalent 	
<p>245</p> <p>Meingan Creek</p> <p>South Johnstone River (Main channel)</p>	<p>Slopes Up 275m at headwaters of Meingan Creek. Other heights of 100m, 144m and 160m.</p> <p>Land Zones Mostly</p>	<p>Large area of:</p> <ul style="list-style-type: none"> - Basalt <p>Small areas of</p> <ul style="list-style-type: none"> - Mudrock 	<p>2801 – 4001mm/yr</p> <p>Large falls – 10m high</p> <p>Electrical storms at the beginning of</p>	<ul style="list-style-type: none"> - Creek with grazing gully erosion occurs (same as 	<ul style="list-style-type: none"> - Good surface to ground water interaction 	<p>Land use:</p> <p><u>Top</u></p> <ul style="list-style-type: none"> - Grazing native vegetation = 36.9% Grazing in 		<ul style="list-style-type: none"> - Good systems and potential for improvement but sediment generated here. 	<ul style="list-style-type: none"> - Riparian good – but bit in the middle is patchy. - Nice system and has potential for 	<ul style="list-style-type: none"> - Barramundi present - Cyclone disturbed and colonised by Giant Bramble.

Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

<ul style="list-style-type: none"> - 8 (Basalt plains and hills) <p>Some</p> <ul style="list-style-type: none"> - 11 (Hills and lowlands on metamorphic rocks). - 3 (alluvium) main on channel <p>Undulating landscape but quite steep in places – south patch is steep which is why it's still there – opportunity for riparian.</p> <p>Same pattern of development of basalt similar to Fisher's Creek.</p>	<ul style="list-style-type: none"> - 8 (Basalt plains and hills) - 11 (Hills and lowlands on metamorphic rocks). - 3 (alluvium) main on channel <p>Undulating landscape but quite steep in places – south patch is steep which is why it's still there – opportunity for riparian.</p> <p>Same pattern of development of basalt similar to Fisher's Creek.</p> 	<ul style="list-style-type: none"> - Alluvium (at bottom on sub catchment on main channel) <p>Starting to get into basalt</p>	<p>monsoon through this area.</p> <p>Unsure if the flow of water through the conservation area has any filtering effect.</p>	<p>Fisheries Creek)</p> <ul style="list-style-type: none"> - Once you get down to the edge of the grazing the creek starts to be permanent - At the conservation park the water is permanent. - The creek is shallow as it goes across rock bars – broad and over the falls and into pool – a pretty creek. - Ephemeral at the top and permanent at the bottom. - Bedrock controlled. - No connections to reef but good intact system. 		<p>middle creates erosion.</p> <ul style="list-style-type: none"> - Other minimal use = 32.1% - Irrigated perennial horticulture (bananas) = 14% <p><u>Lower</u></p> <ul style="list-style-type: none"> - Cropping – sugar = 7.38% <p>Small area of National Park in the middle (Meigan Creek Conservation Park.</p> <p>Previous logged extensively</p>		<ul style="list-style-type: none"> - Water from National Park comes out fairly red. 	<p>improvement in riparian area.</p> <ul style="list-style-type: none"> - Threats of giant bramble. 	
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Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
251 Boolabah Creek Noone Creek Juhas Creek Utchee Creek Boolabah Creek	<p>Slopes Up to 275m at headwaters of Boolabah Creek. Other peaks present (147m and 92m).</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 8 (Basalt plains and hills) - 11 (Hills and lowlands on metamorphic rocks). <p>Some</p> <ul style="list-style-type: none"> - 3 (alluvium) main channel and through centre <p>This is Profile of Wet Tropics stream – wide and full of bars and sediment</p> <p>Larger system</p> <p><u>Juhas Creek</u> Combination of upper slopes, lower slopes in basalt further down more alluvium in areas around the creek line. Small bits of alluvium backed up behind natural rocks that are coming in perched alluvium.</p> <p><u>Utchee Creek</u> - Alluvium even high up the system but narrow pockets of alluvium held up by the rock formations.</p> <p>Lower part - with alluvium and basalt.</p>  <p>Picture showing breakouts:</p>	<p>Large area of:</p> <ul style="list-style-type: none"> - Basalt (near Utchee) <p>Areas of</p> <ul style="list-style-type: none"> - Alluvium (near Boolabah) - Mudrock <p>Semi confined system on alluvium running down through basalts.</p> <p>Shallow alluvium.</p> <p>Metamorphics</p> <p>Alluvium near the river</p> <p><u>Lower</u></p> <p>River can now meander here – shallow alluvium and nothing confining it and bouncing around in the alluvium so not stable.</p> <p><u>Utchee Creek</u></p> <p>Headwaters in metamorphics</p> <p>Well vegetated, fast run off and as we get into the cleared areas – little infiltration – will be ephemeral.</p> <p>Deep and steep down into the creek.</p> <p>Very Incised system</p> <p>A fair bit of alluvium quite far up the system. Pockets of alluvium held up in the rock formations. Leads to a very sinuous river that bounces between the constraining layers on either side.</p>	<p>2801 – 4001mm/yr</p> <p>In 1966 – 1995 Average rainfall of 3610mm (Bureau of Meteorology 2013).</p> <p>Camp Creek falls (4m falls).</p> <p>A highly transformed river system. It would have been much deeper originally, constrained by vegetation.</p>	<p>The river can meander a little at the northern area.</p> <p><u>Juhas Creek</u> Semi confined by harder rocks</p> <p>Fast run off</p> <p><u>Noone Creek</u> – A small creek that runs well all year round and has a big set of falls (20m high) council reserve.</p> <p><u>Utchee Creek</u></p> <ul style="list-style-type: none"> - Fast runoff - Ephemeral - Erosion - Sinuous river - Few paleo channels - Lower part – permanent. - Breakthrough sites at Boolabah and Utchee (minor ones see picture opposite). 	<p>Utchee Creek - Little infiltration</p>	<p>Land use:</p> <p>Upper</p> <ul style="list-style-type: none"> - Nature conservation 10.48% (Japoon National Park) - Grazing native vegetation = 36.25% - Irrigated perennial horticulture = 13.26% <p>Lower</p> <ul style="list-style-type: none"> - Other minimal use = 19.17 - Cropping – sugar 17.32% - Residential = 3% <p><u>Utchee Creek</u></p> <ul style="list-style-type: none"> - The tributaries that originate from upland forest areas in between the Walter Hill and Basilisk ranges (i.e., Mena Creek, Utchee Creek, Boolabah Creek and Stewart Creek) have high land-use scores, which decline as they exit the ranges and pass through agricultural areas on their descent to the South Johnstone River. (Godfrey, P.C. and R.G. Pearson 2012). 	<ul style="list-style-type: none"> - Bananas – extract water and plenty of pumps in the creek. - Flood water harvesting – ponds dams hold the water and get pumped therefore water isn't flowing down the creek anymore. - This is a hydrological issues and causes problems downstream. 	<p>Overall, four of the 17 stream reaches in division 17 that were classified HEV were all in upland areas in protected reserve on Mount Utchee (i.e., Mena Creek, Utchee Creek and Stewart Creek) or in non-protected estate on the Basilisk Range (un-named tributaries of Stewart Creek)</p>	<ul style="list-style-type: none"> - Trees in Hodgkinson formation off slopes - Riparian vegetation <p><u>Utchee Creek</u></p> <ul style="list-style-type: none"> - Well vegetated. The system is good in terms of riparian but patchy across the catchment requires infill. - Minimum riparian at the bottom end. 	<ul style="list-style-type: none"> - Not very stable - It is very hard for re-vegetation in this area that is so confined. - Utchee Ck has endemic Rainbow Fish.

Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

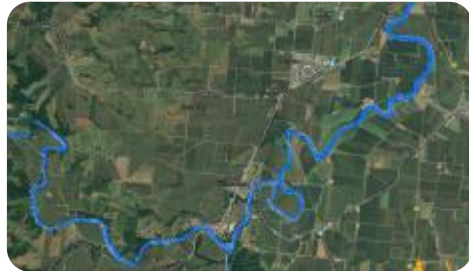
Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
253 Stewart Creek Miskin Creek Mena Creek Meuanbah Creek Juhas Creek Beeta Creek	<p>Slopes Up to 365m (Basilisk Range) at headwaters of Juhas Creek and Beeta Creek.</p> <p>Steep area and it gets flat quickly.</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 8 (Basalt plains and hills) - 11 (Hills and lowlands on metamorphic rocks). - 3 (alluvium) <p>Steeper areas in Hodgkinson formation</p> <p>Flat and eroded</p> <p>Meuanbah into Miskin into Mena into Stewart</p> <p>Picture below showing area where it floods during peak season.</p>	<p>Mostly:</p> <ul style="list-style-type: none"> - Mudrock - Basalt - Alluvium <p>Metamorphics not much basalt upper part.</p> <p>The alluvium goes far up the valley by the dam. Shallow alluvium comes off the metamorphics and creates erosive soils clay.</p> <p>Semi confined against metamorphics.</p> <p>Active bank erosion occur - should be treated (high banks).</p> <p>Sapenthonite on basalt range. Highly mineralised and previously mined.</p> <p>The RE's are rare. Lots of quartz on the surface – usually mined. 7-11-36 RE.</p>	<p>2801 - 4001mm/yr</p> <p>High rainfall and a lot of water and a dam at the top that leaks.</p> <p><u>Mena Creek – Falls</u> Shallow base scouring out and washing down and has taken the road over several times.</p> <p><u>Miskin Creek –</u> Incised lava flows underneath the bridge and waterfalls (cascade).</p> <p>Mena creek used to be an island which has now changed course.</p> <p><u>Stewarts Creek</u> Western side of Stewarts Creek has a number of break out areas.</p>	<ul style="list-style-type: none"> - Headwaters in Mena Creek has quite a few different systems into Stewart Creek - Short sharp and ephemeral streams and a fairly fast run off. - Channel – not defined. - There is a good right hand bank but not good left hand bank. - The creek is jumping at the top as the alluvium is shallower. <p><u>Miskin Creek</u></p> <ul style="list-style-type: none"> - Permanent. - Fast runoff in upper slopes. 		<p>Land use:</p> <ul style="list-style-type: none"> - Other minimal use = 31.5% - Grazing native vegetation = 26.41 - Cropping sugar = 14.84% - Nature conservation = 14.3% <p>(Japoon National Park Basilisk Range National Park).</p> <ul style="list-style-type: none"> - Irrigated perennial horticulture = 7.54% - Residential = 2.18% <p>Grazing all the way up</p> <p>Dam at top</p>	<ul style="list-style-type: none"> - Extracting all the way along. - Stewart Creek has mill sediment ponds. - These are cooling system down at the river which is too hot to touch (steam visible). There have been a number of fish kills years ago and the mill did try to do something about this problem. 	<p><u>Miskin Creek</u> – Good quality.</p> <p>RE 7-11-36 has an impact on the water quality – lowers the pH to around 4.8 in these creeks.</p> <p><u>Mena Creek</u> Fair bit of bramble</p> <p>Discharge just below the bridge. Below bridge – re veg. shallower now. Cobbles and rock. Rock weir – and drowned out so still connection for fish.</p> <p><u>Stewarts Creek</u> Mill impact – huge stock piles of gas and settlement ponds flood. Mill has helped to do riparian work in the past. Some residents have been cutting down and the council have put in a seat and table to accommodate.</p>	<p>No riparian and gully erosion full of hymachea and perched swamps.</p> <p><u>Miskin Creek –</u> Riparian areas good – all alluvial.</p> <p><u>Lower part of Mena Creek –</u> Minimum riparian</p> <p>The extent of riparian habitat on the lower section of the tributaries in division 17 varies considerably, with some streams having continuous and wide riparian vegetation (e.g., Miskin Creek, Stewart Creek), and others having significant fragmentation and thinning (e.g., Mena Creek, Scheus Creek), while the riparian habitat on the South Johnstone</p>	<ul style="list-style-type: none"> - Cattle in this area tramp over everything and can barely see the stream. - Jungle Perch all the way up – good connected system. - Mussels used to be here. - Endemic (rare species) evolved for this mineralisation.

Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

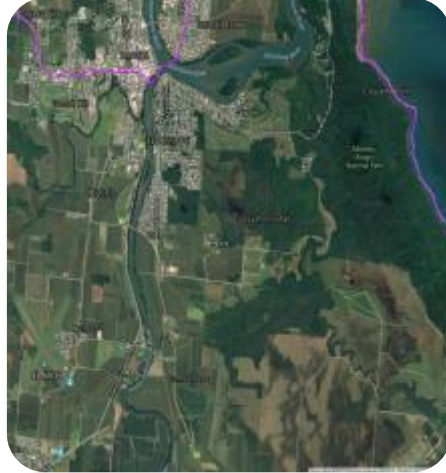



				<p><u>Mena Creek</u></p> <ul style="list-style-type: none"> - Incised and permanent – drops over falls and bank erosion. <p>Lower end – pool and riffle system, permanent flows.</p> <p><u>Sugden Creek</u></p> <ul style="list-style-type: none"> - During peak flood season and it breaks its bank by Silver Bridge – floods lower area. - Becomes Stewart once it junctions – fast run off near permanent into Stewart – fast on Eastern side. 		<p>Logged extensively and highly wind disturbed.</p> <p>Paranella Park in this area.</p> <p><u>Lower end of Mena Creek</u> Grazing and bananas right up the creek –</p> <p>The tributaries that emanate from upland forest areas in between the Walter Hill and Basilisk ranges (i.e., Mena Creek, Utchee Creek, Boolabah Creek and Stewart Creek) have high land-use scores, which decline as they exit the ranges and pass through agricultural areas on their descent to the South Johnstone River. (Godfrey, P.C. and R.G. Pearson 2012).</p>		<p>Overall, four of the 17 stream reaches in division 17 that were classified HEV were all in upland areas in protected reserve on Mount Utchee (i.e., Mena Creek, Utchee Creek and Stewart Creek) or in non-protected estate on the Basilisk Range (un-named tributaries of Stewart Creek)</p>	<p>River is typically narrow and patchy.</p>	
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Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
239 Scheu Creek Lockyer Creek Cheeki Creek Gracey Creek Kalbo Creek	<p>Slopes Up to 96m near Cheeki Creek south Branch. Main South Johnstone channel at 12m.</p> <p>Scheu Creek - Hill slope (greater than 15%) – steep slope for cane.</p> <p>30 degree slope in some places.</p> <p>Small system</p> <p>Land Zones Mostly - 8 (Basalt plains and hills)</p> <p>Some - 11 (Hills and lowlands on metamorphic rocks). (scattered at headwaters and top of sub catchment). - 3 (alluvium) main channel</p> 	<p>Large area of:</p> <ul style="list-style-type: none"> - Basalt - Alluvium (on main channel) <p>Small area of:</p> <ul style="list-style-type: none"> - Mudrock <p>In the upper parts – basalts with a little alluvium.</p> <p><u>Scheu Creek</u> – upper part in basalt – (similar to 251 – alluvium deposited in patches constrained by basalt).</p> <p>Clay present in the Alluvium – prevents it from jumping around even though it's not constrained – 16m clay – hard shale 26m</p> <p>Weathered shale – hard at 26m.</p>	<ul style="list-style-type: none"> - 2401 – 4001mm/yr - Sinuous system - <u>Scheu Creek</u> – has a swimming hole (Floods regularly on small events) - Breakout slowing down the flow through. - Tidal limit on bend. River trust job on where it breaks and floods. - <u>Lockyer Creek</u> Wetland at top end. 	<p><u>Scheu Creek</u></p> <ul style="list-style-type: none"> - semi unconfined, ephemeral becomes permanent as it moves down into the alluvium - Deeply incised <p><u>Lockyer Creek</u></p> <ul style="list-style-type: none"> - No real channel at the upper end (farm drain). <p><u>Gracey Creek</u></p> <ul style="list-style-type: none"> - Permanent systems and significant – confluence to the South Johnstone. Erosion is seen on the banks. Rock bars are also found here in the main river. <p><u>Stewart Creek</u></p> <ul style="list-style-type: none"> - Shallow and down. - Deep incised system, rocky permanent and water from alluvium. - Kabo Creek – well connected. 	<p>Springs present</p> <p>Good surface to groundwater interaction.</p> <p>Work by Marcus on groundwater interaction</p>	<p>Land use:</p> <ul style="list-style-type: none"> - Cropping – sugar = 56% - Grazing native vegetation = 16.8% - Irrigated perennial horticulture = 10% - Other minimal use 7.06% - Residential = 5.34% - Nature conservation = 4.99% - Manufacturing and industrial = 1.5% <p>Runs left to right. Bananas on north side and cane on south side cane in upstream the lower end has trees.</p> <p>Kabo Creek – grazing, cane, bananas (bottom)</p> <p>Chicken farm (Poultry)</p> <p><u>Stewart Creek</u> Cane all the way up to the banks and bananas along the channel.</p>	<p>Weirs and culverts present</p> <p><u>Gracey Creek</u> Has a drain through cane and bananas that is heavily modified.</p> <p><u>Stewart Creek</u> Several rock bars further down.</p> <p>Alluvium the trust has done quite a bit of work near the school – island pushing water through it.</p> <p>Modified farm drain.</p> <p>Gaging station at the end.</p>	<p><u>Scheu Creek</u> Milky water</p> <ul style="list-style-type: none"> - Wangan town is on septic which can be problematic in wet season due to high water flow. - The railways are heavily sprayed all year around and flood regularly on small events. The gravel goes into creek. The railway line requires regular spraying the mill carries out this activity and it directly impacts the water quality. - No buffer in cane and creek. - This area was stabilised but scoured the downstream of break through here on the big flood. 1m erosion would extend for a 10k stretch. A large amount of sediment would have been engaged and taken out to the GBR. This would have had an effect on the mill by the change in speed of water. 	<ul style="list-style-type: none"> - Very thin riparian in central section (in grazing) and not present in lower section. - <u>Kabo Creek</u> - good riparian (middle) headwaters minimal veg - <u>Scheu Creek</u> Minimal riparian - <u>Stewart Creek</u> Little riparian. - Thunbergia on river banks. 	<ul style="list-style-type: none"> - Potential for connection. - Connections – black bream at the mouth and can catch Barramundi. - <u>Gracey Creek</u> – Cane drain has amazing amount of fish species, cat fish, sooty grunter, barramundi, Jungle Perch, Tarpon, Mangrove Jack, Mud Cod, Rainbow Fish, Gudgeon, Tilapia and crocodile, Bull Sharks, Eels & Turtle. found here. - Crocodiles and sharks at old stock yard.

Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
Main channel Stewart Creek to where it meets the Johnstone.	<p>Slopes Flat area</p> <p>Land Zones 3 (alluvium) 11 (Hills and lowlands on metamorphic rocks). 1 – Tidal flats and beaches</p> <p>Picture below showing the main river.</p>  <p>Picture below showing the wetlands:</p> 	<p>Large area of:</p> <ul style="list-style-type: none"> - Alluvium <p>Some:</p> <ul style="list-style-type: none"> - Metamorphics 	2401 – 2801	<ul style="list-style-type: none"> - Incised, shallow and rocky - Permanent Riera's bend, potential for change in river direction that is a scour/erosion risk - Slowing flow - Rock bar Mourilyan mill 		<ul style="list-style-type: none"> - Cropping sugar - Residential - Commercial services - Other minimal use <p>Cane up to banks</p> <p>Bananas up the channel</p>	<ul style="list-style-type: none"> - Small wetland constructed for treatment of banana farm (see map for locality). - River trust doing some work to stabilise but needs more - Floodgates only in Ninns Creek side and leveed. - Floodgate near Mundoo 			<ul style="list-style-type: none"> - Land acquisition and channel stabilisation high priority here

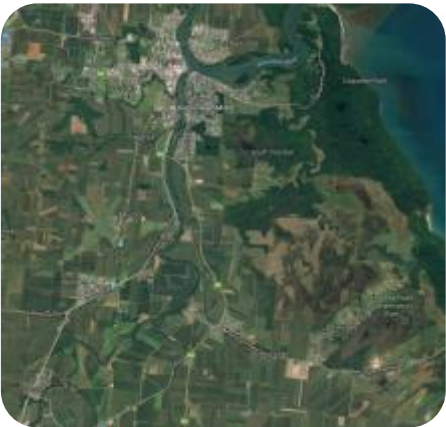

Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

<p>222</p> <p>Bamboo Creek (North Branch)</p> <p>Bamboo Creek (South Branch)</p> <p>Swampy Creek</p> <p>Zahra Creek</p> <p>Junction Creek</p> <p>Eel Creek</p>	<p>Slopes Up to 80m near Warruga.</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 8 (Basalt plains and hills) at top of catchment - 3 (alluvium) main channel <p>Some</p> <ul style="list-style-type: none"> - 11 (Hills and lowlands on metamorphic rocks). (scattered throughout the sub catchment) <p>Narrow floodplain.</p>  	<p>Large area of:</p> <ul style="list-style-type: none"> - Basalt (headwaters) - Alluvium (around main channel) <p>Small area of:</p> <ul style="list-style-type: none"> - Granite - Metamorphic rock bottom of sub catchment <p>Break in slope from basalt's into alluvium.</p> <p>Residential area – is on granite – on an island.</p>	<p>2401 – 4001mm/yr</p> <ul style="list-style-type: none"> - Lots of opportunity for the river to change its course – low areas. - Town used to be palm swamp and it used to be called town swamp. - Main channel breakouts: Stoters Hill, O'Brien's Hill and low area through Sundown - Some wetland areas 	<ul style="list-style-type: none"> - Semi-permanent systems. - Top end – incised . - Headwaters dry out. - Once in the flat the creek turns permanent - Connected all the way through. 	<ul style="list-style-type: none"> - Good groundwater interaction. 	<p>Land use:</p> <ul style="list-style-type: none"> - Cropping – Sugar = 52.84% - Grazing native vegetation = 14.46% - Irrigated perennial horticulture = 8.96% - Residential 8.31% - Other minimal use = 5.84% - Services 3.85% - Manufacturing and industrial = 1.5% - Plantation forestry 1.12% <p>Upper part of catchment is grazing</p> <p>At the edge of Bamboo Creek area used to be landfill.</p> <ul style="list-style-type: none"> - The two branches of Bamboo Creek drain a catchment that is extensively modified by agriculture and urban development so they have very low land-use scores (Godfrey, P.C. and R.G. Pearson 2012). 	<ul style="list-style-type: none"> - Floodgate – stops the river going back the other way when flooding. - Quarry - Landfill and transfer station - Used to be connected under the highway through Swampy Creek into Bamboo Creek – truncated at highway – council filled and put in pipes. - <u>Bamboo Creek</u> - Some of the smaller drains are flood gated to stop saltwater getting up through the system. - Highly modified with floodgates. - Old abattoir 	<ul style="list-style-type: none"> - Landfill leachate - Highly modified - Numerous historic landfill near town - Larry mountain has contaminated soils. - Water quality data has been collected in the estuarine reach of the South Johnstone River and Bamboo Creek (south branch) and in the estuarine and freshwater reaches of Ninds Creek (east branch) during the last two decades (Table 37). (Godfrey, P.C. and R.G. Pearson 2012). - Concentrations of NOx and NH4+ recorded at the four stream reaches were often above the QWQG (2009) trigger value while the concentrations of FRP measured at three of four reaches met the guideline value on more than 50% of occasions. A suite of pesticides have been detected 	<ul style="list-style-type: none"> - Minimal riparian - Bamboo Creek -A lot of issues with para grass and pond apple, running bamboo, Bare banks have guinea grass. - Rainforest restoration success - Bunn et al. (1998) demonstrated the importance of this shading in Bamboo Creek which had been degraded from riparian clearing for sugarcane and had also become overgrown with para grass. Parts of the creek were shaded which resulted in a reduction in the biomass of para grass and an overall improvement in the ecological function and hydrology of the stream 	<ul style="list-style-type: none"> - Drainage lines – proposition to turn into wetland. - Mud cod but mostly tilapia, turtles, eels. - Constant pressure in this area. - Bamboo Creek - tidal 2-3m mangrove jack, barramundi. - Breakouts on the main channel. Major weak point – breakouts – naturally there but need to be conscious of them. Re vegetation wouldn't be good as naturally low points so could get flow throughs anyway. Need to be careful on what you want to do with these areas. Not divert the water but slow it down. Naturally become nutrient traps – multiple outcomes. - Goondi wetland could be restored - Connectivity opportunity
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Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)


Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
227 Ninds Creek Main channel Several unnamed creeks	<p>Slopes Up to 176m at headwaters of Ninds Creek (Moresby Range). 12m on the main channel.</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 3 (alluvium) main channel <p>Some</p> <ul style="list-style-type: none"> - 11 (Hills and lowlands on metamorphic rocks). - 1 (Tidal flats and beaches) - 2 (coastal dunes) <p>Ninds creek –small sub catchment low lying.</p>	<p>Large area of:</p> <ul style="list-style-type: none"> - Alluvium <p>Backed up metamorphic range to the east – fractured.</p> <p>Soils would be quite clayey 50m of alluvial clay.</p> <p>From an agriculture perspective it would be hard to grow anything as it is so wet.</p>	<ul style="list-style-type: none"> - 2401 – 3201mm/yr - Melaleuca open forest at the headwaters of Ninds Creek. - Range adds more water to the system - Massive sump for wetlands (see picture opposite) similar to Hull river. - Estuarine and freshwater 	<ul style="list-style-type: none"> - The channel in Ninds creek is unconfined and shallow. - Connection with estuarine and freshwater system. - Good system in lower reaches of Moresby. 	<p>Good surface to groundwater.</p> <p>High porosity</p>	<p>Land use:</p> <ul style="list-style-type: none"> - Grazing native vegetation = 29.4% - Cropping – sugar = 21.2% - Nature conservation = 13.6% (Moresby Range National Park and Etty Bay Road Conservation Park). - Irrigated perennial horticulture = 9.79% 	<ul style="list-style-type: none"> - Landfill site further up - floodgates to keep salt out - Minimal drainage but previously drained to convert to grazing. - Barrier to estuarine water coming in. - Modified system. 	<p>Weeds – pond apple, Hymenachne and para grass.</p> <p>Sewage treatment now discharges tertiary treated sewage into Ninds Creek, a strong tidal tributary of Johnstone downstream of the confluence of the north and south branches, having discharged secondary treated effluent into it decades before that (Johnstone</p>	<ul style="list-style-type: none"> - Catchment supports some significant vegetation values. - Bramble on the ranges. - Catchment itself has a lot of vegetation. - The mangroves are in good condition. - Freshwater wetlands heavily infested with 	<ul style="list-style-type: none"> - High value system for reef. - A long running battle to drain Etty Bay swamp for cane land which has extensive reed (Lepironia) dominated wetlands to put a plug in, conserving the swamp which won the department ruling. This backs up

Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)


<p>No elevation hills to east – cannot force freshwater out so saltwater comes in.</p> <p>Flat area.</p> <p>Small sub catchment.</p>	 	<ul style="list-style-type: none"> - wetlands and Bulguru swamps held by dunes. to the South East. - High porosity of floodplain with fine grained soil (clay) creates wetlands sitting on top. - Swamp is the last remaining freshwater system. - Large sand dune to the south which would be one of the water sources. Wetland is backed up against the sand plug which would be providing some of the water to the wetlands. - Ninds Creek is a regional wetland. - Ninds Creek system is centred on a protected palustrine wetland with agricultural and urban areas on its margins, which reduce the land-use score for the east and west branches of this creek. (Godfrey, P.C. and R.G. Pearson 2012). 			<ul style="list-style-type: none"> - Other minimal use 9.27% - Residential = 6.83% - Mash/wetland = 5.92% - Services = 1.46% <p>Cane area to the west – drains into Ninds creek. Area that has a potential to have multiple values as big enough in relation to cane and values previously.</p> <p>Grazing and cane on the western side and little banana.</p> <p>One of few places for salt scaled, cleared in 1991-1992.</p>	<ul style="list-style-type: none"> - Some urban and peri urban through catchment. - Floodgates affect connectivity. - Sewerage treatment plant = brand new – right in the middle of it. - Sewage treatment plant (tertiary). East Innisfail sewage drains goes back into the river going down coquette point. - Bulldozed then fire, peat burnt for years and burnt mangroves - Marina proposals further north. 	<p>River Management Plan 2013)</p> <p>Mourilyan on septic</p> <p>Water quality data has been collected in the estuarine reach of the South Johnstone River and Bamboo Creek (south branch) and in the estuarine reaches of Ninds Creek (east branch) during the last two decades (Table 37). Concentrations of NOx and NH4+ recorded at the four stream reaches were often above the QWQG (2009) trigger value while the concentrations of FRP measured at three of four reaches met the guideline value on more than 50% of occasions. A suite of pesticides have been detected in the water column, sediments and the leaf tissue of mangroves in the South Johnstone River and in the sediment in the estuarine section of Ninds Creek (Table 37). They include diuron, atrazine, simazine, hexazinone, tebuthiuron, ametryn, metolachlor, pendimethalin, chlorpyrifos, protiphos, diazinon and chlorfenvinphos (Godfrey, P.C. and</p>	<p>Pond Apple, Hymenachne & Paragrass. All infestations uncontrolled.</p> <ul style="list-style-type: none"> - On the other side of the sand plug are the mangrove of Mourilyan. - Most of the stream reaches in division 18 have moderately degraded riparian habitats with only the middle and lower sections of Ninds Creek and upper and lower sections of the un-named waterway at Flying Fish Point having unbroken riparian vegetation along their banks (Table 37). Overall, most of the streams in division 18 were classified SDA or MDA, including some of those stream reaches in protected reserve (e.g., east and west branches of Ninds Creek) but which have agriculture in areas upstream or surrounding the reserve. (Godfrey, P.C. and R.G. Pearson 2012). 	<p>against the sand plug and gets part of its water from the sand down to the South.</p> <ul style="list-style-type: none"> - Plug has been taken out and reinstated once, needs ongoing monitoring. - There has been development pressure on the council to drain the swamp (a 1980's development). - Flooding from the adjacent residential area results in people putting pressure on council to drain the swamp so it can be used during floods. - After cyclone Larry pushed vegetation into the creeks - lot of the timber into the creeks. - Mangroves and tea tree swamp breeding area of mangrove jack and black bream - Used to have a lot of fisheries values.
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Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)


			<ul style="list-style-type: none"> - High water level in the system. 					<p>R.G. Pearson 2012).</p>		<ul style="list-style-type: none"> - A crocodile nest is here - Still crocodile breeding, one of main areas for breeding. - Used to support a lot of exotic aquarium fish - Guppy, pacific blue eye – exotic fish – connect to estuarine system. - Important to cassowary habitat.
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Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
Overview Slopes Up to 903m at Mount Coleridge at the headwaters of West Liverpool Creek. Mt Marquette 1068m- South Liverpool Land Zones Mostly: <ul style="list-style-type: none"> - 12 (Hills and lowlands on Granite rocks) - 3 (Alluvium) - 11 (hills and lowlands on metamorphic rocks). Some: <ul style="list-style-type: none"> - 2 (Coastal dunes) - 1 (tidal flats and beaches) 	Mostly: <ul style="list-style-type: none"> - Alluvium - Granite Some <ul style="list-style-type: none"> - Mud Rock Small amount of: <ul style="list-style-type: none"> - Sand Unlike Downy Creek, this is all on metamorphics – not much basalt – just a small area at the end. <ul style="list-style-type: none"> - Much shorter system but quite complex - Johnstone and south Johnstone come together like chalk and cheese with sediment. - With a bit of rain the south Johnstone – lots more sediment run off is red. - Liverpool quite clean and moves more due to fines that are coming out of the basalt in the South Johnstone. - Hodgkinson formation 	2401 - 4801mm/yr	fast runoff short creeks		Land use: Mostly; <ul style="list-style-type: none"> - Nature conservation - Cropping – sugar - Other minimal use Division 20 includes Liverpool Creek and seven key tributaries – West Liverpool Creek, Kittabah Creek, Meuribah Creek, Jingu Creek, Bombetta Creek, South Liverpool Creek and Cowley Creek (Figure 23, Table 40). These streams emanate from forest areas in protected estate on Walter Hill and Basilisk ranges and so have high land-use scores for the upper reaches. In contrast, the lower reaches have low land-use scores as the valley floor of the Liverpool Creek basin is mostly freehold land that is used extensively for sugar cane cultivation, cattle grazing and as rural residential areas (Godfrey, P.C. and R.G. Pearson 2012).		It's a hotspot for th e DIN.		<ul style="list-style-type: none"> - Liverpool is clean compared to the Johnstone because its granite catchment. - There are no fines in Liverpool creek and has to be mobilised. - Extra development exacerbated it in south Johnstone. 	

Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
276, 282 West Liverpool Creek Liverpool Creek Scindah Creek Unnamed Creeks	<p>Up to 903m at Mount Coueridge at the headwaters of West Liverpool Creek. Several other peaks such as McNamee Lookout (219m) and Mount Coueridge (858m).</p> <p>Slopes</p> <p>Land Zones</p> <p>Mostly</p> <ul style="list-style-type: none"> - 11 (Hills and lowlands on metamorphic rocks). <p>Some</p> <ul style="list-style-type: none"> - 3 (alluvium) main channel - 12 (Hills and lowlands on Granite rocks) <p>Liverpool Creek – lots of systems running through it and down at the floodplain – diff system.</p> <p>Full of granite and granite sand, steep down to flat.</p> <p>Shorter system than Johnstone or South Johnstone.</p> 	<p>Large area of:</p> <ul style="list-style-type: none"> - Mudrock <p>The rest is made up of</p> <ul style="list-style-type: none"> - Alluvium - Granite (top of sub catchment). <p>Little bit of alluvium down to where the creek bed flattens at the bottom.</p> <p>Bedrock confined creek – granite, sands and rock– river will disappear under the gravel in places.</p>	<p>2801 - 4801mm/yr</p> <p>– waterfalls but small</p>	<ul style="list-style-type: none"> - Starts in West Liverpool Creek. - Fast run off creeks - Very straight – that is naturally the way they are. - Prone to slips - The creek is permanent third of the way down. - In really dry times the water will veer under the gravel. - connections all the way through 	<ul style="list-style-type: none"> - This is all on metamorphic – Hodgkinson formation – no infiltration. Granites at the top, little infiltration. 	<p>Nature conservation = 96% (Japoon National Park)</p> <p>Nearly all National Park apart from lower end which is defence.</p> <ul style="list-style-type: none"> - Other minimal use= 1.73% - Grazing on native vegetation = 1.66% <p>Previously logged and never recovered.</p>			<ul style="list-style-type: none"> - Hot spot for DIN - Weeds, bramble, siam present. - Grasslands and fenlands - Jungle perch, sooty grunter. 	

Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
270 Kittabah Creek Jerry Creek	<p>Slopes Up to 586m at the headwaters of Jerry Creek.</p> <p>Land Zones Mostly - 11 (Hills and lowlands on metamorphic rocks). Some - 3 (alluvium)</p> <p>Picture showing area below</p>  <p>Picture below showing National Parks around the sub catchment.</p>	<p>Large area of:</p> <ul style="list-style-type: none"> - Mudrock <p>Small area of Alluvium</p> <p>In all metamorphic – small bit of alluvium down the end.</p> <p>Sand on gibbon. Underlying metamorphics – dog leg and terraces</p> <p>Granites, boulders and soil minimal due to underlying geologies.</p>	2801 – 4001mm/yr	<ul style="list-style-type: none"> - Permanent flow - Fast run off. Wild dynamic creek – changes course all the time. - Sudden flashy floods. - Very fast flows. - Steep and fast - House is right beside the creek. - S-bend south where Cooyar Creek comes out – bed control structures (boulders). - Connectivity all the through 		<p>Land use:</p> <p><u>Upper</u></p> <ul style="list-style-type: none"> - Nature conservation = 73.08% National Parks are Japoon National Park <p><u>Lower</u></p> <ul style="list-style-type: none"> - Other minimal use= 17.87% - Estuary/coastal waters = 13.51% - Grazing native vegetation = 8.75% <p>All grazing and paw paw</p> <p>Previously heavily logged</p>	<ul style="list-style-type: none"> - Modified at the lower end of it. - Straightened to get the water off - Can see sand in the creek system where the system is coming out. - 25 ton excavator channel was dug right out and riparian dug out on banks so the causeway on the way in didn't go in as often. 		<ul style="list-style-type: none"> - Good riparian apart from the lower part. - No riparian in main channel. - Once riparian gone, very difficult to re-establish as flashy system. - High value on retaining existing riparian 	<ul style="list-style-type: none"> - Wind disturbed. - Would be hard to revegetate this system.



Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
279 Meuribah Creek	<p>Slopes Up to 800m at headwaters of Liverpool Creek. Several other peaks ranging from 170m – 315m.</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 12 (Hills and lowlands on Granite rocks) - 11 (Hills and lowlands on metamorphic rocks). - 3 (alluvium) <p>Lots of erosion as far as the forest. It is worse where it has been cleared. Floods through quickly – due to granite.</p> <p>Some of the area is quite terraced - 2-3 metres with terracing near the road.</p>	<p>Large area of:</p> <ul style="list-style-type: none"> - Mudrock - Granite (top of sub catchment). - Alluvium (bottom of sub catchment). <p>Granites up the top end of the system, extending half way - then metamorphics underneath.</p> <p>Flattens out quickly and turns in to alluvial</p> <p>More alluvium creates more agriculture.</p>	<p>2801 – 4001mm/yr</p> <ul style="list-style-type: none"> - Waterfall downstream. - Permanent wetland found - perched swamps. 	<ul style="list-style-type: none"> - Fast run off streams. - Gravel sand and bedrock controlled. - Permanent water – in the forests. - Slips into the forest. - Flashy creek - The mouth of the creek is very variable jumping around all over the place. - Paleo channels and evidence of past break outs. - Liverpool in general is very dynamic. 	<p>Top end, little infiltration –</p>	<p>Land use:</p> <ul style="list-style-type: none"> - Nature conservation = 66.2% (Japoon National Park) - Other minimal use = 12.13% - Cropping – sugar =10.43% - Grazing native vegetation = 9.11% <p>Grazing at the top end and lower end – cane and specialised horticulture.</p> <p>Quite a bit of cane at the bottom.</p>		<p>Pond apple in perched swamps.</p>	<p>No riparian</p>	<ul style="list-style-type: none"> - Jungle perch all the way through – some sooty gruners but perch far more prevalent.

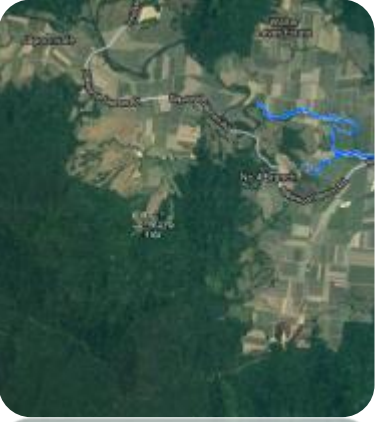
Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
280 Jingu Creek Liverpool Creek	<p>Slopes Up to 500m several other slopes ranging from 200m, 300m and 400m.</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 11 (Hills and lowlands on metamorphic rocks). <p>Some</p> <ul style="list-style-type: none"> - 3 (alluvium) - 12 (Hills and lowlands on Granite rocks) - <p>Recent movement, with erosion (all these creeks are highly erosive).</p> <ul style="list-style-type: none"> - Terracing present 	<p>Large area of:</p> <ul style="list-style-type: none"> - Mudrock - Granite (top of sub catchment) - Alluvium <p>Very similar to (Meuribah Creek) the only difference is there is not much granite in the upper end and not much alluvium except at the end.</p>	2801 – 4001mm/yr	<ul style="list-style-type: none"> - Permanent system - Not as much water as others. - Very sinuous nature as soon as it is out of the forest and into metamorphics 		<p>Land use:</p> <ul style="list-style-type: none"> - Nature conservation = 83.9% (Japoon National Park) - Grazing native vegetation = 8.60% - Other minimal use= 3.87% - Cropping sugar = 2.88% <p>Lower end of the catchment has been cane in past but mostly grazing now.</p>				



Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

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	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
274 Cooyar Creek Liverpool Creek	<p>Picture below showing area.</p>  <p>Slopes Up to 400m at the headwaters of Cooyar Creek.</p> <p>Land Zones Mostly - 11 (Hills and lowlands on metamorphic rocks). Some - 3 (alluvium) No big systems Lower terrace</p> 	<p>Large area of:</p> <ul style="list-style-type: none"> - Mudrock <p>Small areas of:</p> <ul style="list-style-type: none"> - alluvium (on main channel) <p>All underlined by mud rocks – (fine grained)</p> <p>Main creek of Liverpool creek – little bit of alluvium. Lower terrace and more ability for the river to jump around. Change in course happened in one night.</p>	2801 – 4001mm/yr	<ul style="list-style-type: none"> - Fast flashy systems running off granite lots of short sharp systems with exception of small patch of alluvium - Not permanent – except Cooyar Creek. - Boulders and cobbles all the way up. - Pools and riffles - More mobility in river - Sand bars in the river - Bed controls brommels avulsion. - Connections all the way through 		<ul style="list-style-type: none"> - Nature conservation = 62% (Japoon National Park) - Other minimal use (residual native cover) = 23.68% - Grazing native vegetation = 11.59% - Cropping – sugar 2.7% - Formerly logged 		<ul style="list-style-type: none"> - Minimal riparian - Vegetation quite good, but a bit of slipping or bramble through it. - Revegetated 	<ul style="list-style-type: none"> - Jungle perch found 	


Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
283 Wooloogin Creek Woogaka Creek Liverpool Creek	<p>Slopes Up to 448m at the headwaters of Wooloogin Creek.</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 3 (alluvium) - 11 (Hills and lowlands on metamorphic rocks). - 12 (Hills and lowlands on Granite rocks) <p>Heavily terraced- natural and then enhanced.</p> <p>Terrace line 2-3 meter terrace (natural but shaped).</p> <p>Lots of bank erosion even carves out channel</p> 	<p>Large area of:</p> <ul style="list-style-type: none"> - Mudrock - Granite (top of sub catchment) - Alluvium <p>Granites and metamorphics up top.</p> <p>Lot of clays... not much of a sandy footprint.</p> <p>gravelly – decomposed granite</p> <p>Sand throughout the system</p>	<p>2801 – 4001mm/yr</p> <p>Rain all through the year.</p>	<ul style="list-style-type: none"> - Channel deep - Low flow - Near permanent. - Some breakthroughs - Terracing parallel to the river forcing creeks to go west to east. - Terraces send the creek almost parallel to Liverpool creek. - Liverpool creek quite deep - Creek lines – well defined in alluvium and jumps around. - Huge amount of old paleo channels - Sandy creeks 	<p>Good surface to groundwater interaction</p> <p>Groundwater 6m below surface level in gravels.</p> <p>Aquifer in the gravel.</p>	<ul style="list-style-type: none"> - Nature conservation = 46.32% (Japoon National Park). - Cropping –sugar = 19.6% - Other minimal use 13.83% - Grazing native vegetation = 9.2% - Irrigated perennial horticulture = 1.09% - Residential 1.72% <p>Rather marginal area for cane (but better than in the sand).</p> <p>Little bit of grazing in the middle and then cane down in the alluvial area of the middle and bottom.</p> <p>Quarry</p>			<ul style="list-style-type: none"> - Little to no riparian vegetation in the lower section and near permanent flow creeks. - Areas of revegetation 	

Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
273 Beeta Creek Bomeeta Creek Tinkum Creek	<p>Slopes Up to 100m at the headwaters of Bombeeta Creek.</p> <p>Land Zones</p> <ul style="list-style-type: none"> - 11 (Hills and lowlands on metamorphic rocks). - 3 (alluvium) <p>Photo below showing gap (corridor between the two ranges).</p>  <p>Zoom below showing the road through the middle.</p> 	<p>Large area of:</p> <ul style="list-style-type: none"> - Mudrock - Alluvium <p>Bomeeta - Little alluvial area.</p>	<p>2801 – 4001mm/yr</p> <ul style="list-style-type: none"> - No waterholes 	<ul style="list-style-type: none"> - Permanent creek. - Gravel and rocks - 10 m wide channel 		<p>Land use:</p> <p><u>Upper</u></p> <ul style="list-style-type: none"> - Nature conservation = 35.8% <p>Japoon National Park and Basilisk Range National Park</p> <p><u>Middle/lower</u></p> <ul style="list-style-type: none"> - Other minimal use = 38.36% - Grazing native vegetation = 14.40% - Cropping - sugar = 8.19% - Irrigated perennial horticulture = 2.79% 	<ul style="list-style-type: none"> - Road and train line an issue - lots of vehicle strikes. 		<ul style="list-style-type: none"> - Headwaters fully vegetated channel running through with good vegetation. - Small vegetation corridor is an important piece of rainforest connectivity for cassowary and other wildlife movement. 	<ul style="list-style-type: none"> - Jungle perch all the way through it no water falls. - Main corridor between the two ranges. - Cassowaries seen in the gap.

Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
 <p>290 South Liverpool Creek Nyleta Creek Several unnamed creeks</p>	<p>Slopes Up to 722m several other peaks such as 718m and 263m. Some intact significant areas as it is so steep. Big subcatchment</p> <p>Land Zones Mostly - 12 (Hills and lowlands on Granite rocks) Some - 3 (alluvium) - 11 (Hills and lowlands on metamorphic rocks). Similar to Wooloogin Creek lots of bank erosion at the bottom in the cleared area. Very variable system – jumps around a lot in the alluvial system. South Liverpool into Liverpool Creek. Active channel with terracing. Terracing becomes lower in South Liverpool.</p>	<p>Large area of: Granite (from Mount market) Small area of: - Alluvium and Mudrock Lot of sand in the system. Mostly granite with metamorphic (on west) and alluvium (on east) in the lower Granite boulders</p>	<p>2401 - 4801mm/yr lots of rain in this area. water fall drops into a big pool with steep sides 10m high.</p>	<ul style="list-style-type: none"> - Protected headwaters - Semi confined system - Bedrock confined in the beginning – but lots of slips. - Fast run off - Wind disturbed and lots of slips. - Permanent water and permanent water holes - Paths change overnight - High energy. - Rock works gone in on the road. 	<p>no major infiltration –</p>	<p>Land use: - Nature conservation = 88.2% (Japoon National Park) - - Other minimal use = 4.4% - Irrigated tree fruits - Cropping – sugar =3.89% - Grazing native vegetation = 2.0% Cane all the way down and grazing on the west bank. Logged in the past 1980 to 1981</p>	<ul style="list-style-type: none"> - Small weir on Nyleta Creek - Gravity fed. - Reservoir constructed - Rock works on road into Nyleta. - Nyleta – has the offtake for water for mission beach El Arish, Silkwood. - Another intake near mission beach when one has low flow – use the other one – - Supplies 2,000 houses which is not 	<p>Clear water</p>	<ul style="list-style-type: none"> - Well vegetated - Huge blood woods and banksia's - Minimal riparian - very variable system. - Bramble present - A variety of weeds including the Singapore daisy and Siam 	<ul style="list-style-type: none"> - Recovered well but cyclone damage has occurred. - Biodiversity significance - Jungle perch up to the waterfall.

Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Overview of whole area below:



Upper:



Middle:



- Nyleta Creek joins with South Liverpool – on the east side – fast run off creeks and on the west side is cane.
- Semi confined system – up against the rock.
- Last kilometre stable before it enters Liverpool Creek
- Deep riverine – bit of rock that comes through – contained underneath. Alluvium where it comes into Liverpool Creek.
- Hodgkinson formation close to the surface.
- More movement in alluvium, stable before enters Liverpool.
-


a huge amount.

Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)



Lower: showing the creek jumping around.






Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
277 Boundary Creek Liverpool Creek	<p>Slopes Up to 394m at headwaters of Boundary Creek</p> <p>Short steep section of range.</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 3 (alluvium) - 11 (Hills and lowlands on metamorphic rocks). <p>Short steep section of range</p> <p>Huge area of floodplain off range straight into cane.</p> <p>Sinuuous in lower reaches</p> <p>Huge area of floodplain</p> 	<p>Large area of:</p> <ul style="list-style-type: none"> - Mudrock - Alluvium <p>Small area of:</p> <ul style="list-style-type: none"> - Granite <p>Deep and quite a bit of sand through the system.</p> <p>Metamorphics</p> <p>Sand throughout</p>	<p>2401 - 4001mm/yr</p> <p>Wetlands here that are not mapped with palm forests (foot hills).</p>	<ul style="list-style-type: none"> - Quite incised and deep - River runs hard against the mudstone – semi confined system. Then runs down on the western side of the harder geologies. - Meandering system and breakthroughs - The channel re aligned from the bridge. - A 20m drop where the houses are (this area is unstable). - Paleo channels. - Evulsion and course change. - Deep channels that carve out a deep bank overnight. - Advances 2-3 m and sometimes 10m. - Sandbars present. - Liverpool Creek itself quite deep. - Connected through to the higher streams. 	<p>Boundary Creek groundwater is on average 10m below the surface taken near to Japoon road.</p>	<p>Land use:</p> <p><u>Upper</u></p> <ul style="list-style-type: none"> - National Park 15% Basilisk Range National Park - Other minimal use (residual native cover) = 39.95% - Cropping – sugar = 34.33% - Irrigated perennial horticulture =10.76% - Plantation forestry =7.91% - Grazing on native vegetation = 4.71% - Residential = 0.75% <p>As soon as you get off the range it goes into cane.</p> <p>All cane and pieces of wetland in the upper parts – looks well vegetation due to steepness. Sections of river cherries.</p>			<ul style="list-style-type: none"> - Minimal riparian, cleared to top of bank and vegetation in the channel. - Alexander palm in wetlands. - Some sections of river cherry's holding bank in place. - Re - vegetation in the late 90's but many species didn't survive. 	<ul style="list-style-type: none"> - Certain amount of treatment in this system.

Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

										
<p>268 Little Moresby Creek Cowley Creek</p>	<p>Slopes Up to 295m at the headwaters of Cowley Creek (Basilisk Range).</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 3 (alluvium) - 11 (Hills and lowlands on metamorphic rocks). <p>No granites at all on the east side – got very fine grained sediments in the alluvium which means it holds the water.</p> <p>Alluvium in lowland (fine grained) 59 metres of low transmissivity sediments.</p> 	<p>Large area of:</p> <ul style="list-style-type: none"> - Alluvium <p>Areas of Mudrock</p> <p>Small areas of:</p> <ul style="list-style-type: none"> - Ultramafic rock - Granite. <p>Serpentinite on the east ranges.</p> <p>Mud rock, most creeks near where the hyrophilla (blush weed starts). Mapped wetland here. Closed in area – perching of wetlands in this area. Not much wetland till here.</p> <p>Metamorphic (fine grained mudstones) around in upper.</p> <p>Not a lot of soil Underlying geology near to the surface.</p> <p>Foothills – very boggy and wet. Not much soil here and grazing.</p>	<p>2801 - 4801mm/yr</p> <p>Lots of wetlands (melaleuca swamps) showing in picture opposite</p> <p>Closed in area – perching of wetlands in this area. Not much wetland till here.</p> <p>There was quite a lot of melaleuca around the bottom of the ranges.</p> <p>This whole area would have been wetland</p>	<ul style="list-style-type: none"> - Fast runoff from the ranges. - Permanent to near permanent in upper - Once it hits the flat it really slows down – really wet in the flat area. - Water table close to the surface around 1- 2 metres down. - Permanent systems - Creek lines - slow flowing and incised. - Cowley creek – incised but slow flowing. - Connections – all the way through. 	<p>Foothills – very boggy and wet. Soils are very wet – very transmissive.</p> <p>Groundwater and surface water interaction</p>	<p>Land use:</p> <ul style="list-style-type: none"> - National Park 21%= - Warrubullen Conservation Park and Basilisk Range National Park - Cropping – sugar = 18.02% - Grazing native vegetation = 9% - Intensive animal production= 2.91% - Irrigated perennial horticulture= 1.72% - Marsh/wetland= 1.05% - Other minimal use =48.67% <p>Cowley Creek - Cane over to the East – barramundi farm also present as shown in picture opposite.</p> <p>Bananas as well to the right.</p> <p>Grazing in foothills in wet area.</p>	<p>Sand extraction in Liverpool Creek and two areas close to the bridge in Warrabullen Road.</p> <p>Farm extraction.</p> <p>Holes knocked through it for pumps – extraction for bananas and prawn farms.</p> <p>Some drainage</p> <ul style="list-style-type: none"> - Northern banks - has had holes knocked in for pumps etc 		<ul style="list-style-type: none"> - Historically feather palm, some remnants. - Little bit of riparian. - Northern bank has some good riparian - There would have been quite a lot of broad leaf tea tree, coastal paperbark and palm swamps. - Glush weed near melaleuca wetlands 	<ul style="list-style-type: none"> - This area would suit wetland reinstatement for biodiversity value but not treatment - Similar to Ninds Creek. - Could benefit from some infill planting. (Mini Tully)



Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

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271	<p>Slopes</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 3 (alluvium) - 11 (Hills and lowlands on metamorphic rocks). <p>Some</p> <ul style="list-style-type: none"> - 2 (coastal dunes)   	<p>Mainly:</p> <ul style="list-style-type: none"> - Alluvium <p>Some</p> <ul style="list-style-type: none"> - Granite - Ultramafic Rock <p>Have a couple of little outcrops of granite which is constraining the river – and is why it is taking a bit of a kick to the east.</p> <p>Serpentinite range– same all the way down to lower Cowley and a few outcrops of granites (mission beach granite complex).</p> <p>Soil, no clay content – as soon as it gets wet it slumps. This situation starts from the when it comes through the granites there is more sand in the banks.</p> <p>Areas where cane is – more clay and sand closer to creek.</p> <p>Cowley beach gravel and riverine deposits</p>	<p>2401 - 3201mm/yr</p> <p>Tidal limit</p>	<ul style="list-style-type: none"> - No real channel in this area. - Main channel meandering - The mouth of Liverpool creek moves around a lot – natural. - Palaeochannels present - Gravel bed - no creek systems 		<p>Land use:</p> <ul style="list-style-type: none"> - Cropping sugar = 56.81% - Other minimal use = 24.54% - Grazing native vegetation = 6.93% - Irrigated perennial horticulture = 4.09% - Residential = 3.45% - Intensive animal production = 1.86% <p>Large amount is sugar cane right up to the bank.</p>	<p>Quite a few production bores along the curve which have very sand/gravel like sequence down to 20 metres before any bedrock.</p>	<p>Little riparian in the river.</p> <p>Casuarina forest begins at Cowley then patches down into Maria. Mouth in good condition. Well vegetated.</p> <p>Slumps have lost revegetation.</p>		


Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
275 Liverpool Creek Buckleys Creek (Coastal)	<p>Slopes Up to 123m. Other peaks of 9m. Flat little elevation</p> <p>Land Zones Mostly - 3 (alluvium) - Coastal dunes Some - 1 (tidal flats an beaches)</p> <p>little elevation - North of Silkwood Same situation north where water sitting in the sediment and hard to get out. Clay loams - Clay soils down to 7m alternating clay and sand sequences. All clays at the surface – drains everywhere to get the water off – when it rains very wet.</p>	<p>Large area of: - Alluvium</p> <p>Areas of - Granite (outcrop) - Sand</p> <p>Alluvium is 48m down on the surface which is where the water is.</p>	<p>2401 - 3201mm/yr</p> <p>- Large palustrine wetland at coast</p> <p>Very healthy wetland with no weeds and no inflow.</p> <p>Water comes from rainfall and seeps put. It flows across out on the beach across in wonky holes.</p> <p>Major plug of sand with wetlands in there as well.</p>	<p>No channel no major creek lines.</p> <p>Complicated – how the water comes out here one big aquifer.</p> <p>- Cowley Beach - Same pattern – creek line runs on the western side of the dune system and then comes out further north.</p> <p><u>Lower</u> Creek line runs on western side of dune systems and comes out further north.</p>	<p>- Groundwater surface water interaction</p> <p>- Water around 3m down.</p> <p>- Active springs at north.</p> <p>- Saturated soils, drains in it, when rains it pools.</p>	<p>Land use:</p> <p>- Cropping – sugar = 51.98%</p> <p>- Nature conservation 20.25% Kurrimine Beach National Park (by the coast)</p> <p>- Other minimal use = 11.61%</p> <p>- Marsh/wetland = 7.42%</p> <p>- Plantation forestry = 2.46%</p> <p>- Grazing native vegetation = 1.94%</p> <p>- Services = 1.75%</p> <p>- Irrigated perennial horticulture = 1.53%</p> <p>Solid cane.</p>	<p>- Flat - Lots of drains going to Maria Creek</p> <p>- Drainage through the cane, extensive in the alluvium</p> <p>- Healthy wetland with no weeds.</p>	<p>- The weed called bogmoss is only in this single location in the wet tropics, no effective control, in the drain, around the foothill and to the creek.</p> <p>- The only way to get rid of it is blocking the drain with black plastic in the drain. Major concern for all the water ways.</p> <p>- This is a super waterway weed which goes into wander creek – in all cane drains.</p>		<p>- Full of exotic fish (Paraná like fish).</p> <p>- Lower Major freshwater wetland – towards beach. This area is acting as a buffer for all the cane (sitting to the west). No external water into this (no inflow) all the water west nothing should flow in</p> <p>- Dune swales flowing.</p>
288 Overview Mistake Creek North Maria Creek Mijs Gully Pandanus Gully Stagnant Creek Digger Creek	<p>Slopes Up to 321m (Basils Peak). Other peaks are Mount Edna (163m) Double Mountain (294m). Around 9m at Liverpool Creek.</p> <p>Land Zones Mostly - 3 (alluvium) - 12 (Hills and lowlands on Granite rocks) Some - 3 (alluvium) - 2 (Coastal dunes) - 11 (Hills and lowlands on metamorphic rocks).</p>	<p>Large area of: - Alluvium</p> <p>Areas of - Granite - Mudrock</p> <p>Small area of: - Ultramafic Rock</p> <p>Geologically – metamorphic on the higher areas with little bit of granites behind Fingal Bay and coastal deposits.</p> <p>Unconsolidated areas where the mangroves are.</p>	<p>2401 – 4001mm/yr</p> <p>Estuarine mangrove areas, freshwater wetlands.</p> <p>Wetlands with multiple values.</p>	<p>- Not many headwater streams</p> <p>- Fast runoff</p> <p>- Short creeks</p> <p>- Mouth narrower than it was.</p> <p>- Estuarine mangrove areas behind freshwater wetlands</p> <p>- A lot of connection with the estuarine and freshwater</p>	<p>- groundwater close to the surface</p> <p>non transmissive soils</p> <p>Waterlogged</p> <p>Minimal infiltration in the granite</p>	<p>Land use:</p> <p>- Cropping – sugar =33.29%</p> <p>- Nature Conservation =26.73%</p> <p>Maria Creek, National Park, Dijiru National Park, Japoon National Park.</p> <p>- Grazing native vegetation = 8.30%</p> <p>- Irrigated perennial horticulture = 2.45%</p> <p>- Marsh/wetland =1.94%</p>	<p>- The drainage lines are all modified.</p> <p>- Much of the system modified for cane farming</p> <p>- Lots of wetlands in this area that has been drained to keep the cane dry.</p> <p>- A previous barramundi</p>	<p>- Maria Creek NP serves as important filter before water goes into the sea but is under lots of outside pressure. Function is threatened by heavy weed infestation and large Feral Pig impacts.</p> <p>- Limited water quality data has been collected from</p>	<p>The very confined riparian areas are still very rich. Highways for animals, but important for cultural purposes, collecting food and meeting places.</p> <p>Heavy weed & Feral Pig infestations in lower system</p>	<p>- Productive system</p> <p>- High resource area in the past</p> <p>- During floods in past people would travel to high country.</p> <p>- Seagrass lost in hurricane Yasi.</p> <p>- People move in the seasons like the animals. Waterways – their culture – live off the land.</p>



Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Kaygaroo Creek		Deep clays - Hydrosols		system and move from the range to the flood plain into an estuarine area not a wide area – great connection between the entire system.			farm that didn't succeed.	the streams in division 21 with sampling restricted to a single occasion at sites in North Maria Creek and Kaygaroo Creek (Table 43). Concentration s of NOx in both streams exceeded the QWQG 2009 trigger value, as do most streams in this region that receive run-off from the range of intensive land uses. The water quality of the tributaries in the protected reserve is likely to be excellent given that these reaches are located in undisturbed areas and are unlikely to receive input of contaminants (Godfrey, P.C. and R.G. Pearson 2012).	Streams reaches in the protected reserve on the ranges have excellent riparian vegetation, while there is variability in the extent of riparian habitat among the stream reaches on the floodplain (Godfrey, P.C. and R.G. Pearson 2012).	Very wet system and very productive in the past and great value of waterways in terms of multi functions sometimes overloaded with expectations sometimes with infrastructure not compatible.
Lagoon Creek	Low energy system large flood plain	Alluvium fine grained mudstone derived								
Buckleys Creek	Non transitivity hydrosols									
Berryman Creek	Clay wet some with fine grained soils –impeded systems.									
Citrus Gully	Whole area:									
Dargin Creek										
South Maria Creek										
Fox Creek										
Sanderson Creek										
Cobble Creek										
Midgereee Bar Creek										
Muff Creek										
Stockyard Creek										
Framtons Gully										
Whing Creek										
Big Maria Creek										
Coolyn Creek										
Hogans Creek										
Cedar Creek										
Snake Creek										
Stony Gully										
Double Barrel Creek										
Jurs Creek										



Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Lacey Creek									classified as HEVa, SDa or MDa depending on the extent of disturbance to the riparian habitat and the amount of agriculture in their catchments (Godfrey, P.C. and R.G. Pearson 2012).		
Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other	
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure				
288 Bingal Bay (A)	Granite in this area – on the coastal strip – range that is granite. Behind metamorphic , alluvium Coastal country – steep flatter at the back – ½ m bank and depth of about 1m. Bingal bay – gap in granite – alluvium 	Double barrel creek and Stoney creek, cedar pass through granites	Rainfall around 3m - Mangroves and wetlands.	- Cobble creek has fast run off and short creeks runs. - Creek lines – ephemeral at the top and in the main stream permanent. - creeks well incised - 2-3m deep	- Minimal infiltration	- Farm dams. - Until recently all bananas. - All grazing - National Park at top on granites into rural residential - Barramundi farm - Rural urban development.				- Septic	



Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
288 (B)		<ul style="list-style-type: none"> - Lacey Creek and Jurs Creek in a bit of a line between granite and metamorphics. 	<ul style="list-style-type: none"> - Micro climate different as it rains more than other areas. 	<ul style="list-style-type: none"> - The creek coming out of the granites goes west and then turns north. - Fast run off from the range – short, sharp. - 2-3 metres incised on the slopes - Sandy bottoms - In the flat they cut through hard clay. - Some creeks are permanent and some ephemeral. 		<ul style="list-style-type: none"> - All National Park at the top. - Scenic reserves along roadways - Vegetation was heavily logged – now all National Park. 			<ul style="list-style-type: none"> - Bramble extensive along Lacey and Jurs. - Bramble is mobile in flood events in flatter area. 	
288 South Maria Creek (C)	<p>Steep at the ridge.</p> <p>Mixed alluvium</p> 	Rocks in the alluvial	<ul style="list-style-type: none"> - Drier in a pocket, rain shadow around range - 2-3 m deep – a few bores 2-2.5L/s yield from some bores. - Flooding in headwaters of Jurs Creek. 	<ul style="list-style-type: none"> - Lots of paleo channels. - Permanent system. - Palaeochannels - Small creeks coming off Walter Hill Range. 	<ul style="list-style-type: none"> - Not much surface to groundwater interaction - More groundwater Off slopes into alluvium more groundwater - 15-20 m to groundwater 	<ul style="list-style-type: none"> - Granadilla at top end 		<ul style="list-style-type: none"> - Vegetation on creeks and steep banks. - Brambles cleared in the past – re growth is weed. - Vegetated because it is very steep up the ridge. - Much of the remnant vegetation is privately owned. 	<ul style="list-style-type: none"> - Important for biota. - Diverse landholders – than one key landholder – broad range of stakeholders. - Remnant is privately owned. 	


Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
										
288 On western side into small creeks (D)	 An enclosed area.	<ul style="list-style-type: none"> - Clay (down to 20m) in the alluvium. - Gets into alluvium quickly. - Further downstream become sandy areas. - Run off into clay and alluvium and because of this creates wet areas. 	<ul style="list-style-type: none"> - Run off into clay and alluvium and because of this it creates wet areas. - Remnant wetland area – not exclusive. 	<ul style="list-style-type: none"> - Steep in headwaters - Not large headwaters. - Channel is permanent then dry's back to pools. - Creek – pools at the top - Well connected system . 	<ul style="list-style-type: none"> - Spring fed material - Less than a 1ltr a second. = very wet landscape. 	<ul style="list-style-type: none"> - Cane and a little grazing. 	<ul style="list-style-type: none"> - Drainage in the system - Other side of range – highway 	Pig damage	<ul style="list-style-type: none"> - Variable minimal riparian. - All mapped as alluvial 7-3-10 all would have been massive riparian area. - Alluvial – lower mesophyll vine forest – low fertile soil – patches of Mahogany. 	<ul style="list-style-type: none"> - Jungle perch, small turtles, rainbow fish and gudgeons. - Black prawns macrobrachin and platypus.
288 (El Arish) Coolyn Creek Whing Creek	<ul style="list-style-type: none"> - Not high elevation, - The highest contour is 240m - In the metamorphics 	<ul style="list-style-type: none"> - Clay in between palaeochannels - Stagnant Creek – clays – slow and floods easily. - Water retention at the surface right 	<ul style="list-style-type: none"> - Hydrologically very complex area and due to the clay the creeks don't move. - Banks break into stagnant creek and 	<ul style="list-style-type: none"> - Short, sharp creeks - 3-4 m deep channel. - Bedrock controlled 	<ul style="list-style-type: none"> - Little in the way of infiltration. - More interaction with the alluvium. 	<ul style="list-style-type: none"> - Lots of cane in the East and West. - cane is up to bank itself - National Park 	<ul style="list-style-type: none"> - Highway and rail coming through Coolyn Creek - Lots of lifestyle blocks in foothills. 	Giant bramble especially in big Maria.	<ul style="list-style-type: none"> - Minimal riparian vegetation in it - Vegetation heavily logged and wind disturbed. 	<ul style="list-style-type: none"> - Big Maria, Whing and Hogan have Jungle Perch and sooty grunter – up to the waterfall. - Priority investment



Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

<p>Big Maria (E)</p>	<ul style="list-style-type: none"> - More of a valley to the west of El Arish, lots of clays to the west. - Ridgeline present under the surface which continues under alluvium. - Shallow before the shale. - The whole area in Big Maria is flat - Ridgeline present - Potential of erosion from the top soil into drainage channels - -  <p>Picture below showing paleo channels.</p> 	<p>throughout with clay underneath.</p> <ul style="list-style-type: none"> - Sandy loam on the surface with clay underneath – sand is very erodible – soil layer less than a 1m - Shales at 16m - Clay down until 15 – 20m - Creek stable due to clay 	<p>whole basin fills a couple of times a year.</p> <ul style="list-style-type: none"> - Detention basin was probably a wetland in the past. 	<ul style="list-style-type: none"> - Incised high banks. - Main streams in the hills are ephemeral - Evidence of palaeochannels – down the ridgeline. - Gibber beds - Main streams permanent - Gravels and sands - Mariah creek channel deep but line through middle drainage. - Coolyn Creek – drains into Stagnant Creek. <p>Good connectivity to ocean.</p>	<ul style="list-style-type: none"> - Groundwater close to the surface. 	<ul style="list-style-type: none"> - Drainage through the cane lands due to the clay. - A lot of creek lines put into drainage channels - A levee has been built on Big Maria. Has been excavator damage - Straightened Mariah Creek <p>Bores in El Arish</p>		<ul style="list-style-type: none"> - Lots of Giant Bramble, very weedy creeks 	<p>area for biodiversity.</p> <ul style="list-style-type: none"> - Rural residential with septic tanks in El Arish. - Crocodiles move right up into El Arish.
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Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
288 Kaygaroo (F)	 <p>Erosion Similar to El Arish</p>		<p>South Maria runs through estuarine area with some palustrine wetland development.</p> <p>Saltwater interface is just below where the two creeks come together (at the confluence of Kaygaroo and South Maria).</p>	<ul style="list-style-type: none"> - Last major creek line in the Big Maria system. - Little headwaters in vegetated area - Flood plain – near permanent and gets slower. - Evidence of lots of paleo channels in this area (Or could be old creeks that have been filled in) or be because of altered drainage. - 1 m deep, 2 m upstream 		<ul style="list-style-type: none"> - Previously had cattle running down into the creek - Cane and grazing. - Rural residential where enters the floodplain. - National Park in Upper - Right at the mouth, there is a prawn farm. 	<ul style="list-style-type: none"> - Lower down it becomes virtually a cane drain 	<ul style="list-style-type: none"> - Big Maria has very poor water quality because of all the farming up to the creek line and the Hymenachne as well. 	<ul style="list-style-type: none"> - Almost no riparian vegetation – shallow, choked up with weeds. - 1 m deep, 2 m upstream - Through floodplain minimum riparian. - Sedges and para grass in it. - Lot of pond apple. 	


Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
288 Cobble Creek South Maria Creek (G)	 Picture below showing prawn and barramundi farm 			<ul style="list-style-type: none"> - Runs through estuarine areas then into the estuary. Both systems coming together. 		<ul style="list-style-type: none"> - Cane and grazing at the end. - Every year grazing area gets bigger. - Two prawn farms one on south and one on north of Maria Creek National Park (see picture opposite) 			<ul style="list-style-type: none"> - Pond apple & Hymenachne 	<ul style="list-style-type: none"> - This is a buffer area before the Great Barrier Reef.
288 (H) Silkwood Mistake Creek	Flat inundation Poor draining soils. Clays within 1st meter – multiple coloured clays – due to iron modules breaking down.		<ul style="list-style-type: none"> - Low water table. - Little permeability – prone to flooding. 	<ul style="list-style-type: none"> - Possible spring - Ground water interaction - Ground water – rises up to 0.5 below surface further down is 4m 		<ul style="list-style-type: none"> - Completely developed catchment 		<ul style="list-style-type: none"> - This area is a hotspot for nutrients as they escape. - 0.95mill grams per LT (higher than standard) nitrates in ground water. - All dissolved organic nitrogen. 	<ul style="list-style-type: none"> - Minimum riparian - All creeks have very poor vegetation through cane. - Creek lines similar to Big Maria and choked with 	<ul style="list-style-type: none"> - From a natural prospective most degraded system. - King reef – high value area.



Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

										weeds and on top is cane drains
288 (I) Bells Creek				In big floods, it floods into the corner of this National Park – very marginal land. Bits and pieces of remnant wetland in that system			Used to be a transfer station. Transfer station right next to the creek. Where it enters the National Park the creek has been straightened. Barrage has been built to stop the saltwater in flow.	- Problem is under so much pressure on a big flood – thousand tons of cane trash and weeds comes in here. - Water quality also impacted by Feral Pigs.	- Glush weed found here and is the only known infestation in Maria catchment - Plenty of Hymenachne & Siam Weed washing down creek into NP.	Crocodiles come up here.
243 (coastal creeks) <i>Overview</i> Daru Creek Boobah Creek Log Bridge Creek Number one Creek Number Two Creek Mourilyan Creek Moresby River Armit Creek	Slopes Up to 246m (Mount Leeper, Moresby Range) headwaters of Ninds Creek. Other peaks include 176m and 246m Land Zones Mostly Mostly - 1 (tidal flats an beaches) - 2 (Coastal dunes) - 3 (alluvium) Some - 11 (Hills and lowlands on metamorphic rocks). Very different system	Large area of: - Alluvium - Sand Areas of - Mudrock (top of sub catchment) - Metamorphic Rock - Granite (headwaters of Mourilyan Creek) - Ultramafic Rock (headwaters of Log Bridge Creek)	2401 – 3201mm/yr Large Palustrine waterbodies by the coast above Walter Creek, off Moresby River, at the headwaters of Moresby River and Mourilyan Creek.			Land use: - Marsh wetland = 32.4% - Cropping – sugar =30% - Irrigated perennial horticulture = 5.15 - Grazing native vegetation = 4.61 - National Parks 1.2% • Etty Bay Road Conservation Park • Moresby Range National Park • Basilisk Range National Park • Warrubullen Conservation Park - Little Moresby Creek, Daru Creek and Boobah Creek) have high land-	- The collection of water quality data from streams of this division is restricted to sites in the estuarine section of the Moresby River during the period 1993-1994 (Table 39). Concentrations of NOx in this river exceeded the QWQG 2009 trigger value which is typical of estuarine waters in the Wet Tropics that receive the run-off of nitrogen from various intensive land uses (Godfrey,	- The condition of riparian vegetation on the streams in Division 19 varies considerably between those sections in protected estate in which vegetation is largely continuous and wide and those sections in unprotected areas in which vegetation is typically		

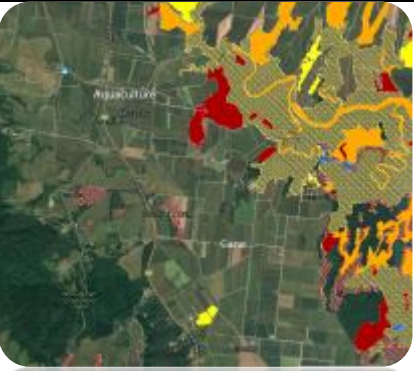
Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

Walter Creek Little Moresby Creek						use scores while the downstream reaches are in developed areas and consequently have low land-use scores (Godfrey, P.C. and R.G. Pearson 2012).		P.C. and R.G. Pearson 2012).	narrow and fragmented (Godfrey, P.C. and R.G. Pearson 2012).	
Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
243 (a) Upper Daru Creek Boobah Creek Log Bridge Creek Little Moresby Creek	<p>Slopes Up to 130m near the headwaters of Boobah Creek (South Branch).</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 11 (Hills and lowlands on metamorphic rocks). - 3 (alluvium) - 2 (Coastal dunes) <p>A flat huge estuarine area and all the sand dunes.</p> <p>Old sand dunes - quaternary.</p> <p>Sand dune on the northern side is the catchment divide</p> <p>Bald areas on the hills as shown in the picture below:</p>	Mainly <ul style="list-style-type: none"> - Alluvium - Mudrock (top of sub catchment) - Ultramafic Rock (headwaters of Log Bridge Creek) - Granite (headwaters of Mourilyan Creek) 	2801 -3201mm/yr <ul style="list-style-type: none"> - Because of the hydrology the area gets unique features. - Underlying geology sand ridges that are influencing the hydrology. 	<ul style="list-style-type: none"> - Moresby has minimal headwaters. 	<ul style="list-style-type: none"> - Massive areas of freshwater wetlands near the coast on top of the sand. 	Land use: <ul style="list-style-type: none"> - Marsh/wetland = 32% - Cropping – sugar = 30% - Irrigated perennial horticulture = 5.15% - Grazing native vegetation = 4.61% - Residential =1.79% - Nature conservation = 1.38% - Basilik Range National Park - Warrubullen Conservation Park 		Three of the 20 stream reaches in division 19 were classified HEV; they were located in upland areas in protected/non-protected estate on the Basilisk Range - Little Moresby Creek, Daru Creek and Boobah Creek (Godfrey, P.C. and R.G. Pearson 2012).	Mangroves are all unique to this area. The broad leaf tea tree is unusual in the wet tropics. It is one of the most extensive stands of mangroves around the Mourilyan harbour and lower Moresby river and is the largest extent of mangroves in the wet tropics type 22a 22b in	<ul style="list-style-type: none"> - Water mouse present (used to be called a false water rat) is endemic. - Restricted ecosystem but not threatened.



Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

									the whole of the wet tropics. - Rainforest on sand this is different from other parts in the bioregion.	
										
Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
243 (b) Middle Mourilyan Creek Number two Creek Little Moresby Creek	Slopes Up to 10m Land Zones Mostly - 2 (Coastal dunes) - 1 (tidal flats an beaches) Not much top soil	Mainly - Alluvium (in the flat sections). Some - Granite - Sand Rocky and lots of mineral – not much top soils – gravel quartz on surface. Serpentine present in mainly southern part of the Basalisk Range.	2401-2801mm/yr Not a huge amount of freshwater. Because of hydrology get unique features The wetland is acting like a treatment system for the cane. Cowley beach coastal dune	Fast run off at headwaters in the Basalisk Ranges Grassy in the channels and has vegetation. Further down short sharp creeks – ephemeral or very low flow. Paleochannels		Land use: Mostly: - Cropping – sugar - Other minimal use (defence) - Marsh/wetland Some: - Residential - Irrigated perennial horticulture - Grazing on native vegetation	- Mirra Mirra falls – pumped and flows for tourists and irrigation for farmers. - High water table therefore lots of drains in the area	- Cowley beach – red iron in the water. - Reeds pick up heavy metals.	- Minimum riparian - exception of Darra Creek, Boobah and Little Moresby. - Small shallow creeks – below Moresby - - lots of cane with	Basalisk Range has plants normally associated with wetlands. Minimal freshwater good for birds No treatment systems. Different freshwater fish species to Johnstone.

Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

		<p>Clay soils 30m – 40m and good aquifers. Bands of clay and sand down to 20m – 30m alluvium right throughout.</p> <p>Windblown sand deposits.</p> <p>Has a mix of white sand clay.</p> <p>Water comes off the ridge lines and gets stuck in this pocket. To north end traces of old basalt flow.</p> <p>Bottom of the catchment have some granite intrusions which must separate the catchments</p>	<p>system slowly feeding surrounding areas, probably not many wonky holes because north south dune runs.</p> <p>Past the sandy pocket it used to be a swampy area and always water present.</p> <p>Saline coastal swamps feature in the Dry Tropics, Usually there is a lot of freshwater in Wet Tropics which mean there is less of a transition zone. It is a productive area and a hard system to replicate because in transition zone between freshwater and estuarine.</p>	<p>In the higher altitudes it will always flow.</p> <p>Good flow (near permanent to permanent) in the headwaters but soaks in when it hits alluvium quickly. Permanent pools are left but not flowing fully.</p> <p>Up at the range – extends further down east than west so bigger effect, fast runoff, short sharp creeks.</p> <p>Connections are not as strong</p>		<p>Aquaculture on main Moresby barramundi and prawns.</p> <p>Paw paw grown - on remains of dune because well drained.</p>			<p>min riparian.</p> <ul style="list-style-type: none"> - Sedgeland species <i>Schoenoplectus</i> – not common in this area. - Undergone a change with brambles. - Moresby Harbour has seagrass meadows. 	<p>Minimal freshwater linkages</p> <p>Don't have the big freshwater influence minimal flow so fewer bigger fish.</p> <p>Barramundi here but no pools and riffles to breed.</p> <p>6000 years cyclone system – last 150 years pause of cyclone history – low cyclone activity period -</p> <p>Relevantly pristine area – not overly developed.</p>
Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall areas and hydrology	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
<p>243 (c) Lower Walter Creek Moresby Creek Walter Creek Armit Creek</p>	<p>Slopes Up to 246m (Mount Leeper, Moresby Range) other peaks including 238m and 176 in the same Moresby range.</p> <p>Land Zones Mostly</p> <ul style="list-style-type: none"> - 2 (Coastal dunes) - 1 (tidal flats and beaches) - 11 (Hills and lowlands on metamorphic rocks). <p>Unconsolidated sediments marine sediments.</p>	<p>Mainly</p> <ul style="list-style-type: none"> - Alluvium - Sand <p>Some</p> <ul style="list-style-type: none"> - Metamorphic Rock (along the coast) <p>Sands and coastal sediment</p> <p>Parallel dune systems pushes river to the north.</p> <p>The geological features are unique. Hard geologies and no alluvium.</p>	<p>2401 - 3201mm/yr</p> <ul style="list-style-type: none"> - Huge estuarine area - Water on the sand runs into the aquifers 	<ul style="list-style-type: none"> - Breakout further up in previous sub catchment Moresby River may have been an old mouth of the Johnstone. 		<p>Land use:</p> <p>Mostly:</p> <ul style="list-style-type: none"> - Other minimal use (defence) - Marsh/wetland <p>Some:</p> <ul style="list-style-type: none"> - Intensive animal production - Residential - Cropping – sugar - Transport and communication (ports and water transport). 	<ul style="list-style-type: none"> - Mourliyan Harbour is a very deep harbour - The mouth of the harbour is twice the size of what it was as it has been blasted. 	<p>The downstream sections of the Moresby River and Mourilyn Creek within protected estate were characterised as SDa because of the agriculture in areas upstream of the protected area (Godfrey, P.C. and R.G. Pearson 2012).</p>	<ul style="list-style-type: none"> - Ant plants in the melaleuca 	<ul style="list-style-type: none"> - People used to live on top of the dune.. - Mourilyn Creek is in a green zone. - The issues that are here are unique and don't exist in a lot of areas. - Focus should be on functionality not

Subcatchment Summaries for the Lower Johnstone (notes for workshop November 2016)

<p>Mosaic of coastal ecosystems towards the coast acting like a filter for practices further up. Rarely get a creek system running through a sand plug.</p>  <p>Swale drainage shown throughout the landscape as shown in the picture below.</p> 	<p>The deepest sand sequence is 31 metres</p> <p>Sharp delineation between sequences of clays and sand.</p>				<ul style="list-style-type: none"> - National Park - Etty Bay Road Conservation Park - Moresby Range National Park - Barramundi and prawns aquaculture. Aquaculture systems have treatment systems. - The downstream reaches of Moresby River and Mourilyn Creek are located in a protected estate but their catchments are dominated by agriculture, which reduces the land-use score for the downstream reaches of these streams. (Godfrey, P.C. and R.G. Pearson 2012). 				<p>return to pre clear.</p>
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