Norman Wells Operations Annual Flowline Integrity and Break-Up Report

October 2017

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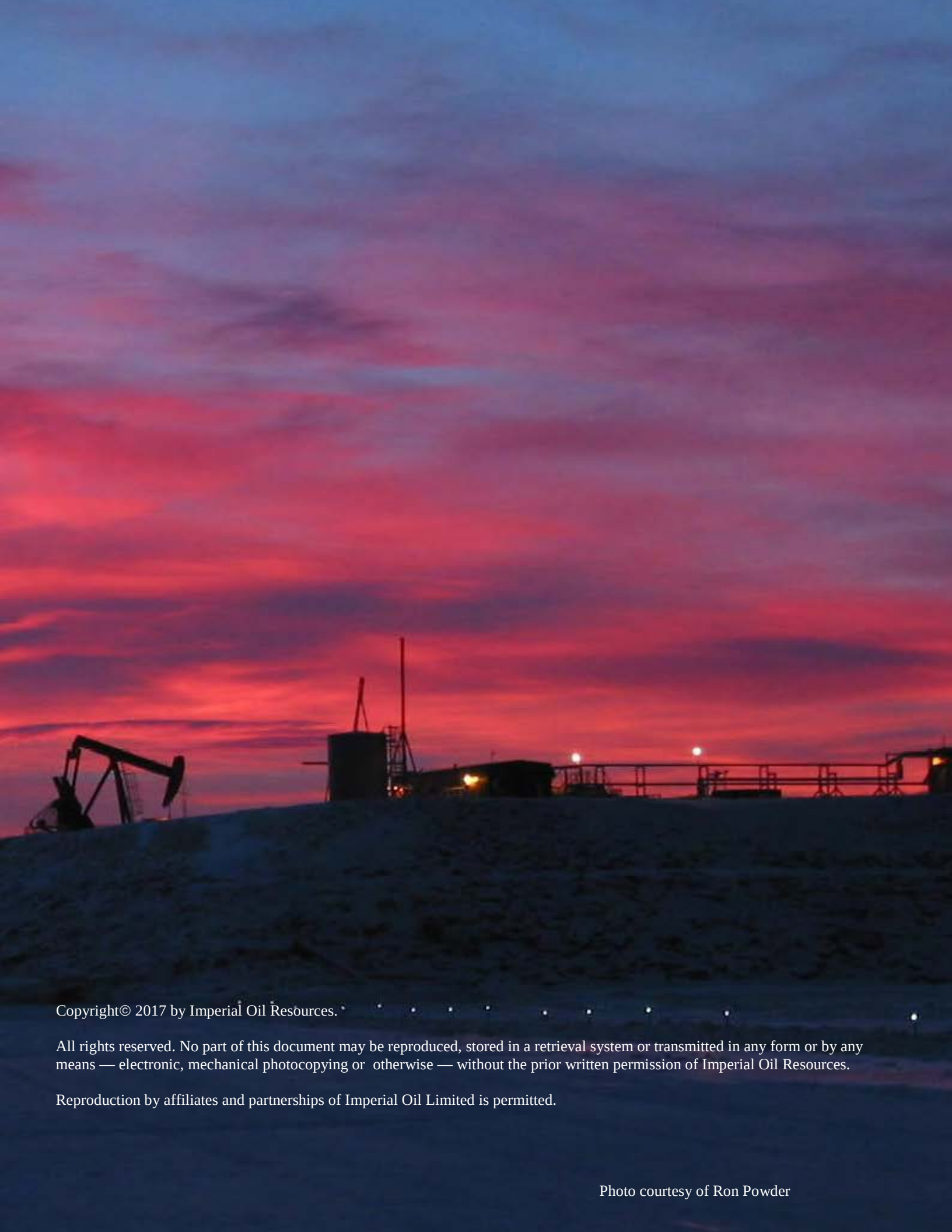

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ACRONYMS

AANDC	Aboriginal Affairs and Northern Development Canada
BIT	Bear Island Terminal
cm	centimeters
CPF	Central Processing Facility
GIT	Goose Island Terminal
GPS	Global Positioning System
IOR	Imperial Oil Resources
LT	Land Terminal
m^3	metres cubed
m	metres
masl	metres above sea level
N/A	Not applicable
NWO	Norman Wells Operations
PM	Preventative Maintenance
RTK	Real Time Kinematic
SLWB	Sahtu Land and Water Board
SSSV	Subsurface Safety Valves

1 INTRODUCTION

Imperial Oil Resources N.W.T. Limited (Imperial) is required by the Sahtu Land and Water Board (SLWB) Water Licence S13L1-007 (Schedule 5, Item 1) to annually submit a Flowline Integrity and Break-Up Report no later than October 31st of the year being reported.

Details on the licence requirements for this report and corresponding section within the report can be found in the following concordance table.

Licence Requirement			Section of Report
a)	i.	Locations, depth, and volume of channel scour in the vicinity of any Flowline(s)	Section 5
	ii.	Locations and magnitude of Artificial Island slope erosion	Section 6
	iii.	Locations and severity of Artificial Island rip rap disturbance	Section 6
	iv.	Structural integrity of the Artificial Islands, and other related structures	Section 6
	v.	Structural integrity of the Natural Islands where it is applicable to project activities	Section 6
b)	The dates and results of Flowline(s) and fuel storage tank integrity tests		Section 7
c)	Details on necessary repair and maintenance work along with a schedule for completing such work prior to the following spring Mackenzie River Break-Up period.		Section 5 & 6

2 2016 BREAK-UP SUMMARY

As per the water licence Imperial shall undertake any necessary annual maintenance required to preserve the structural integrity of the islands. In addition, Imperial inspects the riverbeds, channels and banks of the Mackenzie River in the vicinity of the flowline(s). In order to determine structural integrity of the islands Imperial conducts an annual artificial island inspection. The results of these surveys are submitted in this *Flowline Integrity and Break-Up Report* along with details of the year's Mackenzie River break-up events.

The average water level during the Mackenzie River break-up at Norman Wells is approximately 9 m (44.5 masl) and typically occurs between May 10th and May 15th. Due to technical issues with realtime data on the federal government website, it is difficult to determine the exact day the break-up occurred. This year's break-up occurred between May 12th (7.515 m) and May 15th (13.146 m).

Details on water levels of the Mackenzie River during break up from April 24th to May 26th as reported in the Water Survey of Canada Highwater Report are provided in Appendix A. Photos of the Mackenzie River at Norman Wells taken during break-up are also included in this report in Section 4.

2.1 Annual Inspections

This year's bathymetric survey was completed in June 2017 the results of which are summarized in Section 5 of this report.

The annual artificial island inspection was performed in August 2017 and summarized in Section 6 of this report.

3 BREAK-UP PREPARATION

Prior to each year's Mackenzie River break-up a number of essential tasks must be completed. The key items are listed below:

- Spot heavy equipment on Bear and Goose Island
- Service equipment (e.g. compressors, operator trucks, etc.,)
- Plug wells (e.g. wireline activity)
- Verify bunker lids and water intake hatch are secured and protected from ice flow
- Install and function test sub surface safety valves (SSSVs)
- Ensure adequate supply of chemical, fuel and potable water on island locations
- Remove equipment from low lying areas
- Inspect Bear Island purge equipment and review purge plan
- Finalize helicopter plans in preparation for ice road closure
- Execute weekly ice profiles
- Close ice road to equipment
- Remove ice road signage
- Monitor river levels and upstream break up conditions

4 MACKENZIE RIVER AT NORMAN WELLS BREAK-UP PICTURES

Post break-up pictures were taken on May 23, 2017.

Image A: Mainland Dock – May 23, 2017

Image B: Island 1 – May 23, 2017

Image C: Island 2 – May 23, 2017

Image D: Island 3 – May 23, 2017

Image E: Island 4 – May 23, 2017

Image F: Island 5 – May 23, 2017

Image G: Island 6 – May 23, 2017

Image H: Goose Island – May 23, 2017

Image I: Bear Island – May 23, 2017

5 2017 BATHYMETRIC SURVEY

The annual bathymetric survey was performed between June 17th and 25th by WSP Canada Inc. The purpose of the survey is to:

- Determine the amount of instream cover over Imperial's eight cross river flowline bundles located in the bed of the Mackenzie River
- Monitor the river bed immediately adjacent to eight cross river flowline bundles enabling interception of scour hole movement towards flowline bundles
- Monitor the river bed at the base of the six artificial islands and Bear and Goose causeways for possible erosion or scouring
- Monitor the build-up or movement of the sandbars over the flowline bundles
- Identify any changes in the shape and elevation of the river bed in the areas adjacent to the islands, causeways, and docks

For information on typical bathymetric survey equipment used for the Norman Wells survey refer to Appendix B.

5.1 Bathymetric Survey Results

The 2017 cross-river flowline bundle survey results are provided in the following sections. No repair work is currenty planned for 2018. Copies of the bathymetric survey drawings can be found in Appendix C.

A specific cross river flowline corridor depth of cover has not been specified for Norman Wells. The corridors are managed on a case by case basis. Cover material is intended to:

1) Provide protection against physical impact, and
2) Provide protection against failure modes due to pipeline free-span (e.g. vortex induced vibration, bending)

The primary intent of the bathymetric survey is to verify that pipline bundles are not exposed (i.e. depth of cover remains > 0m), such that the risks outlined above are reduced to the extent possible.

Areas which show relatively low cover (<1.0m) or significant increases or decreases in cover between surveys are flagged for review on an annual basis.

In cases where exposure or near-exposure of the bundle is confirmed, appropriate remedial action will be triggered.

Remedial action typically consists of deposition of armoring rock on the pipeline corridor. This armoring rock is sized to be stable during anticipated river flow rates and is not expected to be subject to scour. If armoring material is confirmed to be in place, the flowline corridor is considered to be protected from the risks described above.

5.1.1 Flowline Bundle Profiles

5.1.1.1 Island 1 to Mainland Flowline

The 2017 profile data are very similar to the previous year's surveys. The flowline corridor has adequate cover throughout its entire length.

5.1.1.2 Island 2 Mainland Flowline

The 2017 profile data are very similar to the previous year's surveys. The flowline corridor has adequate cover throughout its entire length.

The monitoring location at 1+579 appears to have similar cover as compared to last year.

5.1.1.3 Island 3 to Goose Island Flowline

Water levels did not permit the collection of multibeam data for the entire corridor.

Similar to the 2016 survey, the 2017 data suggests there is approximately 0.1 m of cover between stations 0+581 and 0+600. A visual survey of this area was completed in early 2017 by boring a hole in the ice cover and inserting a waterproof camera. This survey confirmed the presence of armoring rock and did not identify any areas of exposed piping. This location will be subject to ongoing monitoring through the annual bathymetric survey.

The approach to Island 3 (0+661 to 0+700m) showed a reduction in depth of cover which may be attributable to a slight changes in survey paths year on year. The area will be subject to ongoing monitoring through the annual survey.

The flowline corridor adequate cover throughout its entire length.

5.1.1.4 Island 3 to Mainland Flowline

The 2017 profile data are very similar to the previous year's surveys. The flowline corridor has adequate cover throughout its entire length.

5.1.1.5 Island 4 to Goose Island Flowline

The 2017 profile data are generally very similar to the previous year's surveys.

Notable changes from the 2016 survey include:

- Decreased depth of cover at 0+357m. This location was not surveyed due to low water levels in 2015 and 2016. Verification of coverage at this location is recommended.

The flowline corridor has adequate cover throughout its entire length.

5.1.1.6 Island 5 to Bear Island Flowline

The 2017 profile data are generally similar to the previous year's surveys. Areas of higher levels of riverbed activitiy are noted on this corridor.

Notable changes from the 2016 survey include:

- Increased depth of cover between 0+148 and 0+223m
- Decreased depth of cover at 0+334m
- Increased depth of cover between 0+790 and 0+820

The flowline corridor has adequate cover throughout its entire length.

5.1.1.7 Island 6 to Bear Island Flowlines

The 2017 profile data are generally similar to the previous year's surveys. Areas of higher levels of riverbed activitiy are noted on this corridor.

Notable changes from the 2016 survey include:

- Decreased depth of cover between 0+242 and 0+300m to levels consistent with 2014 profiles

The flowline corridor has adequate cover throughout its entire length.

5.1.1.8 Bear Island to Goose Island Flowlines

The 2017 profile data are very similar to the previous year's surveys. The flowline corridor has adequate cover throughout its entire length.

5.1.2 Surrounding Areas

The results of the 2017 bathymetric survey for the artificial island locations are provided in the following sections. Results indicate there has been minimal change from the previous year and there are no immediate concerns. No repair work is planned for 2018.

5.1.2.1 Mainland Dock

The 2017 contours, compared to the previous year's surveys show some change but no immediate concers.

5.1.2.2 Bear Island and Goose Island Causeway

The 2017 contours, compared to the previous year's surveys show some change but no immediate concerns.

6 PROTECTION ASSESSMENT AND MAINTENANCE

6.1 Summary of Protection Assessment and Maintenance

6.1.1 2016 Repairs

Artificial island repairs were completed in February 2017 as per recommendations in the 2016 Artificial Island Inspection Report. Approximately 720 m^3 of rip rap was used to repair the artificial islands as part of this work. Details of the repairs completed are described in the next sections.

6.1.1.1 Island 1

The inspection showed Island 1 to be in good condition; therefore, no maintenance was required in 2017

6.1.1.2 Island 2

The inspection showed Island 2 to be in good condition; therefore, no maintenance was required in 2017

6.1.1.3 Island 3

The inspection showed Island 3 to be in good condition; therefore, no maintenance was required in 2017.

6.1.1.4 Island 4

The inspection showed Island 4 to be in good condition; therefore, no maintenance was required in 2017

6.1.1.5 Island 5

The inspection showed Island 5 to be in good condition; therefore, no maintenance was required in 2017.

6.1.1.6 Island 6

Approximately 720 m^3 of rip rap was placed on the on the north-west of Island 6 during the winter of 2017.

6.1.1.7 Mainland Dock

The inspection showed the mainland dock to be in good condition; therefore, no maintenance was required in 2017.

6.1.1.8 Goose Island Boat Landing

The inspection showed Goose Island Boat Landing to be in good condition; therefore, no maintenance was required in 2017.

6.1.2 2018 Proposed Repairs

The 2017 Artificial Island Inspection was conducted between August 15th to 17th, by Wim M. Veldman Consulting and Advisian. The 2017 recommendations put forth by the inspectors form the basis of island repairs to be completed during the 2018 winter season.

6.1.2.1 Island 1

The inspection showed Island 1 to be in good condition; therefore, no repairs are required in 2017/2018 winter period.

6.1.2.2 Island 2

The inspection showed Island 2 to be in good condition; therefore, no repairs are required in 2017/2018 winter period.

6.1.2.3 Island 3

The inspection showed two areas where gaps have formed in the riprap protection that will require Class E rockfill. Both areas were on the upstream corner, Norman Wells side of the island. Each gap measured approximately 50 m^2 and, therefore, will require approximately 100 m^3 of Class E material to be placed.

6.1.2.1 Island 4

The inspection showed Island 4 to be in good condition; therefore, no repairs are required in 2017/2018 winter period.

6.1.2.2 Island 5

The inspection showed one area where a gap has formed in the riprap protection that will require rockfill. The area was on the upstream face, near the Norman Wells side corner blocks. The gap was measured as approximately 50 – 75 m^2 and, therefore, will require approximately 50 – 75 m^3 of Class E material to be placed.

6.1.2.3 Island 6

The inspection showed Island 6 to be in good condition; therefore, no repairs are required in in 2017/2018 winter period.

7 FLOWLINE AND FUEL STORAGE TANK INTEGRITY

The operational integrity of all critical equipment is stewarded through Imperial's preventative maintenance program which is derived from OIMS 6.2 Facility Integrity Management System (FIMS). FIMS is the system that identifies critical equipment and sets forth required preventative maintenance programs and frequencies.

7.1 Fuel Storage Tank Integrity Inspections

Table A lists the storage tanks on site, the type and frequency of inspection performed on each tank, along with the results.

Table A: Fuel Storage Tank Integrity Inspections

Tank Name	Type of Inspection	Results
Goose Island Diesel	5 Year External UT	– Last completed 2015; no issues Next inspection 2020
	1 Month External Visual	– Completed monthly; no issues
Goose Island Gas	5 Year External UT	– Last completed 2015; no issues Next inspection 2020
	1 Month External Visual	– Completed monthly; no issues
Bear Island Gas	5 Year External UT	– Last inspected 2016; no issues Next inspection due in 2021
	1 Month External Visual	– Completed monthly; no issues
Bear Island Diesel	5 Year External UT	– Last inspected 2016; no issues Next inspection 2021
	1 Month External Visual	– Completed monthly; no issues
Mainland Diesel	5 Year External UT	– Installed in 2015 Next inspection due in 2020
	1 Month External Visual	– Completed monthly; no issues
CPF T-103 Diesel	5 Year External Settlement	– Last inspected 2017; no issues Next inspection due in 2022
	5 Year External Visual	– Last inspected 2016; no issues Next inspection due in 2021
	10 Year Internal	– Inspection completed 2016; no issues Next inspection due in 2026
T-104 Emergency Generator Diesel	5 Year External Visual	– Inspection completed 2016; no issues
	10 Year External UT	– Inspection completed 2007; no issues Next inspection due in 2017
Mainland Heating Oil	1 Month External Visual	– Completed monthly; no issues.

7.2 Flowline Integrity

Table B lists the flowline integrity inspections completed in 2017, along with the inspection type for each of the flowlines and the inspection results.

Table B: Flowline Integrity Inspections 2017

Flowline Number	Type of Inspection	Results
133	Verification Digs for 2016 In-Line Inspection	External corrosion noted and remedied. Internal corrosion found to be minimal. Dent identified on ILI found to be free of corrosion.
490	Verification Digs for 2016 In-Line Inspection	Localized external corrosion noted; working with ILI vendor to asses. Internal corrosion consistent with ILI data. Dent identified on ILI found to be free of corrosion.
448	Verification Digs for 2016 In-Line Inspection	Internal corrosion consistent with ILI data. Wall thickness transition pieces flagged for further evaluation.
87, 88, 242, 527	Excavation, Ultrasonic Inspection	External corrosion noted and remedied. Feature depths less than ancipated based on previous inspections.

LIST OF APPENDICES

Appendix A. Water Survey of Canada Highwater Reports (2017)
Appendix B. Bathymetric Survey Equipment
Appendix C. Bathymetric Drawings (2017)

Appendix A. Water Survey of Canada Highwater Reports (2017)

Water Survey of Canada Highwater Reports for the period of April 24th to May 26th is filed behind this page. These water reports highlight the Mackenzie River conditions during break-up.

Environment Canada
Environnement

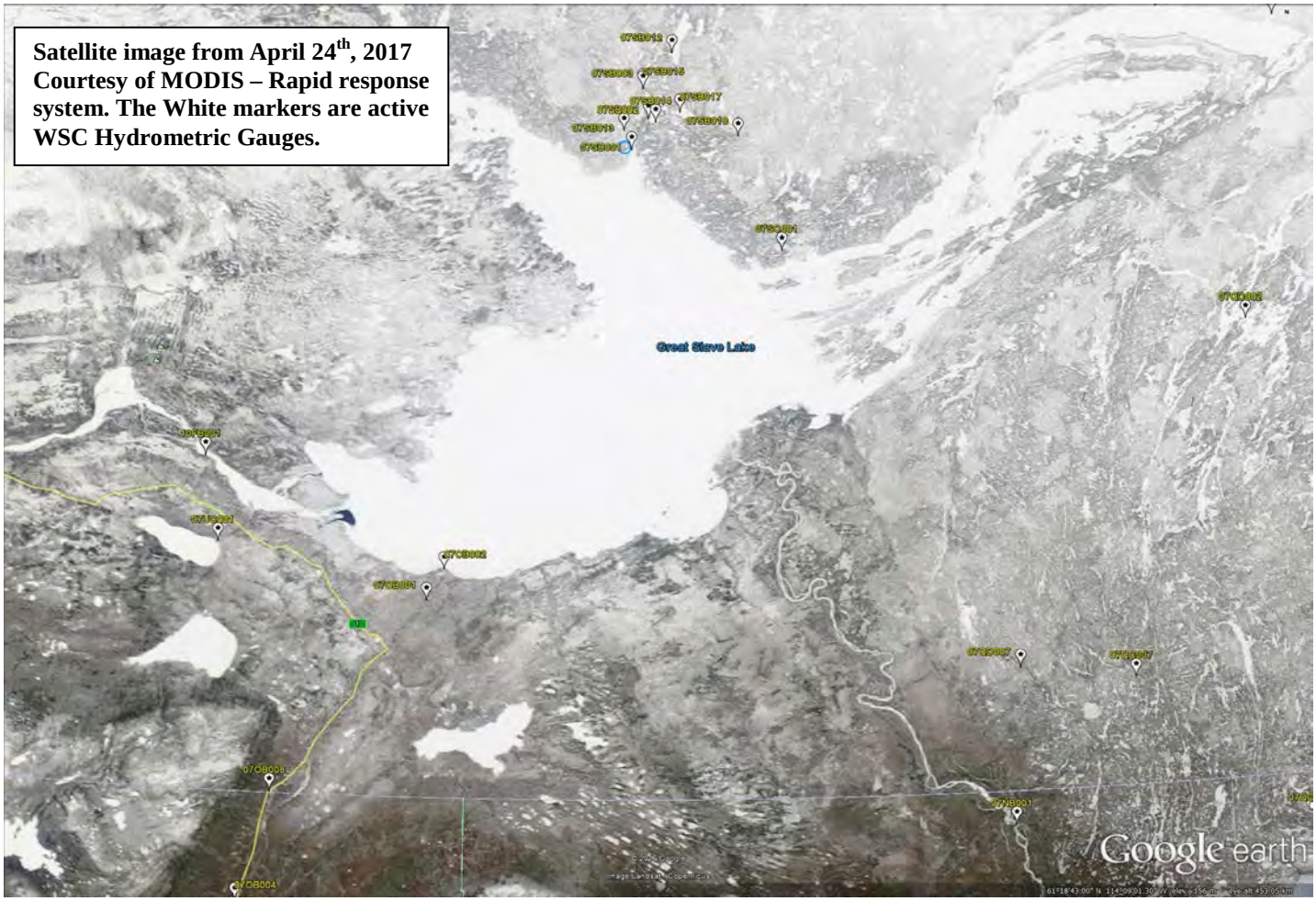
Water Survey of Canada
Suite 400, 5019 – 52 Street
Yellowknife, NWT
X1A 2P7

Report for April 24th, 2017

This is the first NWT High-Water Report for 2017. The information presented is reported by Water Survey of Canada (WSC) staff in Ft. Simpson, Inuvik, Yellowknife, and numerous contacts in various communities. Their contributions are gratefully acknowledged. If you have any comments or do not wish to receive further reports, please contact WSC at (867) 669-4774 or FAX (867) 669-4750.

Regional Weather

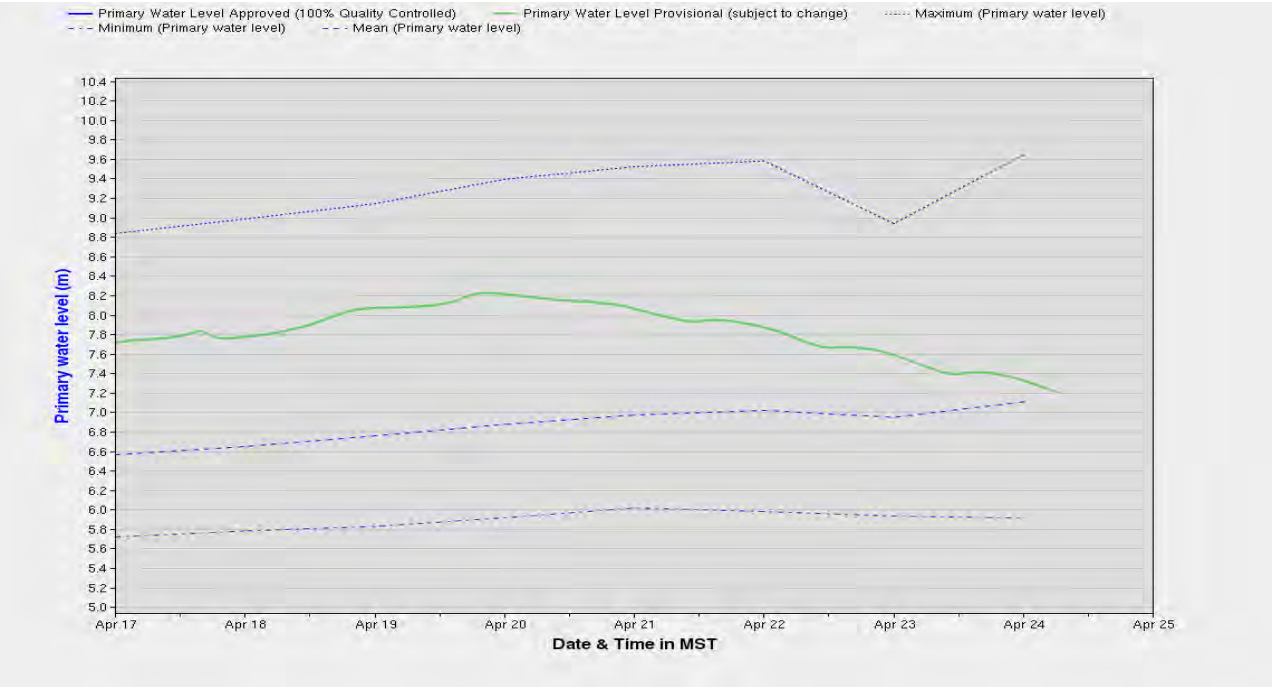
Regional Weather	Today	Tuesday	Wednesday
North Slave	High -2 /Low -12	High +5 /Low -7	High +7/ Low -5
Deh Cho	High +9/ Low -2	High +13/ Low -2	High +9/ Low -3
Sahtu	High 0/ Low -9	High 0/ Low -6	High 0/ Low -7
Delta	High -10/ Low -17	High -12/ Low -16	High -11/ Low -15



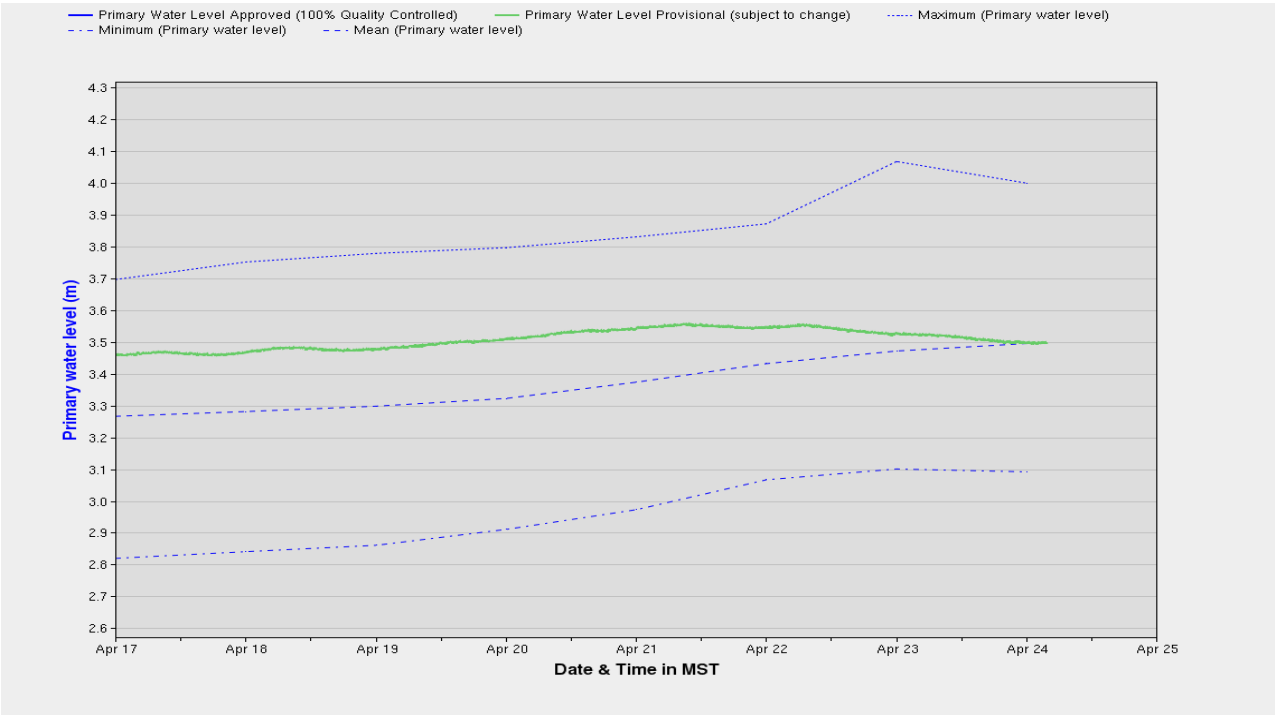
Satellite image from April 24th, 2017 Courtesy of MODIS – Rapid response system. The White markers are active WSC Hydrometric Gauges.

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Peace River at Peace Point (07KC001) - Current water level is 7.199m. Average break-up level is around 8-14m and occurs around April 29th.

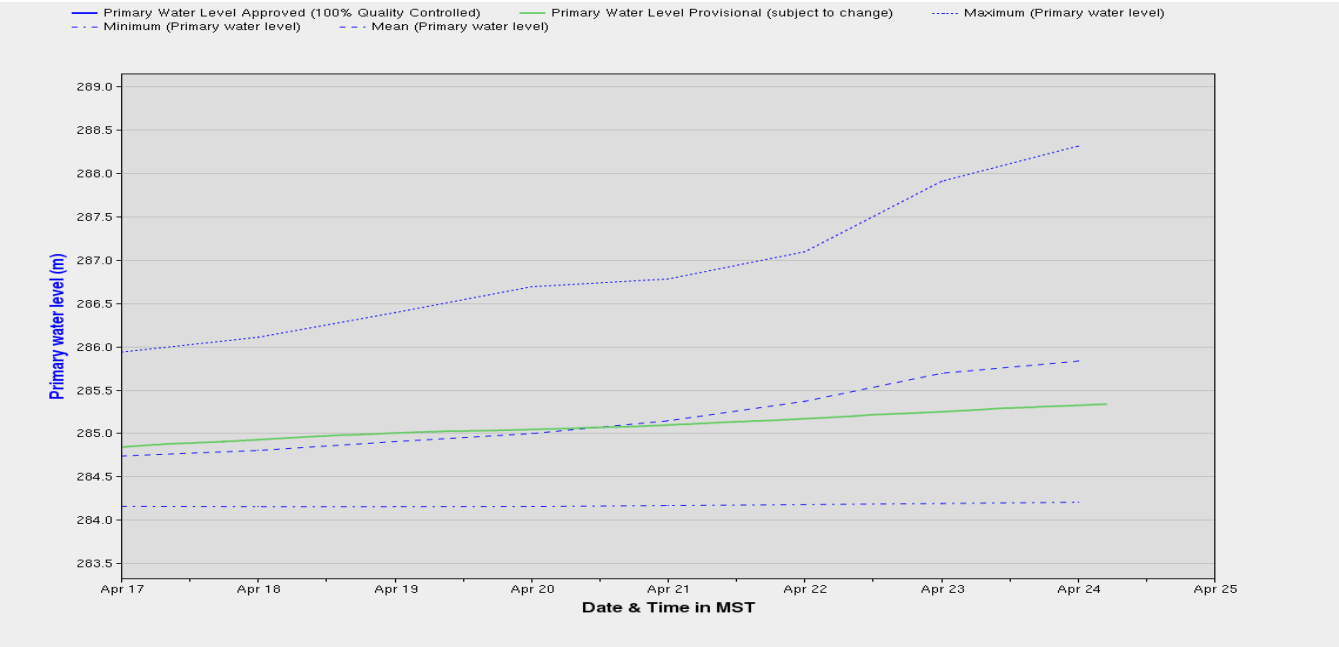


Slave River at Fitzgerald (07NB001) - Current water level is 3.499m. Average break-up level is around 4m with break-up occurring around April 30th.

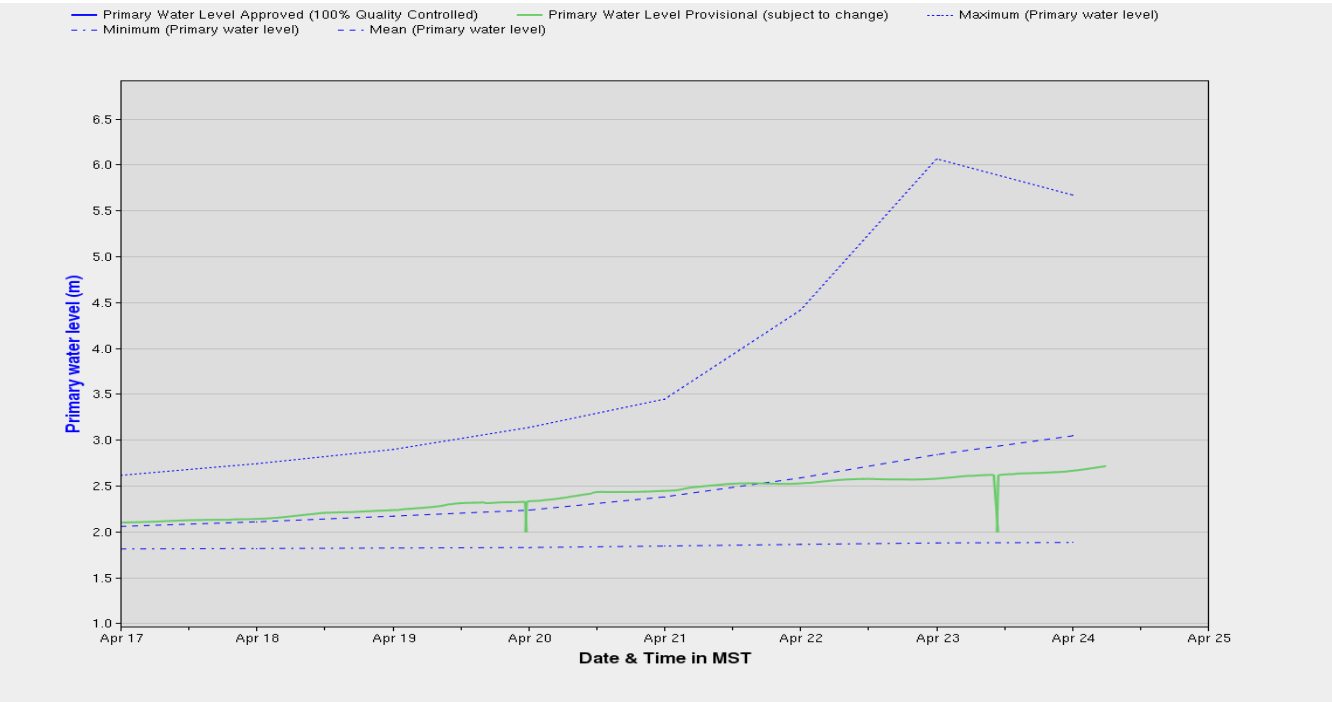


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Hay River near ALTA/NWT Boundary (07OB008) – Current water level is 285.336m. Latest report from the Hay River Flood Watch Committee is that the ice at Meander River and Zama crossing remains intact.

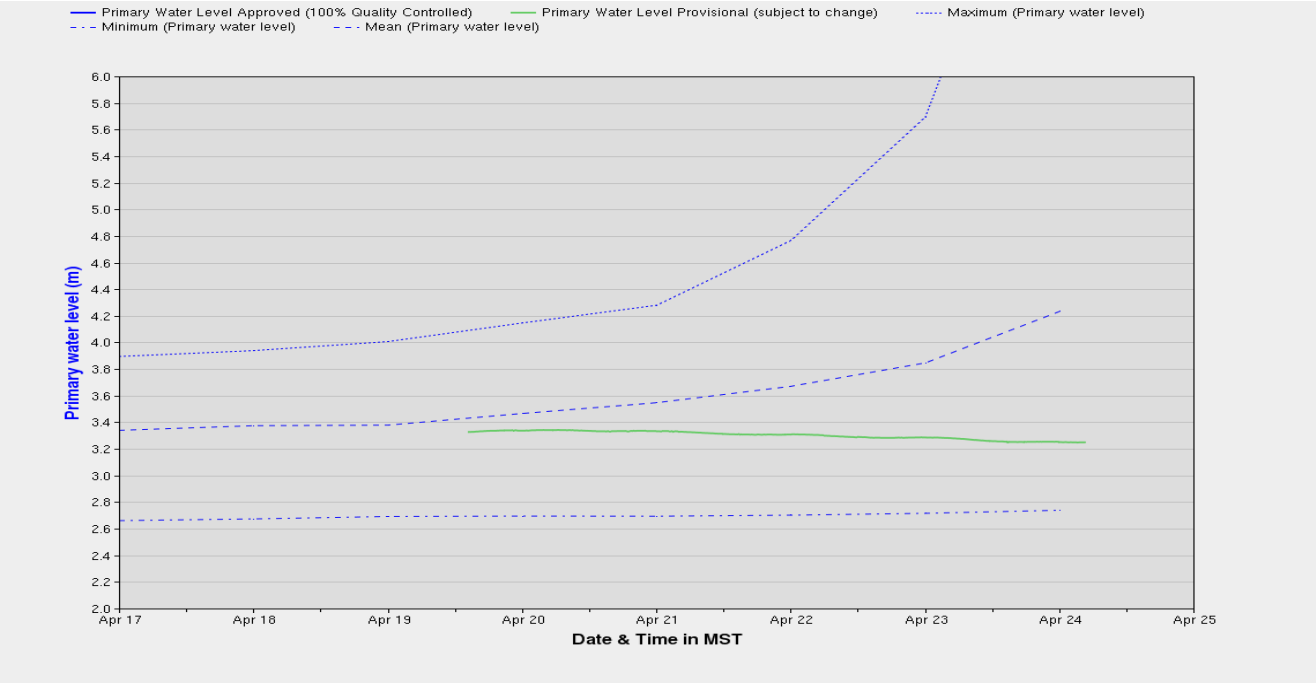


Hay River @ Hay River (07OB001) - Current Water Level is 2.712m. Average break-up level is approximately 8 meters with break-up occurring around April 30th. For more information on breakup conditions in Hay River click on the following link: http://hayriver.com/residents/2017-breakup-information/

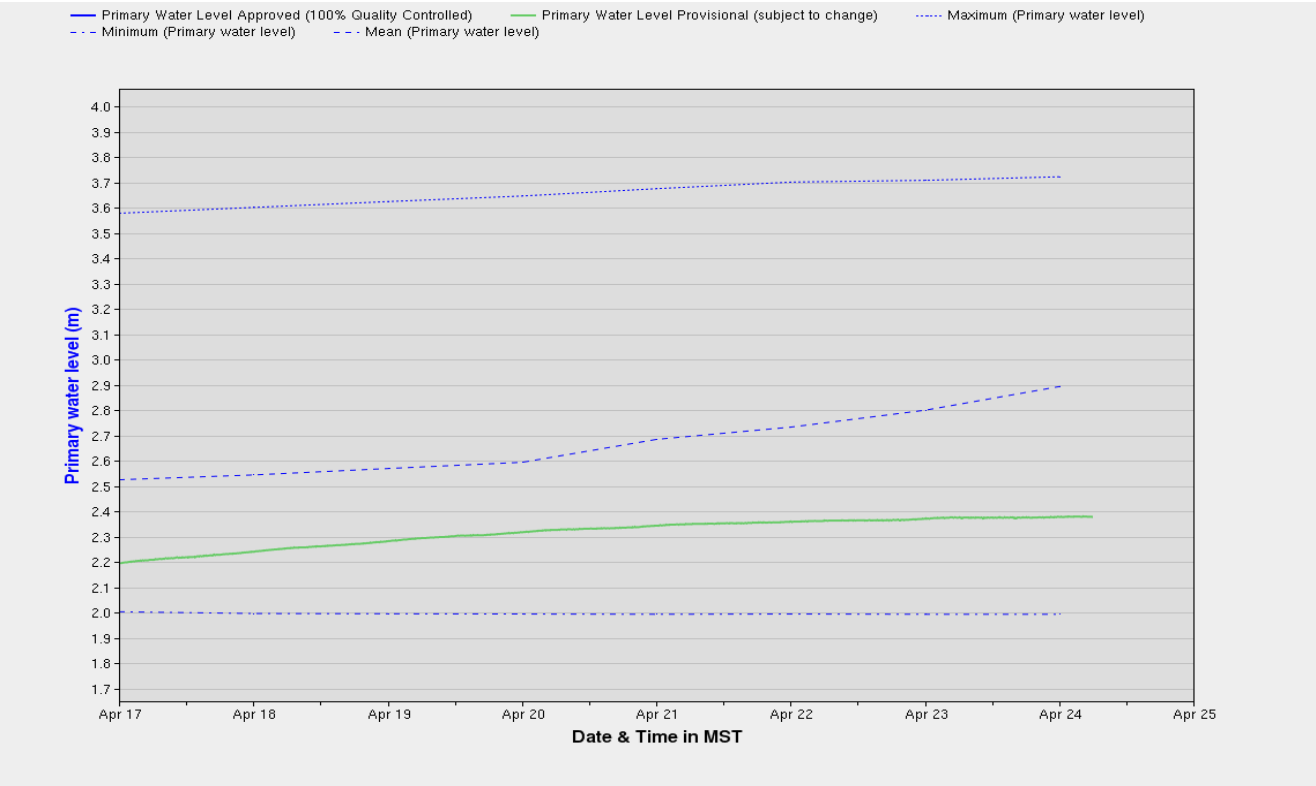


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Liard River @ Ft. Liard (10ED001) - Current water level is 3.249m. Average break-up is around April 30th.



Liard River near the Mouth (10ED002) - Current water level is 2.378m. Average break-up level is around 4.4m with break-up occurring around May 4th.

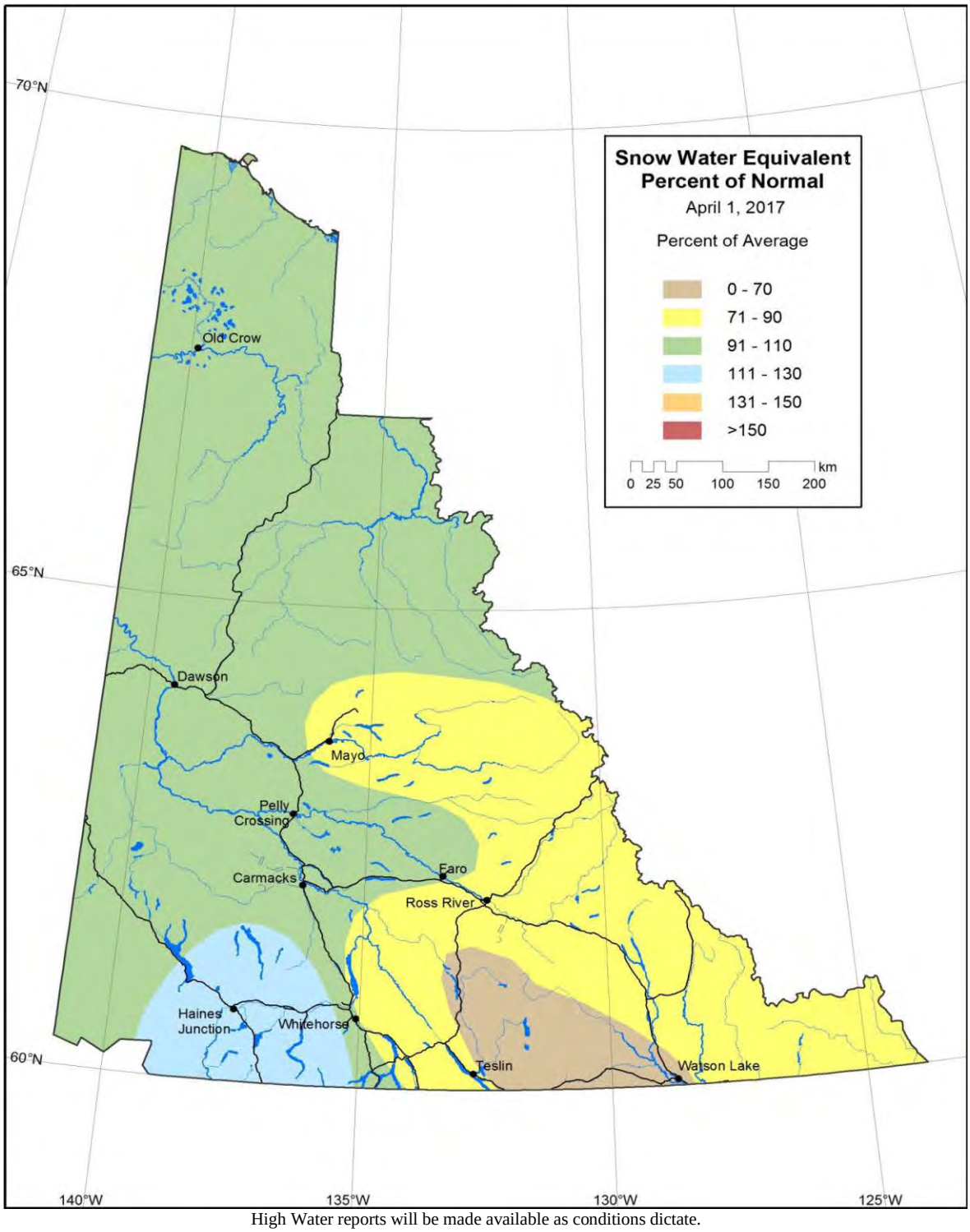


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Listed below are maps of snow pack and spring runoff information for the Yukon, B.C. and Alberta.

Yukon Snow survey as of April 1, 2017

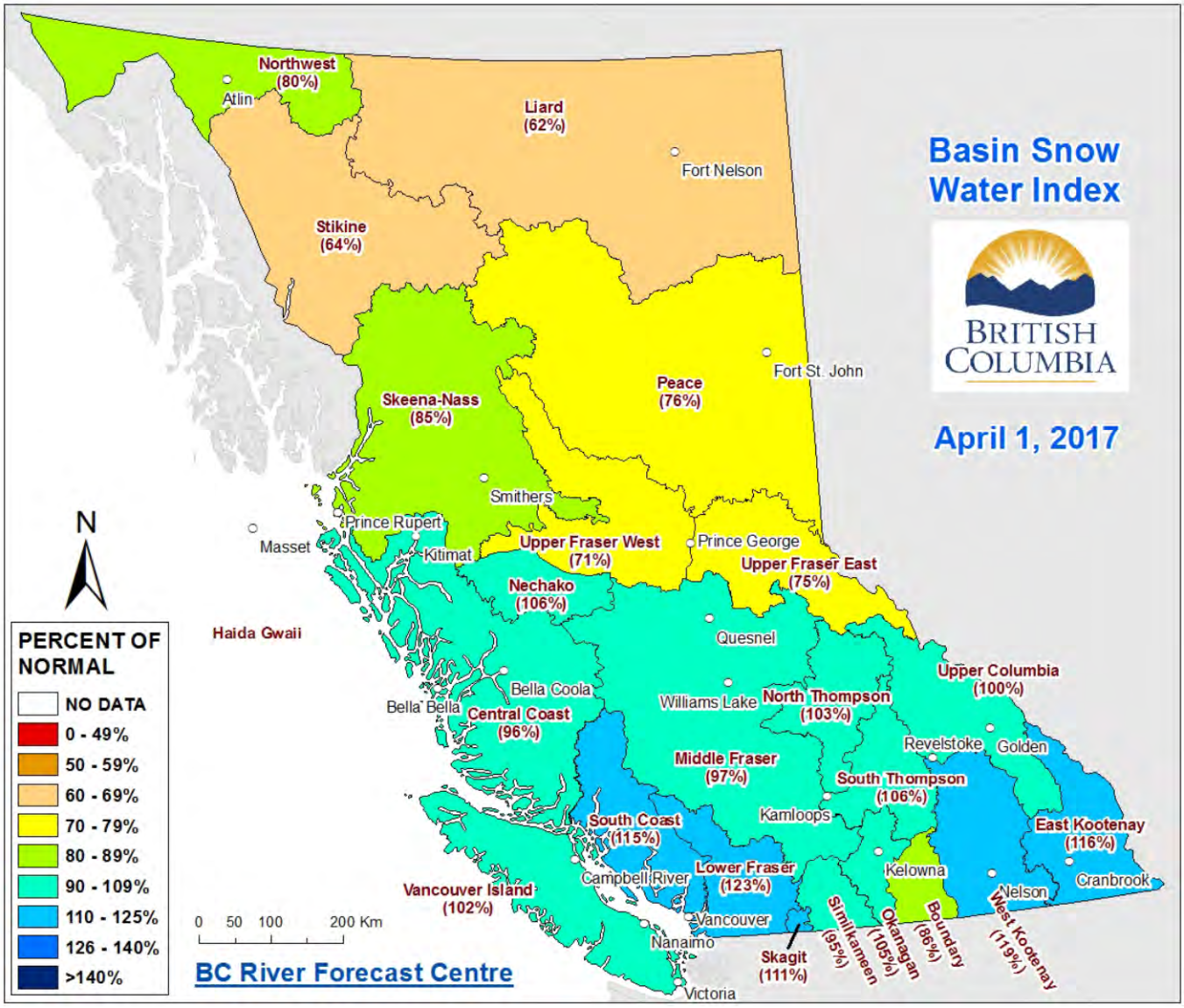
You can find the full Yukon snow survey bulletin & water supply forecast report and other useful information at the following link: http://www.env.gov.yk.ca/air-water-waste/snow_survey.php



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Basin snow water index for British Columbia as of April 1, 2017

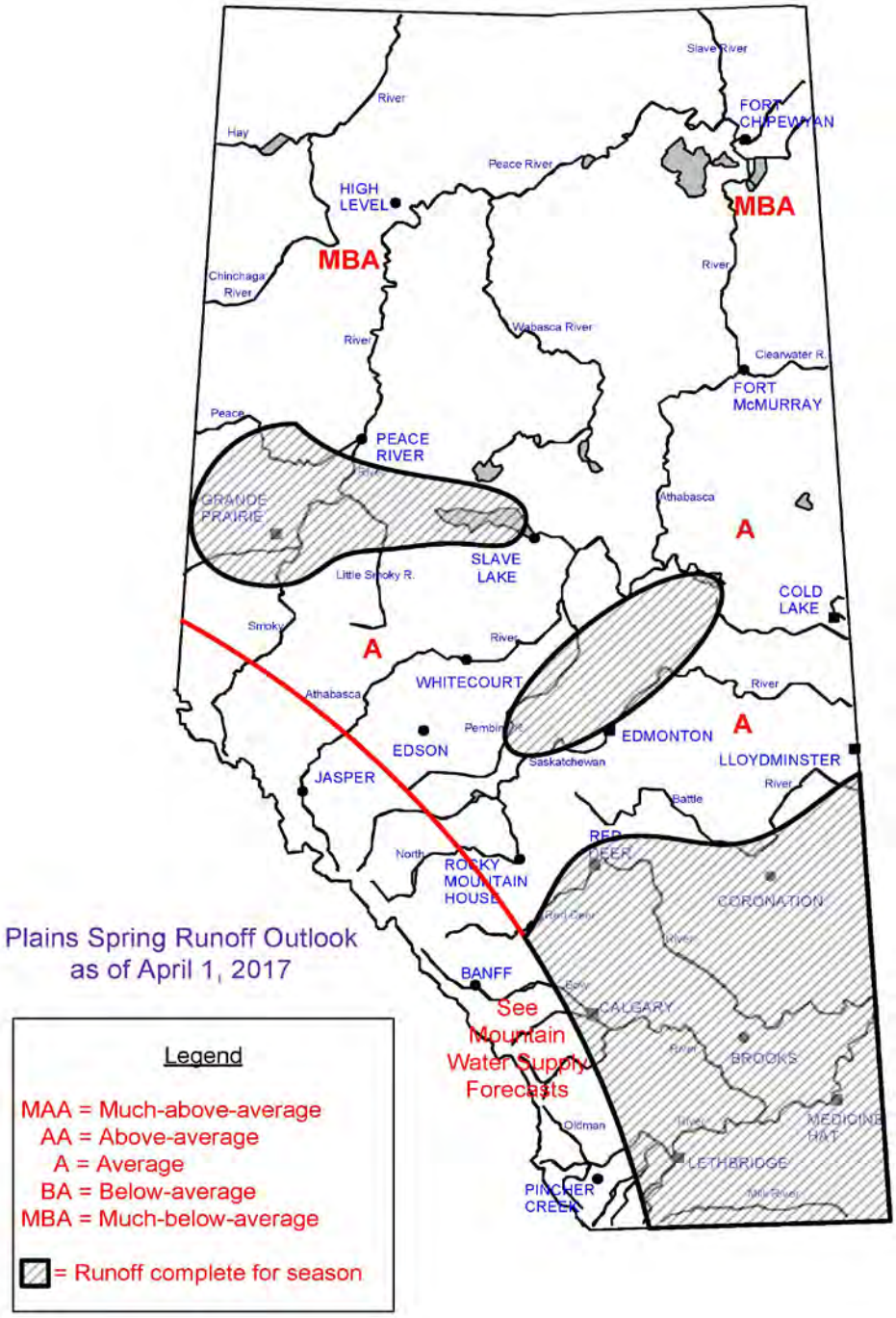
You can find the full B.C. snow survey & water supply bulletin report and more useful information at the following link: http://bcrfc.env.gov.bc.ca/bulletins/watersupply/current.htm



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Spring runoff outlook for Alberta as of April 1, 2017

You can find the water supply outlook for Alberta and more useful information at the following link: http://environment.alberta.ca/forecasting/WaterSupply/index.html



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Environment Canada
Environnement

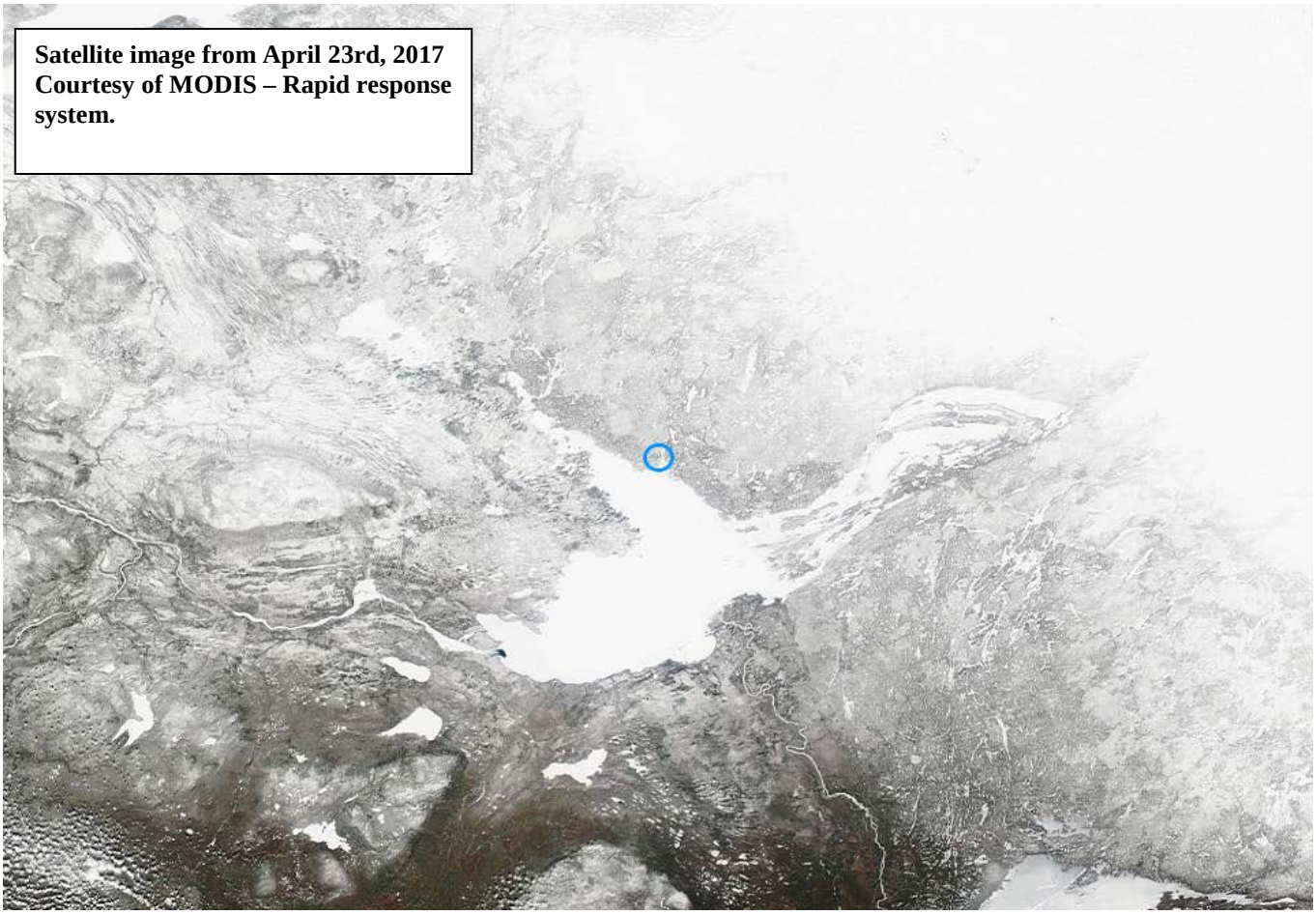
Water Survey of Canada
Suite 400, 5019 – 52 Street
Yellowknife, NWT
X1A 2P7

Report for April 25th, 2017

The information presented is reported by Water Survey of Canada (WSC) staff in Ft. Simpson, Inuvik, Yellowknife, and numerous contacts in various communities. Their contributions are gratefully acknowledged. If you have any comments or do not wish to receive further reports, please contact WSC at (867) 669-4774 or FAX (867) 669-4750.

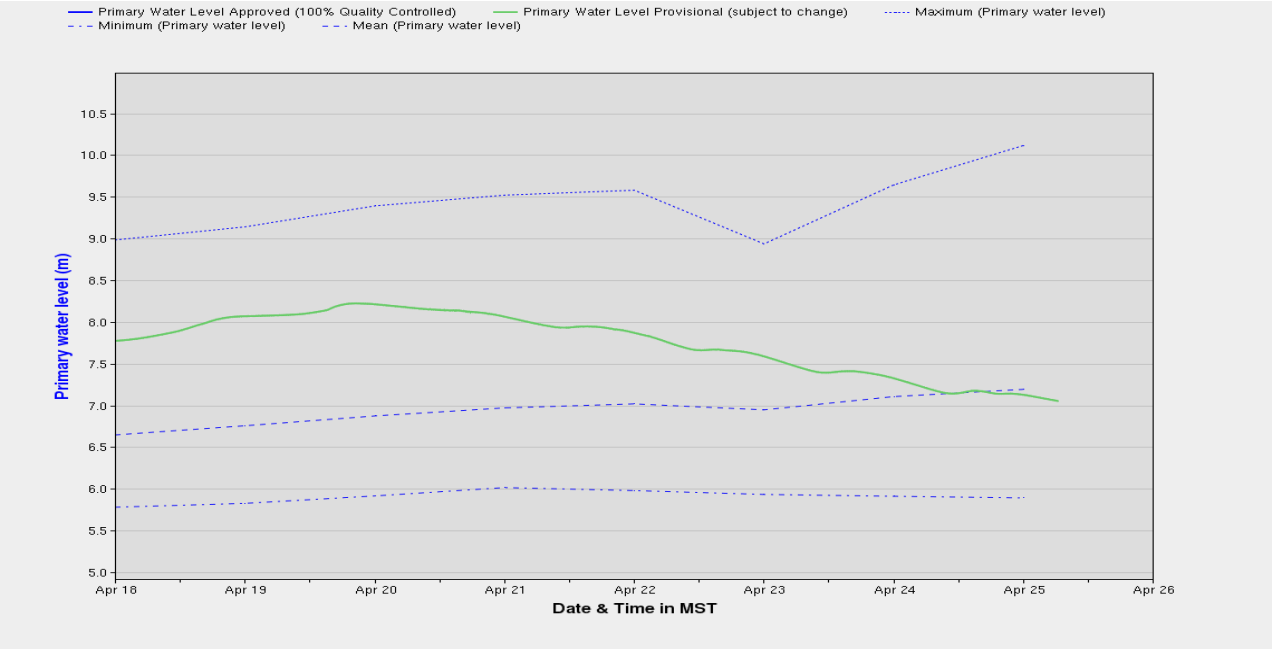
Regional Weather

Regional Weather	Today	Wednesday	Thursday
North Slave	High +4 /Low -4	High +5 /Low -6	High +4/ Low -5
Deh Cho	High +11/ Low -3	High +6/ Low -4	High +4/ Low -6
Sahtu	High -2/ Low -9	High -4/ Low -9	High -2/ Low -7
Delta	High -12/ Low -18	High -12/ Low -17	High -9/ Low -13

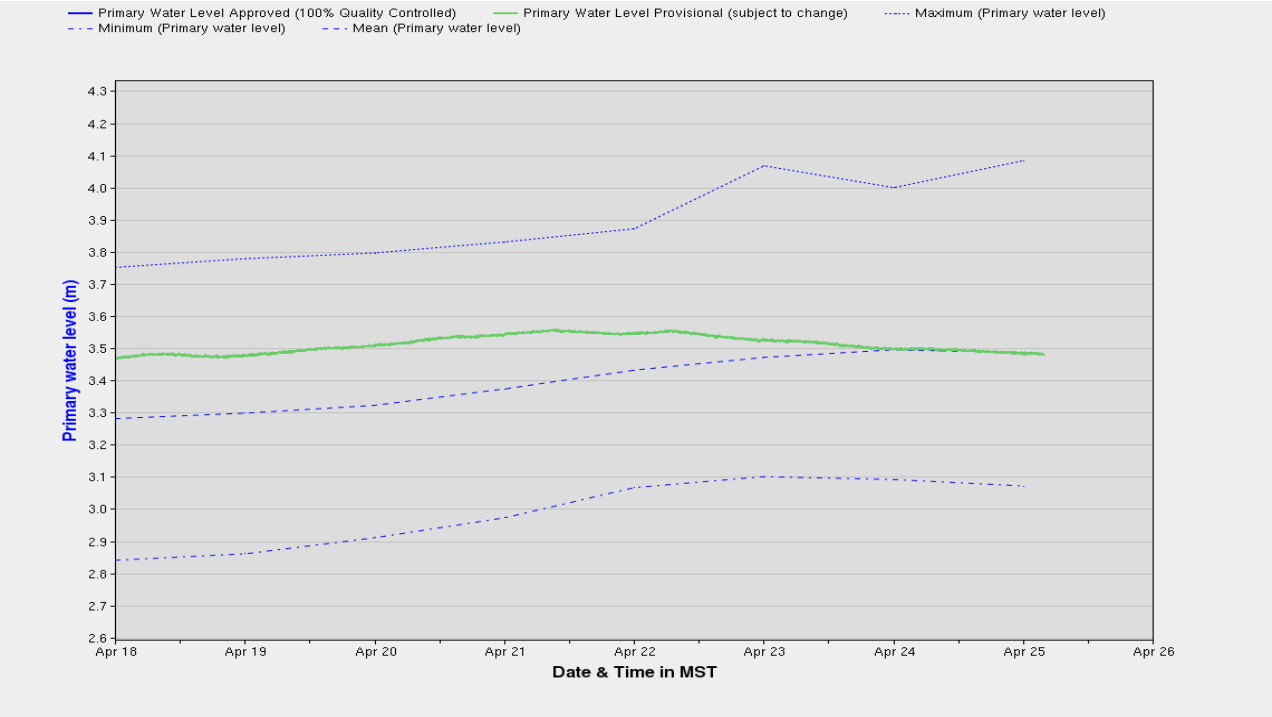


Satellite image from April 23rd, 2017
Courtesy of MODIS – Rapid response system.

Peace River at Peace Point (07KC001) - Current water level is 7.052m. Average break-up level is around 8-14m and occurs around April 29th.

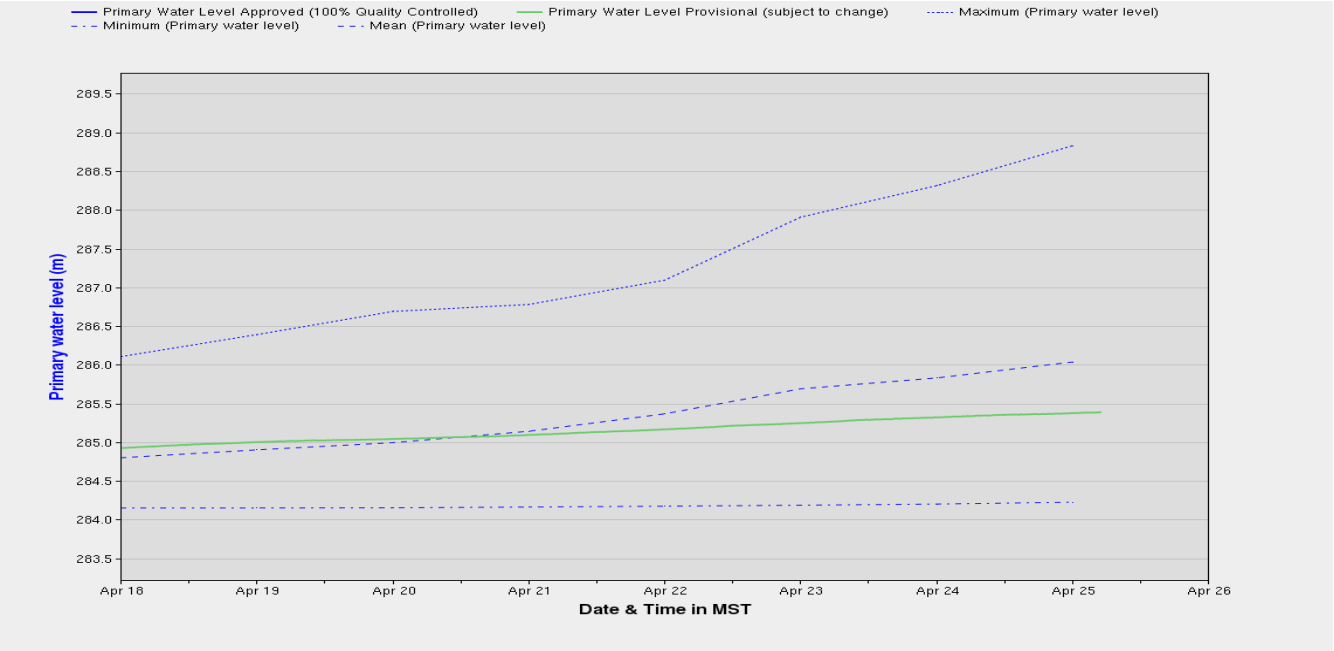


Slave River at Fitzgerald (07NB001) - Current water level is 3.482m. Average break-up level is around 4m with break-up occurring around April 30th.

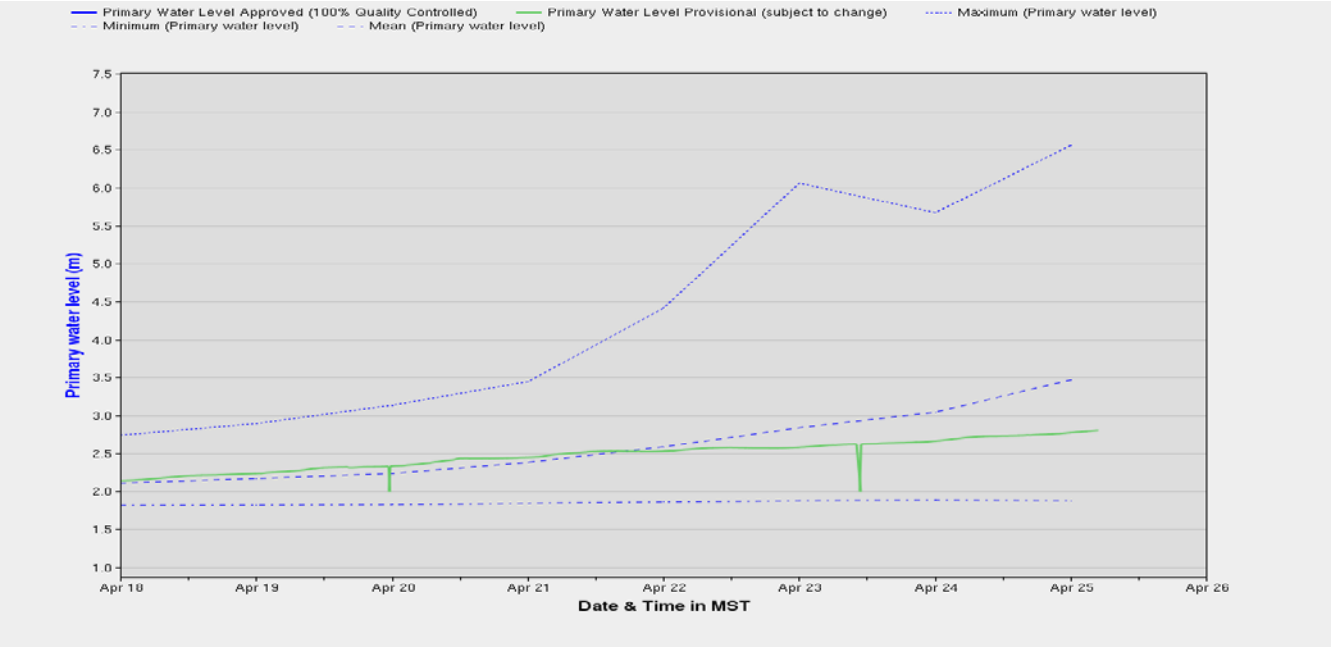


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Hay River near ALTA/NWT Boundary (07OB008) – Current water level is 285.387m.

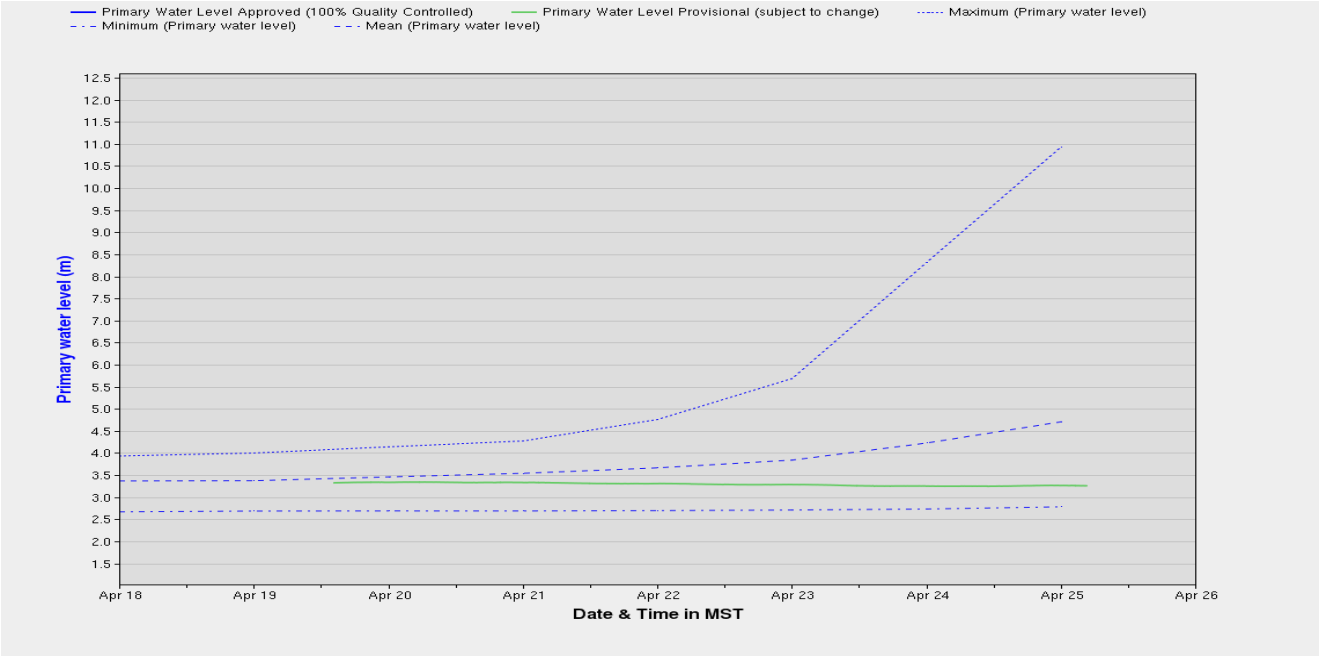


Hay River @ Hay River (07OB001) - Current Water Level is 2.805m. Average break-up level is approximately 8 meters with break-up occurring around April 30th. For more information on breakup conditions in Hay River click on the following link: http://hayriver.com/residents/2017-breakup-information/

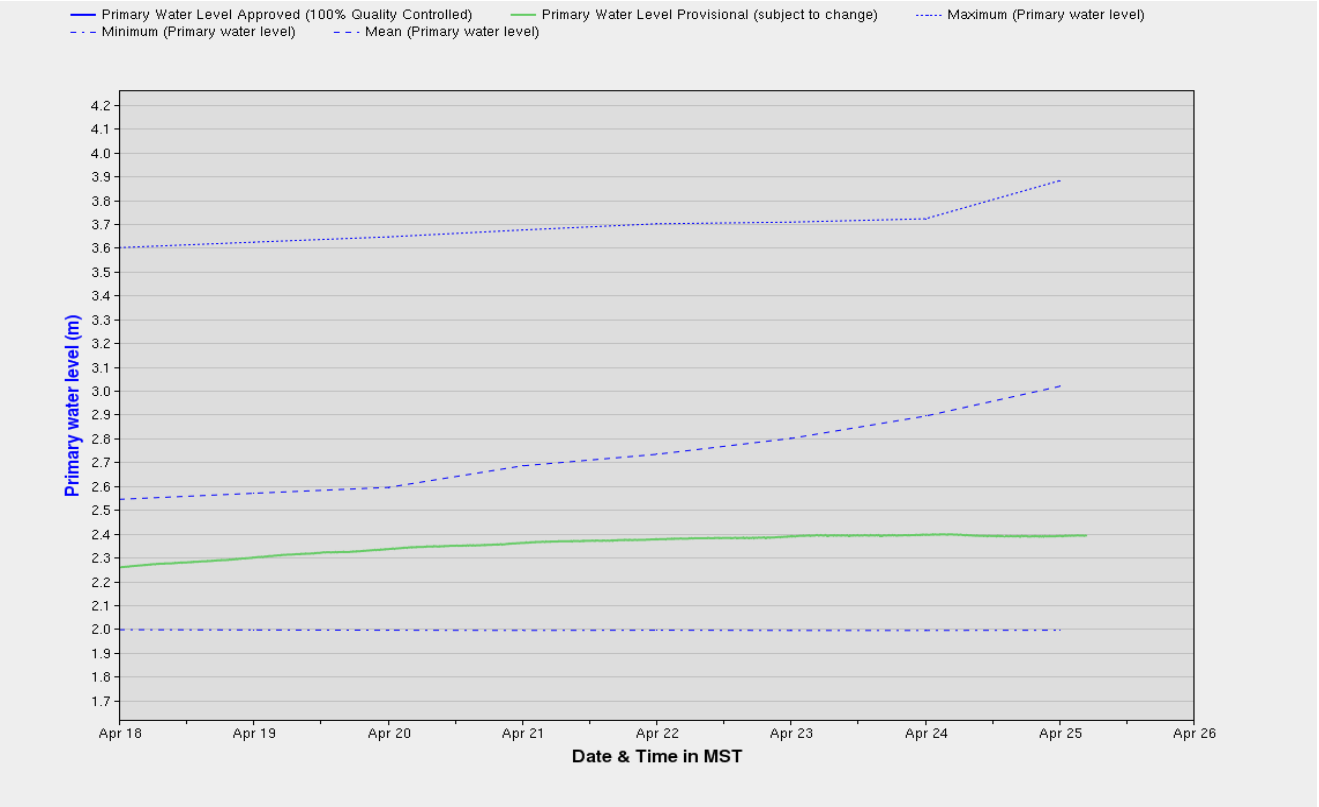


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Liard River @ Ft. Liard (10ED001) - Current water level is 3.257m. Average break-up is around April 30th.



Liard River near the Mouth (10ED002) - Current water level is 2.392m. Average break-up level is around 4.4m with break-up occurring around May 4th.



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

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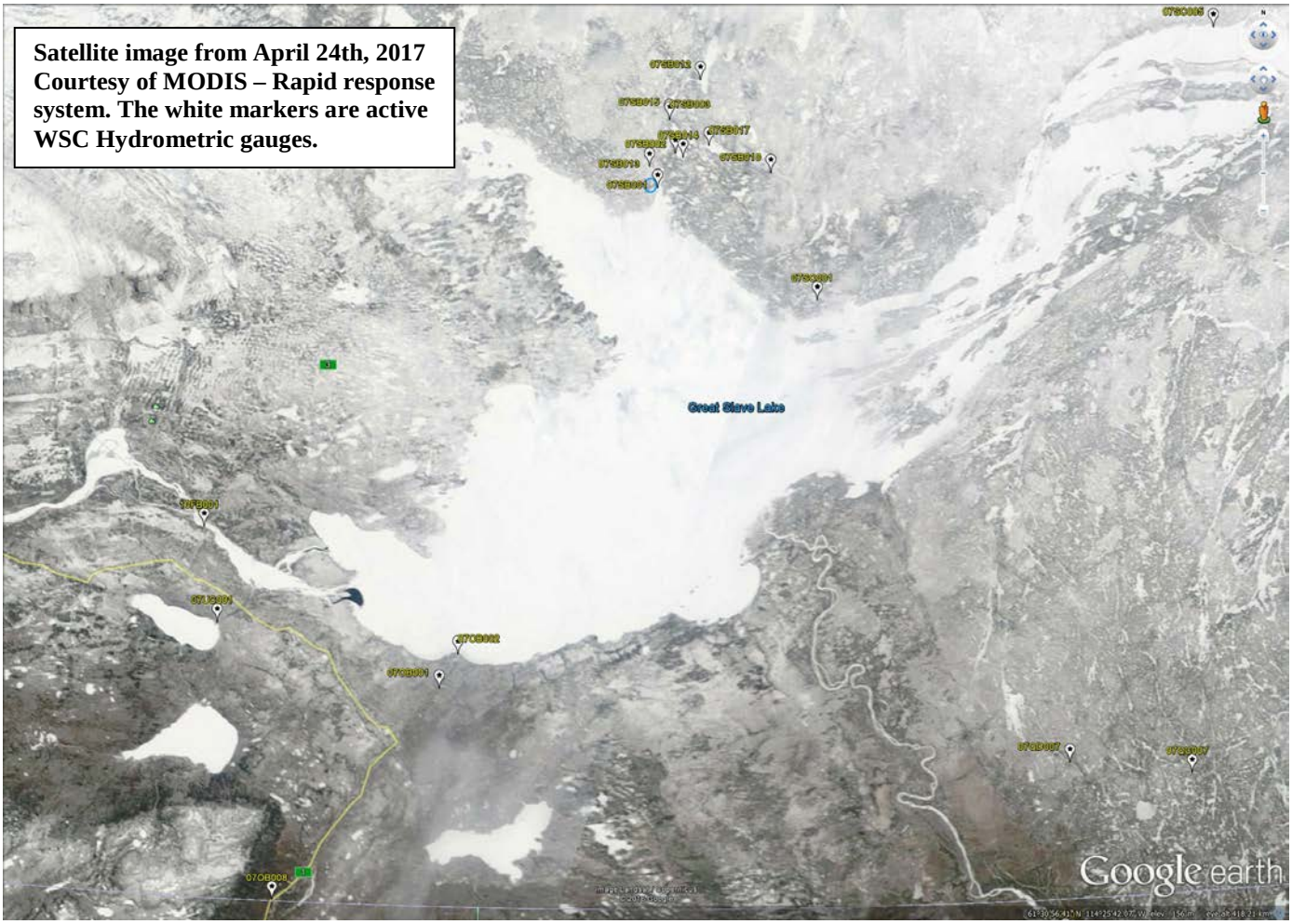
Report for April 26th, 2017

The information presented is reported by Water Survey of Canada (WSC) staff in Ft. Simpson, Inuvik, Yellowknife, and numerous contacts in various communities. Their contributions are gratefully acknowledged. If you have any comments or do not wish to receive further reports, please contact WSC at (867) 669-4774 or FAX (867) 669-4750.

Regional Weather

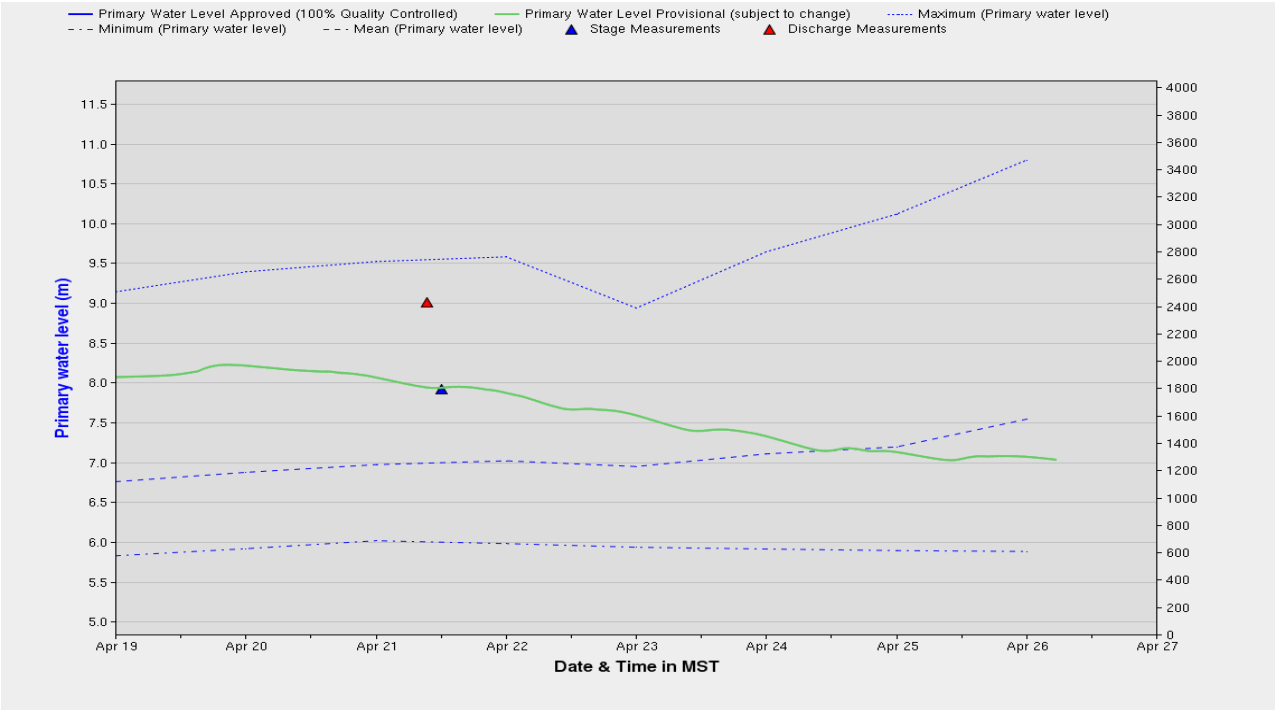
Regional Weather	Today	Thursday	Friday
North Slave	High +6 /Low -7	High +3 /Low -5	High +1/ Low -5
Deh Cho	High +7/ Low -6	High +3/ Low -6	High +13/ Low -5
Sahtu	High -3/ Low -8	High -1/ Low -6	High +2/ Low -8
Delta	High -14/ Low -17	High -8/ Low -12	High -4/ Low -7



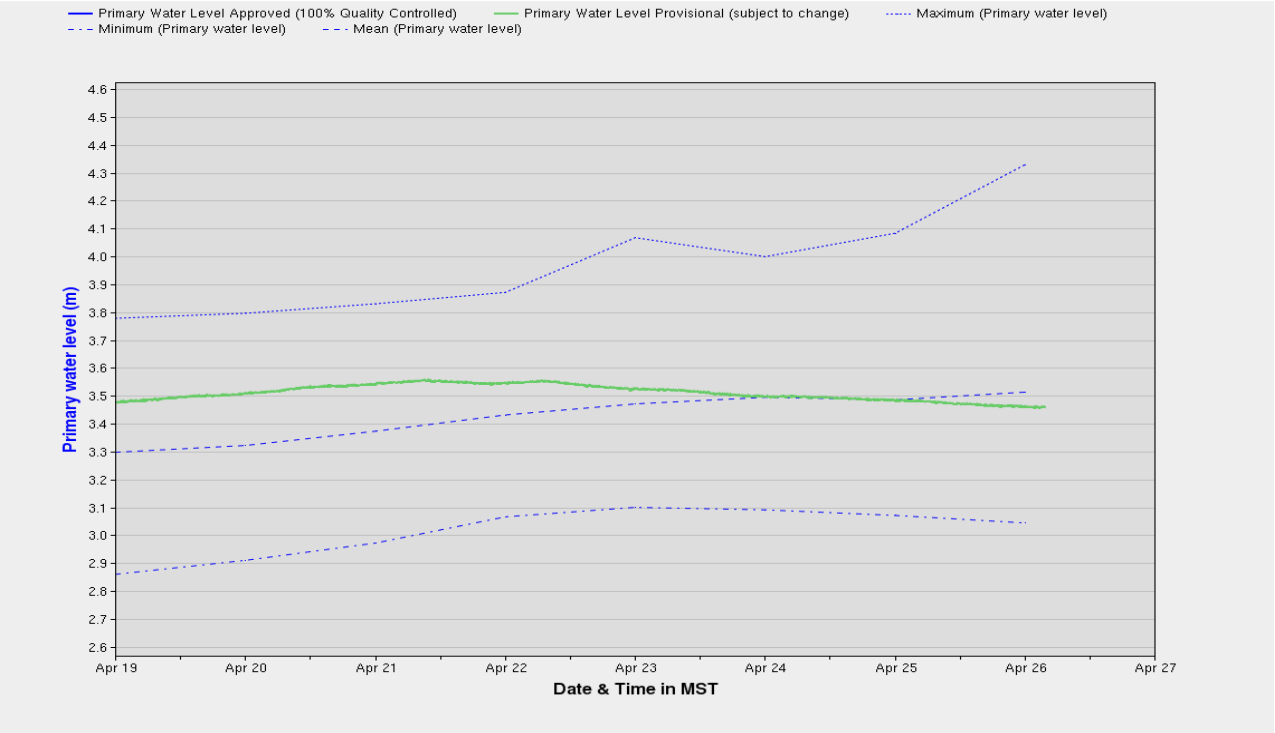
Satellite image from April 24th, 2017 Courtesy of MODIS – Rapid response system. The white markers are active WSC Hydrometric gauges.

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Peace River at Peace Point (07KC001) - Current water level is 7.029m. Average break-up level is around 8-14m and occurs around April 29th.

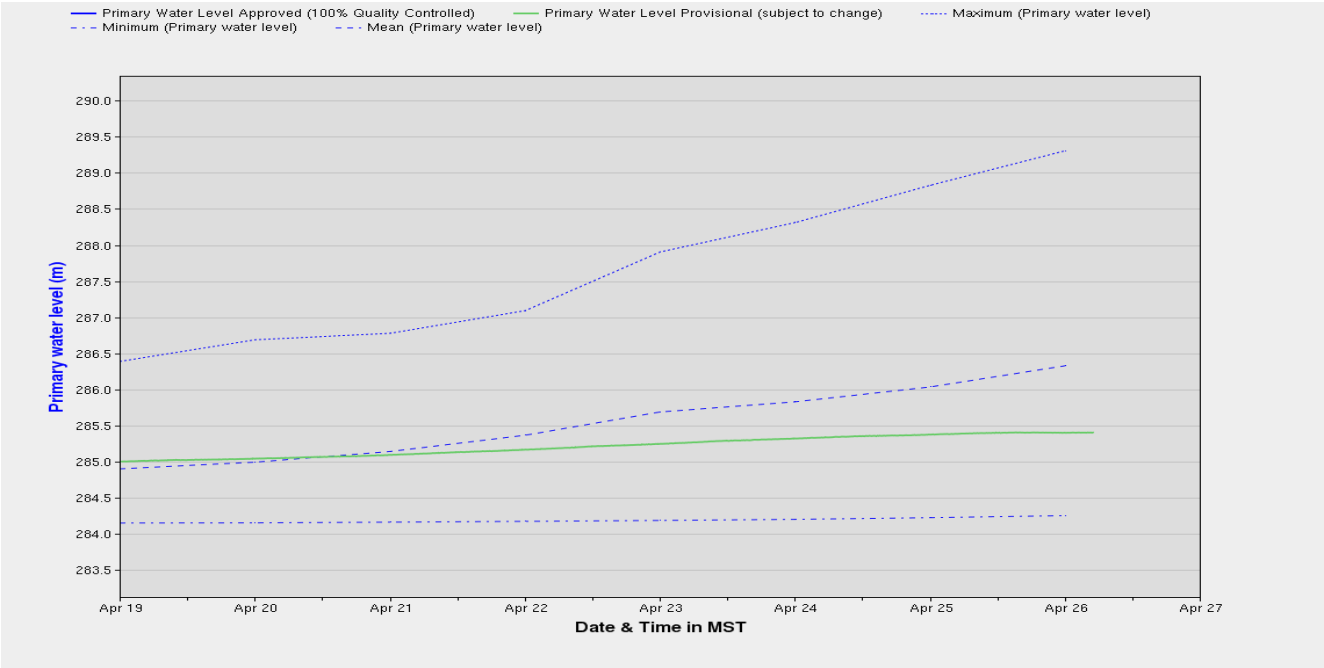


Slave River at Fitzgerald (07NB001) - Current water level is 3.460m. Average break-up level is around 4m with break-up occurring around April 30th.

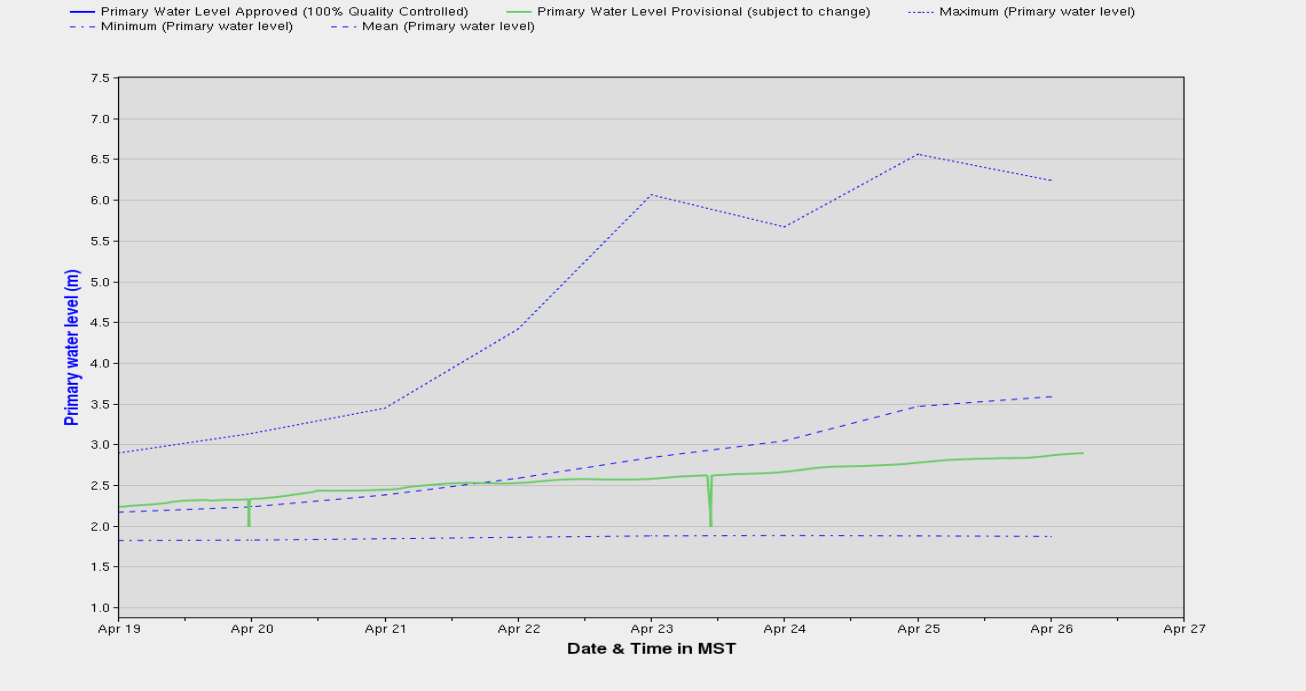


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Hay River near ALTA/NWT Boundary (07OB008) – Current water level is 285.404m. Latest report from the Hay River Flood Watch Committee yesterday is that the ice at the Meander River has broken, while the ice at the Zama crossing was still intact.

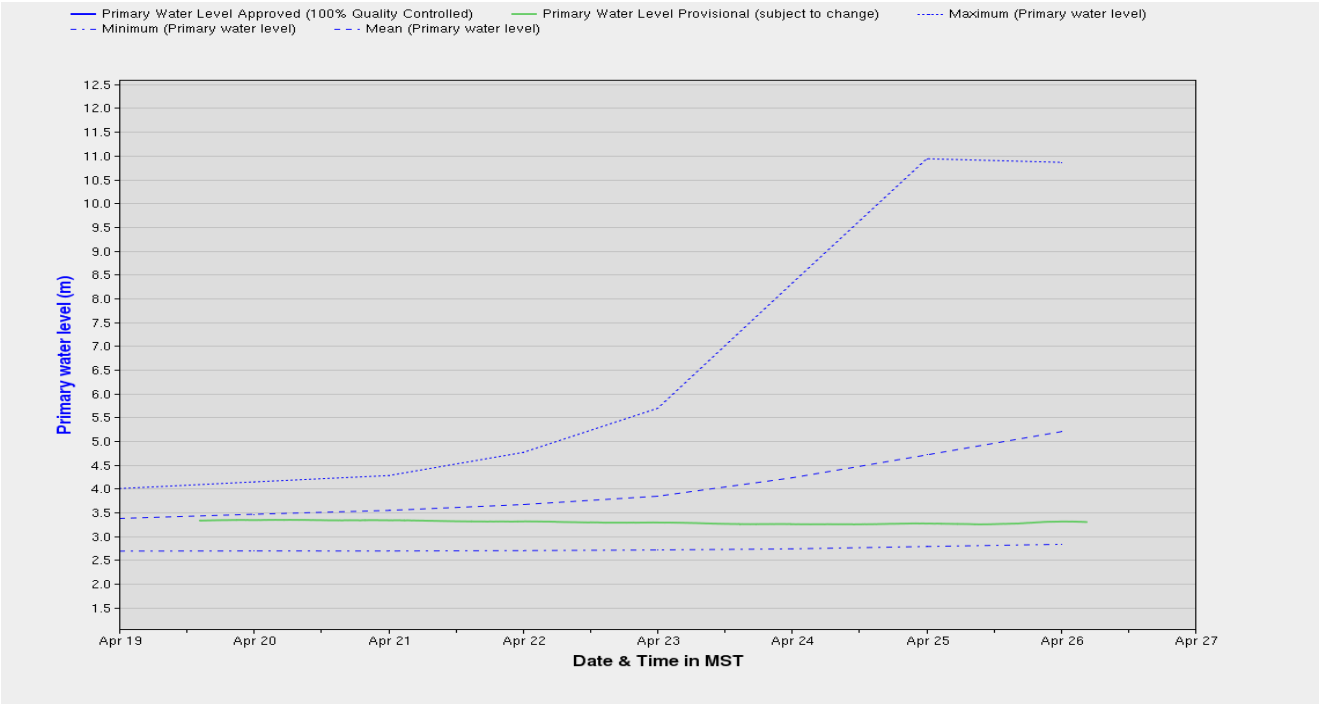


Hay River @ Hay River (07OB001) - Current Water Level is 2.891m. Average break-up level is approximately 8 meters with break-up occurring around April 30th. For more information on breakup conditions in Hay River click on the following link: http://hayriver.com/residents/2017-breakup-information/

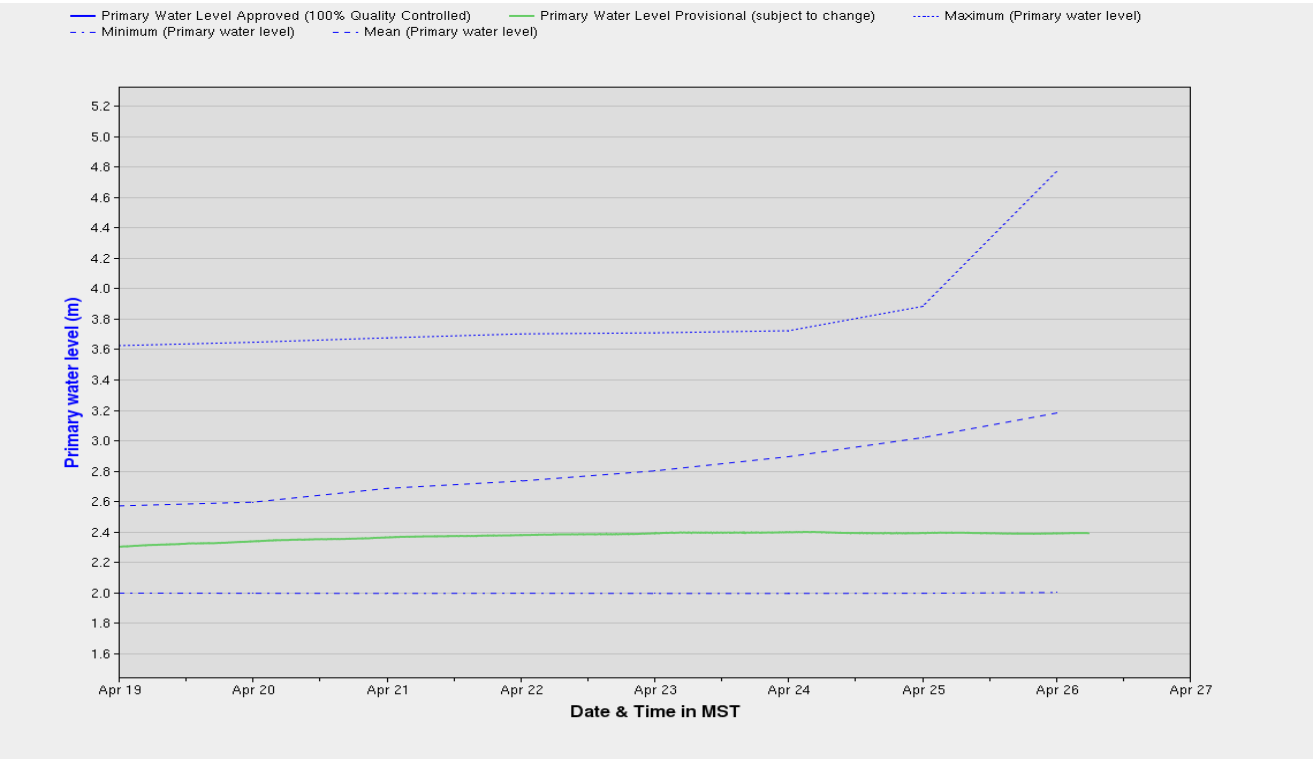


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Liard River @ Ft. Liard (10ED001) - Current water level is 3.297m. Average break-up is around April 30th.

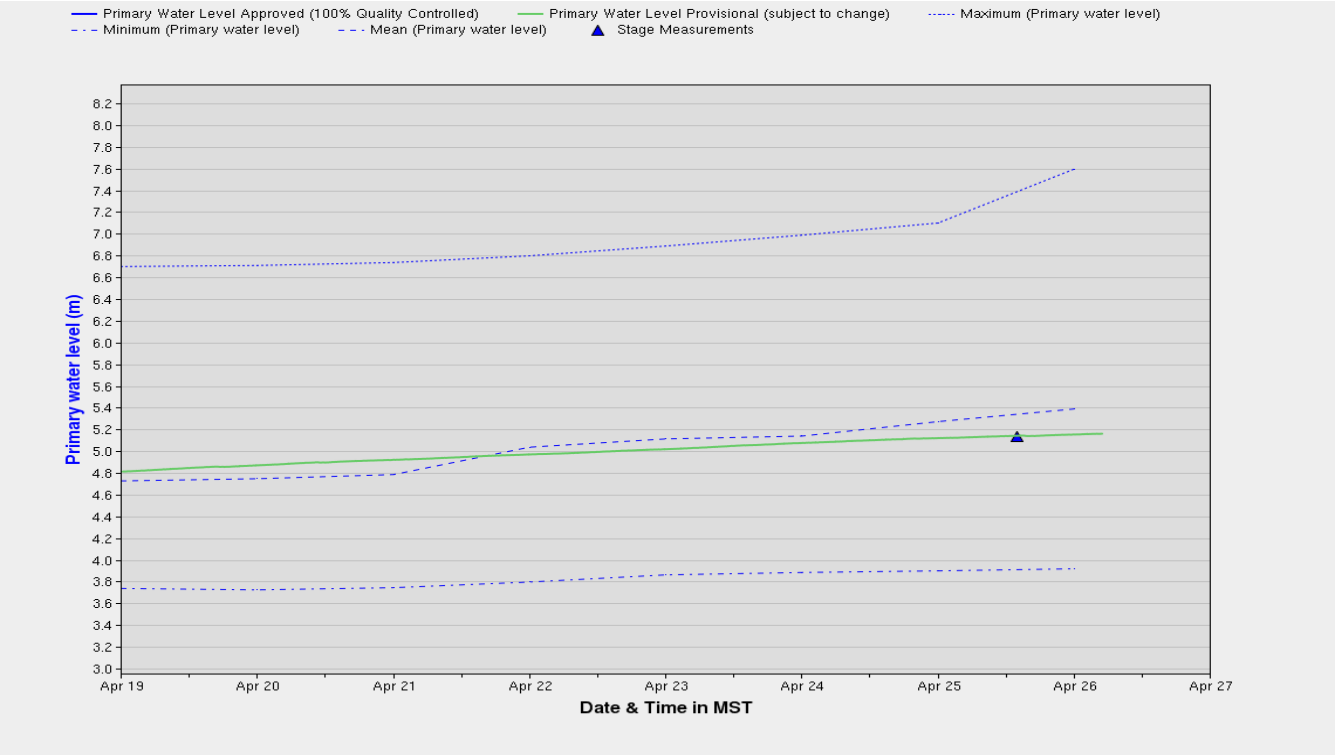


Liard River near the Mouth (10ED002) - Current water level is 2.390m. Average break-up level is around 4.4m with break-up occurring around May 4th.



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River at Fort Simspon (10GC001) – Current water level 5.160m. Average break-up level over the last ten years is around 7.3m with break-up occurring around May 5th.



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

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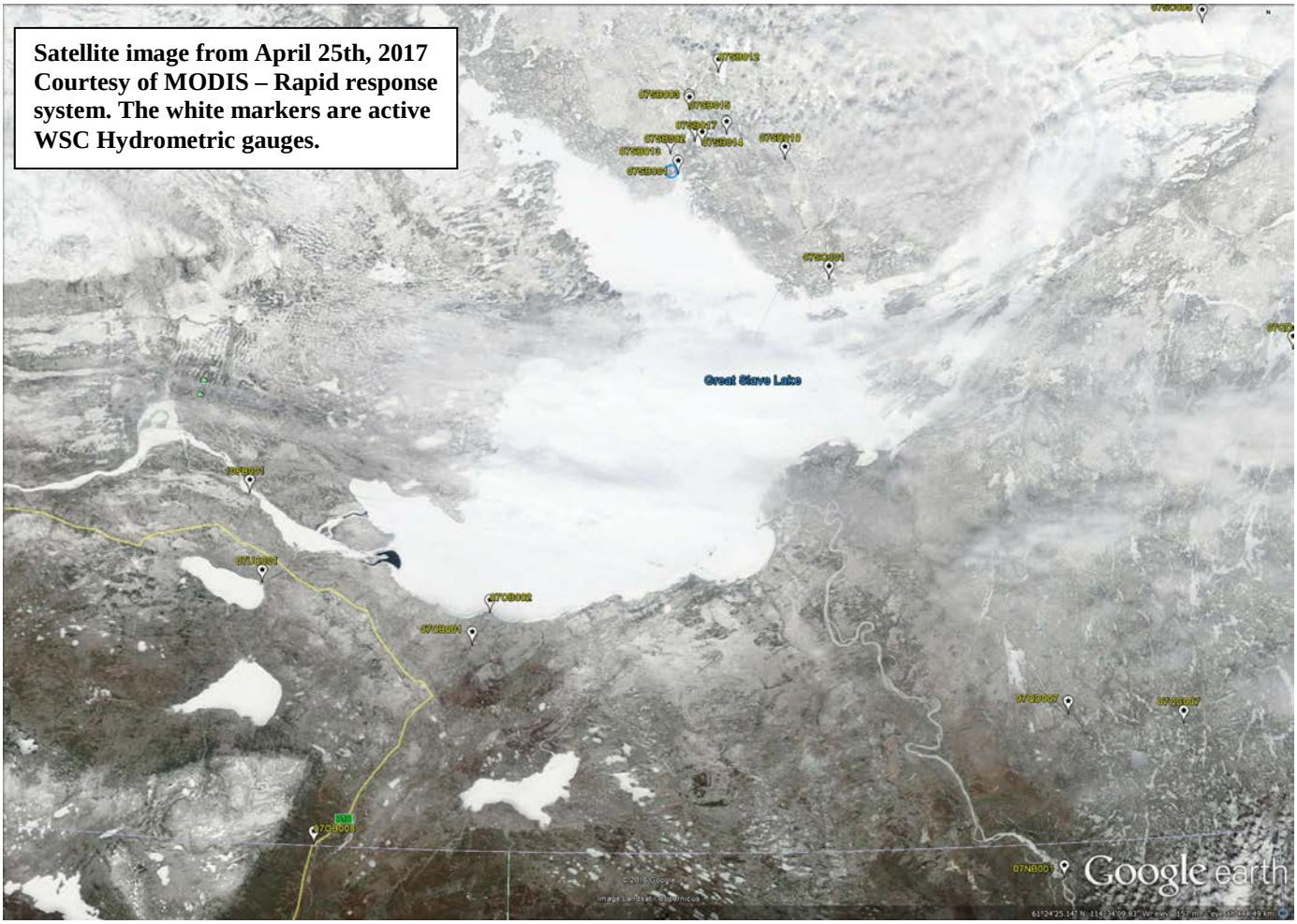
Report for April 27th, 2017

The information presented is reported by Water Survey of Canada (WSC) staff in Ft. Simpson, Inuvik, Yellowknife, and numerous contacts in various communities. Their contributions are gratefully acknowledged. If you have any comments or do not wish to receive further reports, please contact WSC at (867) 669-4774 or FAX (867) 669-4750.

Regional Weather

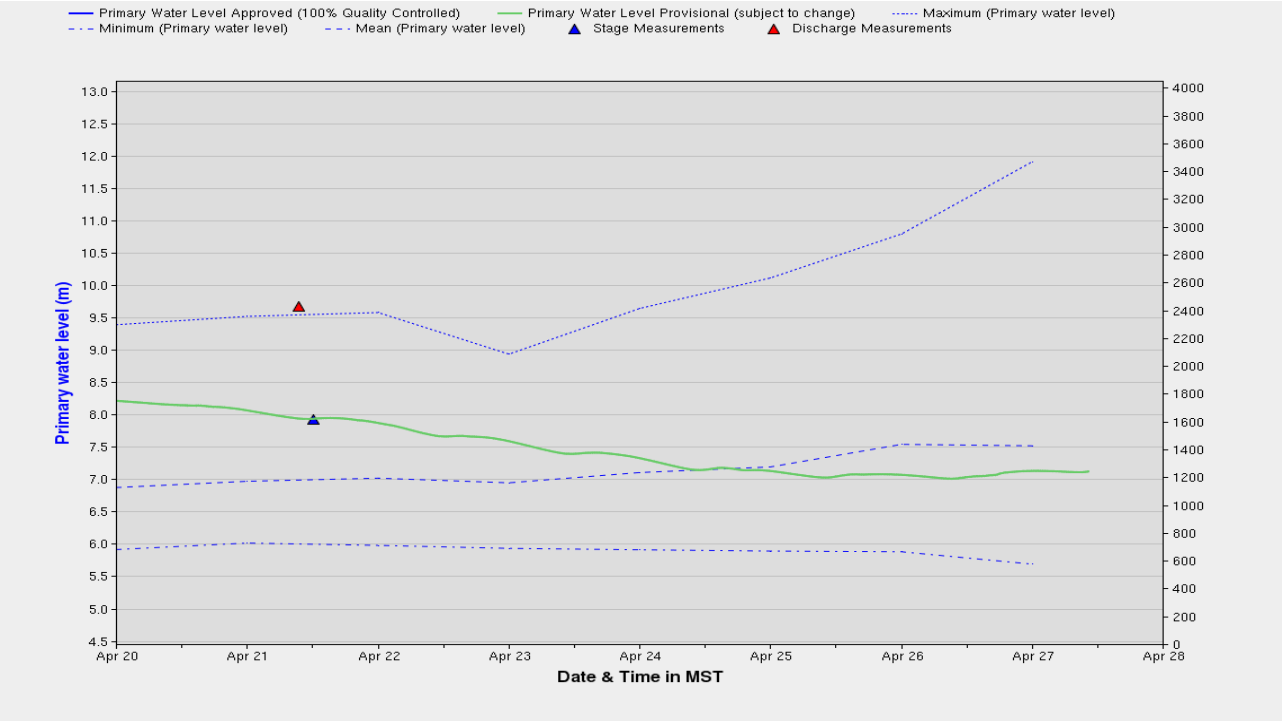
Regional Weather	Today	Friday	Saturday
North Slave	High +5 /Low -3	High +5 /Low -4	High +9/ Low -5
Deh Cho	High +8/ Low -6	High +12/ Low -4	High +5/ Low -4
Sahtu	High -2/ Low -7	High 0/ Low -7	High +1/ Low -8
Delta	High -10/ Low -15	High -6/ Low -8	High -3/ Low -9



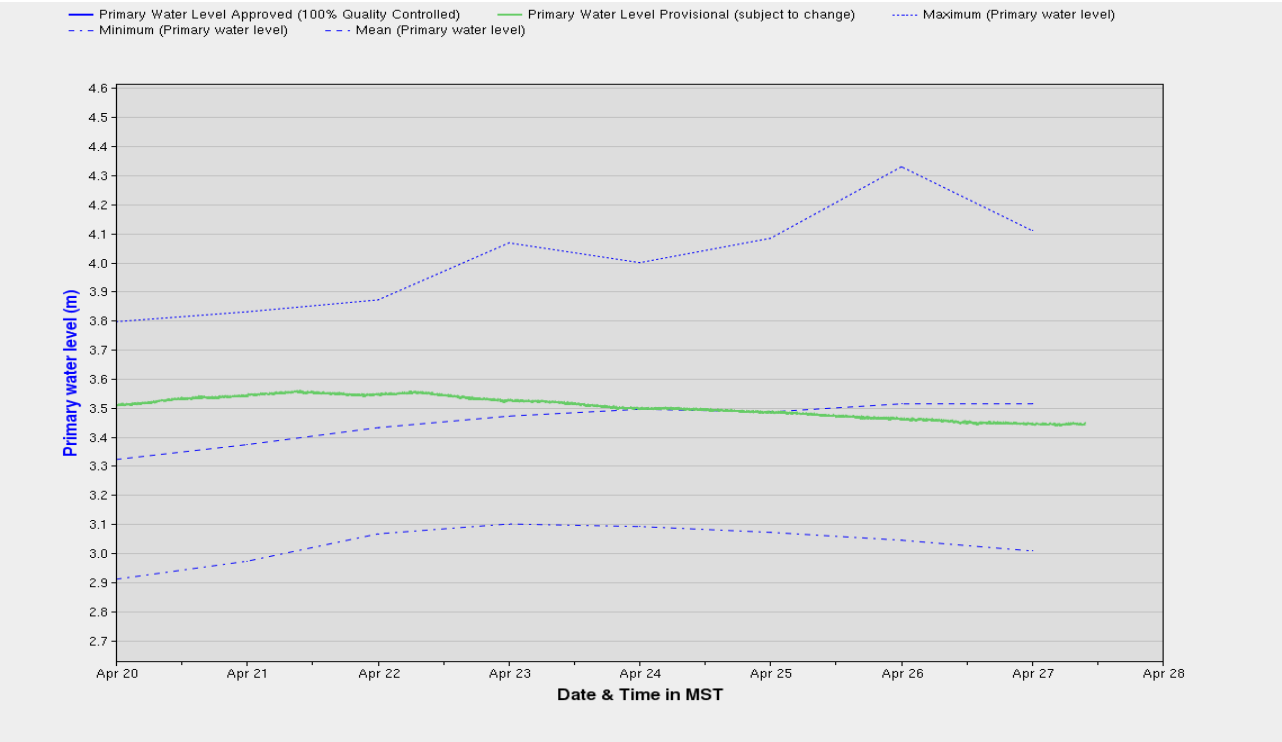
Satellite image from April 25th, 2017 Courtesy of MODIS – Rapid response system. The white markers are active WSC Hydrometric gauges.

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Peace River at Peace Point (07KC001) - Current water level is 7.123m. Average break-up level is around 8-14m and occurs around April 29th.

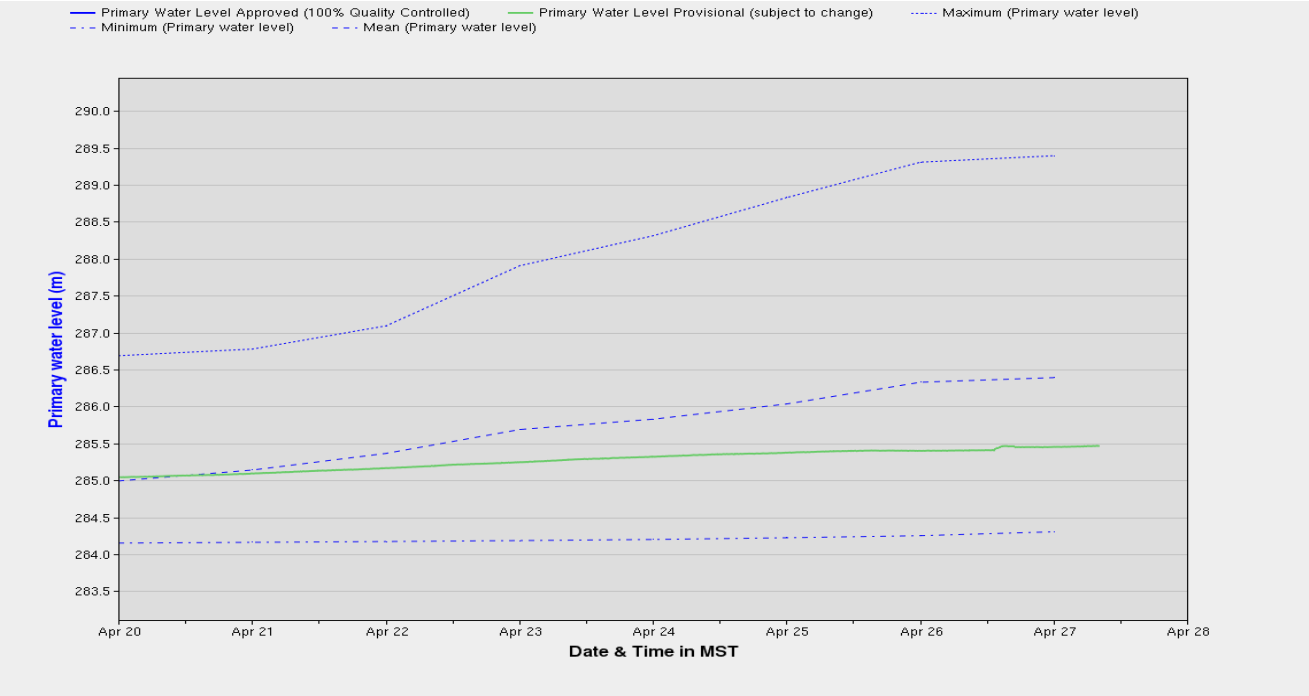


Slave River at Fitzgerald (07NB001) - Current water level is 3.445m. Average break-up level is around 4m with break-up occurring around April 30th.

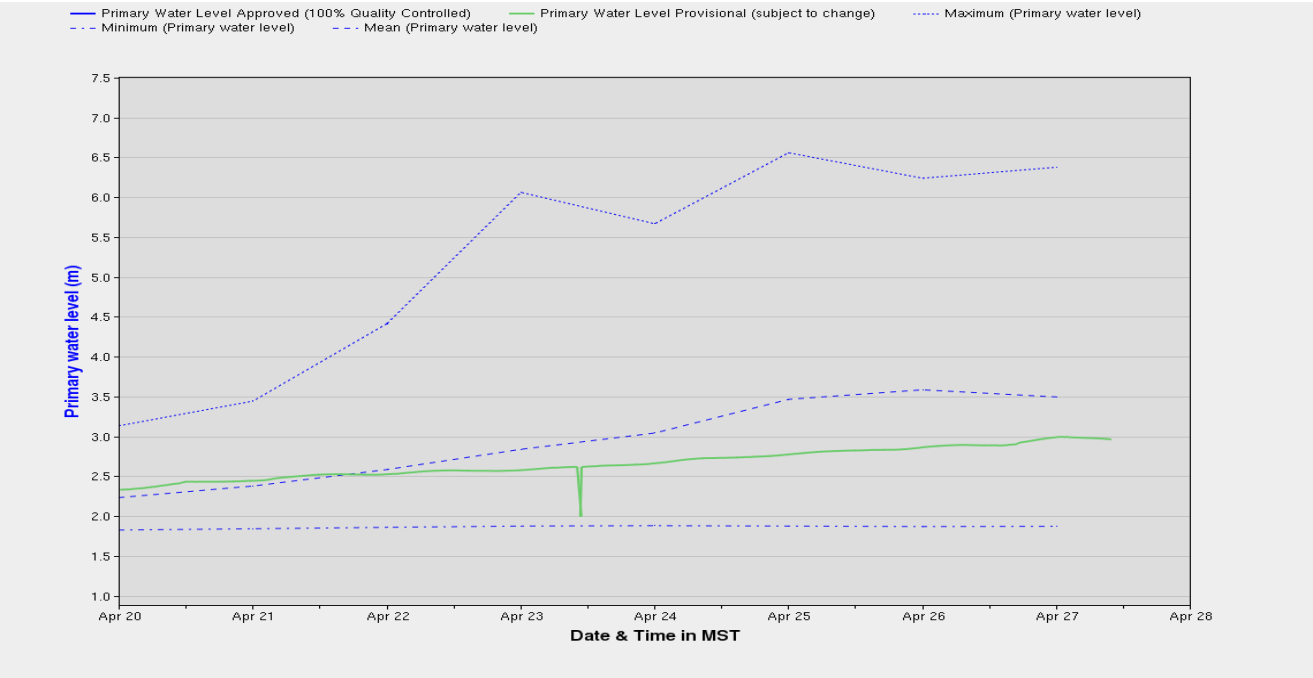


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Hay River near ALTA/NWT Boundary (07OB008) – Current water level is 285.467m.

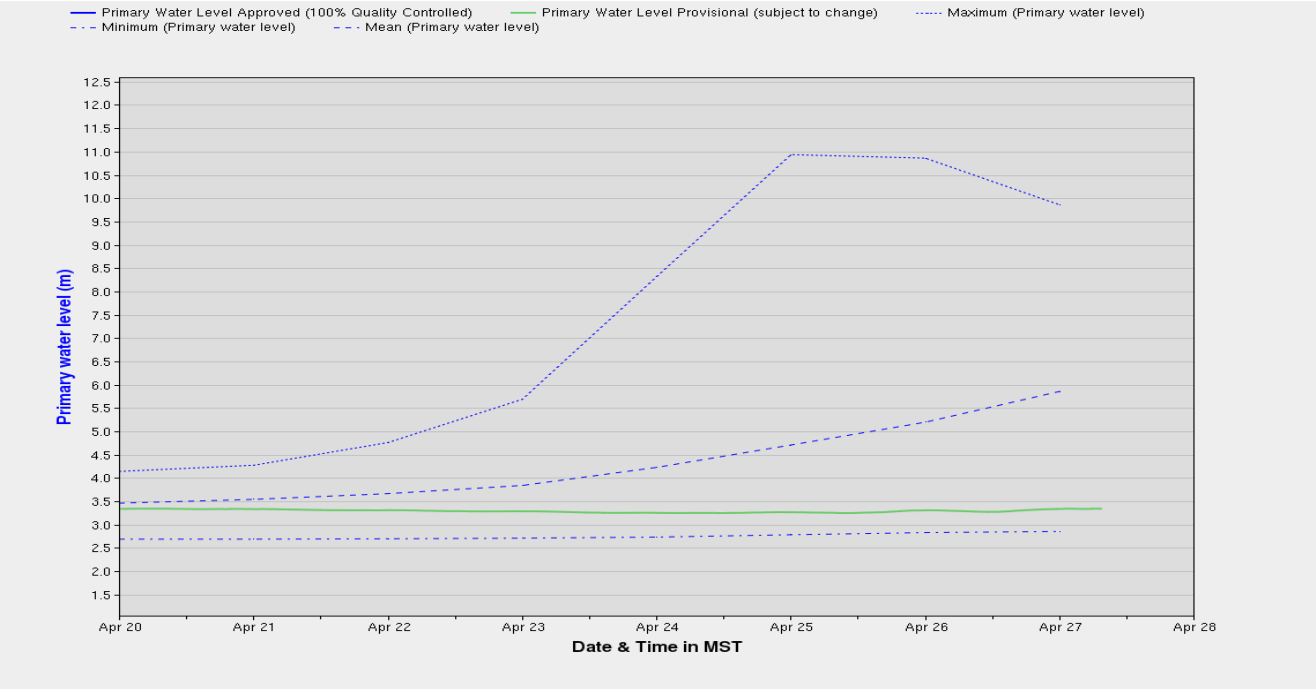


Hay River @ Hay River (07OB001) - Current Water Level is 2.961m. Average break-up level is approximately 8 meters with break-up occurring around April 30th. For more information on breakup conditions in Hay River click on the following link: http://hayriver.com/residents/2017-breakup-information/

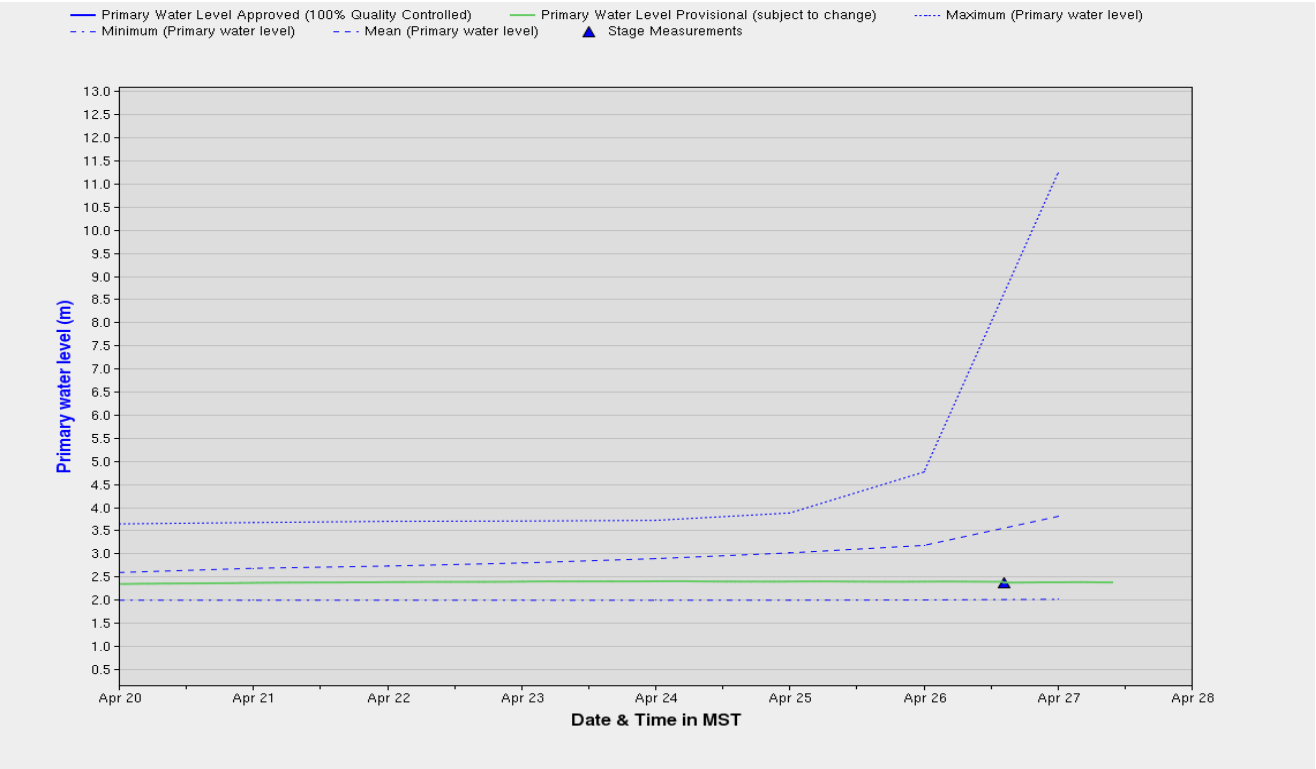


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Liard River @ Ft. Liard (10ED001) - Current water level is 3.343m. Average break-up is around April 30th.

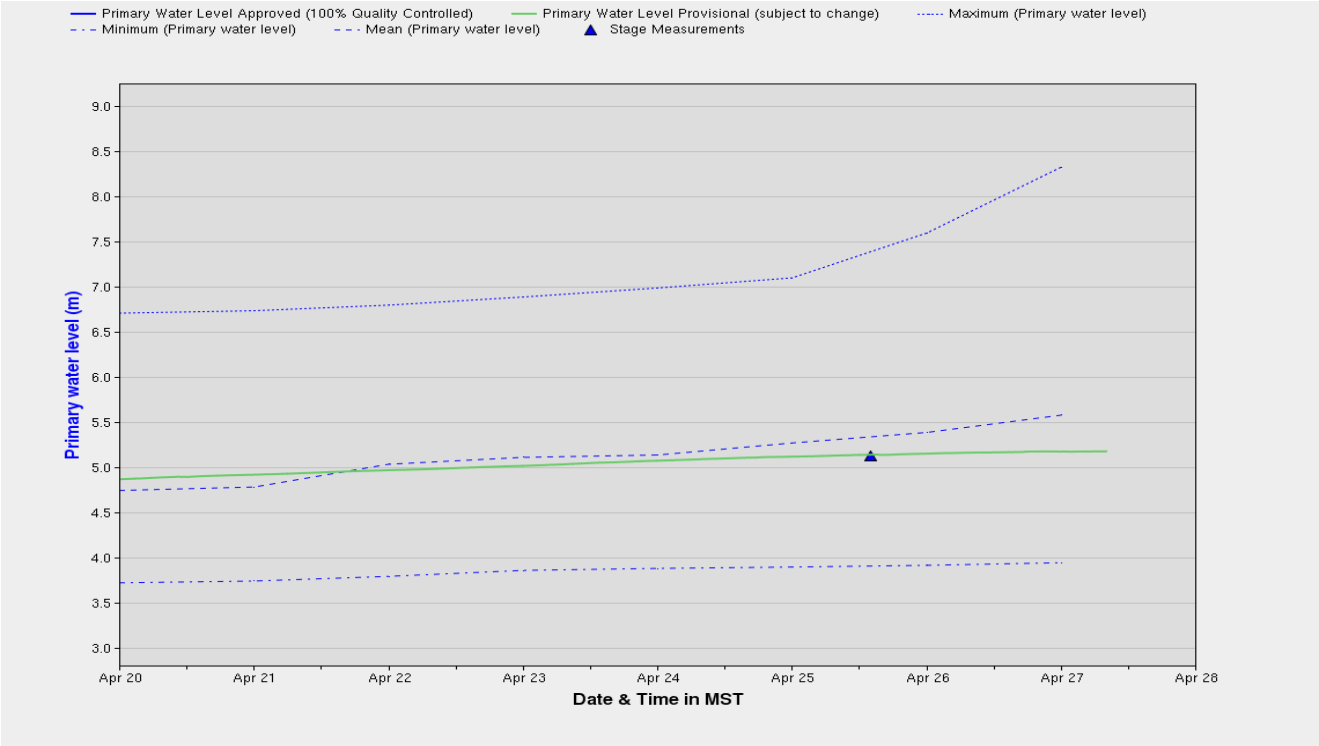


Liard River near the Mouth (10ED002) - Current water level is 2.372m. Average break-up level is around 4.4m with break-up occurring around May 4th.



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River at Fort Simspon (10GC001) – Current water level 5.179m. Average break-up level over the last ten years is around 7.3m with break-up occurring around May 5th.



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

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Suite 400, 5019 – 52 Street
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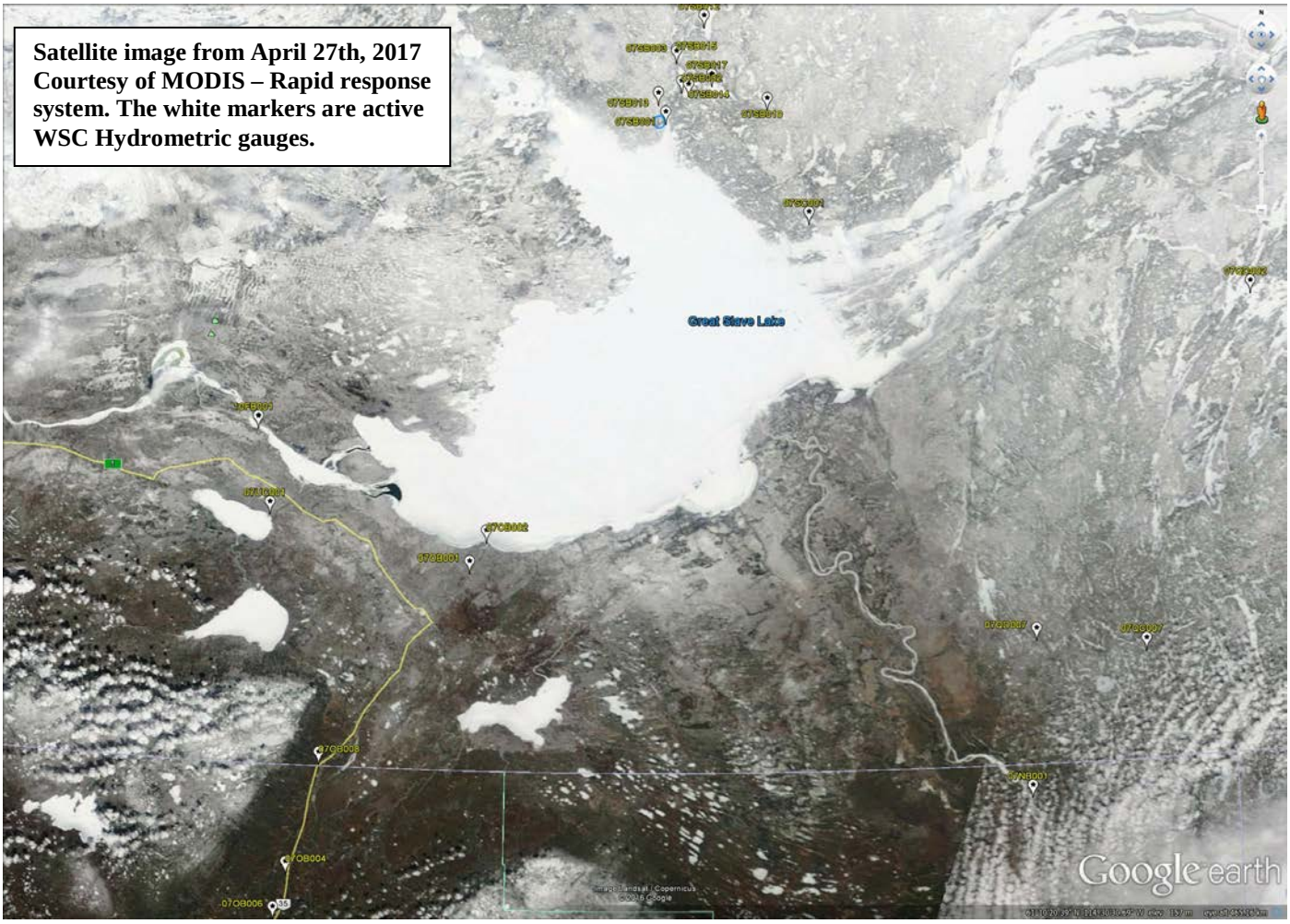
X1A 2P7

Report for April 28th, 2017

The information presented is reported by Water Survey of Canada (WSC) staff in Ft. Simpson, Inuvik, Yellowknife, and numerous contacts in various communities. Their contributions are gratefully acknowledged. If you have any comments or do not wish to receive further reports, please contact WSC at (867) 669-4774 or FAX (867) 669-4750.

Regional Weather

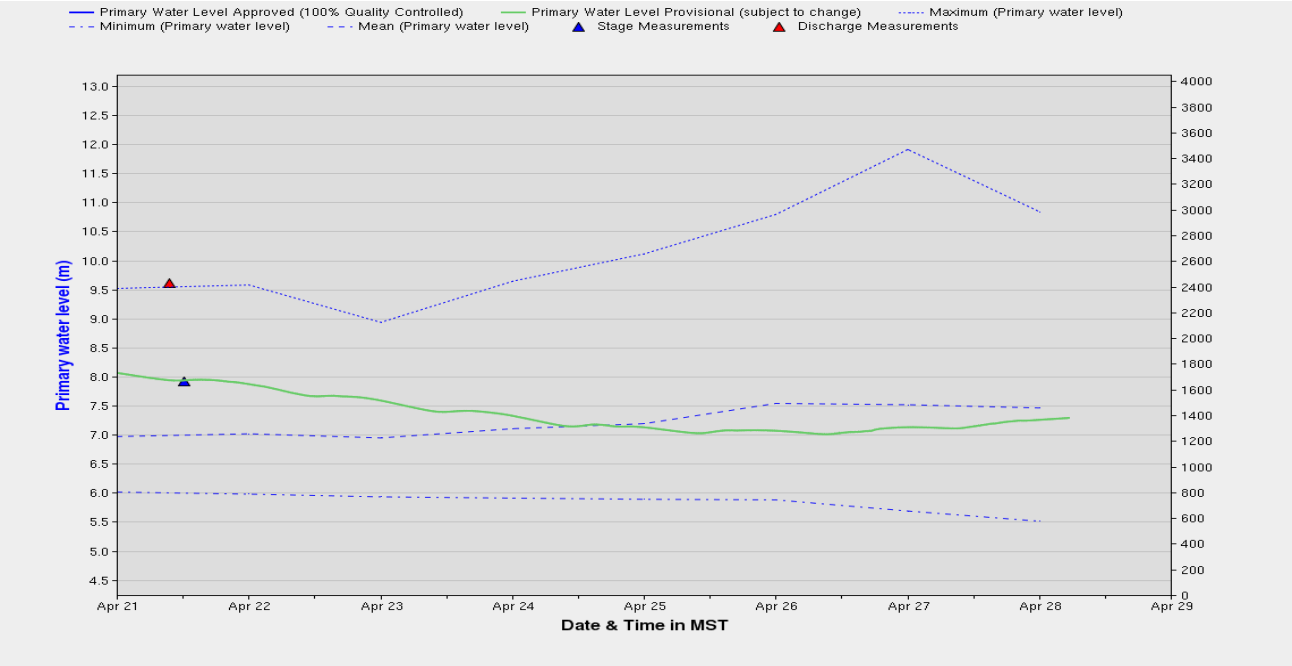
Regional Weather	Today	Saturday	Sunday
North Slave	High +6 /Low -1	High +7 /Low -3	High +5/ Low -6
Deh Cho	High +13/ Low -4	High +5/ Low -5	High +5/ Low -5
Sahtu	High -1/ Low -9	High 0/ Low -8	High -1/ Low -8
Delta	High -5/ Low -8	High -4/ Low -8	High -2/ Low -8



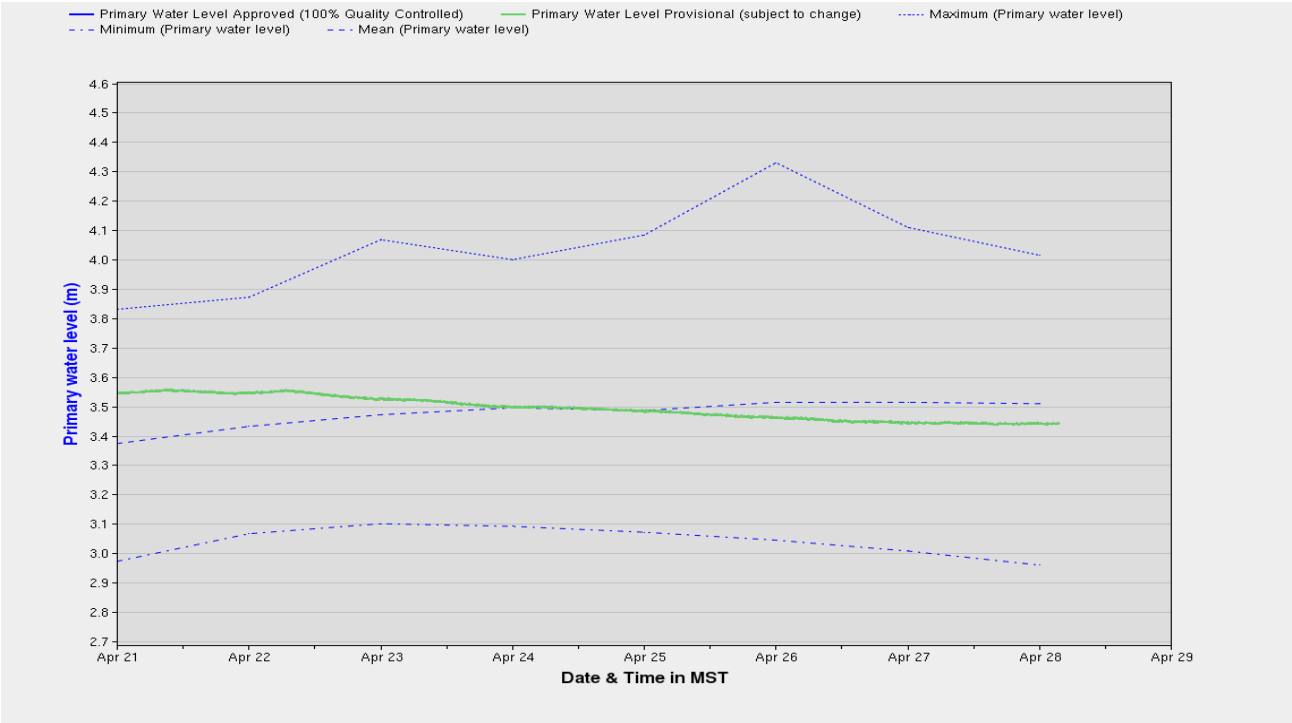
Satellite image from April 27th, 2017 Courtesy of MODIS – Rapid response system. The white markers are active WSC Hydrometric gauges.

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Peace River at Peace Point (07KC001) - Current water level is 7.290m. Average break-up level is around 8-14m and occurs around April 29th.

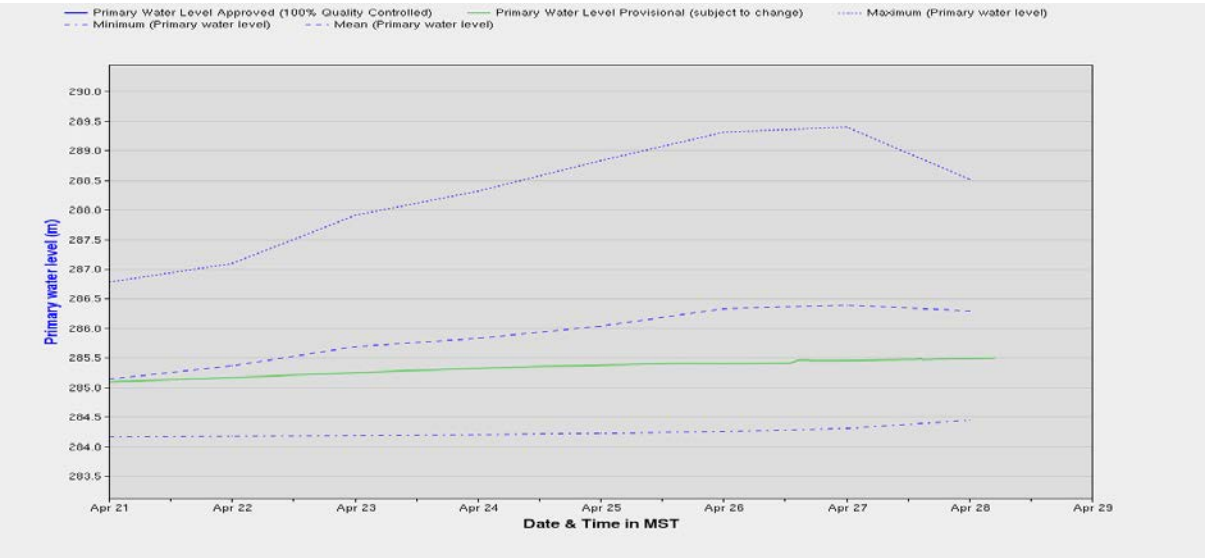


Slave River at Fitzgerald (07NB001) - Current water level is 3.442m. Average break-up level is around 4m with break-up occurring around April 30th.



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

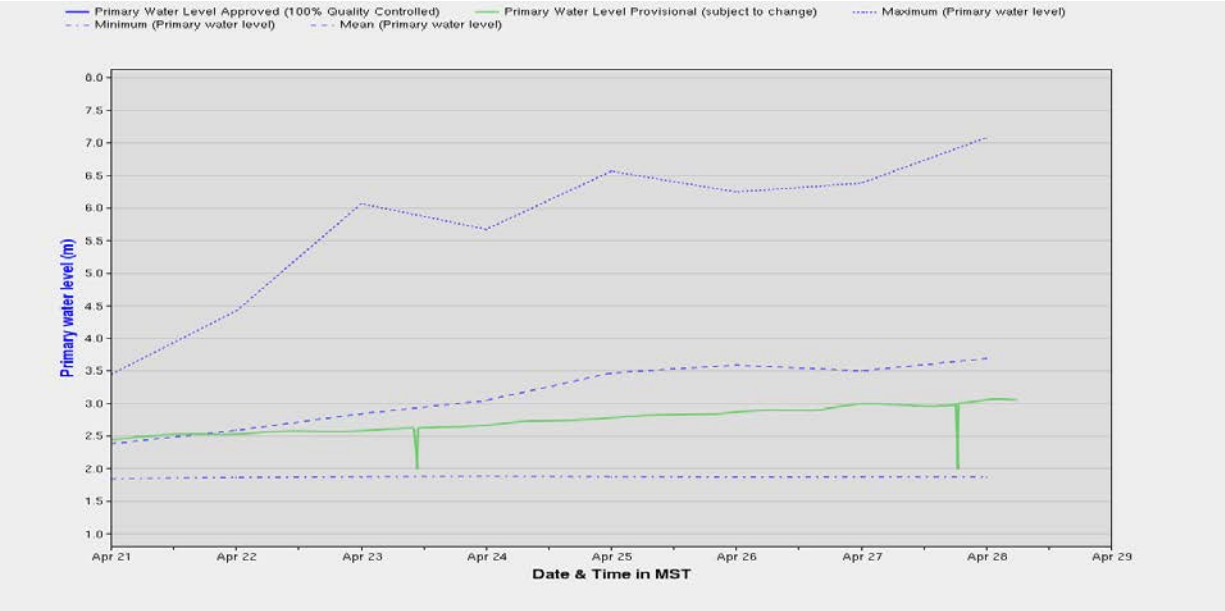
Hay River near ALTA/NWT Boundary (07OB008) – Current water level is 285.496m.



Hay River @ Hay River (07OB001) - Current Water Level is 3.045m. Average break-up level is approximately 8 meters with break-up occurring around April 30th. The latest report from the Hay River Flood Watch Committee from yesterday can be read below:

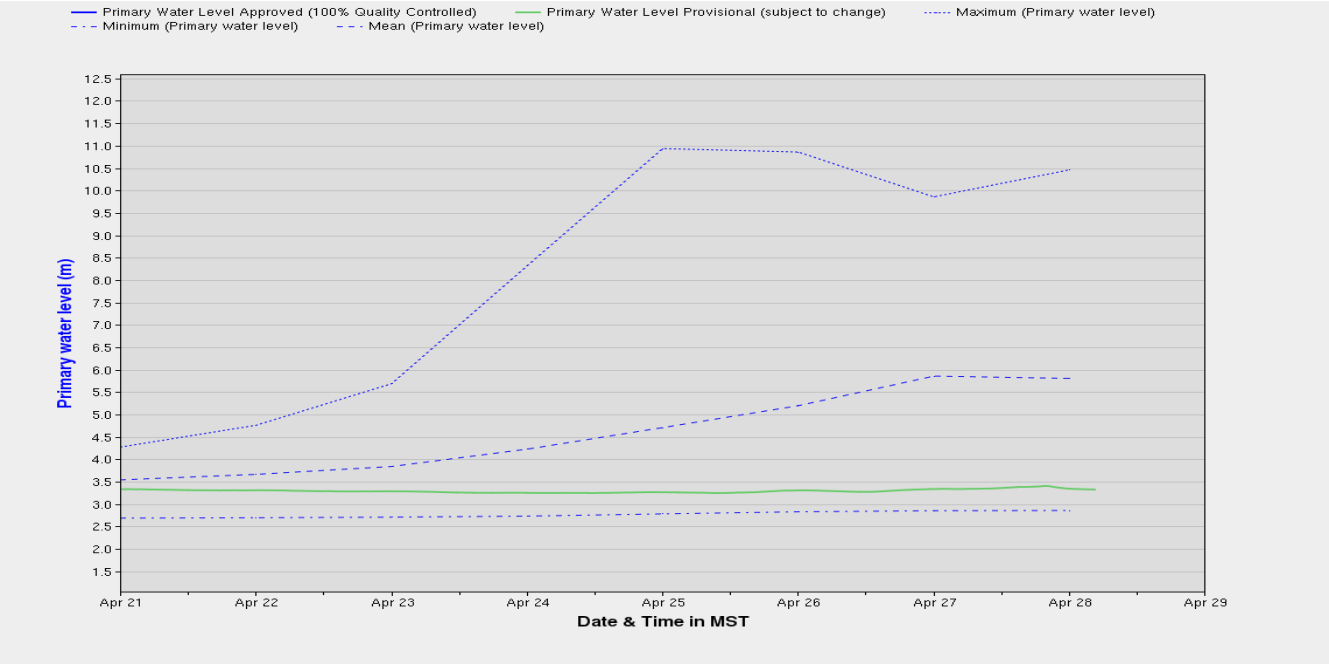
> Breakup Report
>
> Good evening, Breakup 2017 continues along the Hay River, levels are still dropping at Meander River and climbing slowly along the rest of the Hay River. There is a fair amount of water flowing over the falls presently and we expect to see a complete break of ice at the monitoring station above the falls very soon which will start the ball rolling with the local breakup of the river.
>
> We are anticipating the level to rise at Paradise Valley and possibly even some cracking of ice in that area in the near future. The same is true with the ice at the Pine Point Bridge.
>
> EMO personnel are at this time closely monitoring the situation and will advise as things develop on the river.

For more information on breakup conditions in Hay River click on the following link: http://hayriver.com/residents/2017-breakup-information/

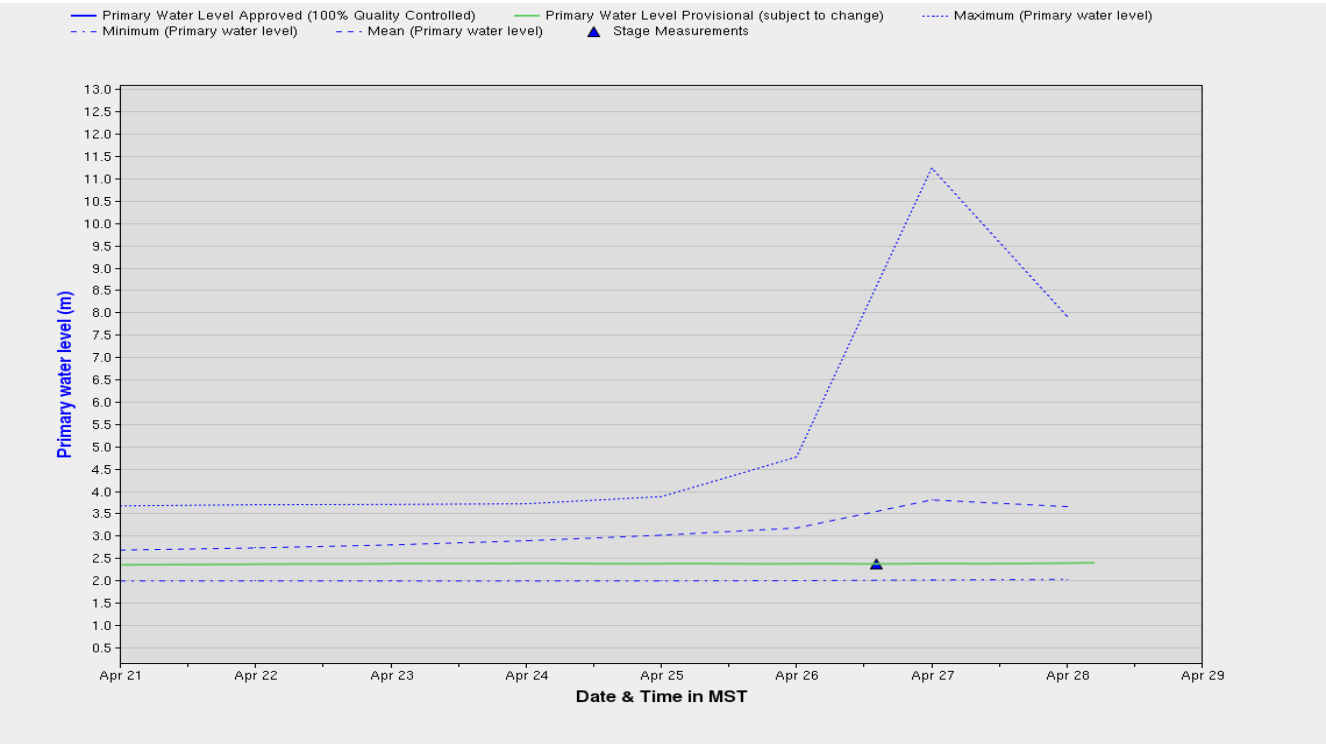


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Liard River @ Ft. Liard (10ED001) - Current water level is 3.324m. Average break-up is around April 30th.

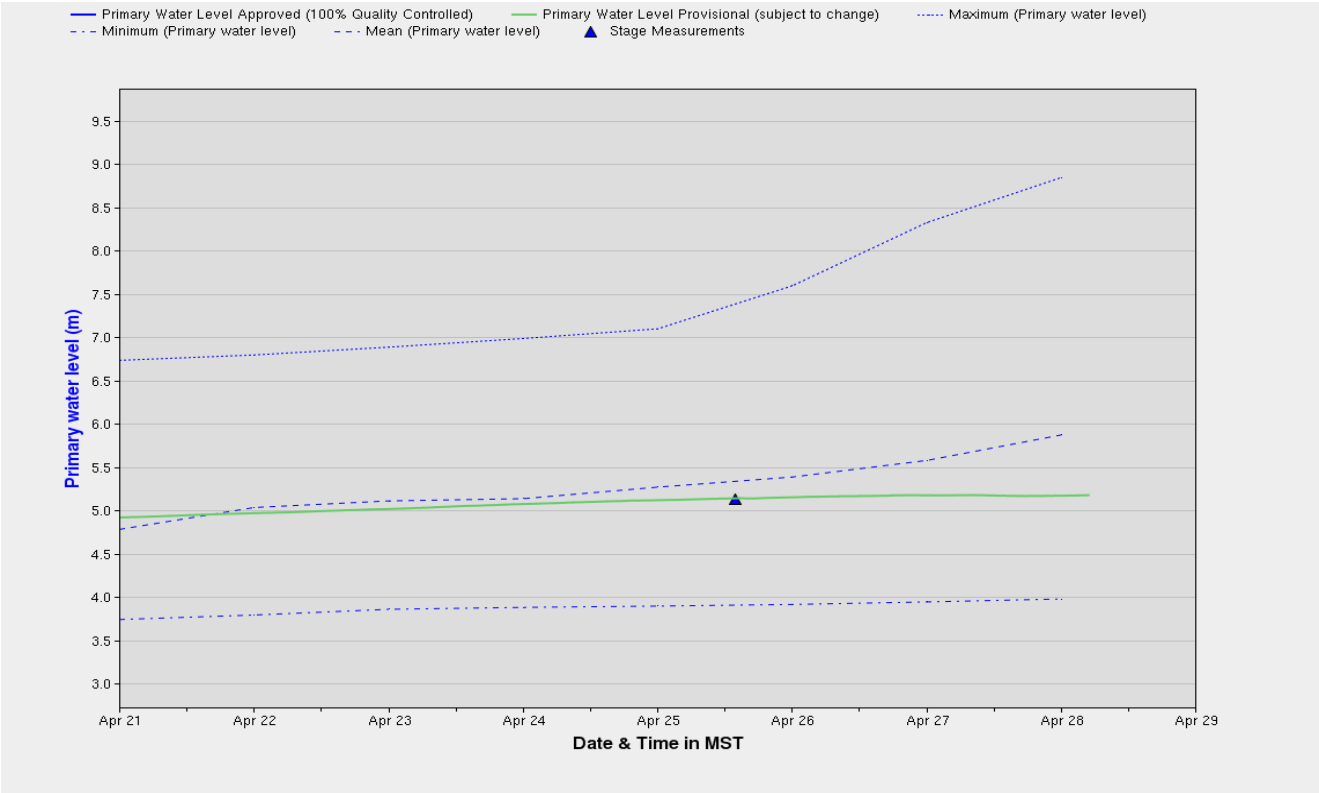


Liard River near the Mouth (10ED002) - Current water level is 2.394m. Average break-up level is around 4.4m with break-up occurring around May 4th.



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River at Fort Simspon (10GC001) – Current water level 5.179m. Average break-up level over the last ten years is around 7.3m with break-up occurring around May 5th.



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

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Environnement

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X1A 2P7

Report for May 1st, 2017

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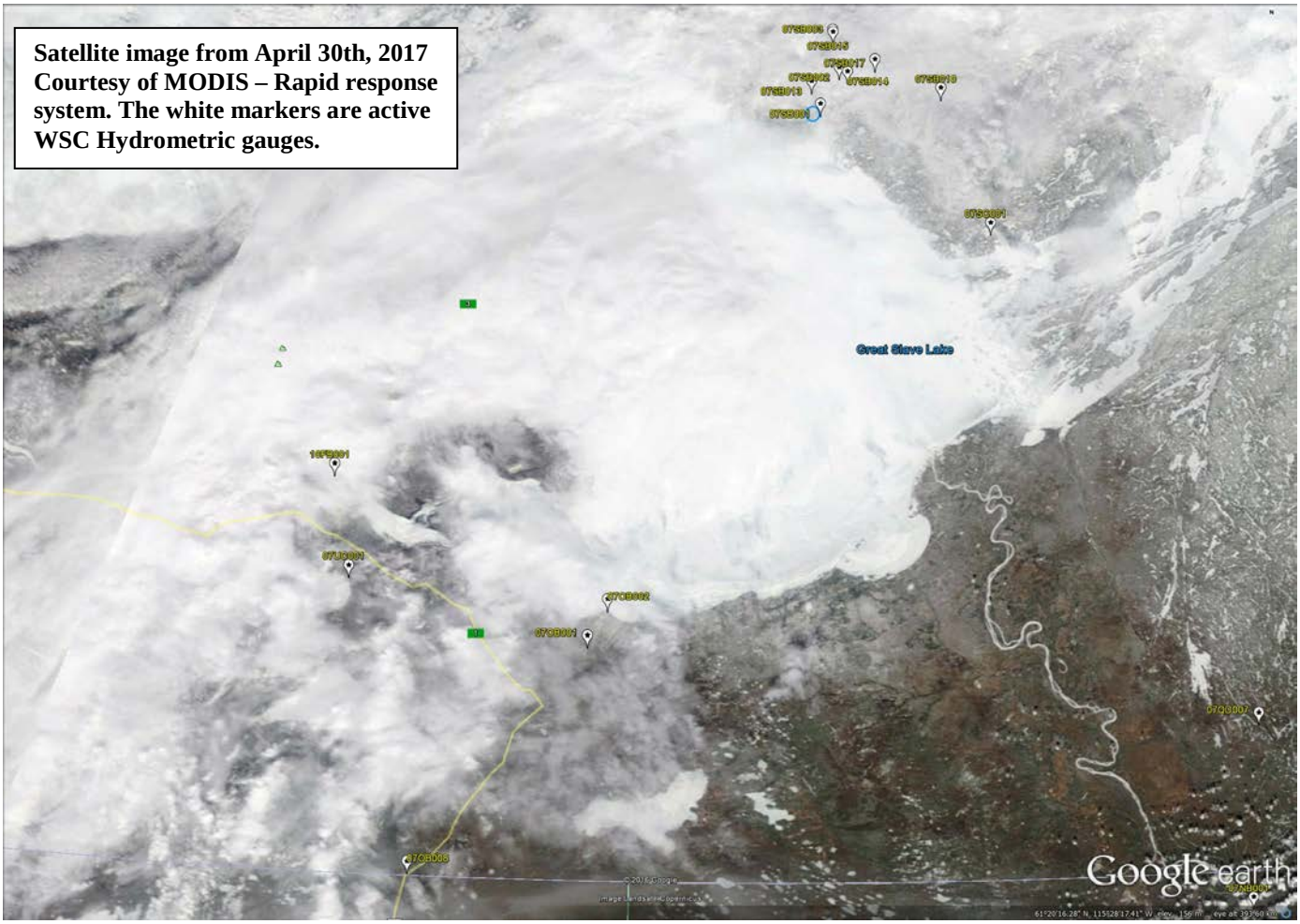
Regional Weather

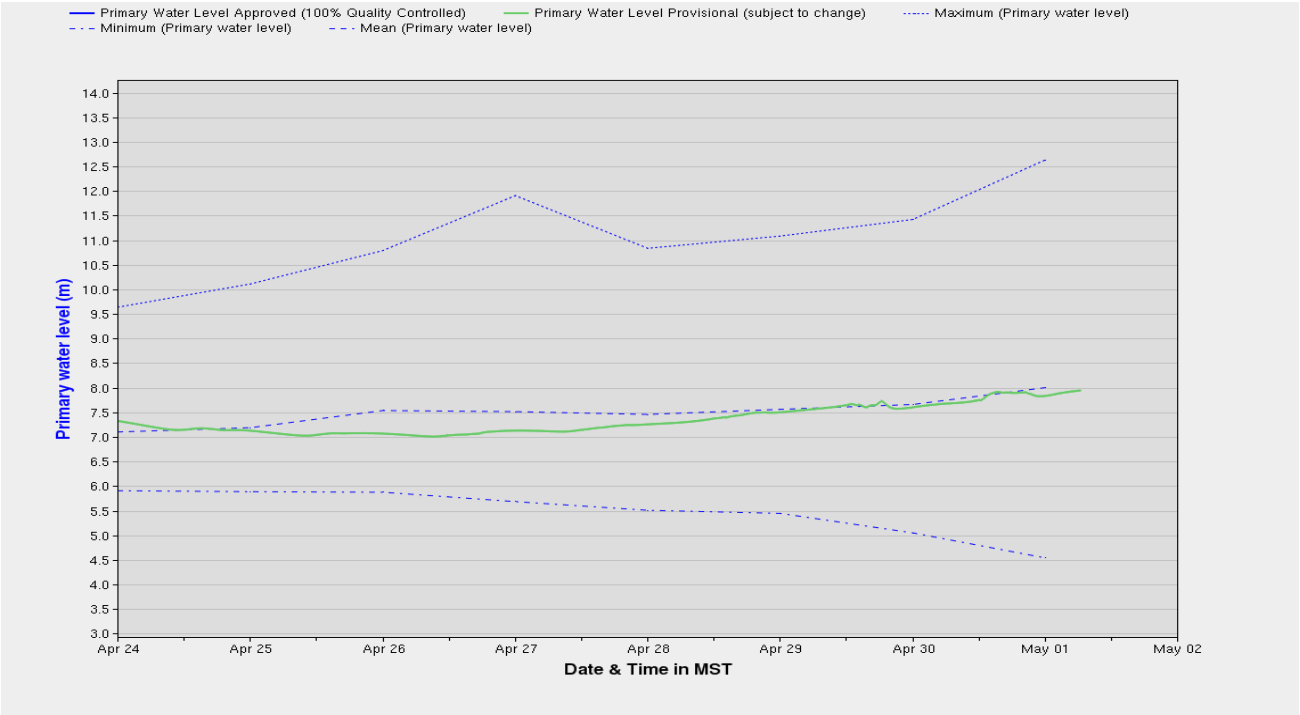
Regional Weather	Today	Tuesday	Wednesday
North Slave	High +5 /Low -7	High +2 /Low -7	High +8/ Low -3
Deh Cho	High +13/ Low -1	High +13/ Low 0	High +12/ Low +3
Sahtu	High +3/ Low -6	High +4/ Low -2	High +5/ Low -4
Delta	High -1/ Low -5	High +1/ Low -4	High +3/ Low -3



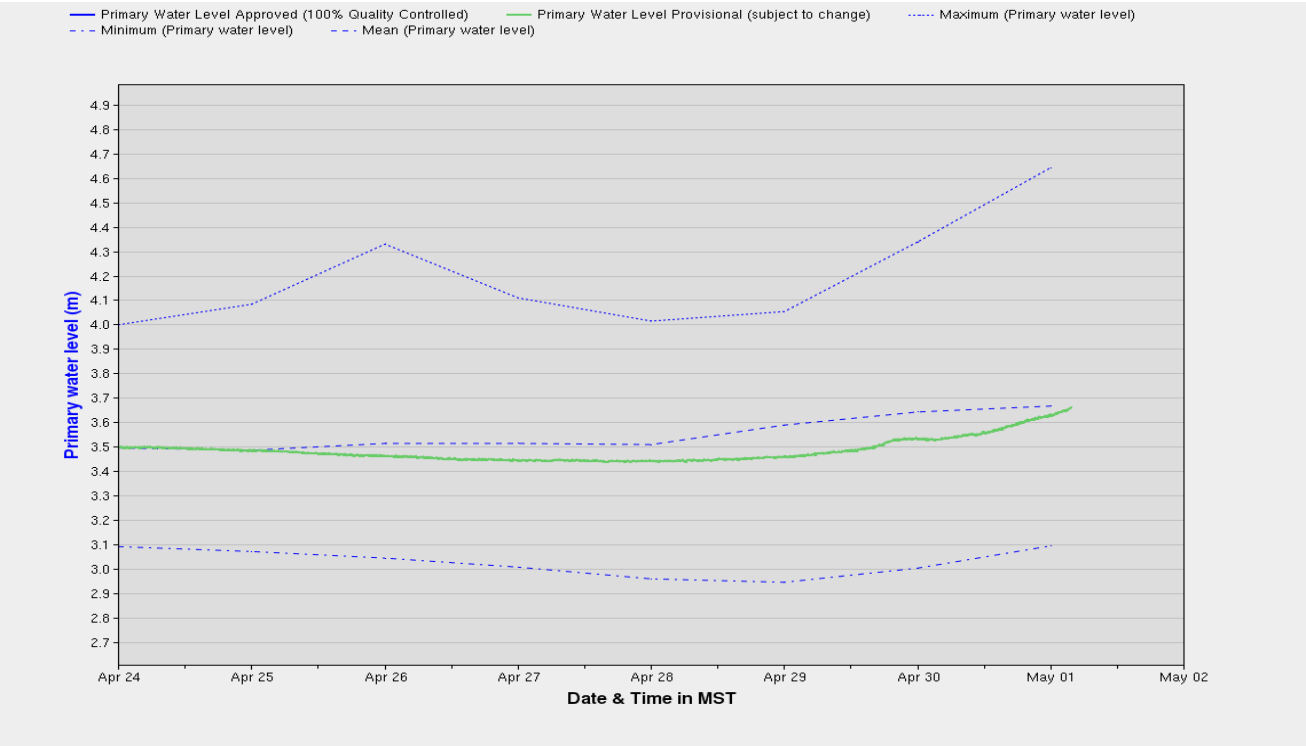
Satellite image from April 30th, 2017 Courtesy of MODIS – Rapid response system. The white markers are active WSC Hydrometric gauges.

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Peace River at Peace Point (07KC001) - Current water level is 7.945m. Average break-up level is around 8-14m and occurs around April 29th.

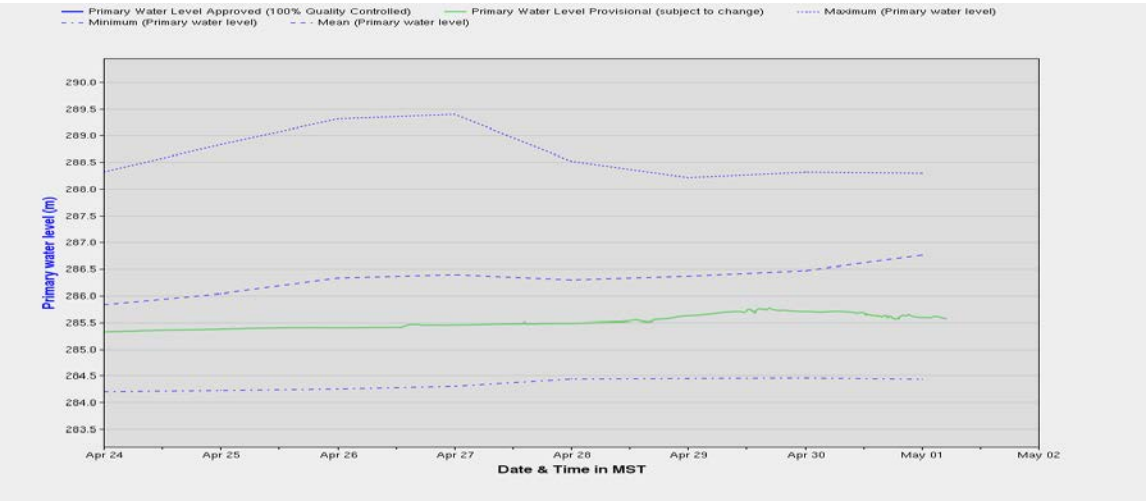


Slave River at Fitzgerald (07NB001) - Current water level is 3.656m. Average break-up level is around 4m with break-up occurring around April 30th.



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

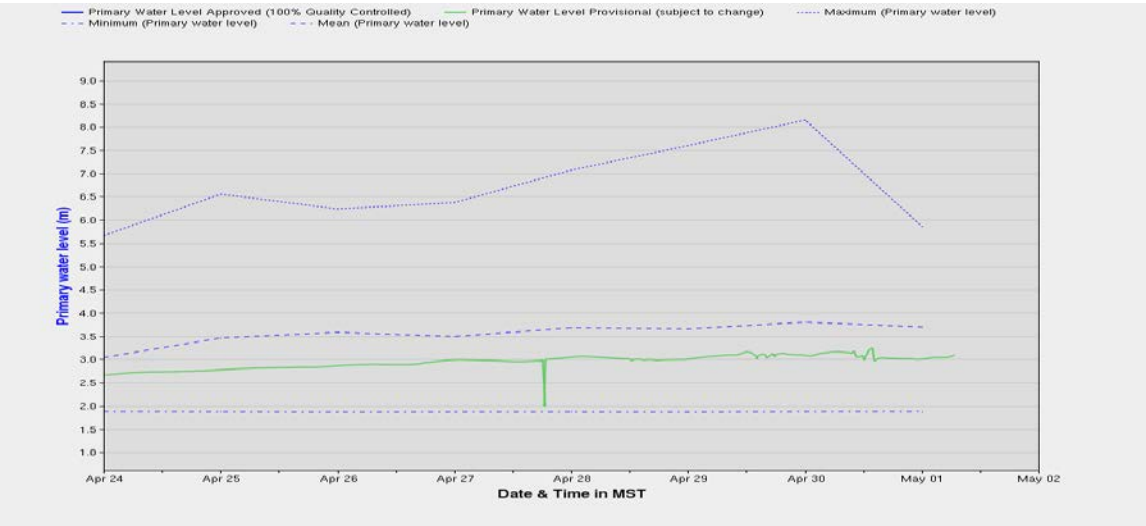
Hay River near ALTA/NWT Boundary (07OB008) – Current water level is 285.562m.



Hay River @ Hay River (07OB001) - Current Water Level is 3.100m. Average break-up level is approximately 8 meters with break-up occurring around April 30th. The latest report from the Hay River Flood Watch Committee on April 30th can be read below:

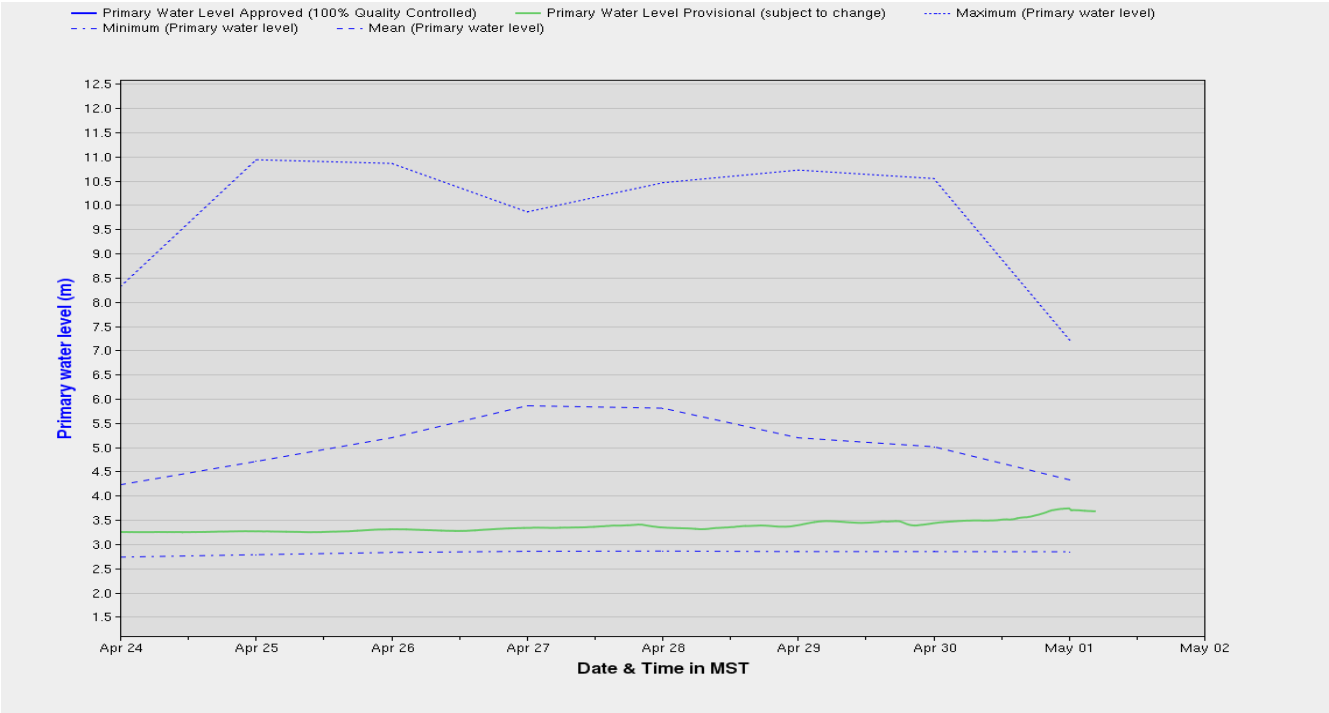
> Breakup Report
>
> Good afternoon, Breakup 2017 continues along the Hay River, levels are still dropping at Meander River and climbing slowly along the rest of the Hay River. We did a trip south today to see what is happening along the river and found that the river at Indian Cabins just south of the border is clear at this time. There are intermittent open stretches of water between the Border and Hay River which means things are progressing nicely. Levels at the border are still climbing slowly but at this time nothing alarming. The Paradise camera is showing clear water from shore to shore but this is only true for a short portion of the river in front of the camera. Levels rose slightly at Paradise last night but they are holding again at this time and are not at an alarming level. All levels north of Paradise are climbing slowly but not alarmingly.
>
> EMO personnel are still closely monitoring the situation and will advise as things develop on the river.

For more information on breakup conditions in Hay River click on the following link: http://hayriver.com/residents/2017-breakup-information/

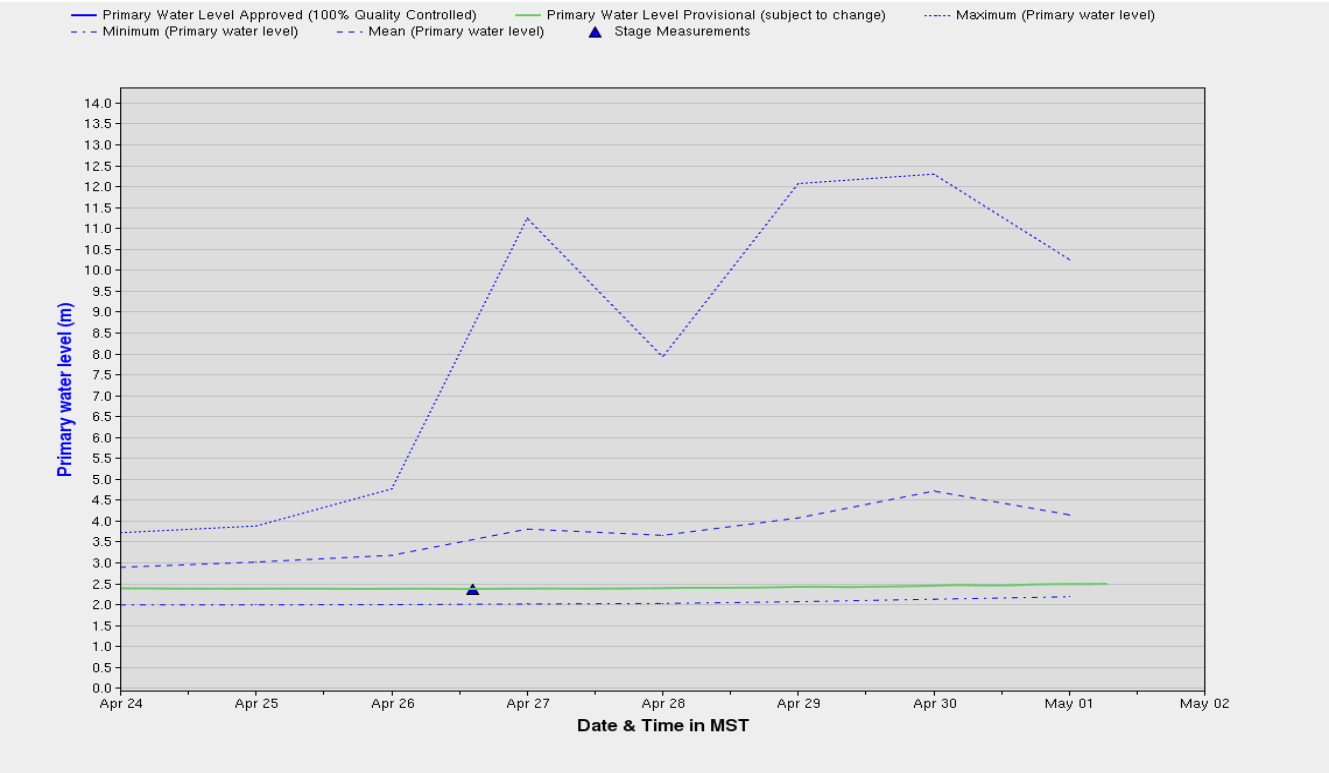


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Liard River @ Ft. Liard (10ED001) - Current water level is 3.677m. Average break-up is around April 30th.

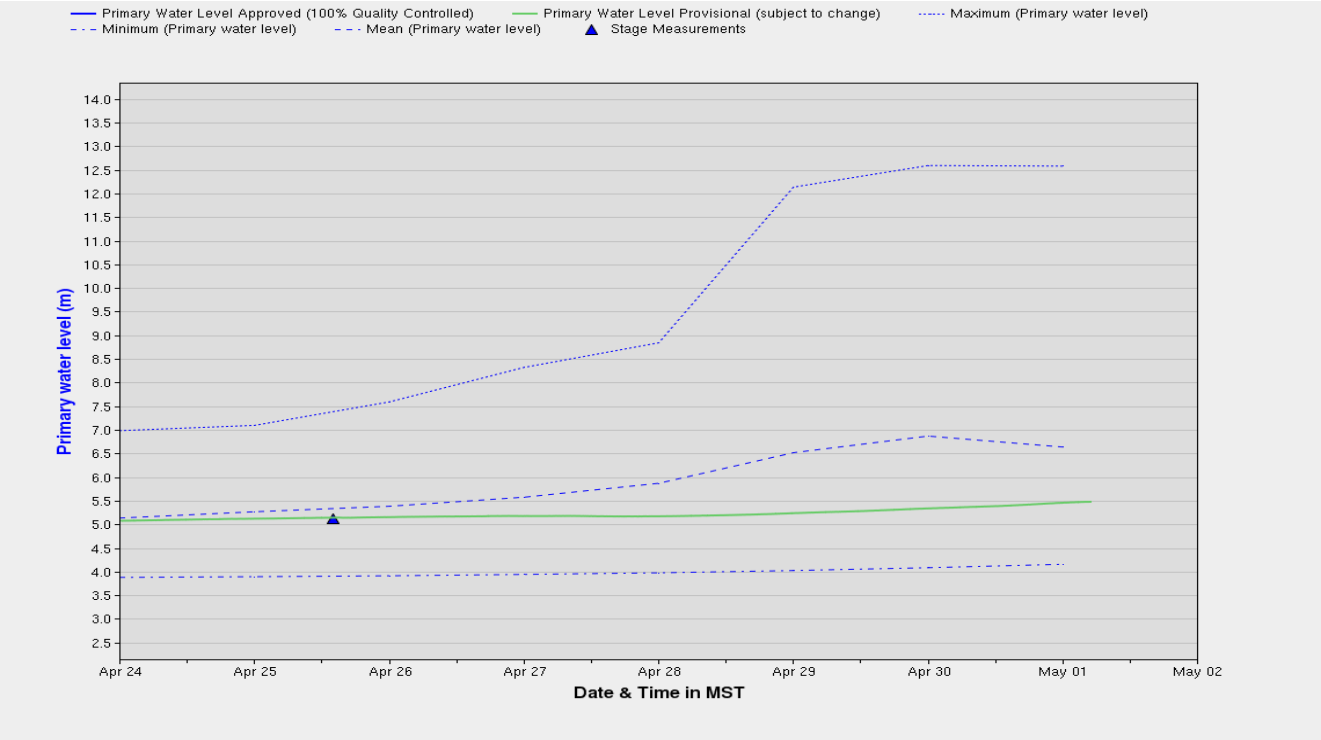


Liard River near the Mouth (10ED002) - Current water level is 2.488m. Average break-up level is around 4.4m with break-up occurring around May 4th.

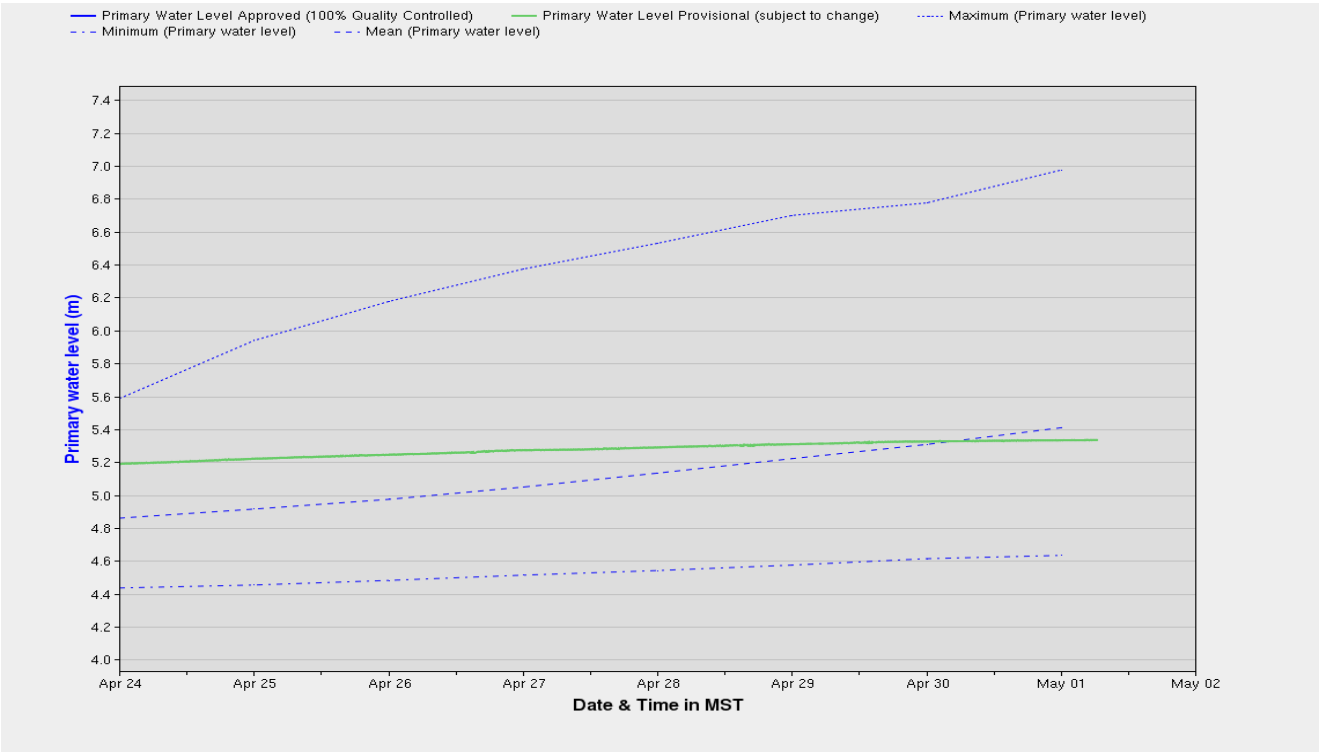


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River at Fort Simspon (10GC001) – Current water level is 5.478m. Average break-up level over the last ten years is around 7.3m with break-up occurring around May 5th.



Mackenzie River at Norman Wells (10KA001) – Current water level is 5.334m. Average breakup level is around 9m with breakup occurring between May 10th- 15th



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Environment Canada
Environnement

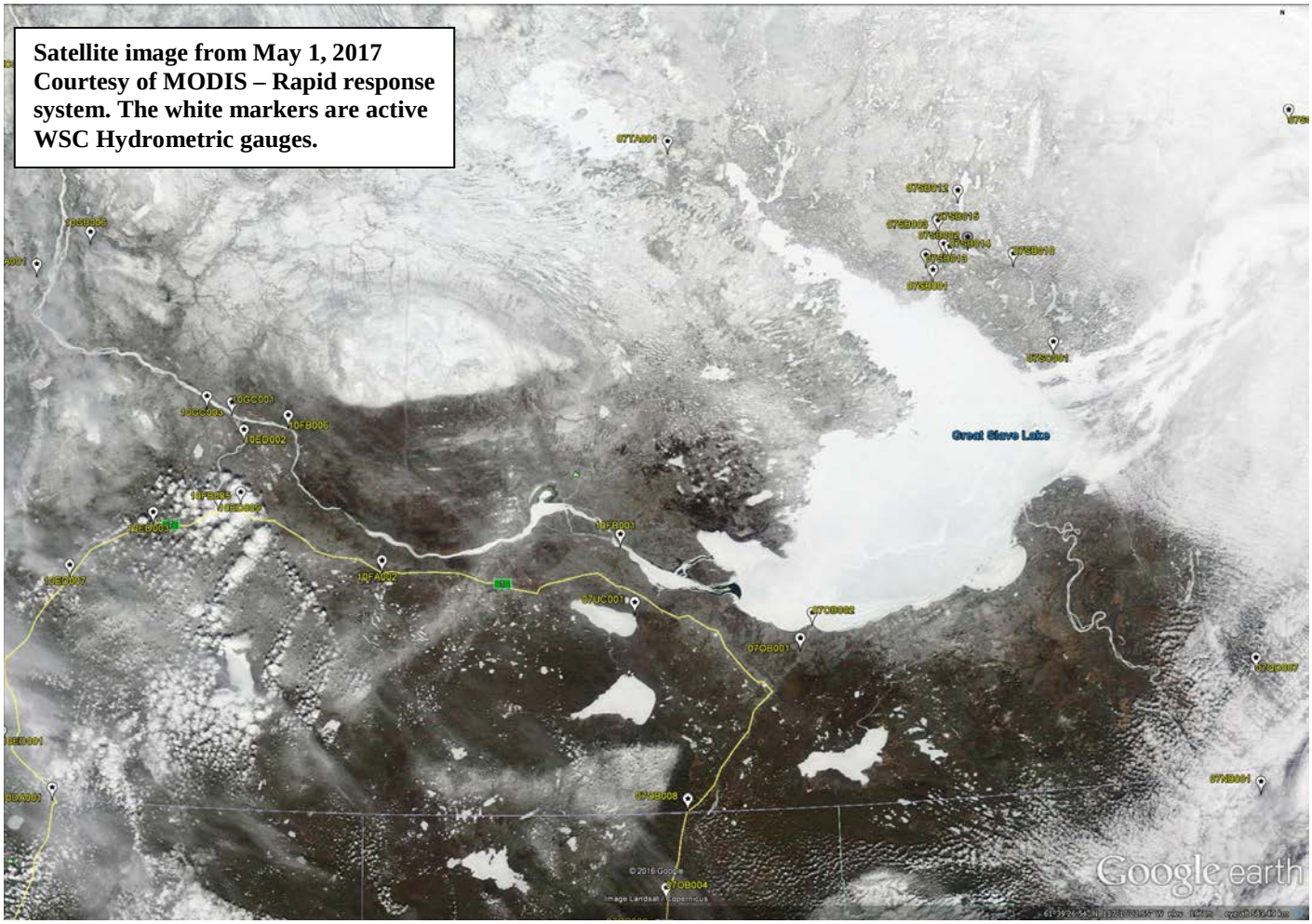
Water Survey of Canada
Suite 400, 5019 – 52 Street
Yellowknife, NWT
X1A 2P7

Report for May 2nd, 2017

The information presented is reported by Water Survey of Canada (WSC) staff in Ft. Simpson, Inuvik, Yellowknife, and numerous contacts in various communities. Their contributions are gratefully acknowledged. If you have any comments or do not wish to receive further reports, please contact WSC at (867) 669-4774 or FAX (867) 669-4750.

Regional Weather

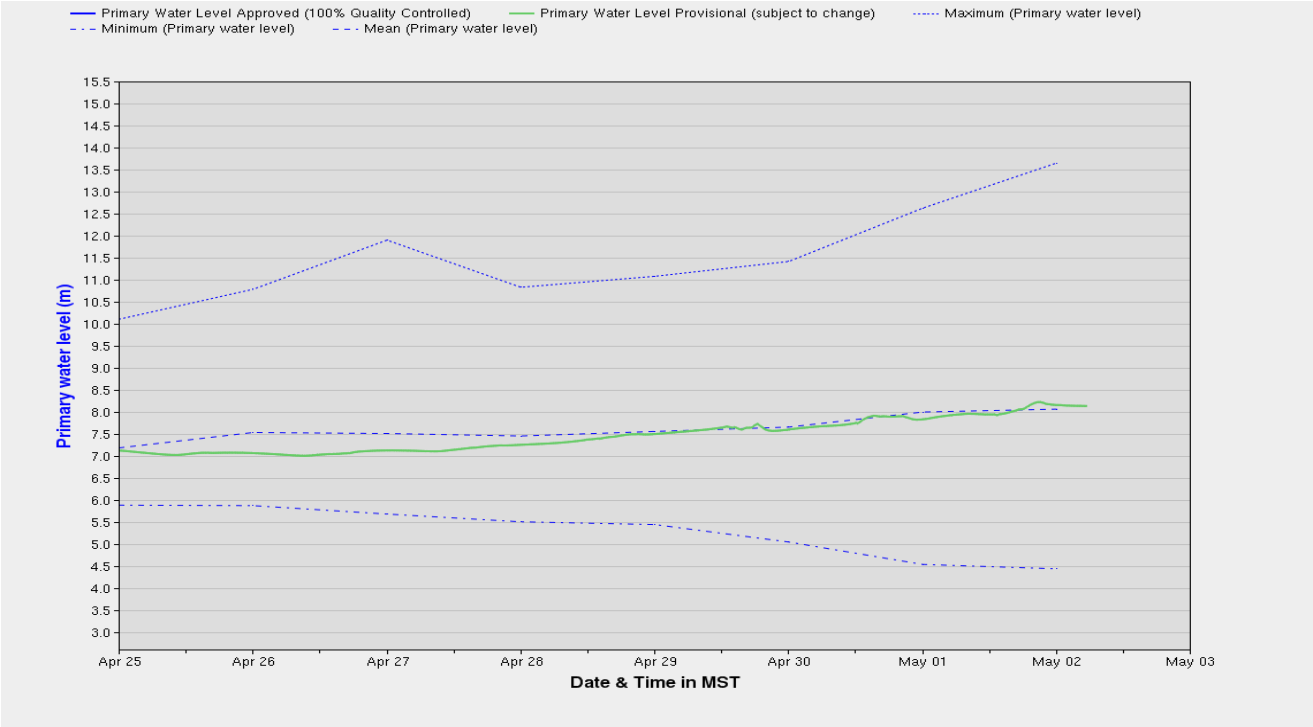
Regional Weather	Today	Wednesday	Thursday
North Slave	High +3 /Low -5	High +7 /Low 0	High +10/ Low -2
Deh Cho	High +14/ Low +3	High +16/ Low +5	High +14/ Low 0
Sahtu	High +8/ Low -4	High +7/ Low -1	High +6/ Low -4
Delta	High +4/ Low -5	High +5/ Low -2	High +3/ Low -2



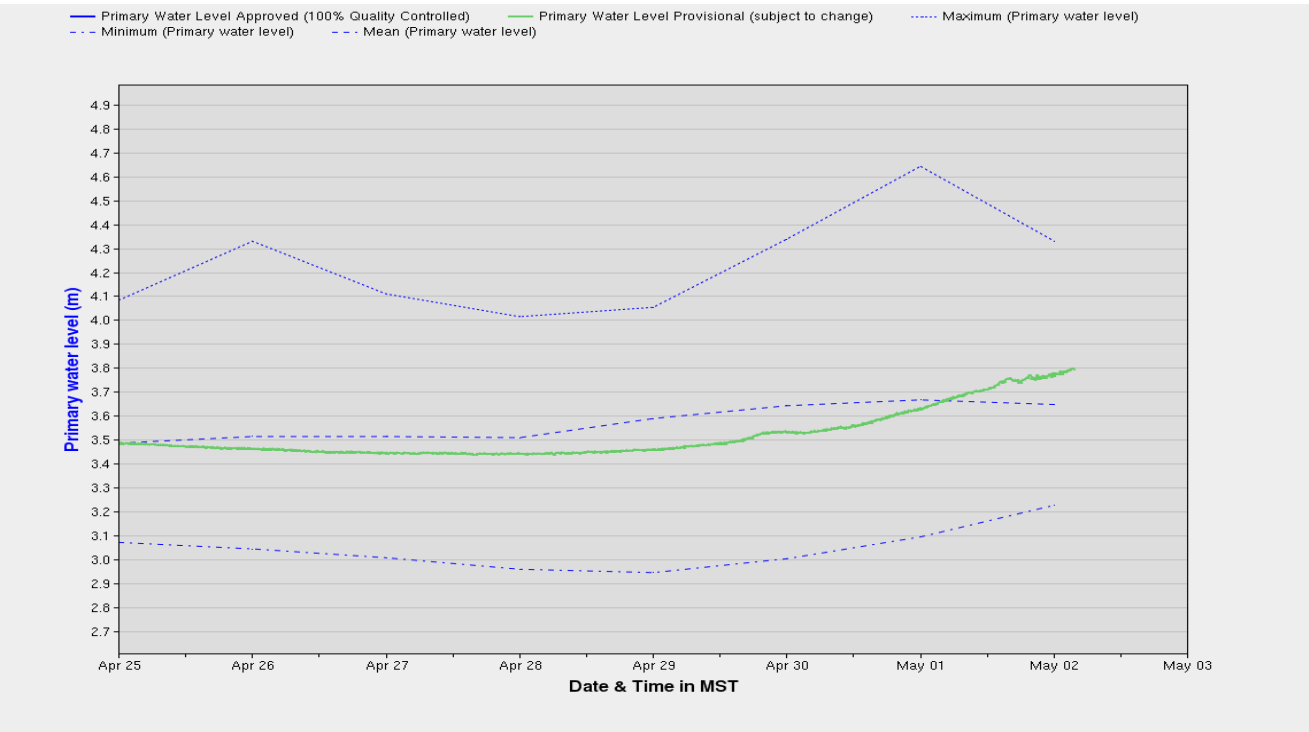
Satellite image from May 1, 2017 Courtesy of MODIS – Rapid response system. The white markers are active WSC Hydrometric gauges.

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Peace River at Peace Point (07KC001) - Current water level is 8.135m. Average break-up level is around 8-14m and occurs around April 29th.

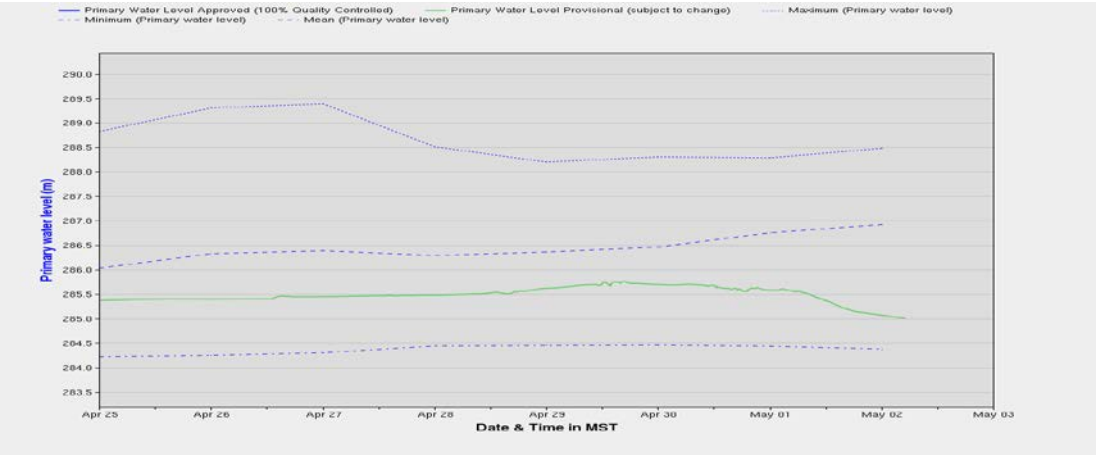


Slave River at Fitzgerald (07NB001) - Current water level is 3.799m. Average break-up level is around 4m with break-up occurring around April 30th.



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

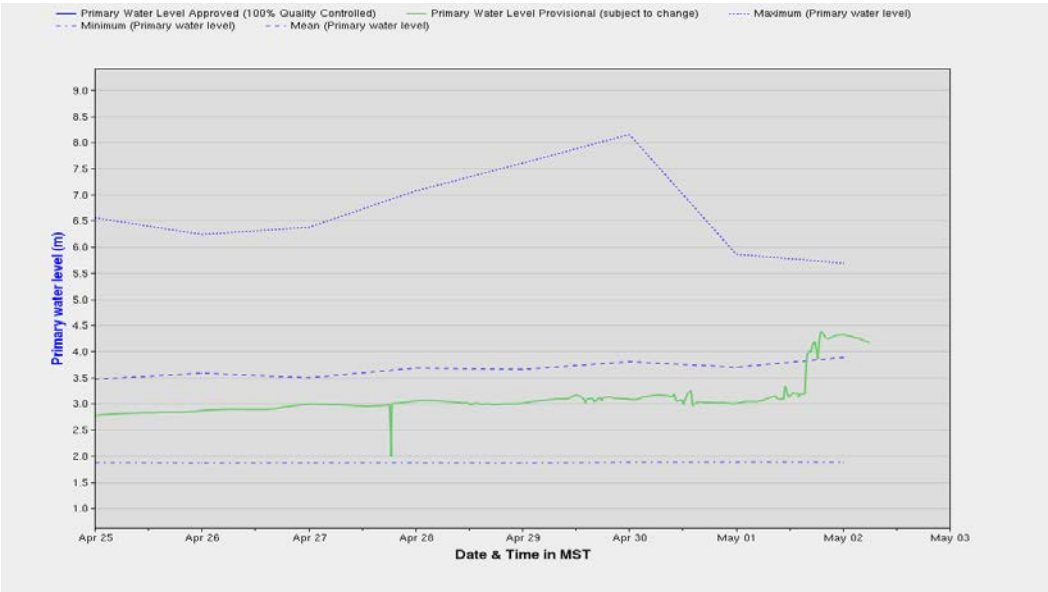
Hay River near ALTA/NWT Boundary (07OB008) – Current water level is 285.005m.



Hay River @ Hay River (07OB001) - Current Water Level is 3.100m. Average break-up level is approximately 8 meters with break-up occurring around April 30th. The latest report from the Hay River Flood Watch Committee this morning can be read below:

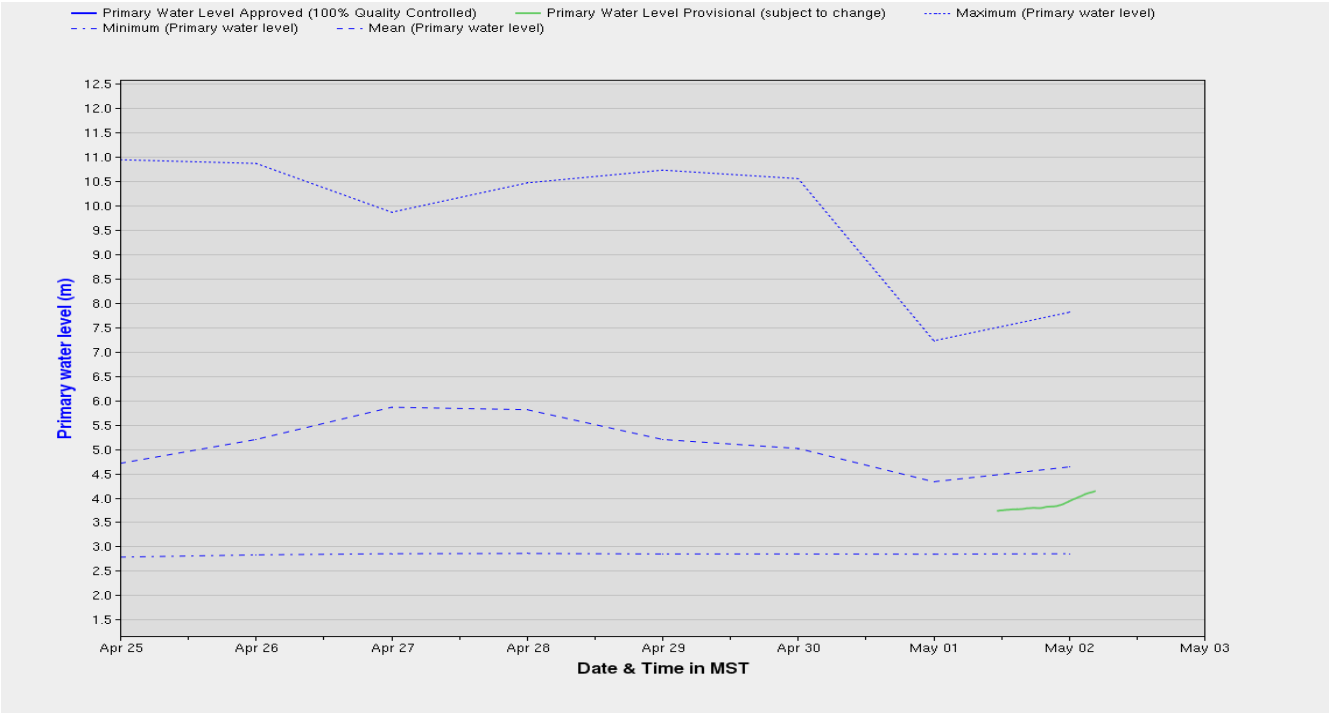
> Breakup Report
>
> Good morning, breakup is still underway in the Hay River area. As of 07:00 this morning there is slush ice from the Chamber Park all the way back to the Golf Course. Pan ice is still in place from the Chamber Park through new town. The West Channel has some breakup underway as does the East Channel.
>
> At this point we expect to see levels rise in the back of the slush ice then a push will develop when temperatures rise and the showers start as the day goes on and then we will see more of the ice breaking up throughout the new town area. Ice will start to move on the West Channel then East Channel on an alternating basis throughout the day.
>
> The EMO Team is watching what is happening and will advise if things start to develop negatively but so far all looks good.

For more information on breakup conditions in Hay River click on the following link:
http://hayriver.com/residents/2017-breakup-information/

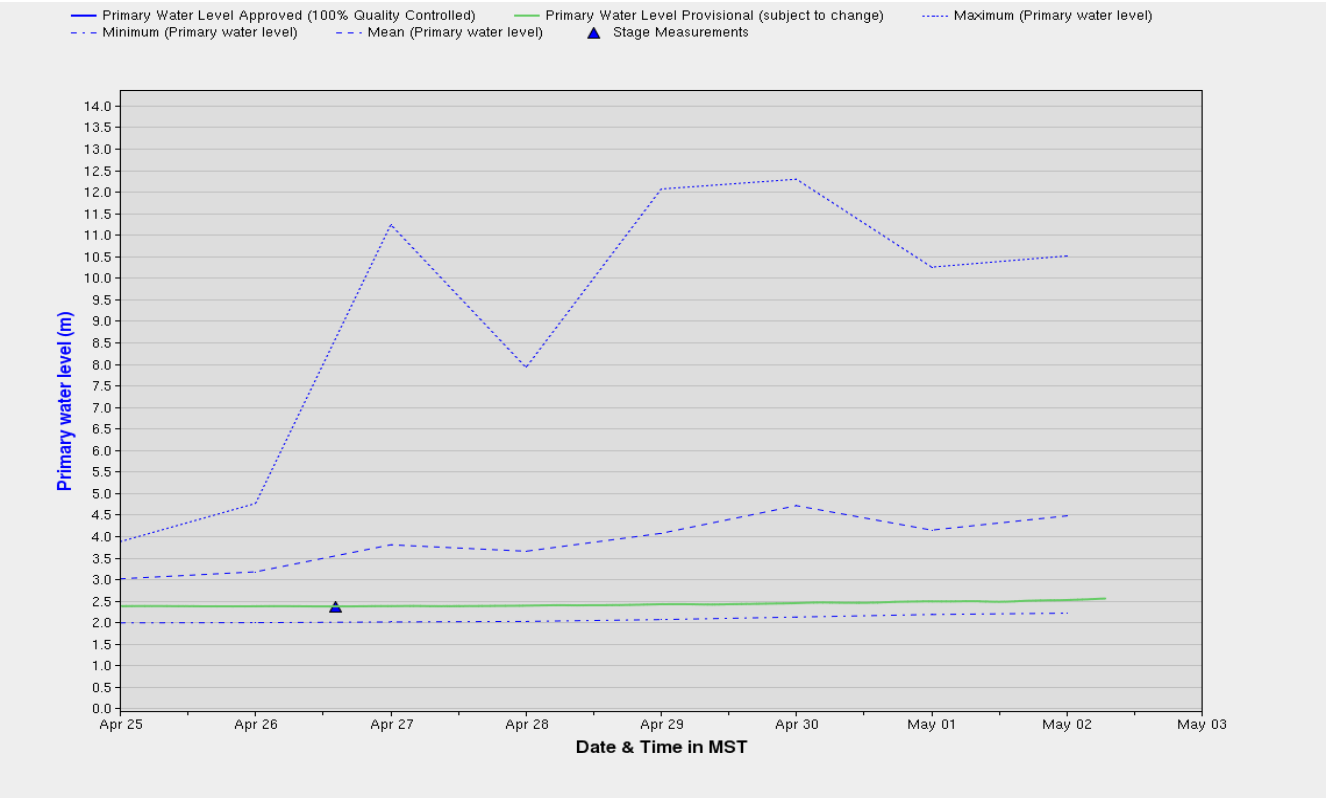


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Liard River @ Ft. Liard (10ED001) - Current water level is 3.818m. Average break-up is around April 30th.

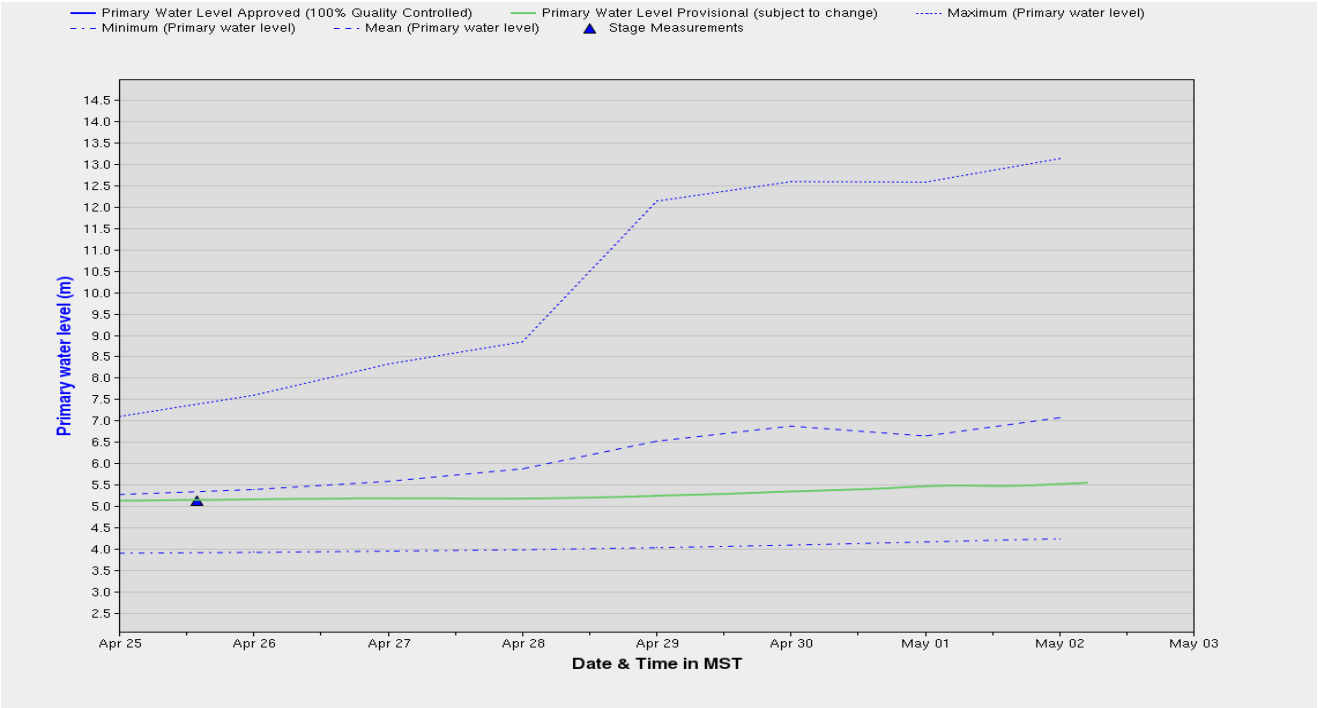


Liard River near the Mouth (10ED002) - Current water level is 2.551m. Average break-up level is around 4.4m with break-up occurring around May 4th.

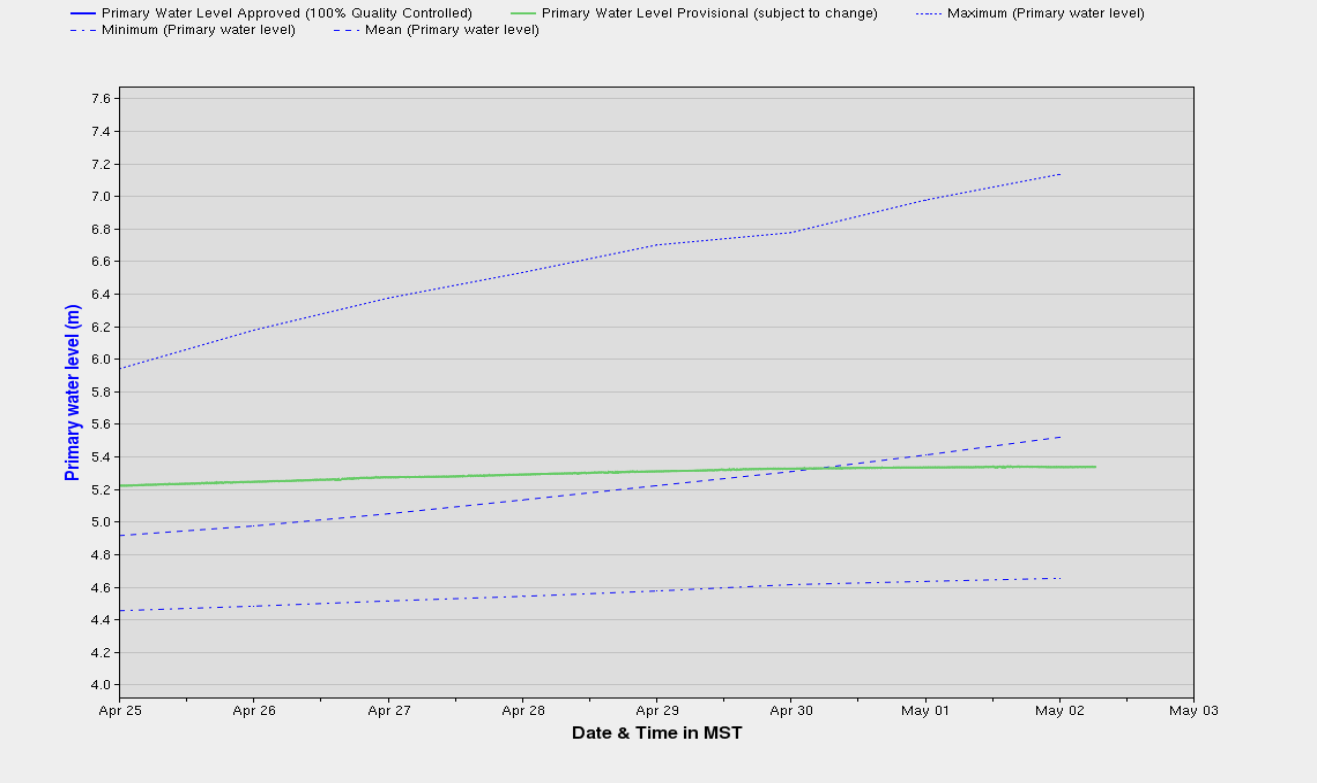


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River at Fort Simspon (10GC001) – Current water level is 5.544m. Average break-up level over the last ten years is around 7.3m with break-up occurring around May 5th.



Mackenzie River at Norman Wells (10KA001) – Current water level is 5.336m. Average breakup level is around 9m with breakup occurring between May 10th- 15th



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Environment Canada
Environnement

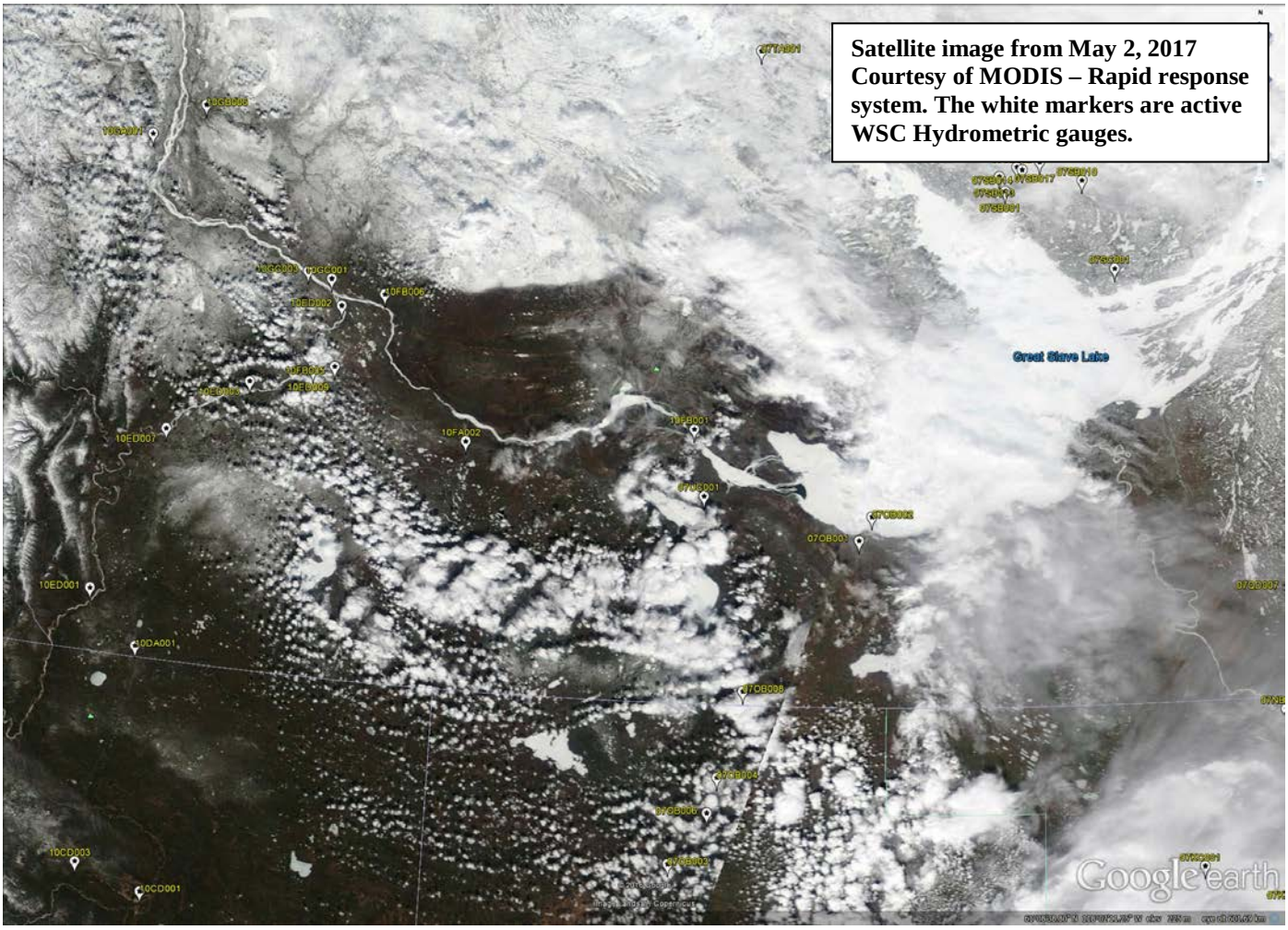
Water Survey of Canada
Suite 400, 5019 – 52 Street
Yellowknife, NWT
X1A 2P7

Report for May 3rd, 2017

The information presented is reported by Water Survey of Canada (WSC) staff in Ft. Simpson, Inuvik, Yellowknife, and numerous contacts in various communities. Their contributions are gratefully acknowledged. If you have any comments or do not wish to receive further reports, please contact WSC at (867) 669-4774 or FAX (867) 669-4750.

Regional Weather

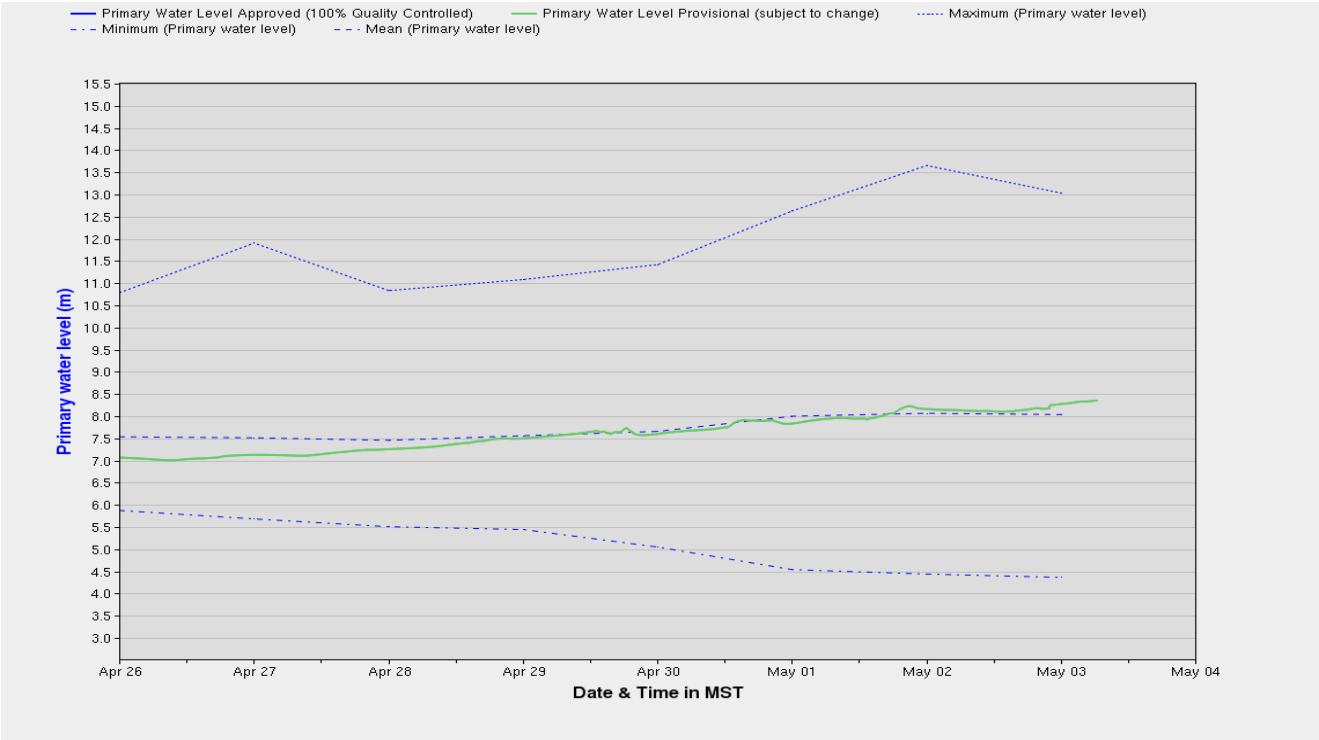
Regional Weather	Today	Wednesday	Thursday
North Slave	High +8 /Low +2	High +10 /Low -2	High +12/ Low +2
Deh Cho	High +16/ Low +4	High +15/ Low +2	High +14/ Low +3
Sahtu	High +7/ Low -2	High +6/ Low -4	High +6/ Low -3
Delta	High +3/ Low -2	High +3/ Low -2	High +3/ Low -3



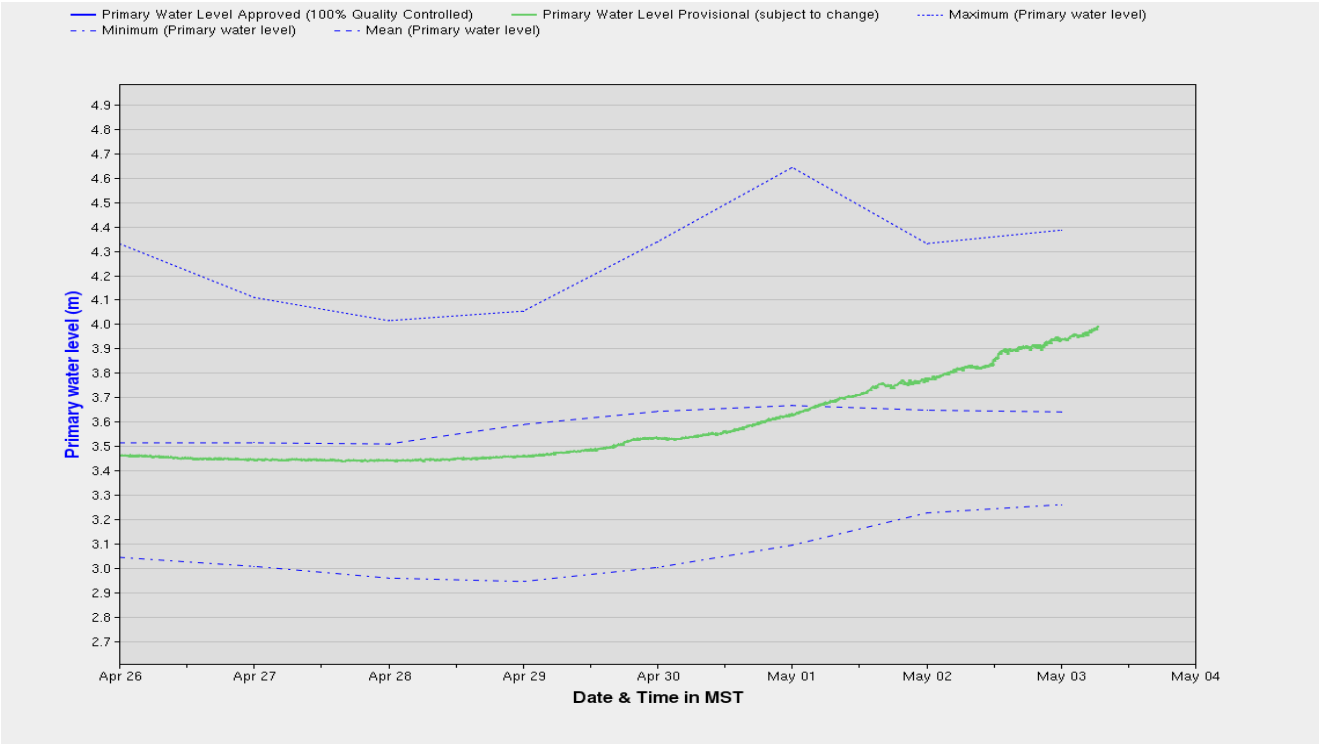
Satellite image from May 2, 2017 Courtesy of MODIS – Rapid response system. The white markers are active WSC Hydrometric gauges.

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Peace River at Peace Point (07KC001) - Current water level is 8.355m. Average break-up level is around 8-14m and occurs around April 29th.



Slave River at Fitzgerald (07NB001) - Current water level is 3.990m. Average break-up level is around 4m with break-up occurring around April 30th.

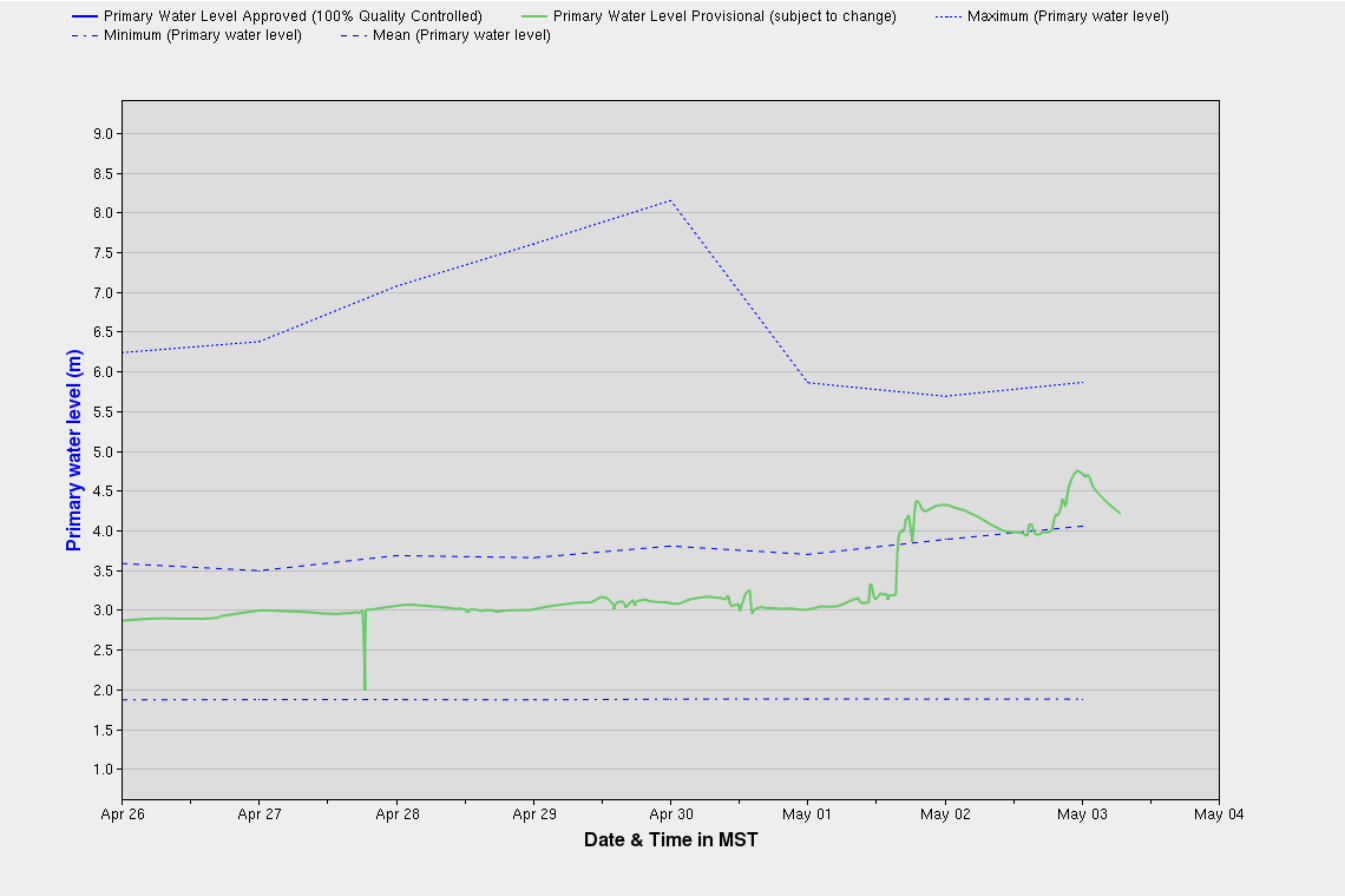


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

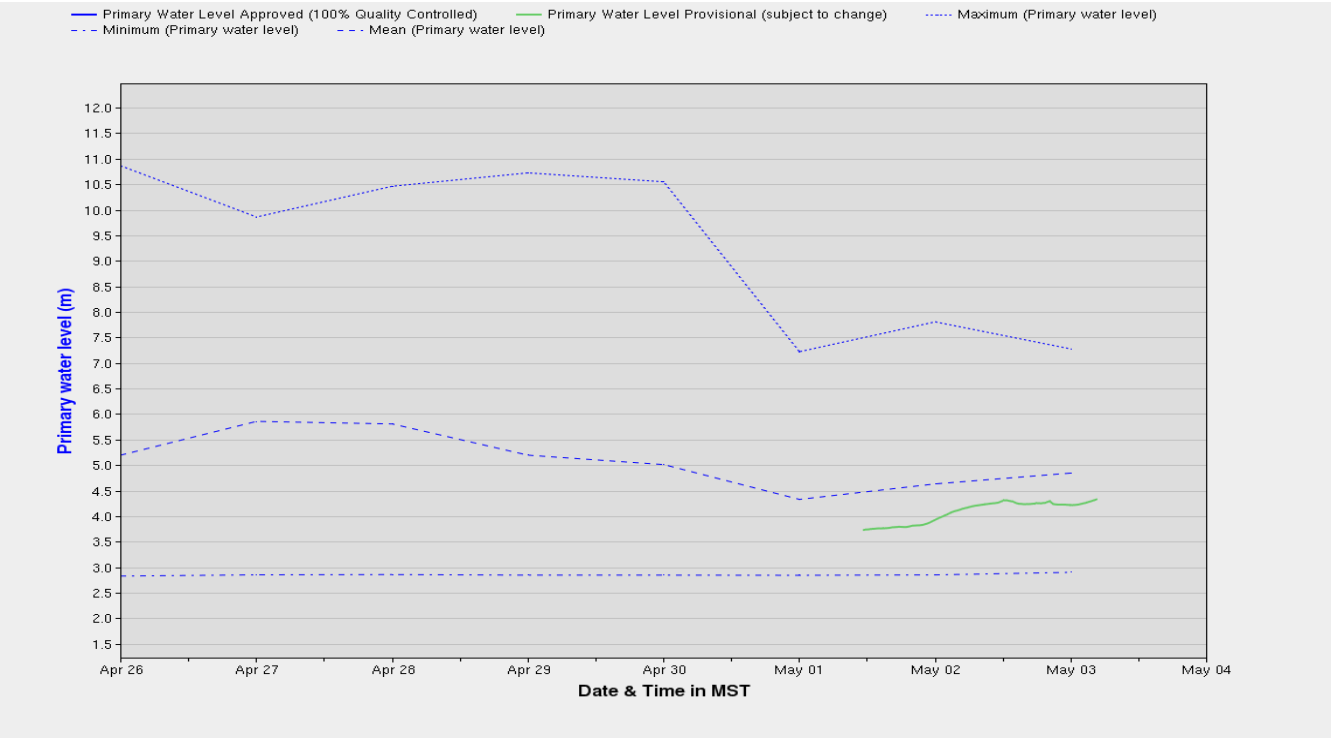
Hay River @ Hay River (07OB001) - Current Water Level is 4.198m. Average break-up level is approximately 8 meters with break-up occurring around April 30th. The latest report from the Hay River Flood Watch Committee this morning can be read below:

> Breakup Report
>
> Good morning, not much change from yesterday but breakup is still underway in the Hay River area. There is slush ice from the Chamber Park all the way back to Smith's Drive. Pan ice is still in place from the Chamber Park through new town. The West Channel has some breakup underway as does the East Channel.
>
> At this point we expect to see levels rise in the back of the slush ice then a push will develop when temperatures rise and the showers start (if the weather forecast is right) as the day goes on and then we will see more of the ice breaking up throughout the new town area. Ice will start to move on the West Channel then East Channel on an alternating basis throughout the day.
>
> The EMO Team is watching what is happening and will advise if things start to develop negatively but so far all looks good.

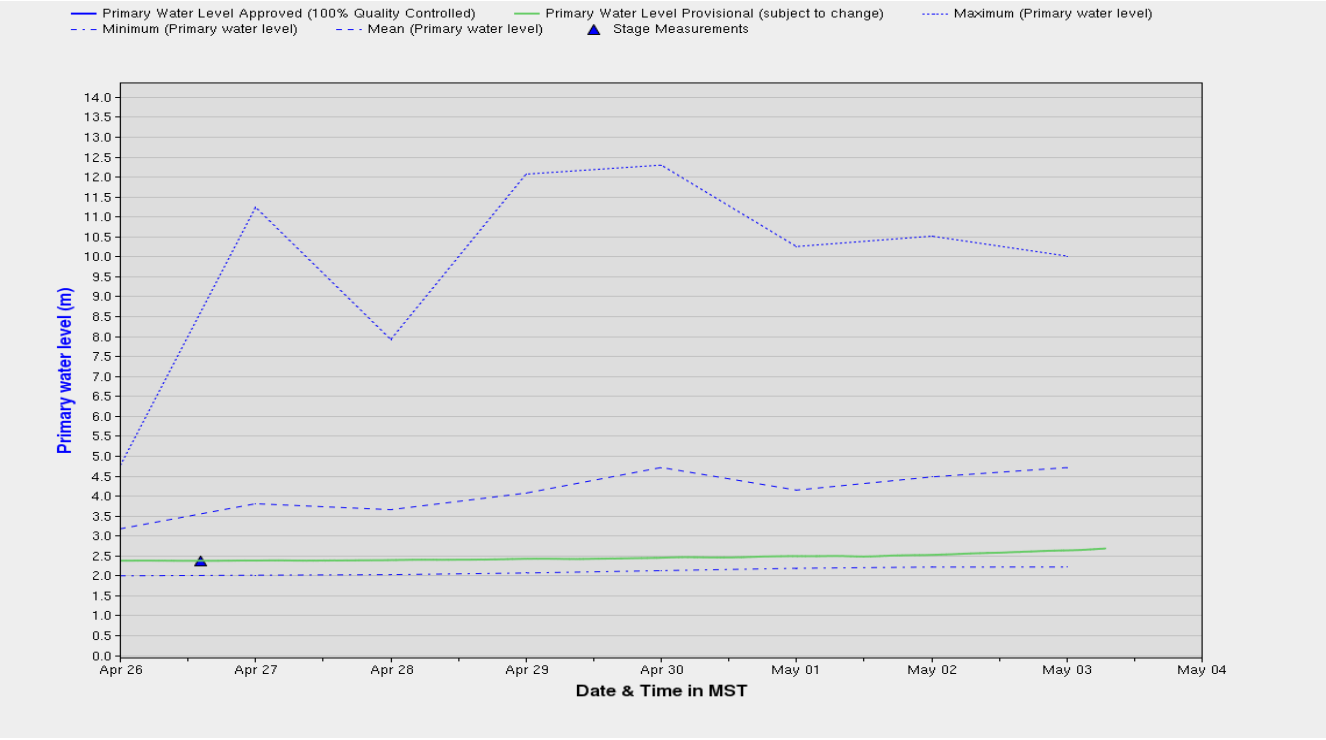
For more information on breakup conditions in Hay River click on the following link:
http://hayriver.com/residents/2017-breakup-information/



Liard River @ Ft. Liard (10ED001) - Current water level is 4.340m. Average break-up is around April 30th.

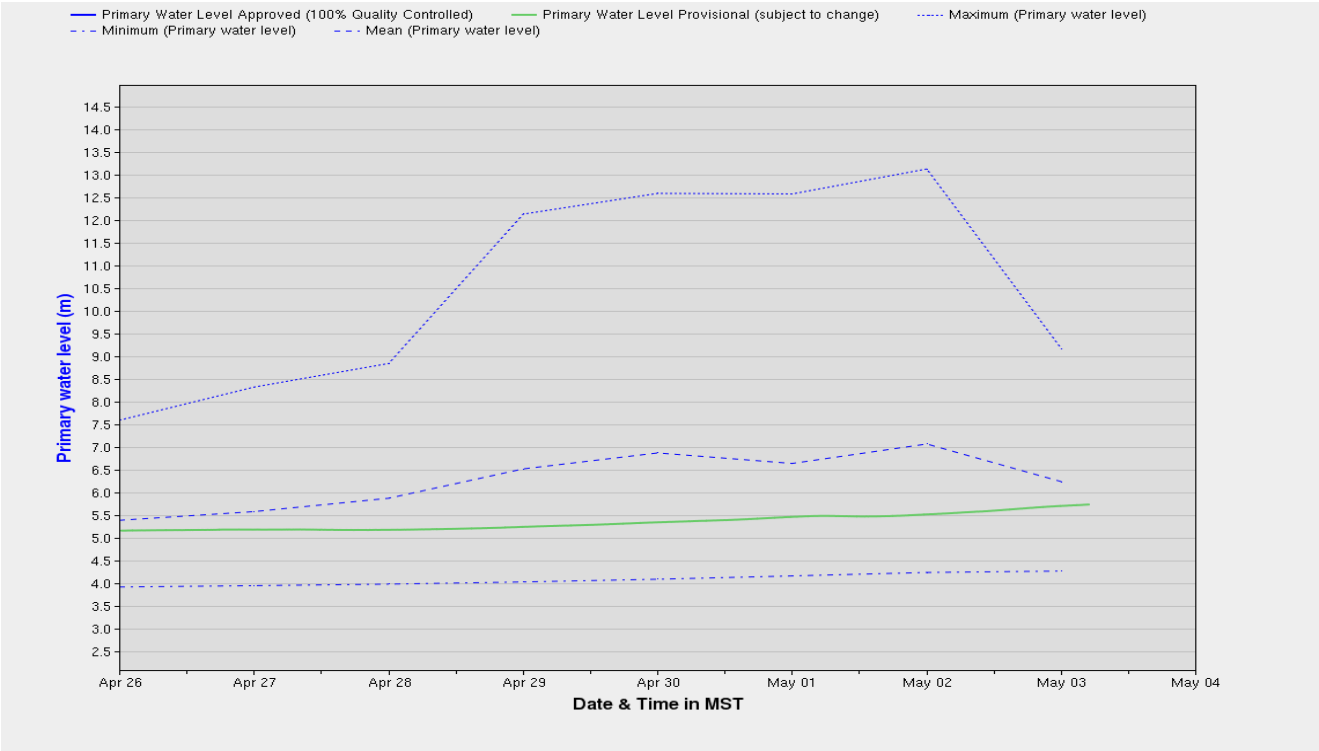


Liard River near the Mouth (10ED002) - Current water level is 2.676m. Average break-up level is around 4.4m with break-up occurring around May 4th.

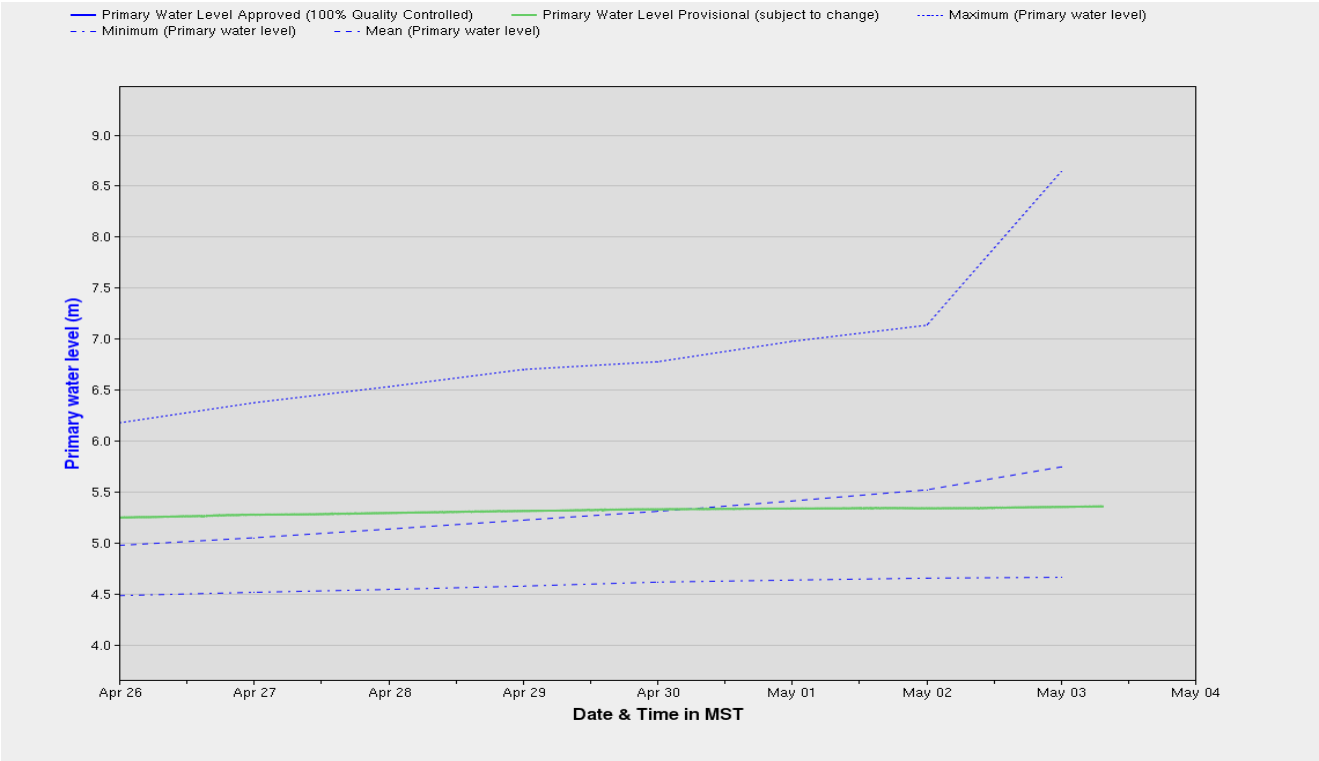


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

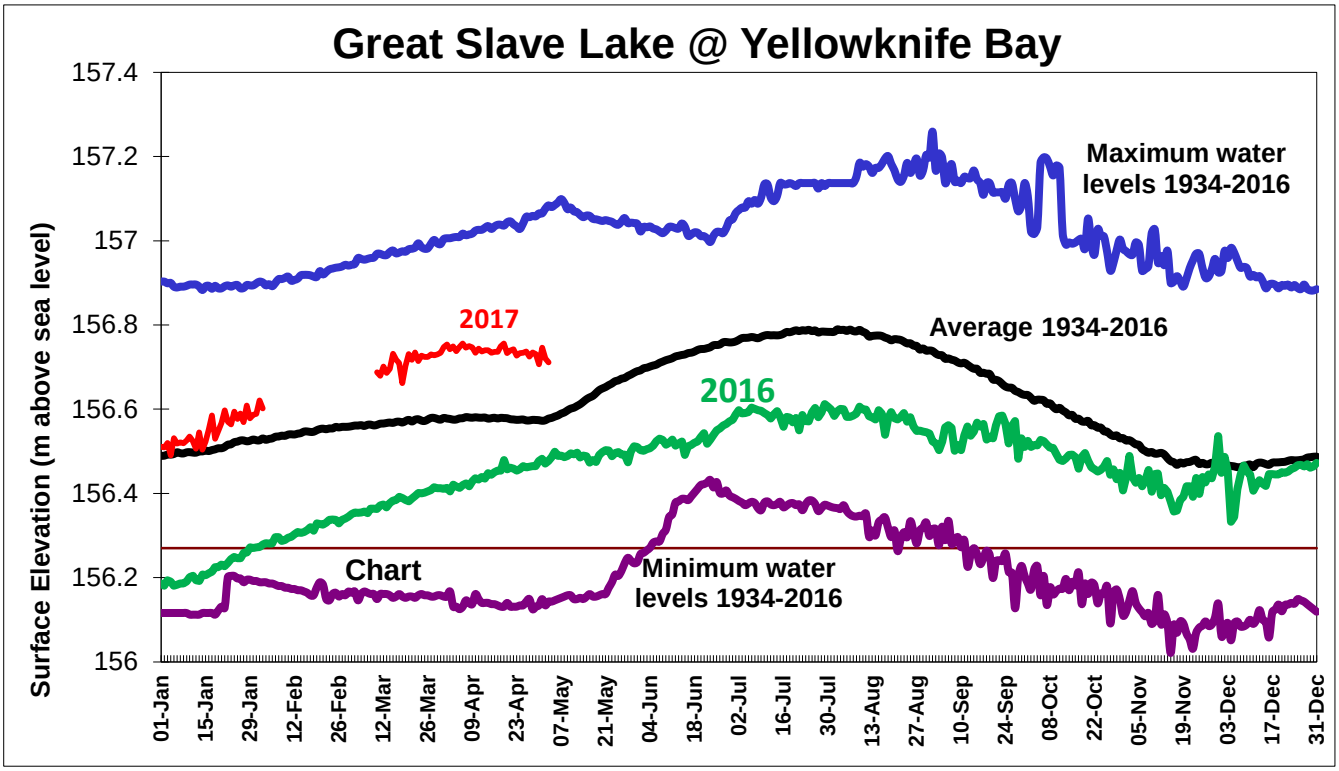
Mackenzie River at Fort Simspon (10GC001) – Current water level is 5.731m. Average break-up level over the last ten years is around 7.3m with break-up occurring around May 5th.



Mackenzie River at Norman Wells (10KA001) – Current water level is 5.353m. Average breakup level is around 9m with breakup occurring between May 10th- 15th



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Environment Canada
Environnement

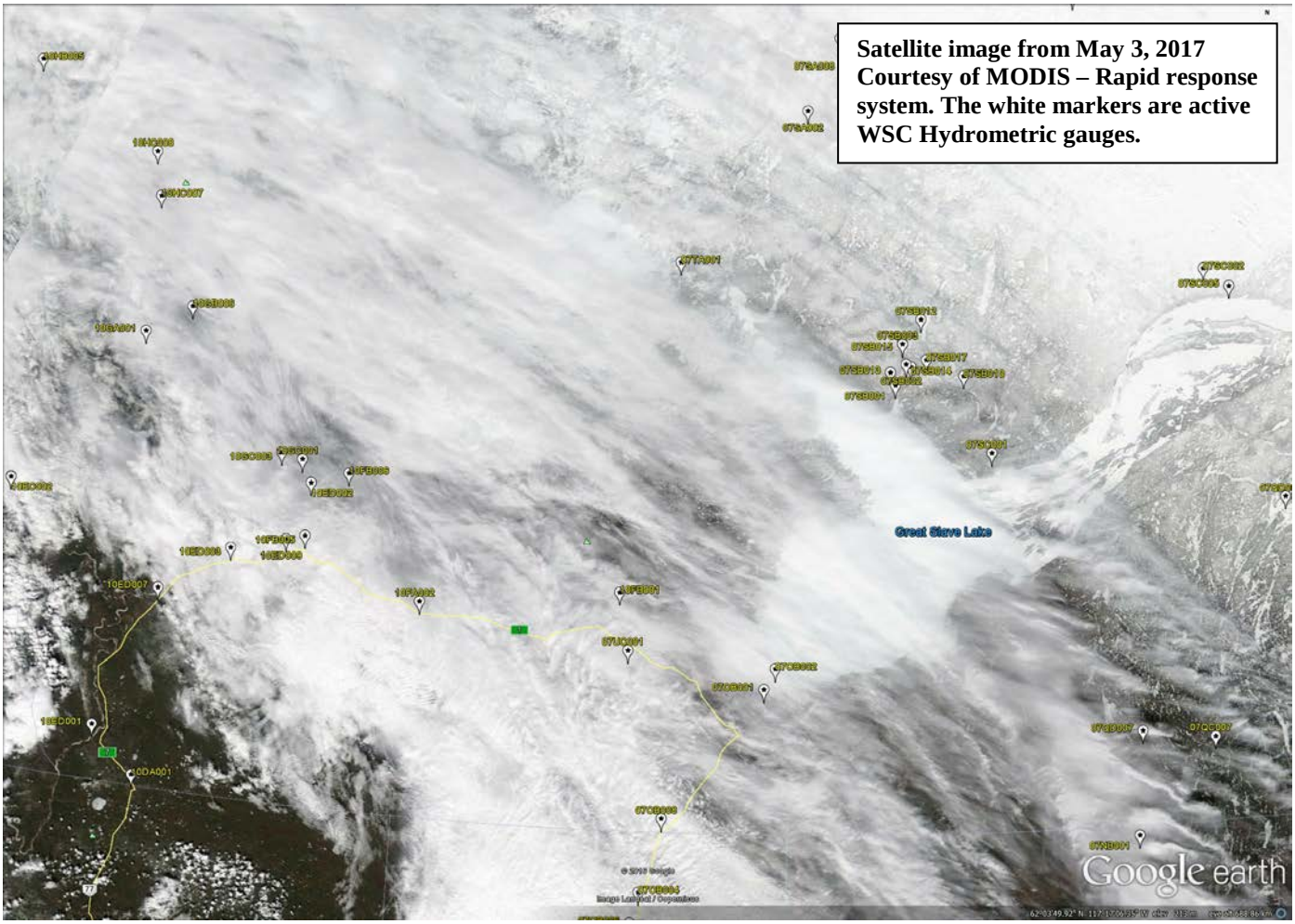
Water Survey of Canada
Suite 400, 5019 – 52 Street
Yellowknife, NWT
X1A 2P7

Report for May 4th, 2017

The information presented is reported by Water Survey of Canada (WSC) staff in Ft. Simpson, Inuvik, Yellowknife, and numerous contacts in various communities. Their contributions are gratefully acknowledged. If you have any comments or do not wish to receive further reports, please contact WSC at (867) 669-4774 or FAX (867) 669-4750.

Regional Weather

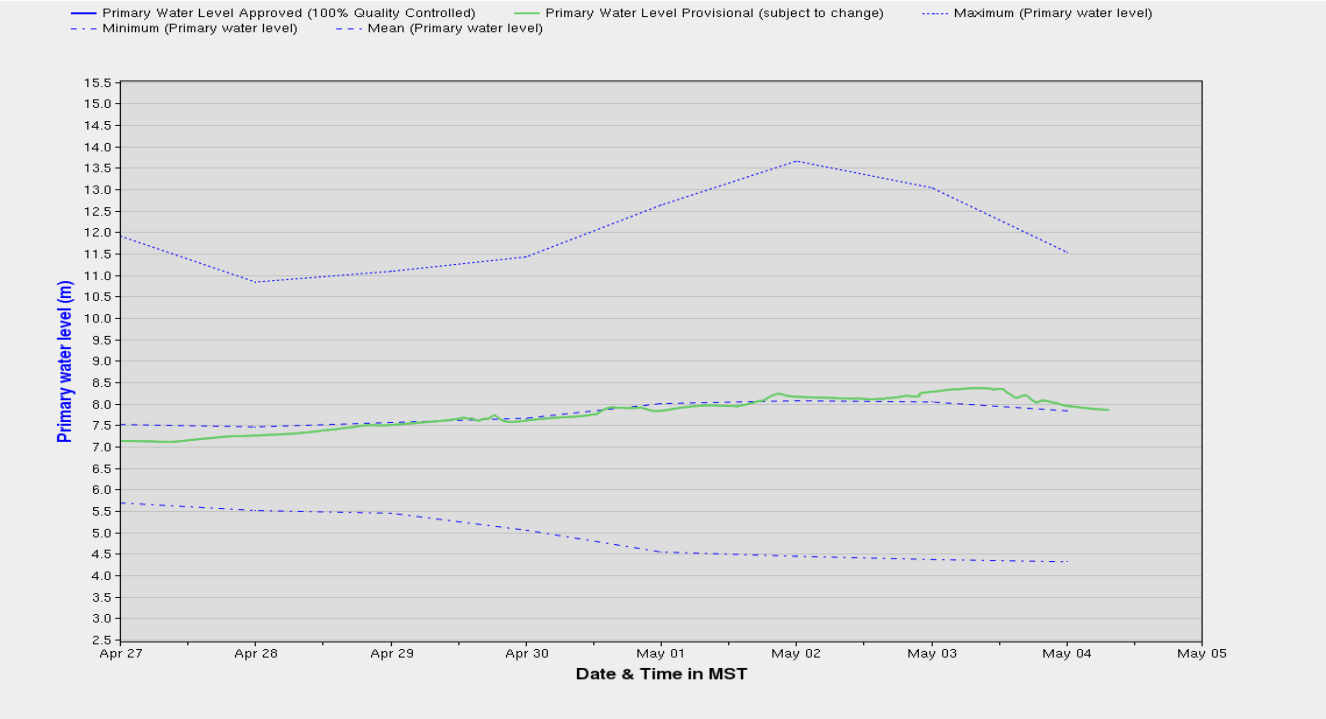
Regional Weather	Today	Friday	Saturday
North Slave	High +11 /Low -1	High +14 /Low +3	High +6/ Low +2
Deh Cho	High +15/ Low +3	High +15/ Low +3	High +4/ Low +1
Sahtu	High +6/ Low -4	High +5/ Low -2	High +7/ Low -1
Delta	High +1/ Low -3	High +1/ Low -1	High +4/ Low -2



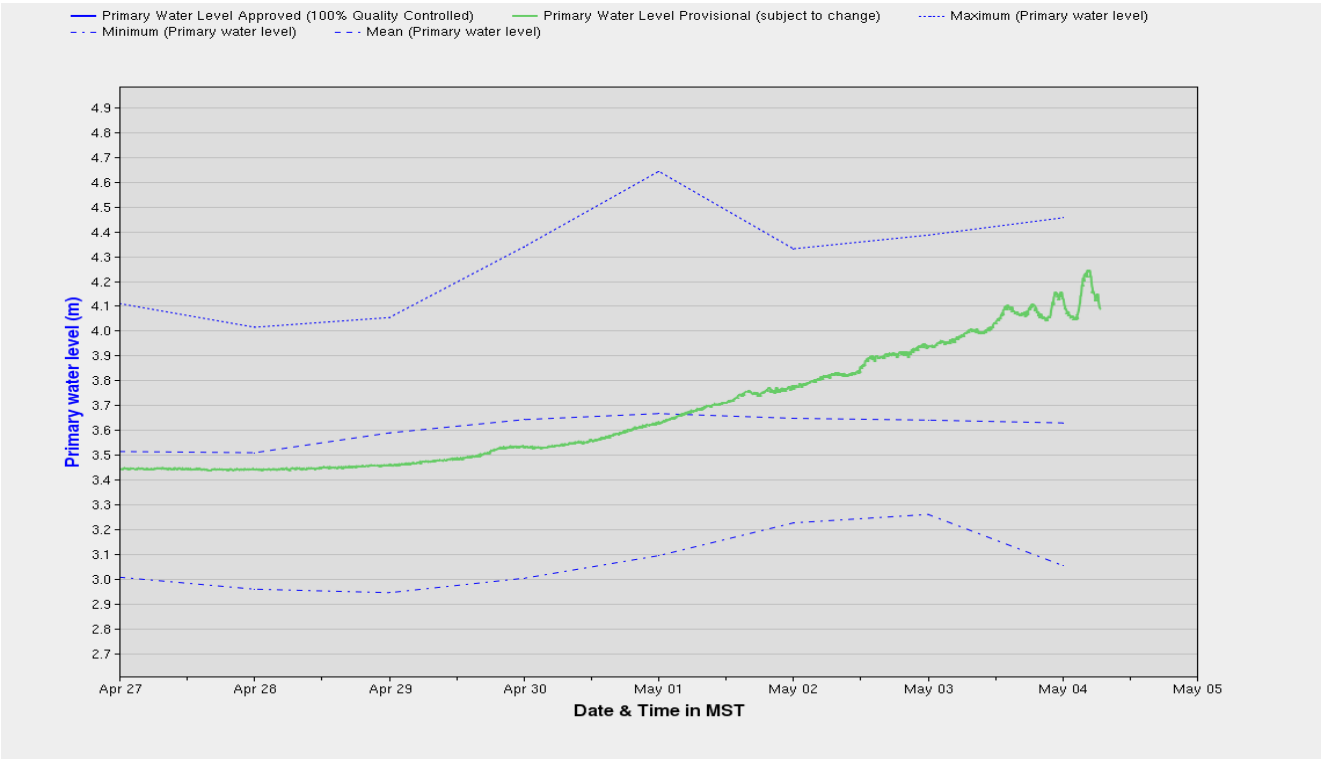
Satellite image from May 3, 2017 Courtesy of MODIS – Rapid response system. The white markers are active WSC Hydrometric gauges.

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Peace River at Peace Point (07KC001) - Current water level is 7.856m. Average break-up level is around 8-14m and occurs around April 29th.



Slave River at Fitzgerald (07NB001) - Current water level is 4.081m. Average break-up level is around 4m with break-up occurring around April 30th.

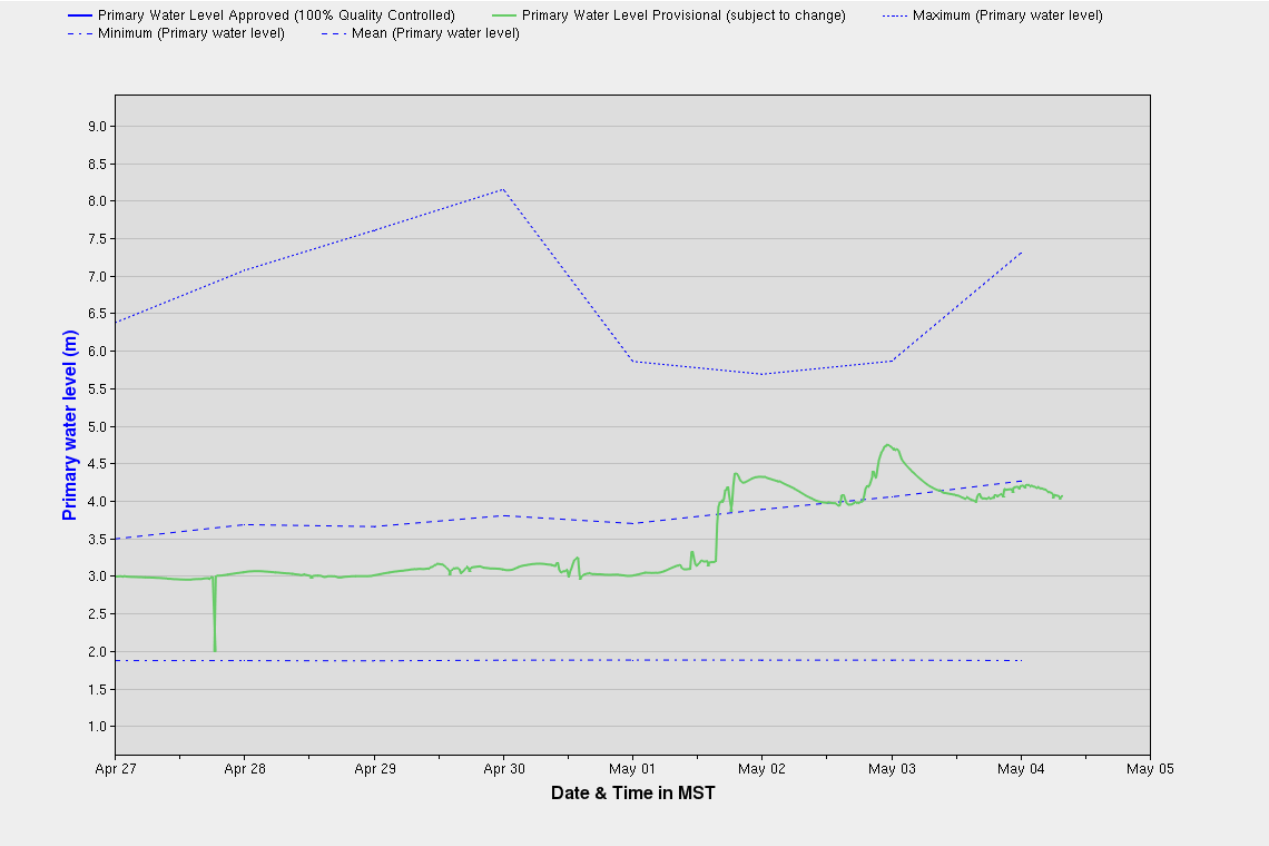


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

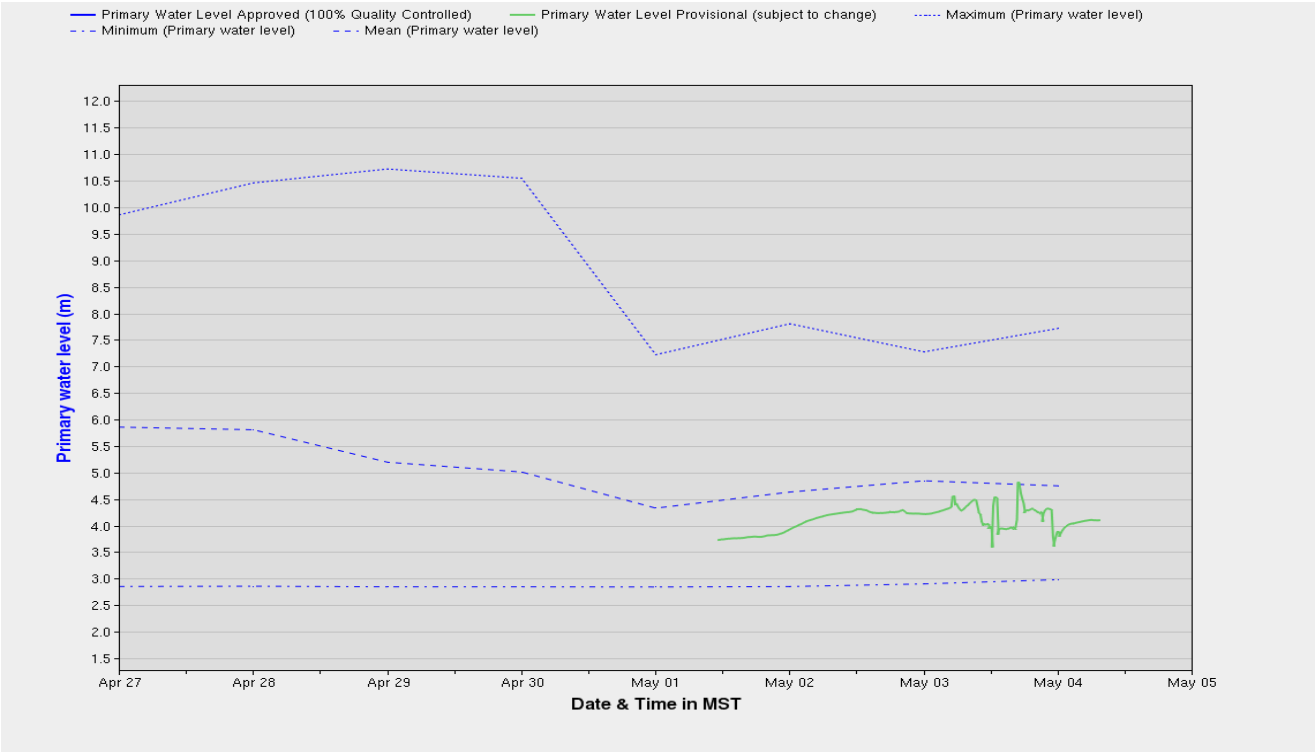
Hay River @ Hay River (07OB001) - Current Water Level is 4.064m. Average break-up level is approximately 8 meters with break-up occurring around April 30th. The latest report from the Hay River Flood Watch Committee this morning can be read below:

> Breakup Report
>
> Good morning, not much change from yesterday but breakup is still underway in the Hay River area. There is slush ice from the Chamber Park all the way back to the Pine Point Bridge side of Delancey Estates. Pan ice is still in place from the Chamber Park through new town. The West Channel has some breakup underway as does the East Channel.
>
> At this point it is looking like we are going to have a melt out rather than a breakup this year however the EMO Team continues to monitor the situation in the event that there is a blockage or something else goes awry.
>
> We will continue to keep you informed as things progress with this year's Breakup/Melt out.

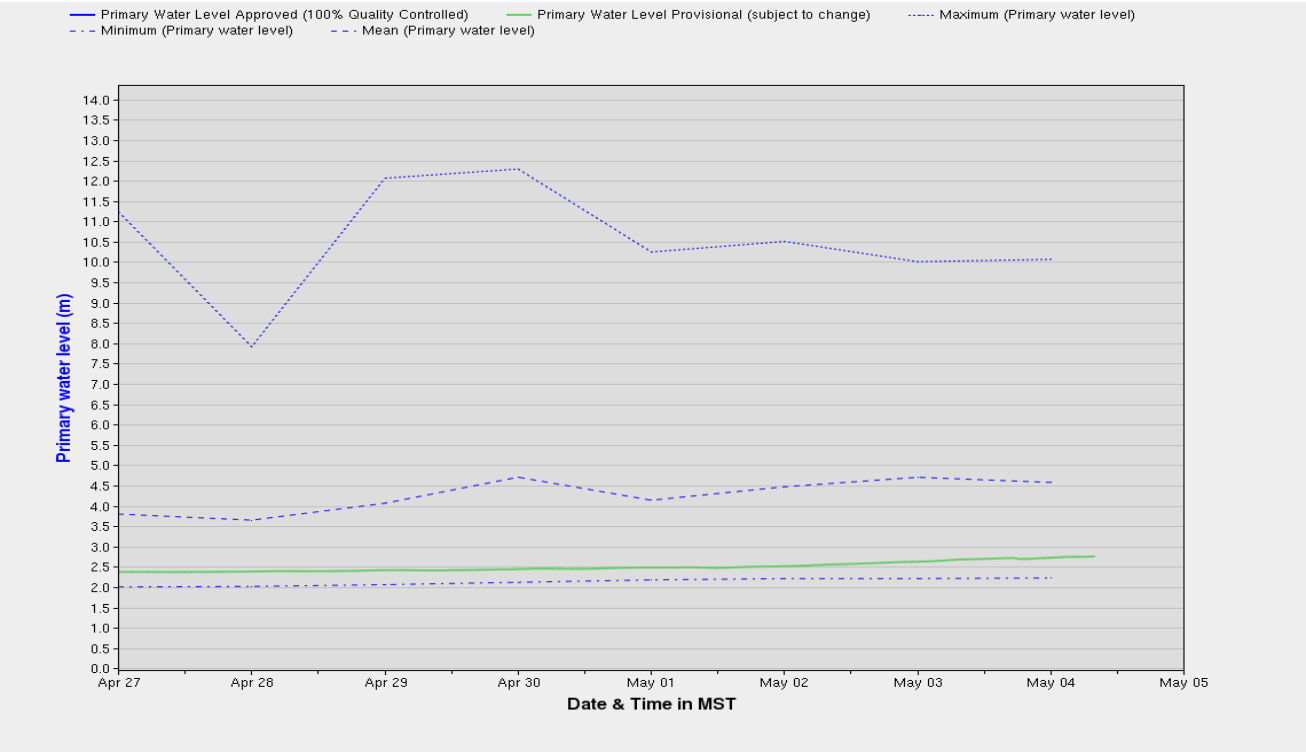
For more information on breakup conditions in Hay River click on the following link:
http://hayriver.com/residents/2017-breakup-information/



Liard River @ Ft. Liard (10ED001) - Current water level is 4.105m. Average break-up is around April 30th. Latest report is that the ice has been moving and stopping since yesterday.

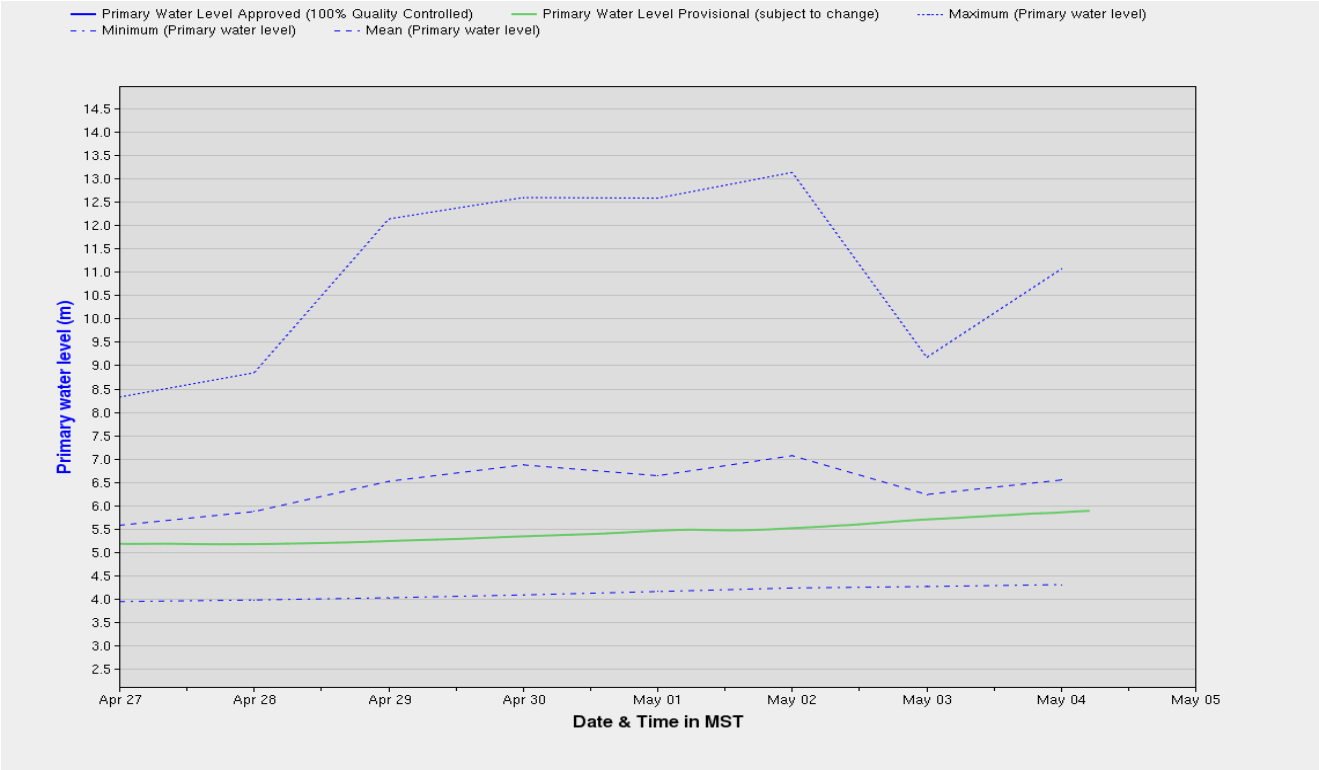


Liard River near the Mouth (10ED002) - Current water level is 2.756m. Average break-up level is around 4.4m with break-up occurring around May 4th.

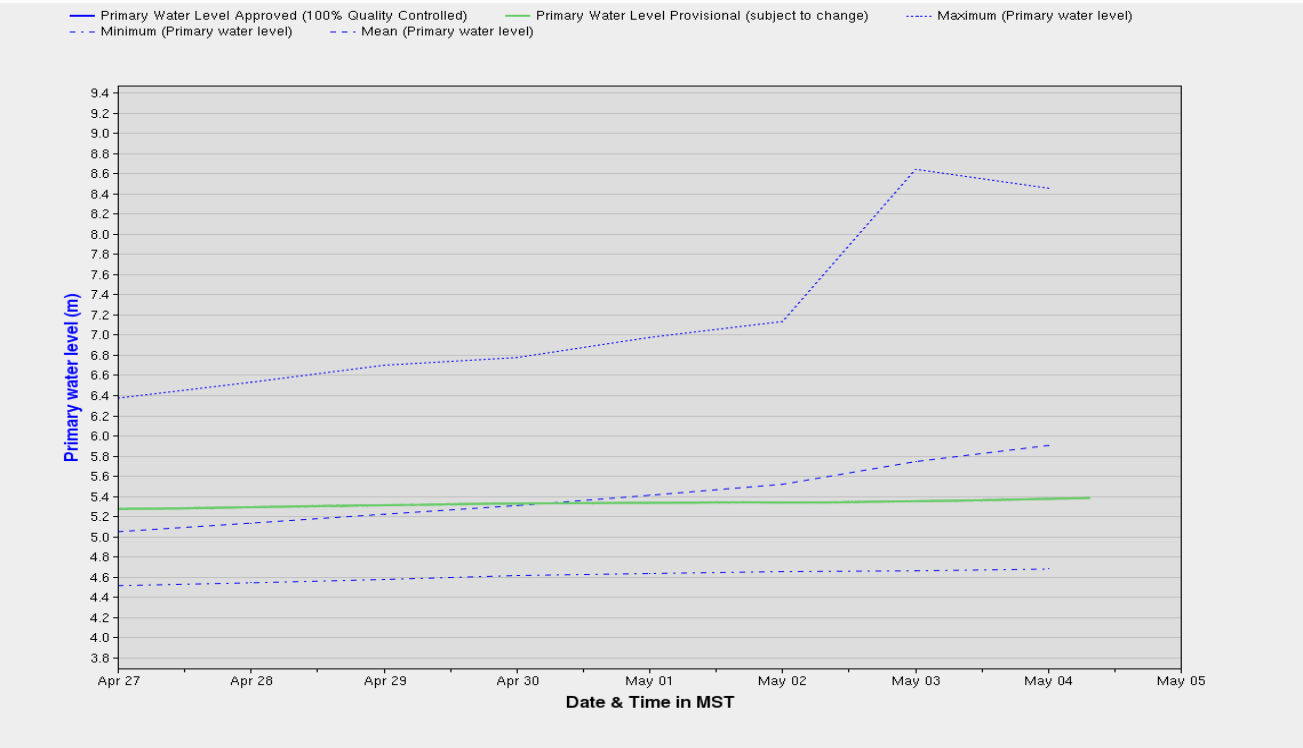


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River at Fort Simspon (10GC001) – Current water level is 5.883m. Average break-up level over the last ten years is around 7.3m with break-up occurring around May 5th.



Mackenzie River at Norman Wells (10KA001) – Current water level is 5.381m. Average breakup level is around 9m with breakup occurring between May 10th- 15th



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Please see below for the end of season snow survey bulletin for the NWT. Data and summaries are also available on-line at http://www.enr.gov.nt.ca/programs/snow-surveys.

ENR Spring Snow Surveys - Northwest Territories
Snow Water Equivalent - 2017

	Long	Lat	Elevation	Length of Record (years)	Historical Mean SWE (mm)	Current Mean Value Mar-Apr 2017 surveys Depth (cm)	SWE (mm)	Percentage of Normal SWE 2017	
Yellowknife River Basin									
Tibbitt Lake	-113.38	62.50	244	35	86.4	41.0	84.0	97.2	
Bluefish Hydro	-114.25	62.68	168	22	83.0	61.7	99.0	119.3	
Allan Lake	-113.05	62.95	297	29	88.2	51.5	84.0	95.2	
Denis Lake	-112.62	63.37	411	30	110.5	55.1	94.0	85.1	
Little Latham Lake	-113.63	63.20	305	30	99.6	55.1	93.5	93.9	
Nardin Lake	-113.85	63.51	366	30	107.5	60.1	105.5	98.1	
Sharples Lake East	-112.82	63.90	369	30	109.3	53.2	84.5	77.3	
					97.8	**54.0**	**92.1**	**95%**	**MEANS**
Snare River Basin									
Big Spruce Lake	-116.00	63.50	225	39	104.1	56.5	95.5	91.7	
Ghost Lake	-115.07	63.88	290	40	105.4	63.3	112.5	106.7	
Indin Lake	-115.03	64.38	290	39	110.9	67.7	110.0	99.2	
Snare Lake	-114.04	64.20	360	39	113.0	59.2	106.0	93.8	
Winter Lake	-113.03	64.50	365	39	82.0	36.3	60.0	73.2	
Mattberry Lake	-115.96	64.09	255	40	98.2	60.4	102.0	103.9	
Castor Lake	-115.99	64.52	295	40	115.4	64.3	112.0	97.1	
Mesa Lake	-115.14	64.85	385	40	126.7	55.7	90.0	71.0	
Big Lake	-112.55	64.48		21	122.9	50.5	139.0	113.1	
White Wolf Lake	-114.60	65.00		22	133.2	61.5	148.0	111.1	
Christison Lake	-114.90	64.38		23	113.4	51.4	104.0	91.7	
					111.4	**57.0**	**107.2**	**96%**	**MEANS**
North Slave Region									
Mosquito Creek	-116.16	62.7		18	104.7	62.1	120.5	115.1	
South Slave Region									
Boundary Lake	-115.55	59.48	820	26	158.2	82.6	158.0	99.9	
Fort Resolution, Forestry	-113.73	61.02		3	115.0	76.3	127.0	110.4	
Fort Smith	-111.86	60.00	205	34	89.6	53.3	85.5	95.4	
Hook Lake	-112.78	60.67	159	27	96.2	60.7	92.5	96.2	
Little Buffalo Tower	-113.79	61.00	170	35	120.2	73.8	132.5	110.2	
Nyarling River	-114.17	60.33	245	34	104.1	68.7	123.0	118.2	
Pine Point A	-114.36	60.82	175	35	136.8	83.4	169.0	123.5	
Thubun Lake	-111.75	61.50	168	33	91.4	56.4	93.0	101.8	
					113.9	**69.4**	**122.6**	**107%**	**MEANS**
Taltson River Basin									
Piers Lake	-111.17	60.32	260	33	104.1	59.4	100.0	96.1	
Tortuous Lake	-111.70	60.75	230	47	85.0	55.3	93.5	110.0	
Dunvegan Lake	-107.28	62.33	490	49	112.6	69.5	143.5	127.4	
Whirlwind Lake	-108.68	60.25	430	47	97.8	72.3	122.5	125.3	
Alcantara Lake	-108.28	60.90	425	47	102.8	71.2	132.0	128.4	
Hill Island Lake	-109.90	60.50	325	49	95.6	60.1	97.0	101.5	
Thekulthili Lake	-110.23	60.97	320	47	88.4	55.5	85.0	96.2	
Nonacho Lake	-109.67	61.72	320	49	105.3	67.9	109.5	104.0	
Halliday Lake	-109.03	61.38	350	49	101.8	72.7	114.5	112.5	
Gray Lake	-108.30	61.80	324	50	107.5	62.2	127.0	118.1	
Dymond Lake	-106.28	61.38	395	48	118.1	80.4	149.0	126.2	
					101.7	**66.0**	**115.8**	**113%**	**MEANS**
Dehcho Region									
Blackstone River	-122.90	61.05	198	15	95.6				
Caen Tower, Forestry	-117.16	61.67		3	84.5	62.7	105.5	124.9	
Checkpoint (previously JMC)	-121.25	61.45		17	108.2	73.3	85.0	78.6	
Fort Providence, Forestry	-117.46	61.26		3	96.5	69.6	109.0	113.0	
Fort Simpson	-121.33	61.80	155	22	98.8	58.9	112.0	113.4	
Fort Liard	-123.47	60.23	335	17	127.6				
Fort Liard, Forestry	-121.25	61.45		2	79.7	63.0	89.0	111.7	
Hay River (Forestry)	-115.84	60.77		1		85.2	137.5		
Jean Marie River (Forestry)	-120.65	61.52		3	97.7	57.6	82.0	83.9	
Kakisa River	-117.27	61.00	205	36	106.8	67.7	102.0	95.5	
Kimble Tower, Forestry	-117.73	61.14		3	112.0	75.9	119.5	106.7	
Nahanni Butte Rd, Forestry	-123.11	61.95		3	106.7	70.9	115.0	107.8	
Ndulee Lookout, Forestry	-122.53	62.15		3	94.3	62.2	93.0	98.6	
Shale Creek	-122.2	62.07	168	17	112.0	69.9	91.0	81.3	
Swede Creek	-116.57	60.27	290	36	92.0	56.2	82.0	89.1	
Swede Creek, Forestry	-116.56	60.27		3	108.3	57.8	94.5	87.3	
Trout Lake, Forestry	-119.81	61.14		3	100.3	46.6	65.0	64.8	
Wrigley, Forestry	-123.41	63.20		3	88.9	62.4	94.0	105.7	
					100.6	**65.0**	**98.5**	**97%**	**MEANS**
Sahtu Region									
Colville Lake	-126.06	67.02		2	87.5	56.2	99.0	113.1	
Déline	-123.43	65.19		2	102.0	63.4	108.0	105.9	
Fort Good Hope	-128.61	66.27		1		61.7	99.0		
Norman Wells	-126.76	65.28		2	94.0	62.5	123.0	130.9	
Tulit'a	-125.53	64.90		2	99.3	63.4	106.5	107.3	
						61.4	**107.1**	**114%**	**MEANS**
Inuvik/Gwich'in Regions									
Rengleng River	-133.83	67.63	84	32	128.5		130.0	101.2	
Caribou Creek	-133.48	68.05	76	32	122.5		124.0	101.2	
Fort McPherson	-134.74	67.47		2	116.3		89.5	77.0	
Midway Lake	-135.44	67.23		2	156.0		130.0	83.0	
James Creek	-136.00	67.14		1	84.0				
					121.5			**91%**	**MEANS**

Number of Stations Sampled in 2017 = 61

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Environment Canada
Environnement

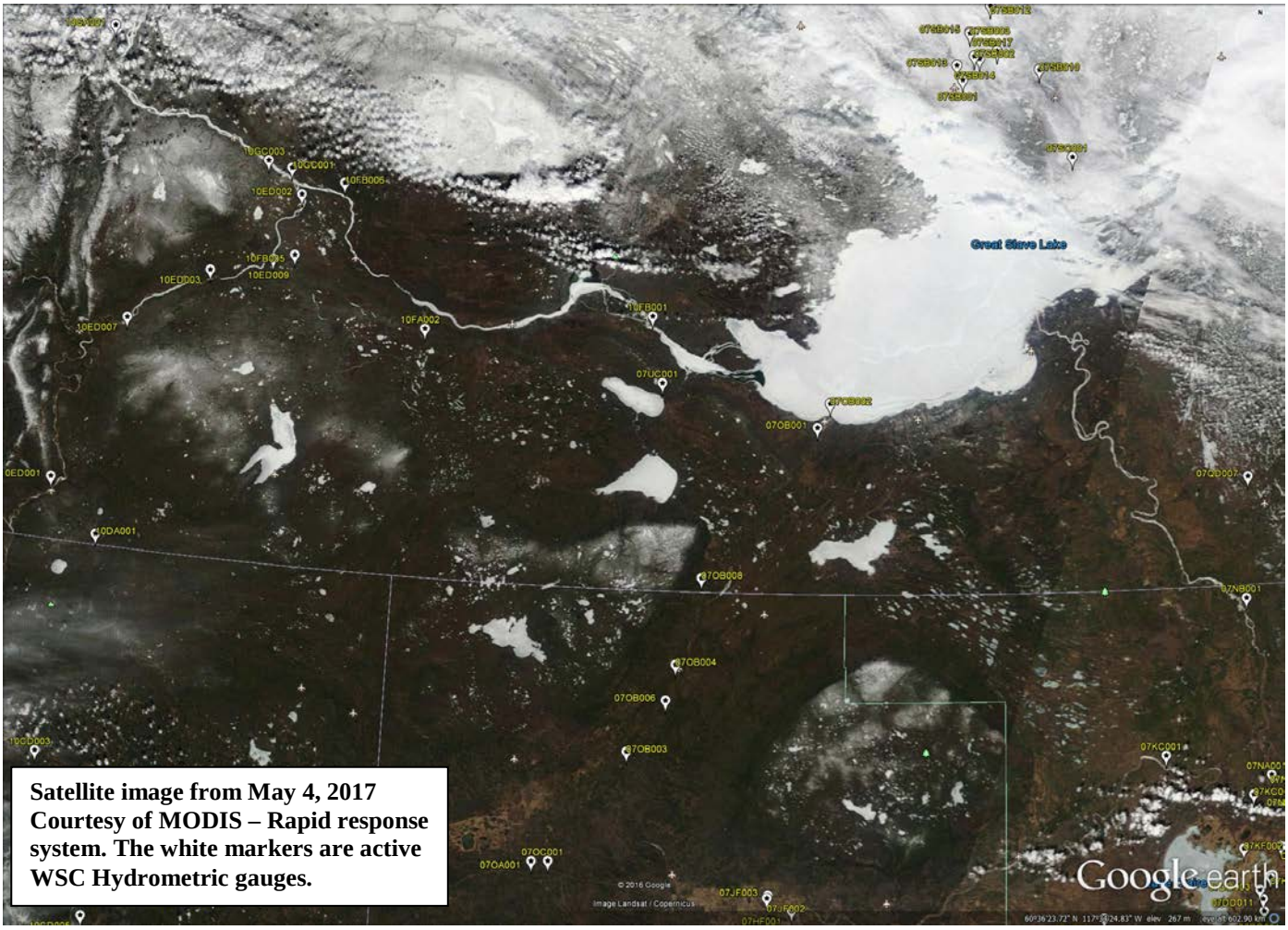
Water Survey of Canada
Suite 400, 5019 – 52 Street
Yellowknife, NWT
X1A 2P7

Report for May 5th, 2017

The information presented is reported by Water Survey of Canada (WSC) staff in Ft. Simpson, Inuvik, Yellowknife, and numerous contacts in various communities. Their contributions are gratefully acknowledged. If you have any comments or do not wish to receive further reports, please contact WSC at (867) 669-4774 or FAX (867) 669-4750.

Regional Weather

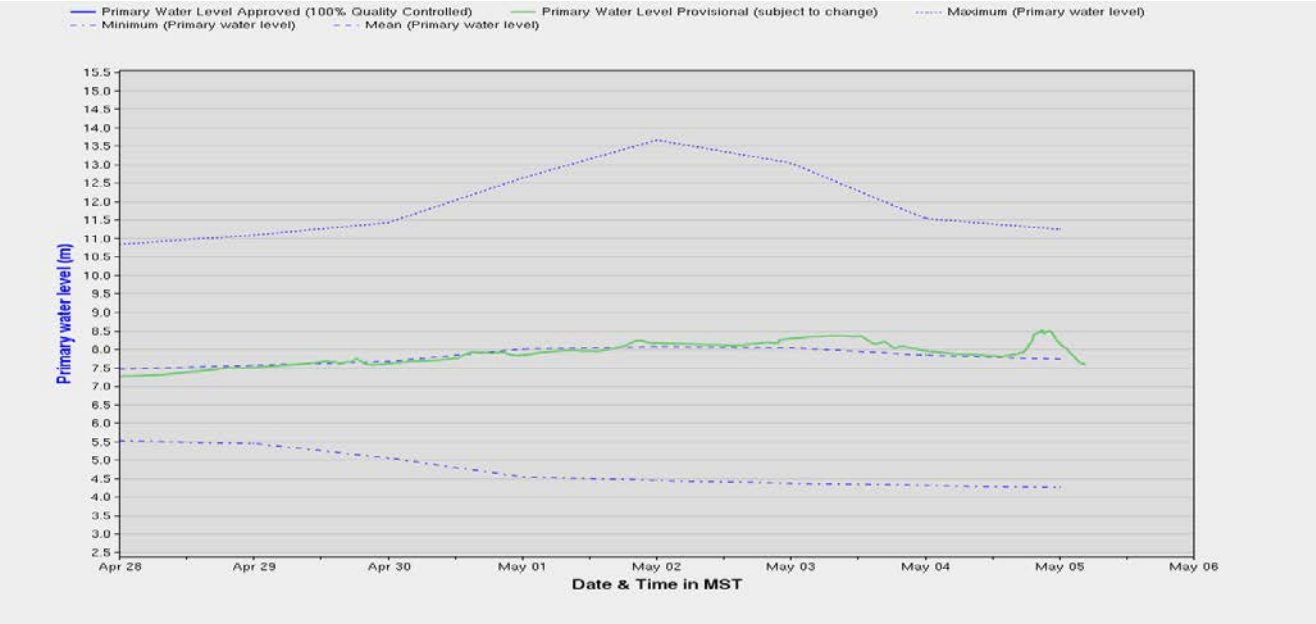
Regional Weather	Today	Saturday	Sunday
North Slave	High +14 /Low +5	High +7 /Low +4	High +10/ Low +2
Deh Cho	High +15/ Low +5	High +7/ Low +1	High +7/ Low 0
Sahtu	High +9/ Low -1	High +6/ Low 0	High +8/ Low 0
Delta	High +1/ Low 0	High +4/ Low -1	High +2/ Low -3



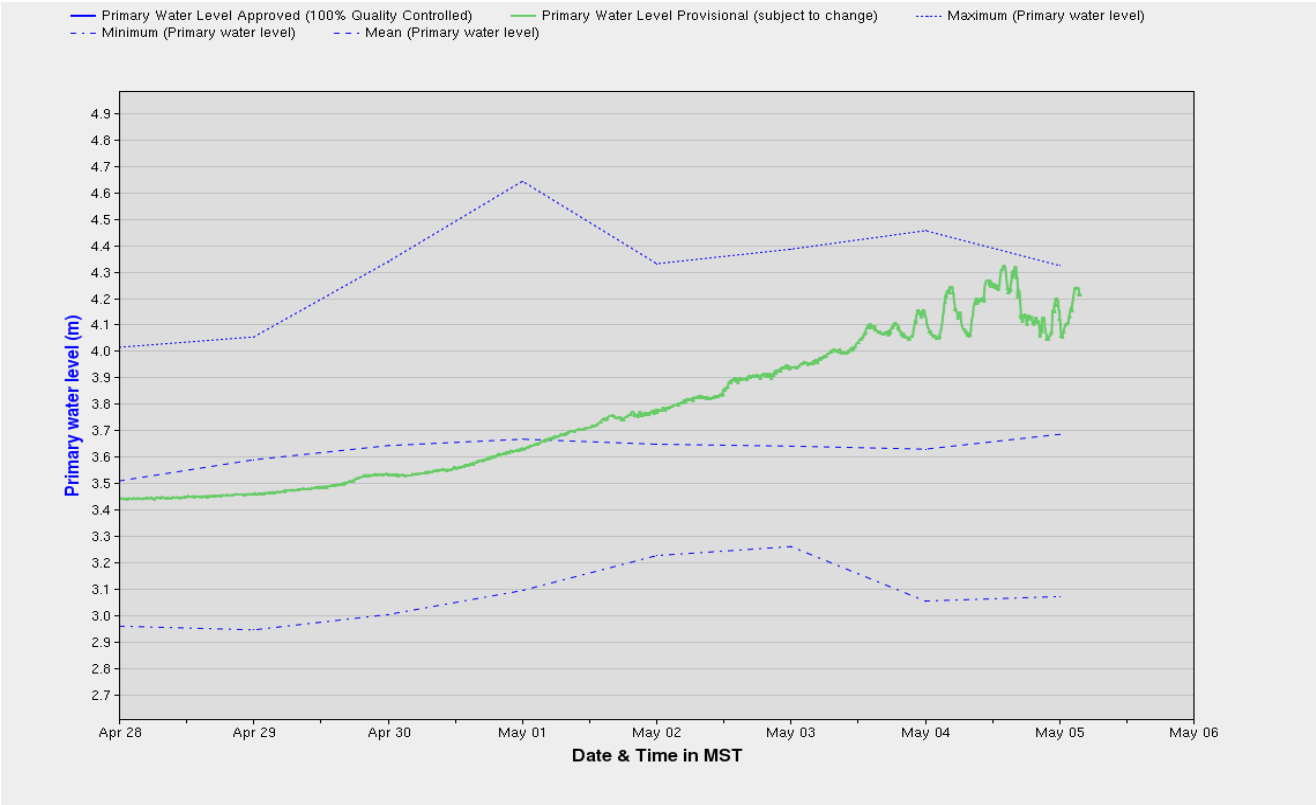
Satellite image from May 4, 2017 Courtesy of MODIS – Rapid response system. The white markers are active WSC Hydrometric gauges.

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Peace River at Peace Point (07KC001) - Current water level is 7.583m. Average break-up level is around 8-14m and occurs around April 29th.



Slave River at Fitzgerald (07NB001) - Current water level is 4.201m. Average break-up level is around 4m with break-up occurring around April 30th.

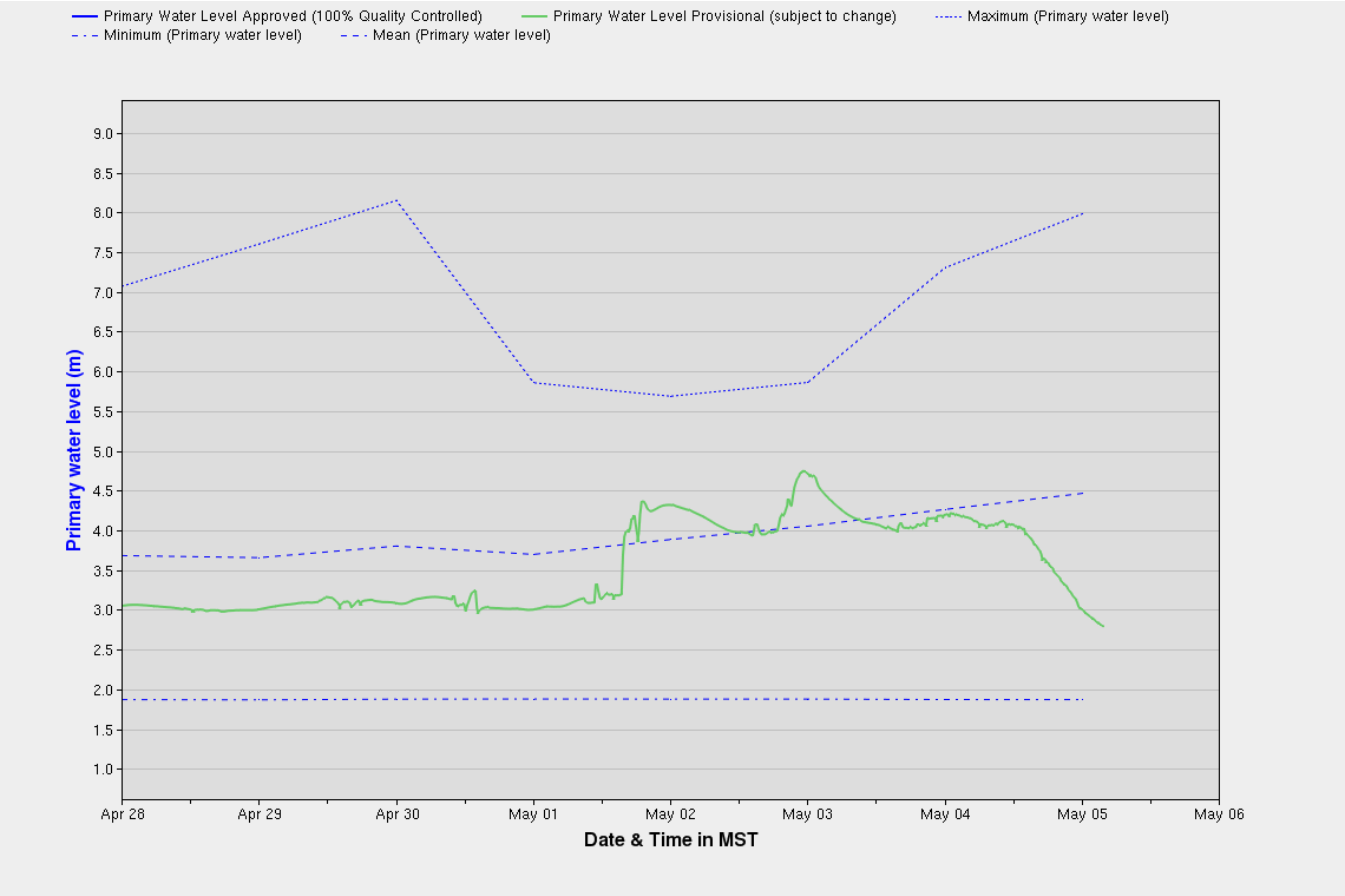


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Hay River @ Hay River (07OB001) - Current Water Level is 2.786m. Average break-up level is approximately 8 meters with break-up occurring around April 30th. The latest report from the Hay River Flood Watch Committee this morning can be read below:

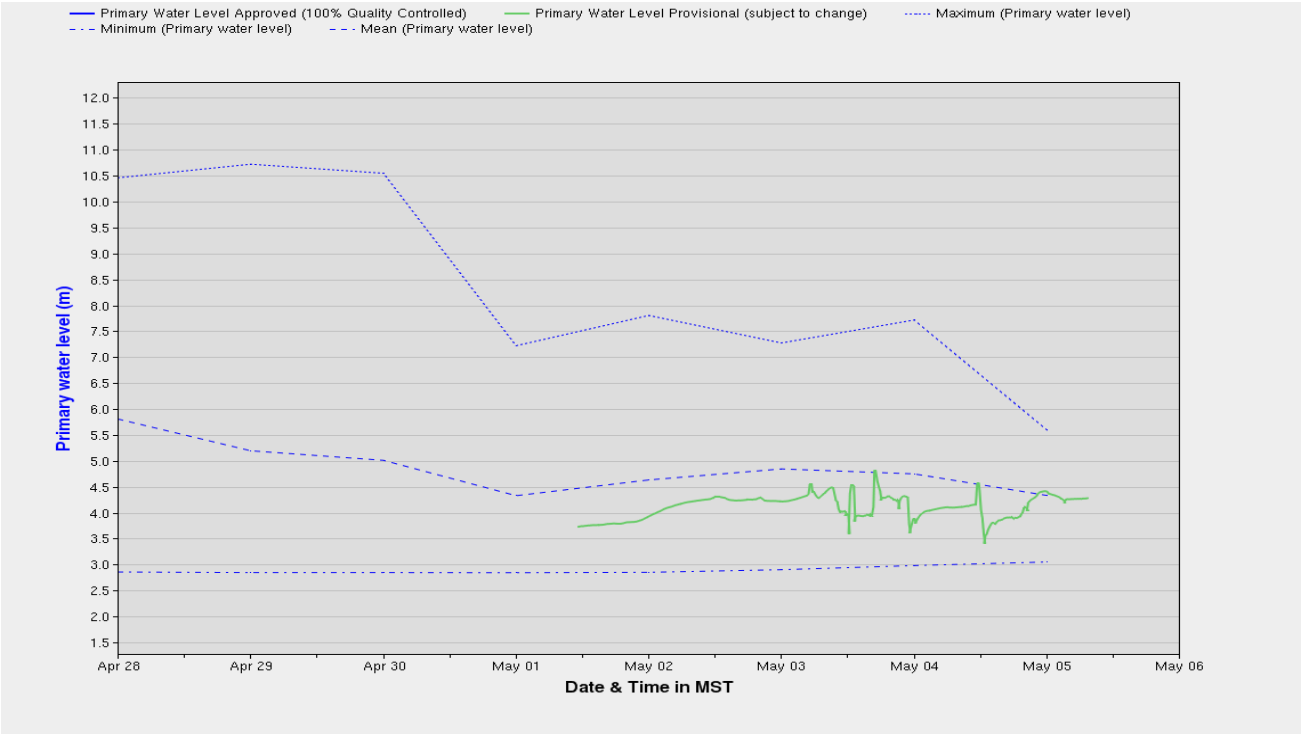
> Breakup Report
> Good morning, not much change from yesterday but breakup is still underway in the Hay River area.
> There is slush ice from the Chamber Park to the mile
> 5 area. Pan ice is still in place from the Chamber Park through new town.
> The West Channel has some breakup underway as does the East Channel.
> At this point the water levels are dropping at all locally monitored stations and it is looking like we are going to have a melt out rather than a breakup this year however the EMO Team continues to monitor the situation in the event that there is a blockage or something else goes awry.
> We will continue to keep you informed as things progress with this year's Breakup/Melt out.

For more information on breakup conditions in Hay River click on the following link:
http://hayriver.com/residents/2017-breakup-information/

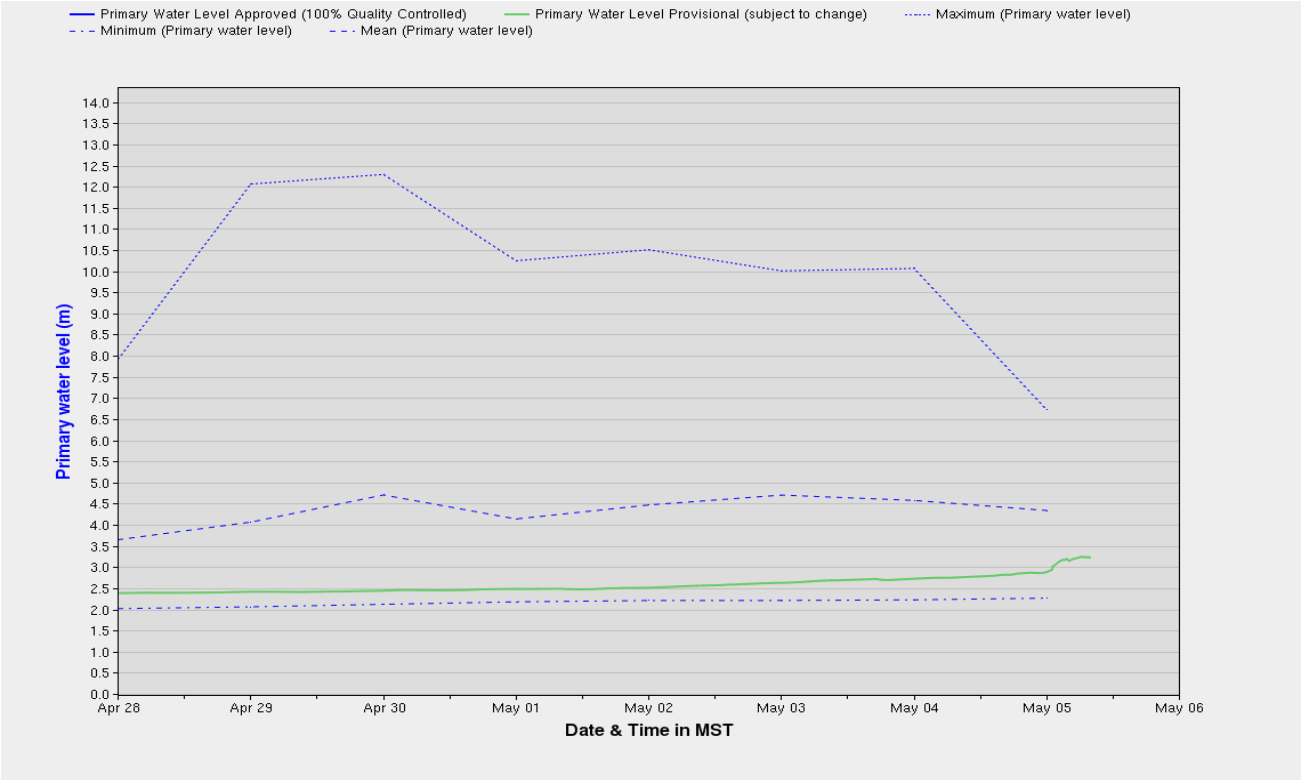


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Liard River @ Ft. Liard (10ED001) - Current water level is 4.289m. Average break-up is around April 30th. A photo of conditions from Wednesday can be seen at the end of this report.

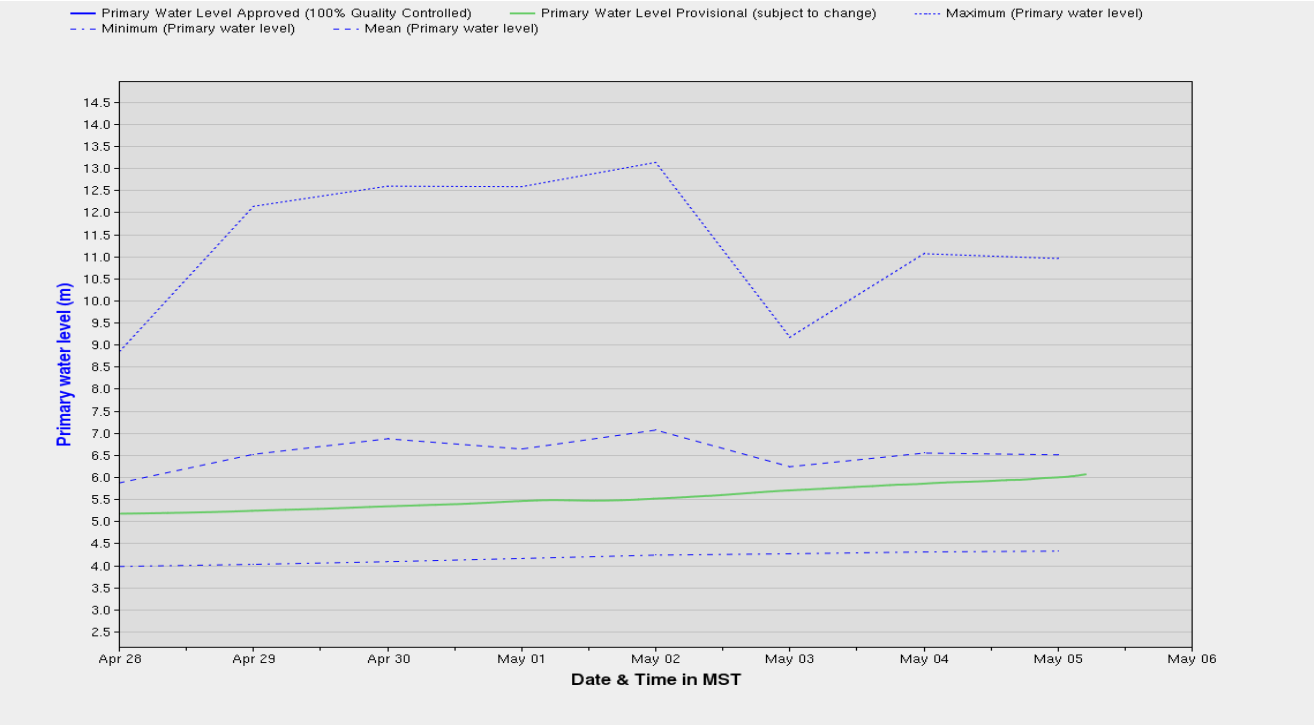


Liard River near the Mouth (10ED002) - Current water level is 3.253m. Average break-up level is around 4.4m with break-up occurring around May 4th.

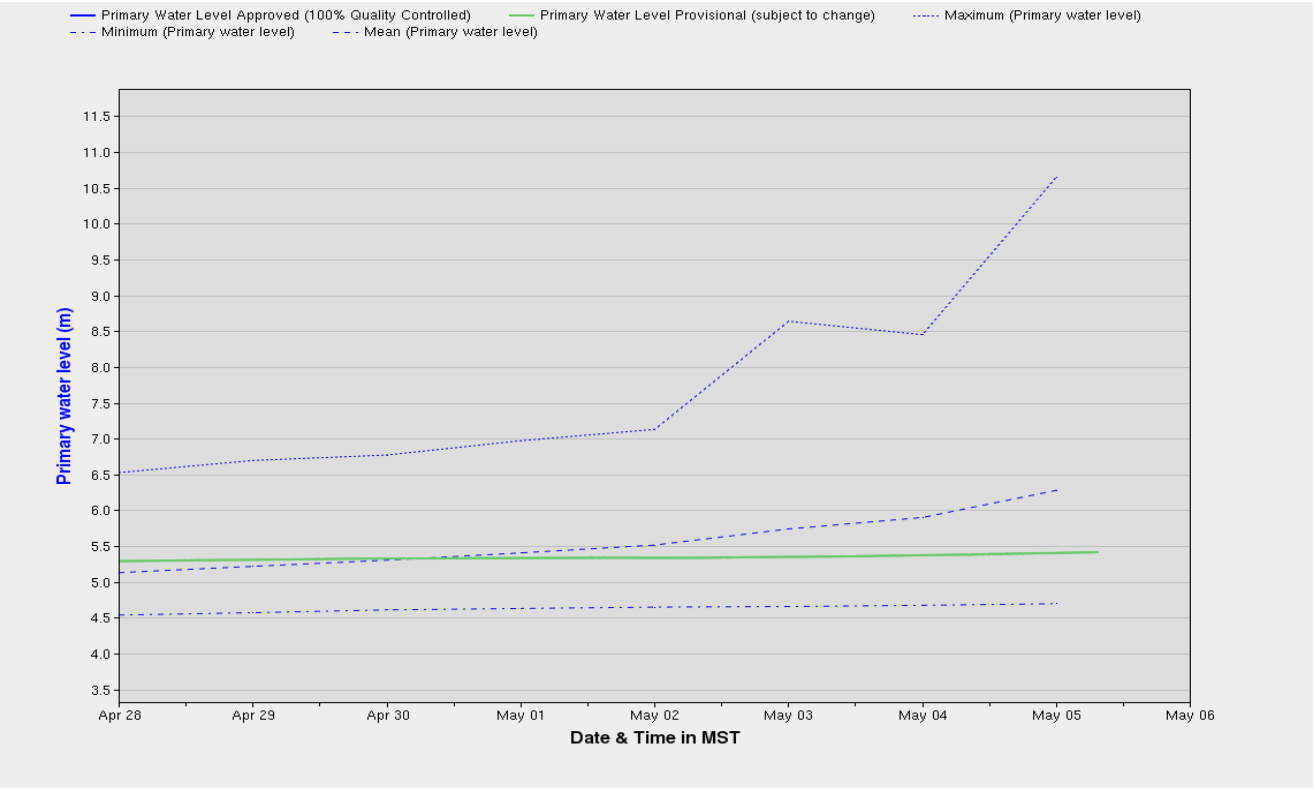


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River at Fort Simspon (10GC001) – Current water level is 6.067m. Average break-up level over the last ten years is around 7.3m with break-up occurring around May 5th.



Mackenzie River at Norman Wells (10KA001) – Current water level is 5.414m. Average breakup level is around 9m with breakup occurring between May 10th- 15th



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Liard River at Ft. Liard – Wednesday May 3, 2017

Photo Courtesy of Michael Cooper

Environment Canada
Environnement

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Report for May 8th, 2017

The information presented is reported by Water Survey of Canada (WSC) staff in Ft. Simpson, Inuvik, Yellowknife, and numerous contacts in various communities. Their contributions are gratefully acknowledged. If you have any comments or do not wish to receive further reports, please contact WSC at (867) 669-4774 or FAX (867) 669-4750.

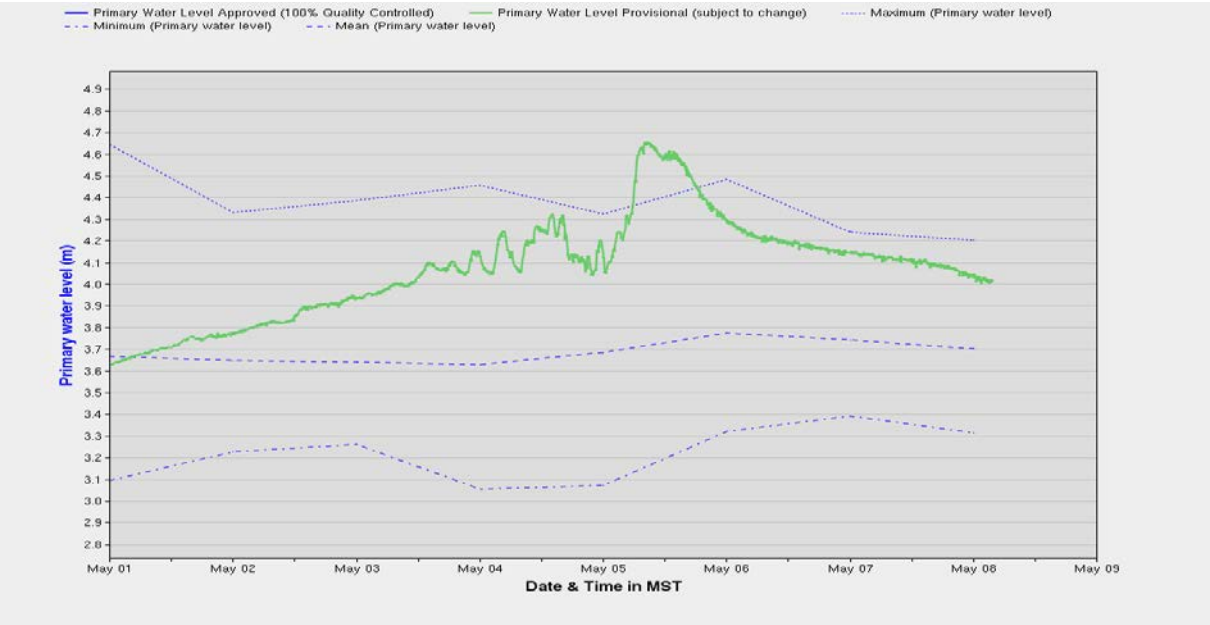
Regional Weather

Regional Weather	Today	Tuesday	Wednesday
North Slave	High +8 /Low +2	High +12 /Low +1	High +10/ Low -1
Deh Cho	High +16/ Low +4	High +16/ Low +1	High +17/ Low 4
Sahtu	High +13/ Low -3	High +11/ Low -1	High +15/ Low +1
Delta	High +4/ Low -7	High +4/ Low -1	High +1/ Low -4

There is no satellite image available for today as it was completely obscured by cloud cover.

Please see the end of this report for this year's ENR Water Resources Division NWT Spring Water Level Outlook report.

Slave River at Fitzgerald (07NB001) - Current water level is 4.018m. Average break-up level is around 4m with break-up occurring around April 30th.

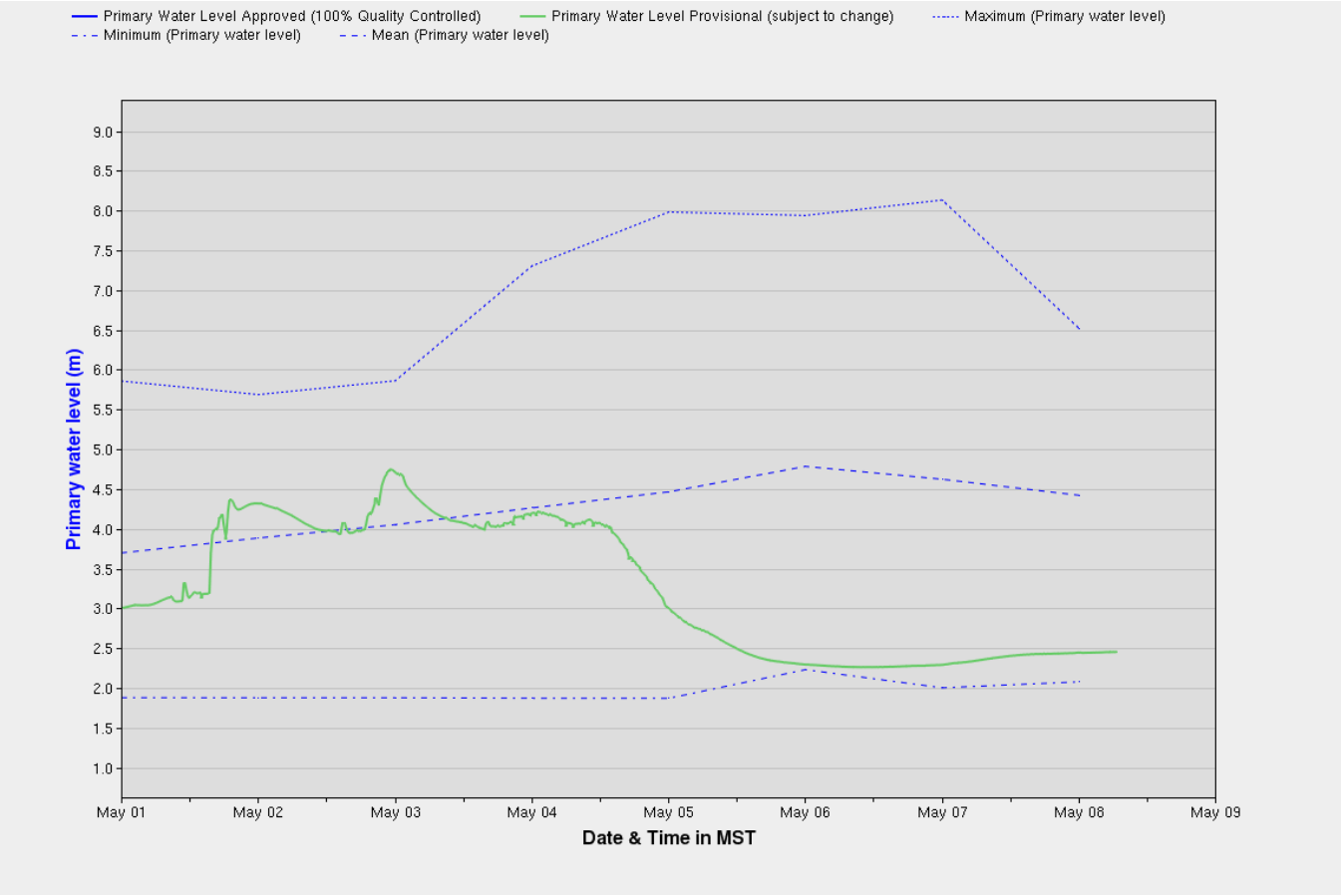


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Hay River @ Hay River (07OB001) - Current Water Level is 2.455m. Average break-up level is approximately 8 meters with break-up occurring around April 30th. The latest report from the Hay River Flood Watch Committee this morning can be read below:

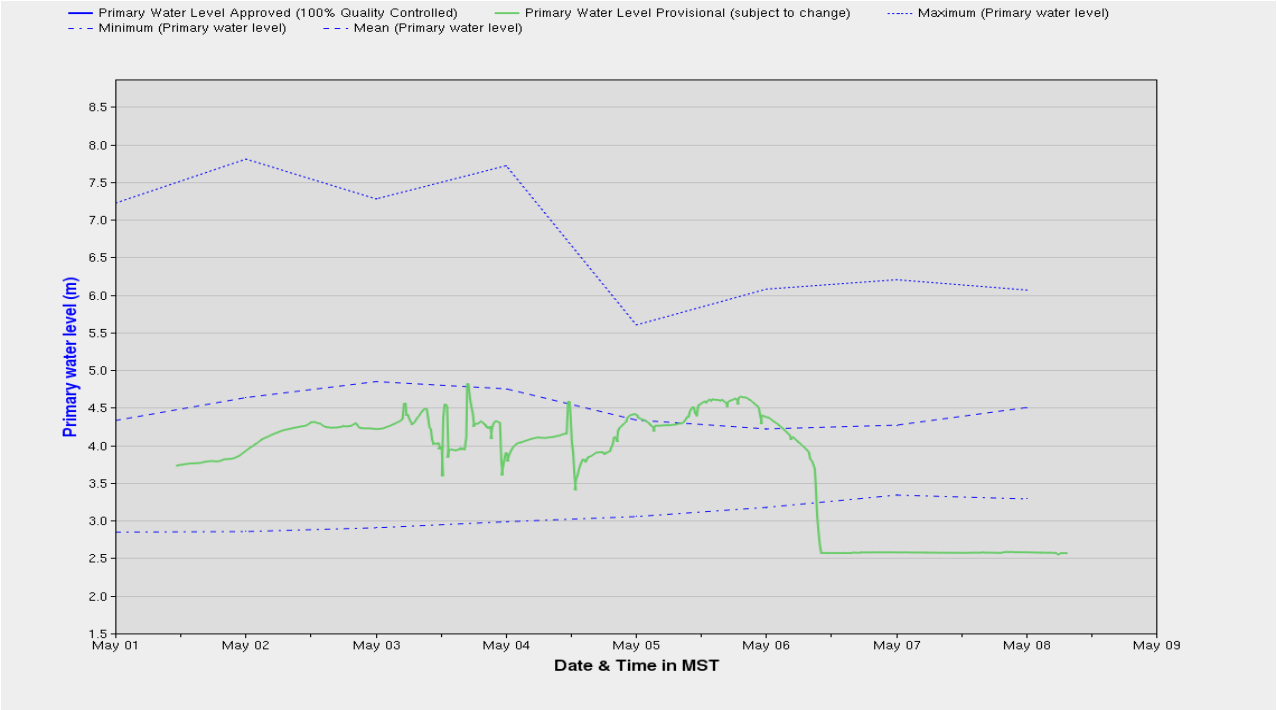
> Breakup Report
>
> Good morning, we are pleased to announce that Breakup Watch 2017 has pretty much come to an end as of 6:00 am this morning as both the East and West Channels have cleared pretty much all the way to the lake and the water levels are low at this time.
>
> EMO personnel will continue to watch until all the ice has cleared but will not be reporting any longer unless an unforeseen problem crops up.

For more information on breakup conditions in Hay River click on the following link:
http://hayriver.com/residents/2017-breakup-information/

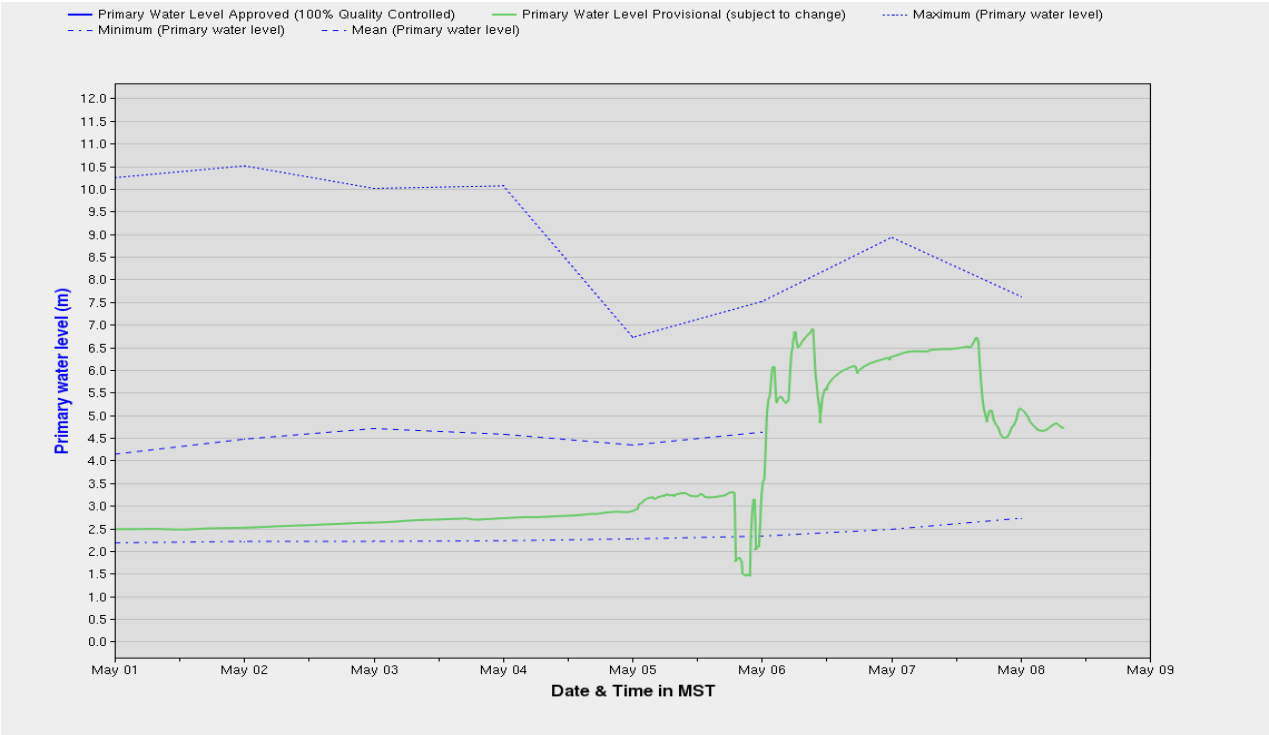


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Liard River @ Ft. Liard (10ED001) - Current water level is unavailable. WSC staff will be in the area today to service the gauge.

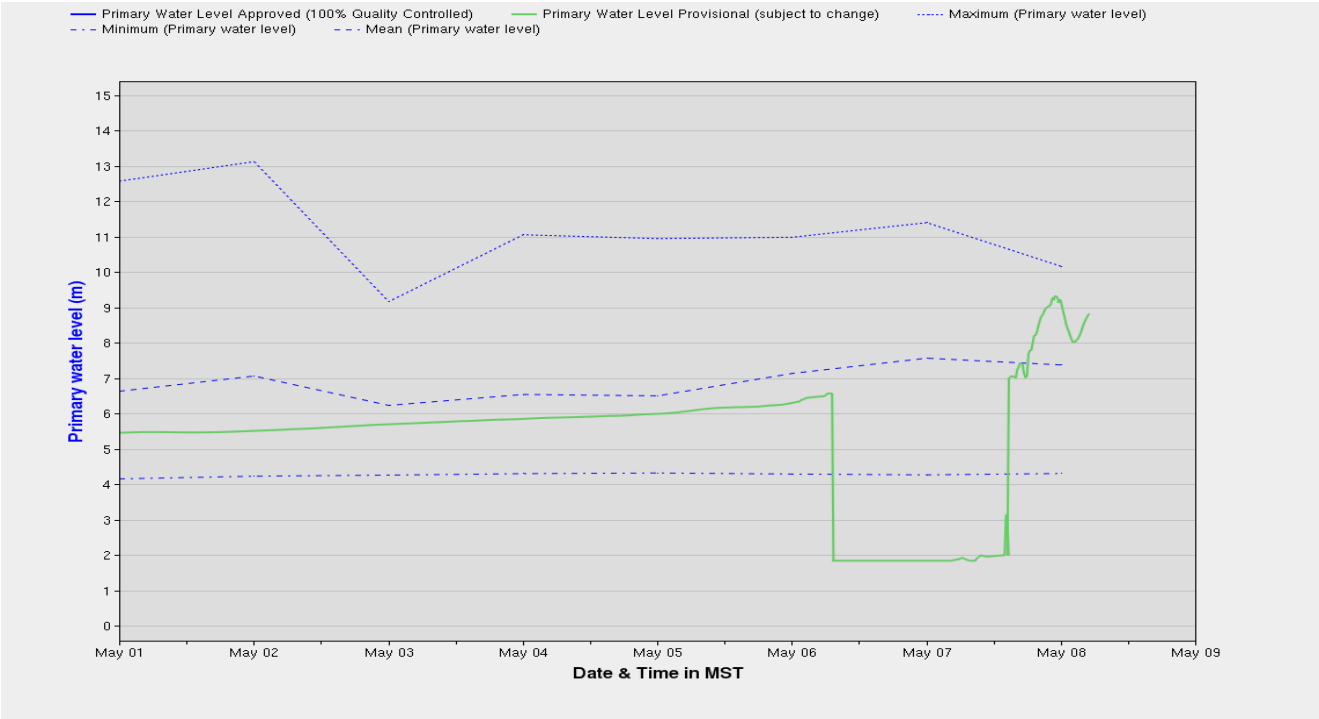


Liard River near the Mouth (10ED002) - Current water level is 4.727m. Average break-up level is around 4.4m with break-up occurring around May 4th. Latest report is that the ice broke up over the weekend.

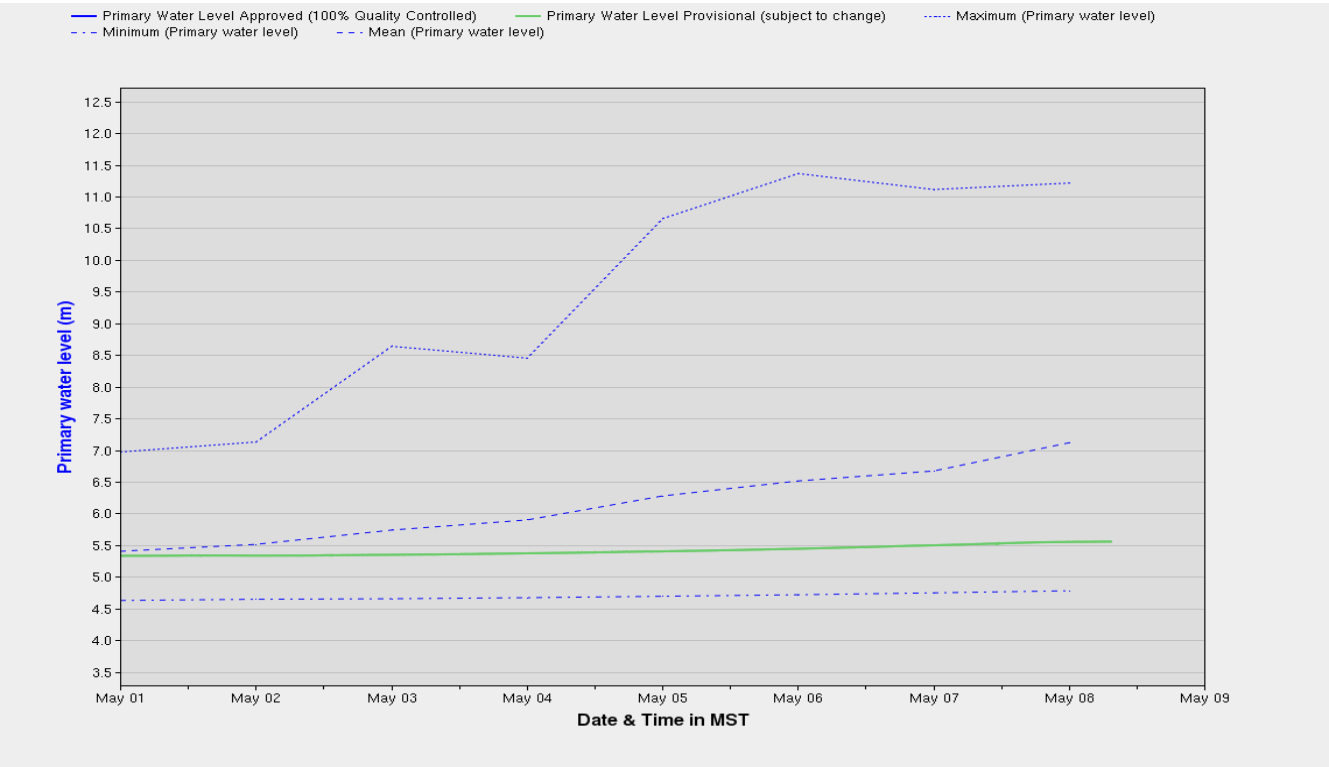


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River at Fort Simspon (10GC001) – Current water level is 8.901m. Average break-up level over the last ten years is around 7.3m with break-up occurring around May 5th. Latest report is that the ice broke up over the weekend. A photo of current conditions can be seen at the end of this report.



Mackenzie River at Norman Wells (10KA001) – Current water level is 5.557m. Average breakup level is around 9m with breakup occurring between May 10th- 15th



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River at Fort Simpson – Monday May 8, 2017

Photo Courtesy of WSC Staff

NWT Spring Water Levels Outlook 2017

Shawne Kokelj
Research & Studies Section, Water Resources Division

May 3, 2017

This is an outlook for anticipated spring water levels in the NWT, with information compiled from several sources.

Through the winter of 2016-17, La Nina conditions dominated through the early portion of the winter (Nov-January), which generally brings colder than normal conditions which are associated with lower than usual snowfall (True North Weather Consulting for ENR). Atmospheric conditions have transitioned to a neutral state since February (True North). The North American Drought Monitor indicates the south-western portions of the NWT are part of the moderate drought conditions being experienced in northern British Columbia and the Yukon (https://www.ncdc.noaa.gov/temp-and-precip/drought/nadm/maps).

The potential occurrence and severity of freshet flooding depends in large part on the weather over the next few weeks and how this interacts with existing water levels and snow pack amounts. Extremely warm temperatures, extreme rain or rain on snow events greatly increase the likelihood of flooding.

Water level data are part of the NWT Hydrometric Monitoring Network, funded by Environment Canada and the GNWT, and operated by the Water Survey of Canada. Data can be seen and/or downloaded at https://wateroffice.ec.gc.ca/search/searchRealTime_e.html.

Yellowknife and Snare River basins

ENR snow surveys show that the snowpack in the Yellowknife and Snare River basins are at about average amounts, at 95% and 96% respectively. While there are a few exceptions, the water levels on most of the lakes and rivers in the North Slave region with monitoring gauges remain below average. Evidence of spring freshet has not hit these North Slave streams due to the enduring cold temperatures. Based on the values seen in North Slave region snow surveys and the existing moisture deficit, there is likely not enough moisture to replenish most river systems in the region back to average levels. Much will now depend on rain through late spring and summer.

Hay River Watershed

For the Hay River watershed, the spring runoff outlook of Alberta Environment is anticipating much below average runoff, with the end of season snow ranked as much below average. The snow survey site at Assumption (AB) was at 58% of normal as of April 1st, while snow surveys in

the area near Swede Creek indicated snow pack was just under 90% of normal (GNWT ENR). Hay River break-up is ongoing, and the Hay River Director of Protective Services, Ross Potter, reported that while they are keeping a close watch on conditions, at this point, there is little threat of flooding in Town. This is due to low over-winter snow in the basin headwaters, as well as relatively average to just below average water levels in the river.

Peace and Athabasca River Basins

Alberta Environment spring runoff outlook as of April 1st for the Peace and Athabasca river basins ranged from average in the upper (more southerly) portions of the basins, to much-below-average in the lower reaches (more northerly) within Alberta. The % of precipitation between Nov 1 2016 and April 1 2017 was much-below-average in the northern third of the province, including the Peace and Athabasca river basins, with a small region of above average precipitation in the upper basin of both the Peace and Athabasca rivers. The BC River Forecast Centre indicates that as of April 1, 2017, there was 76% of normal basin snow water index in the BC portion of the Peace River basin. South Slave region snow surveys completed by ENR indicated a snow pack that was just slightly above average values.

Slave River and Great Slave Lake

While the water level on the Slave River is currently above average, levels are extremely variable over freshet. Similarly, Great Slave Lake water level is above average at this time, but has remained relatively stable over the past couple of weeks.

Liard River Basin

For the Liard River Basin, snow pack in the Yukon is well below average as of April 1st, according to Environment Yukon, with values ranging from 36% of normal at Pine Lake Airstrip to 89% at Hyland River. A basin-wide value of 67% of normal (Yukon Snow Survey April 2017) has been estimated. The average flow volume for the Liard River upstream of Upper Liard was 75% of normal for March and given normal summer meteorological conditions, flow volumes are expected to range between 70-75% of normal (Yukon Snow Survey). Accumulation in the British Columbia portion of the Liard basin is also below average (overall, 62% of normal) with values ranging from 61% of normal at Sikanni Lake to 102% measured at Fort Nelson airport, indicating a potential for increased risk of summer low flows (BC River Forecast Centre).

Dehcho Region

ENR snow surveys in the Dehcho Region indicate that snow pack is average (97%). The water level on the Liard River at Fort Liard has been well below average over most of the winter, and remains there currently, although levels have just started to climb this week with freshet, as is usual for this time of year. Water levels on the Mackenzie River were generally well below

average at Fort Simpson since December but just above average at Norman Wells. Both sites currently reflect seasonally normal upward trends.

Inuvik Region

ENR snow surveys in Inuvik region indicate snow pack is a bit below average (91%).

Seasonal precipitation forecast

Below is an indication of what various seasonal weather forecasting models show as likely to occur (True North Weather Consulting for ENR):

May

- Northern BC – areas of ongoing drought forecast;
- Dehcho, Sahtu, Inuvik regions – potential for below seasonal precipitation;
- Great Bear Lake region, portions of North and South Slave regions - majority of models
- indicate above normal precipitation.

June

- Dehcho – most models suggest below average precipitation
- All other regions - models have variable results with little consensus

July

- Deh Cho, North Slave and Sahtu – above normal precipitation
- South Slave – below normal precipitation
- Inuvik region – no significant trends
- Northern NWT – little trend

August

- Northern NWT – below normal precipitation
- Southern NWT – above normal precipitation

Environment Canada
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Yellowknife, NWT
X1A 2P7

Report for May 9th, 2017

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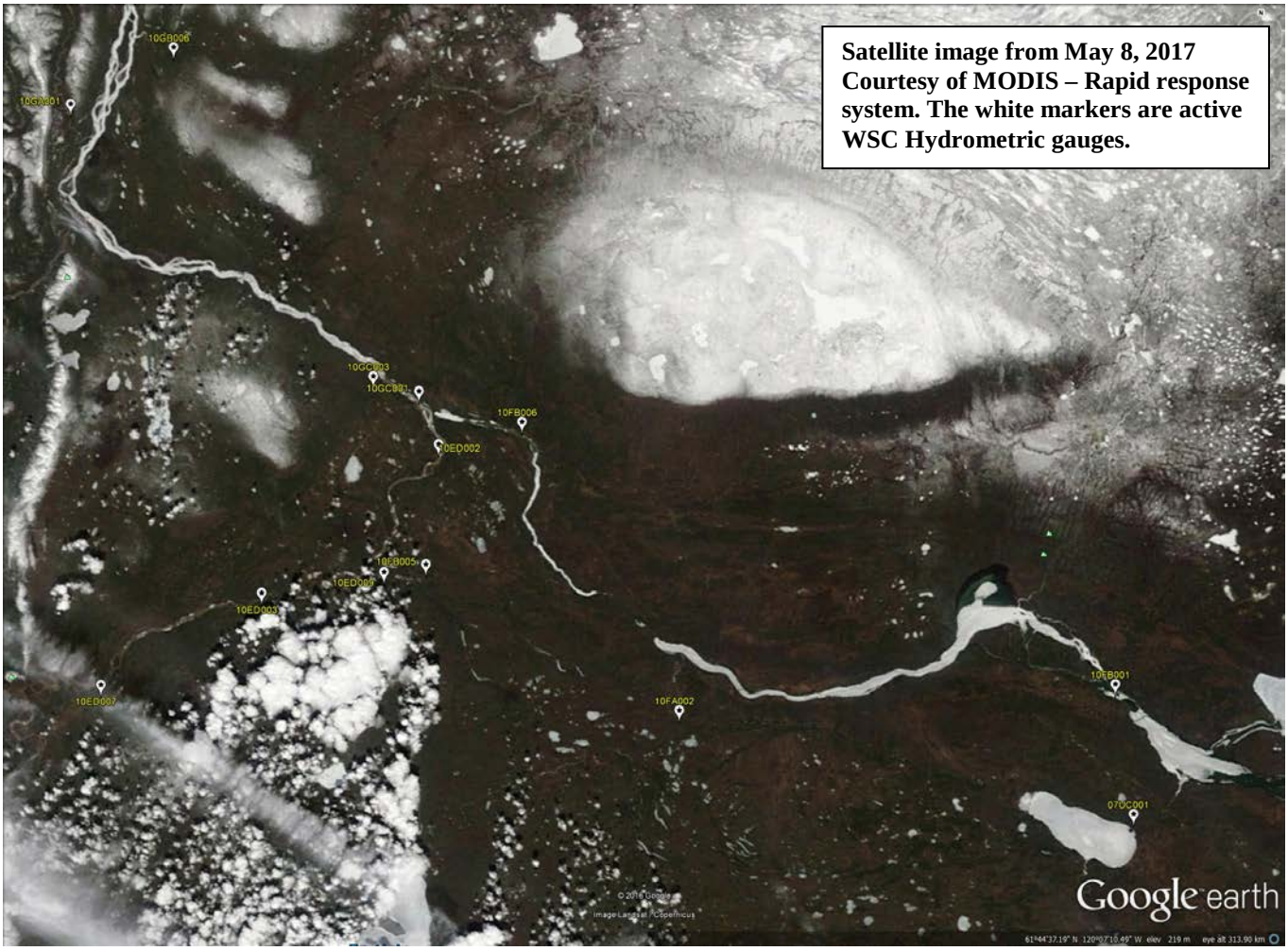
Regional Weather

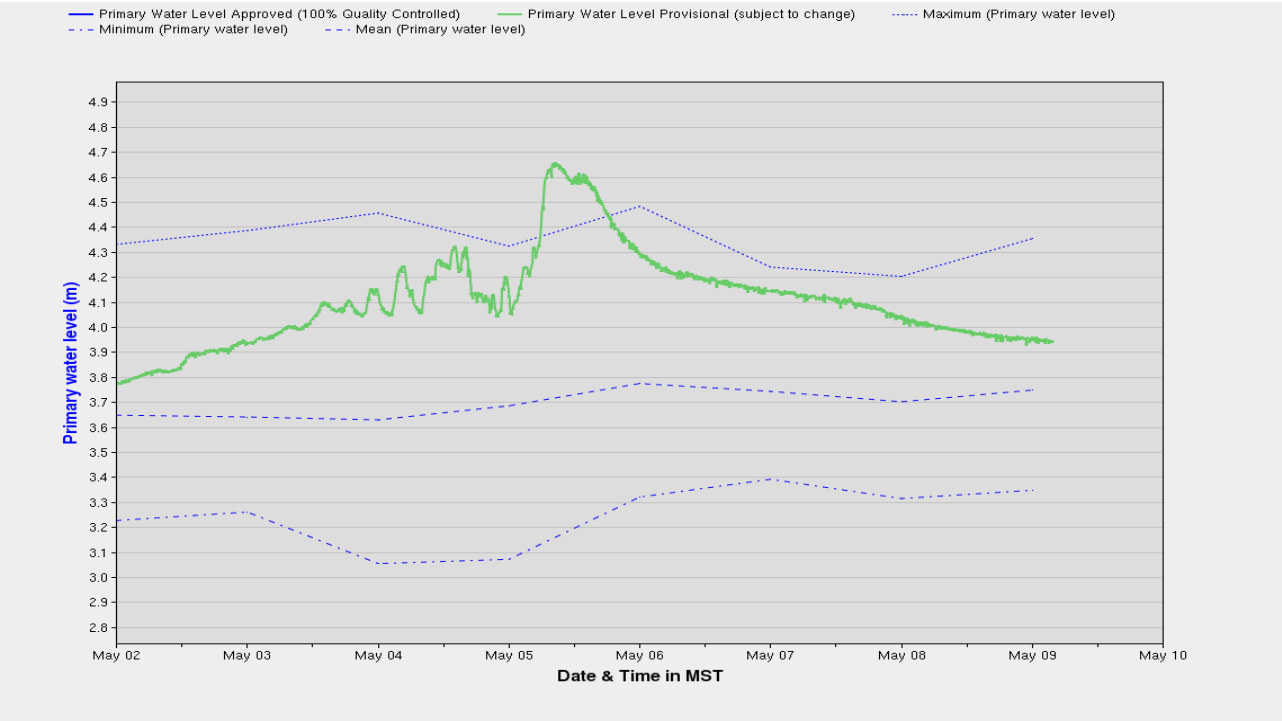
Regional Weather	Today	Wednesday	Thursday
North Slave	High +13 /Low 0	High +11 /Low -1	High +9/ Low 0
Deh Cho	High +16/ Low +2	High +15/ Low +2	High +18/ Low +4
Sahtu	High +10/ Low 0	High +12/ Low 0	High +15/ Low +2
Delta	High +2/ Low -2	High 0/ Low -3	High 0/ Low 0



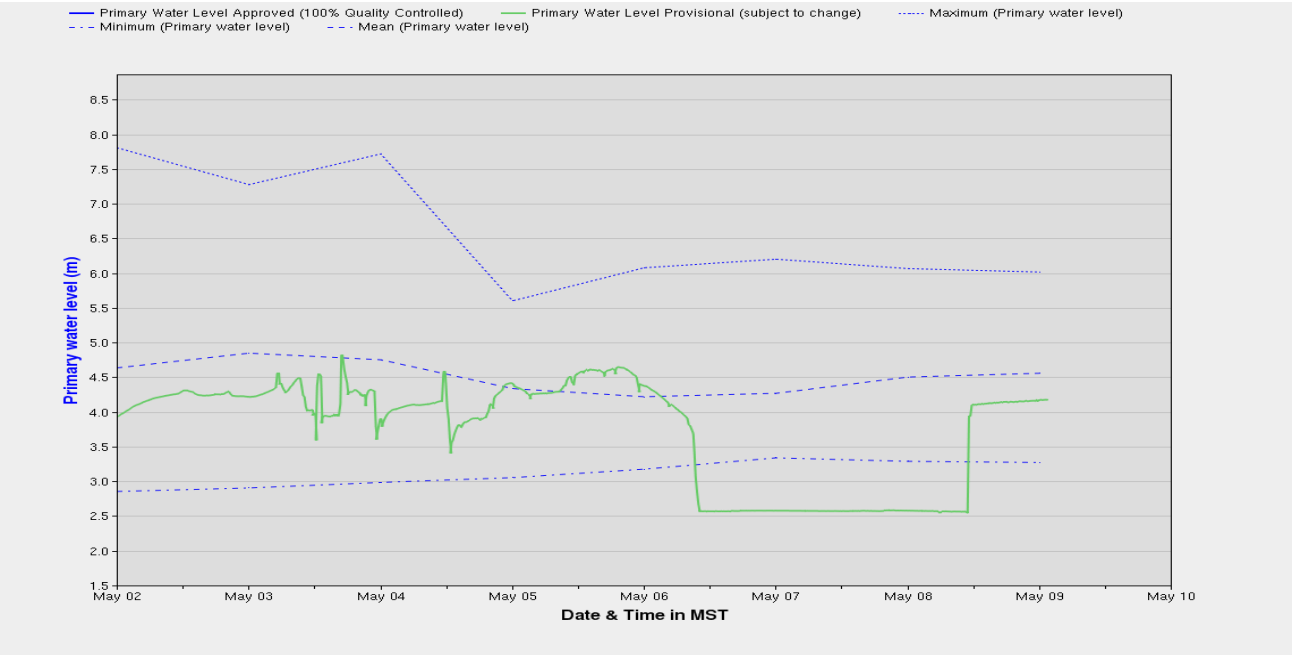
Satellite image from May 8, 2017 Courtesy of MODIS – Rapid response system. The white markers are active WSC Hydrometric gauges.

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Slave River at Fitzgerald (07NB001) - Current water level is 3.940m. Average break-up level is around 4m with break-up occurring around April 30th. The latest satellite image shows that the area around the gauge is now free and clear of ice.

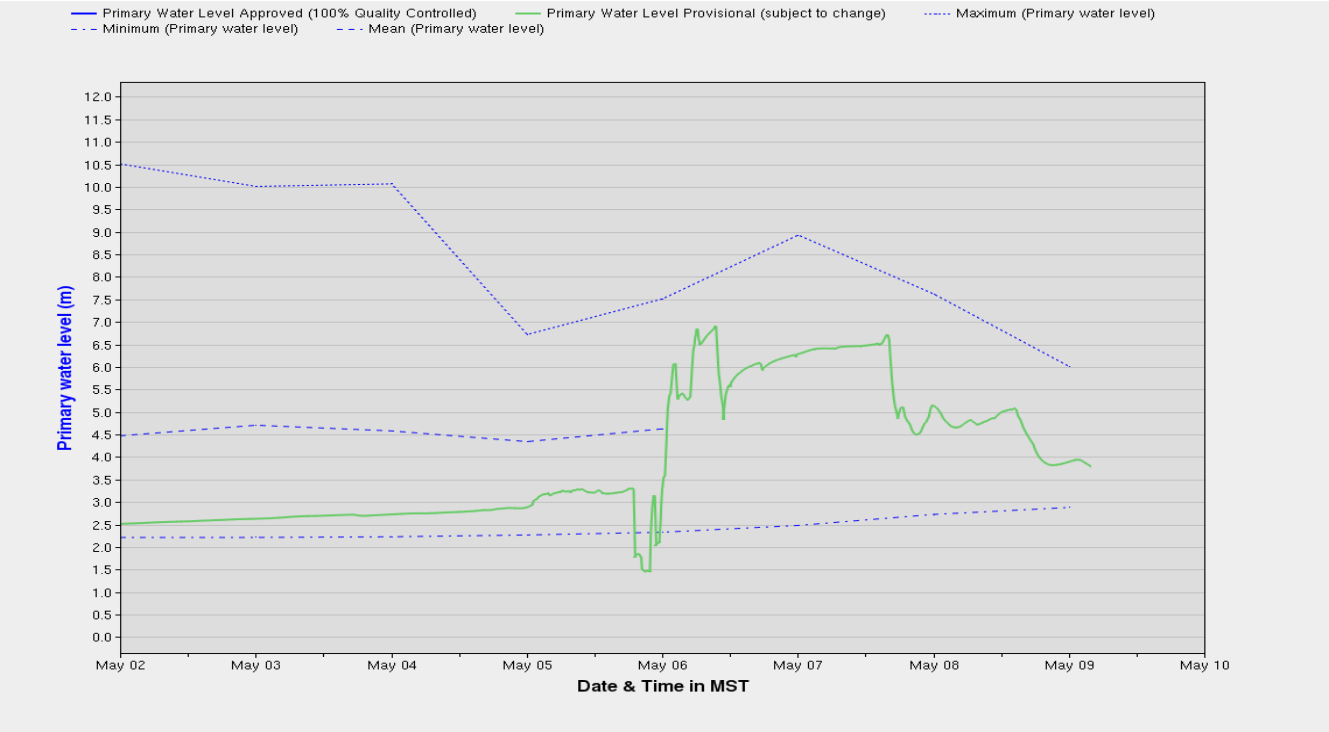


Liard River @ Ft. Liard (10ED001) - Current water level is 4.177m. A photo of river conditions from yesterday can be seen at the end of the report.

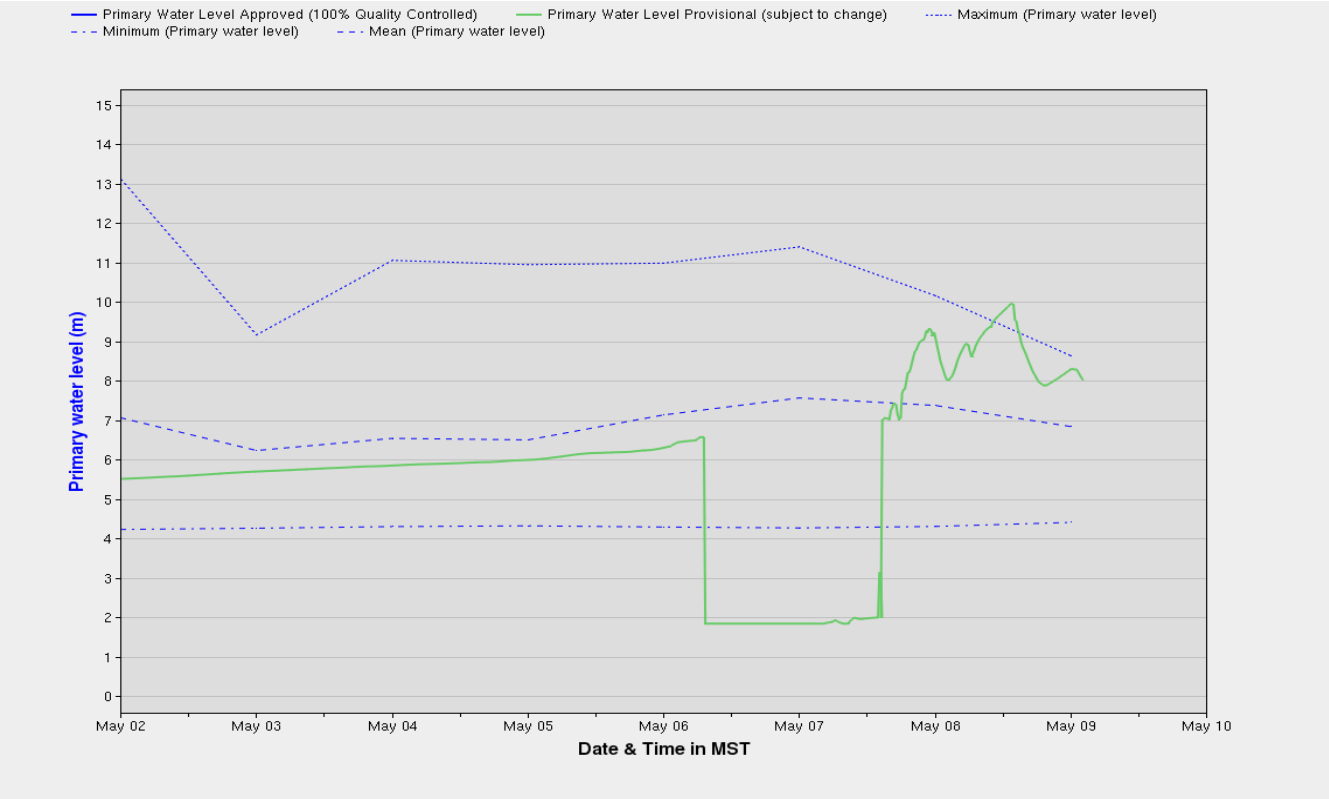


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Liard River near the Mouth (10ED002) - Current water level is 3.776m.

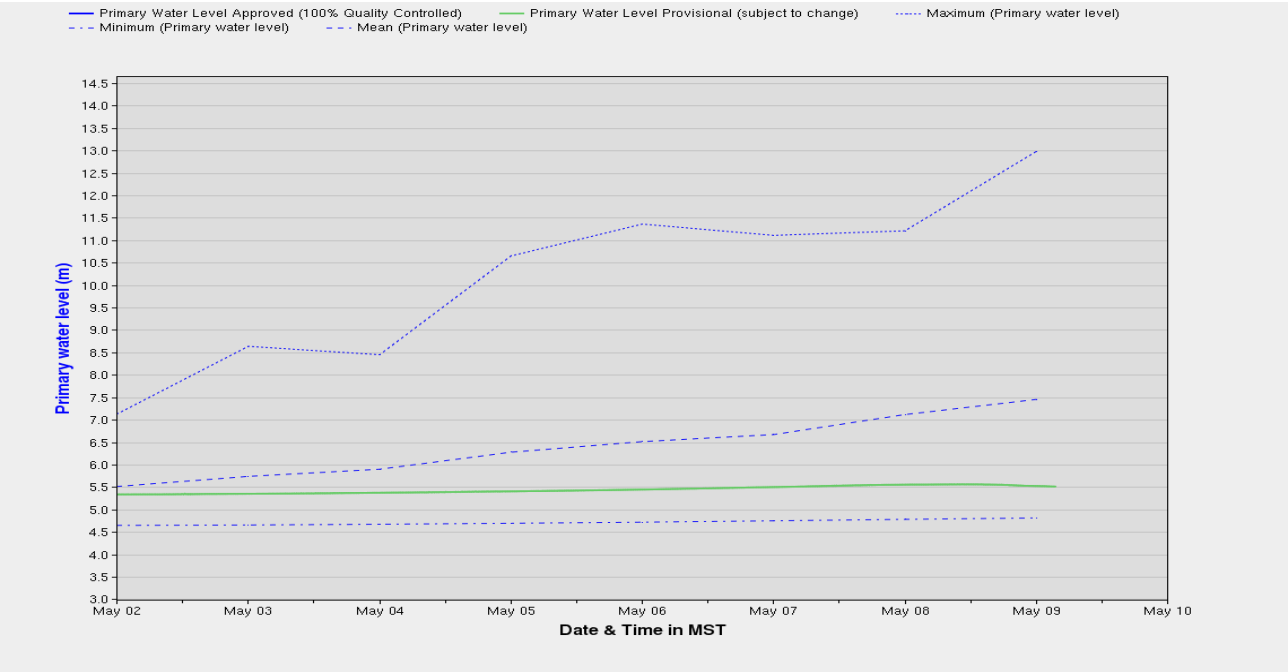


Mackenzie River at Fort Simspon (10GC001) – Current water level is 7.971m.

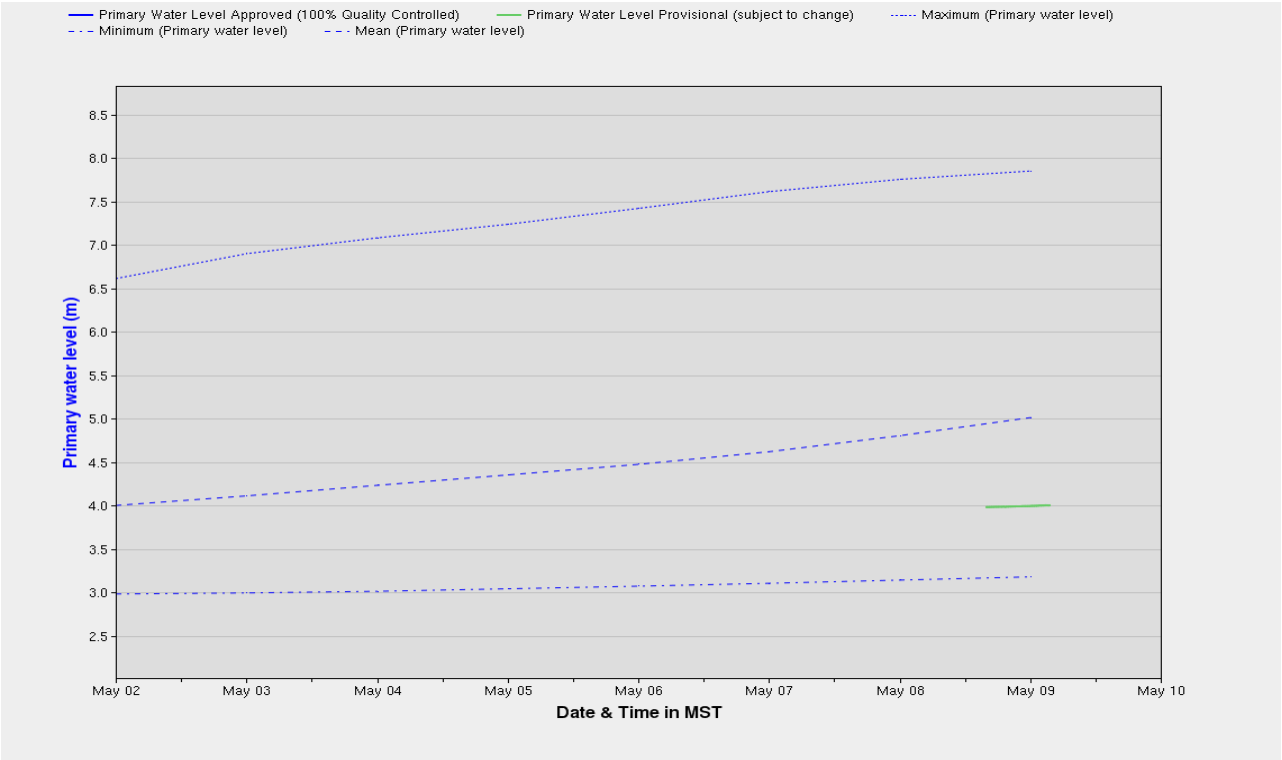


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River at Norman Wells (10KA001) – Current water level is 5.509m. Average breakup level is around 9m with breakup occurring between May 10th- 15th

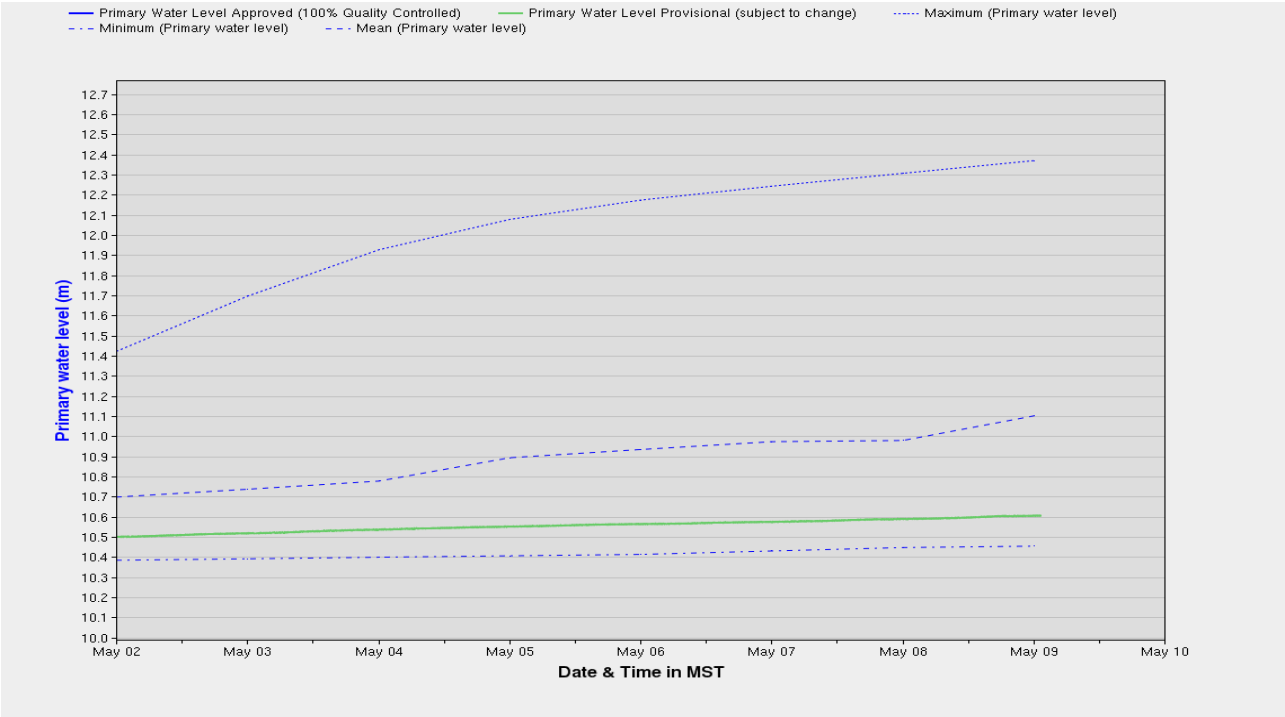


Mackenzie River @ Arctic Red River (10LC014) – Current water level is 4.003m. Average breakup level is between 8-9m occurring around May 18th.

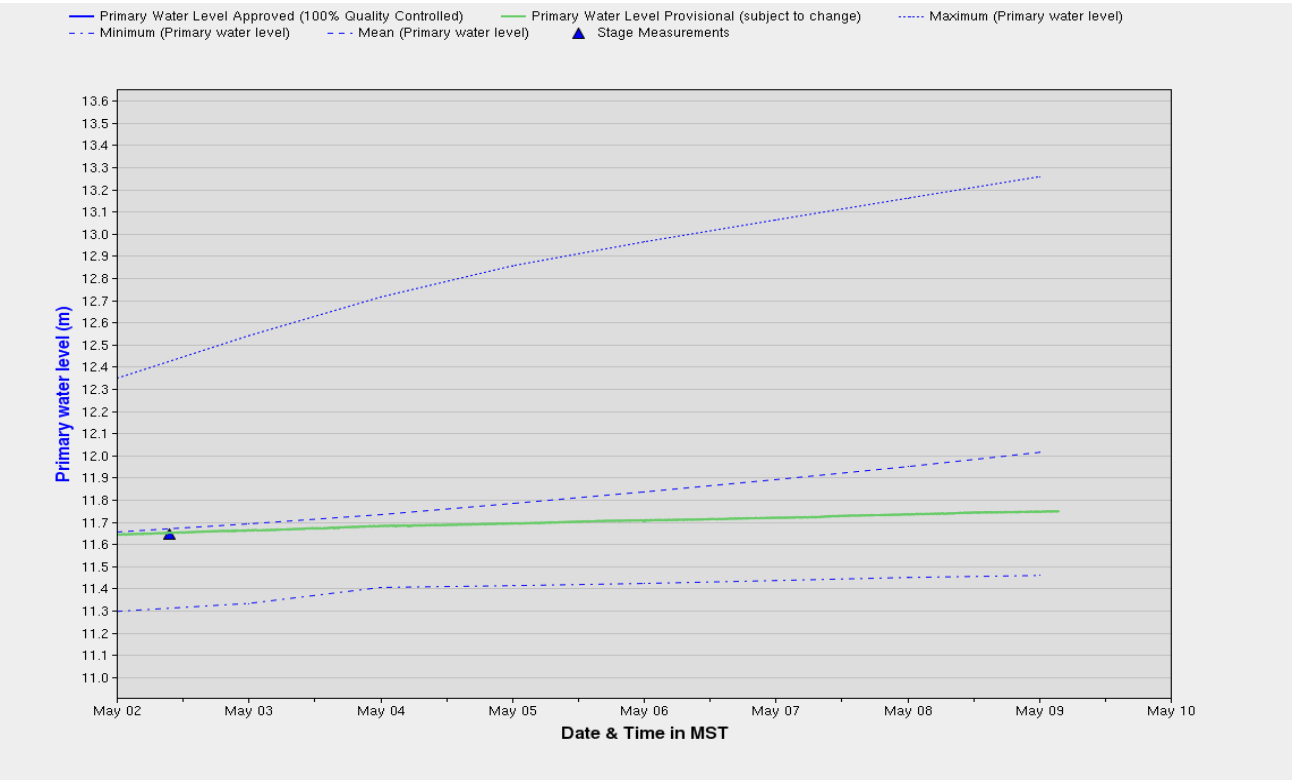


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River (Peel Channel) above Aklavik (10MC003) – Current water level is 10.605m. Average breakup level is between 13-14m occurring sometime between May 25th and 30th.



Mackenzie River (East Channel) at Inuvik (10LC002) - Current water level is 11.748m. Average breakup level is between 12-14m occurring between May 20th and 25th.



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Liard River at Ft. Liard – May 8, 2017

Photo Courtesy of WSC Staff

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Water Survey of Canada
Suite 400, 5019 – 52 Street
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X1A 2P7

Report for May 10th, 2017

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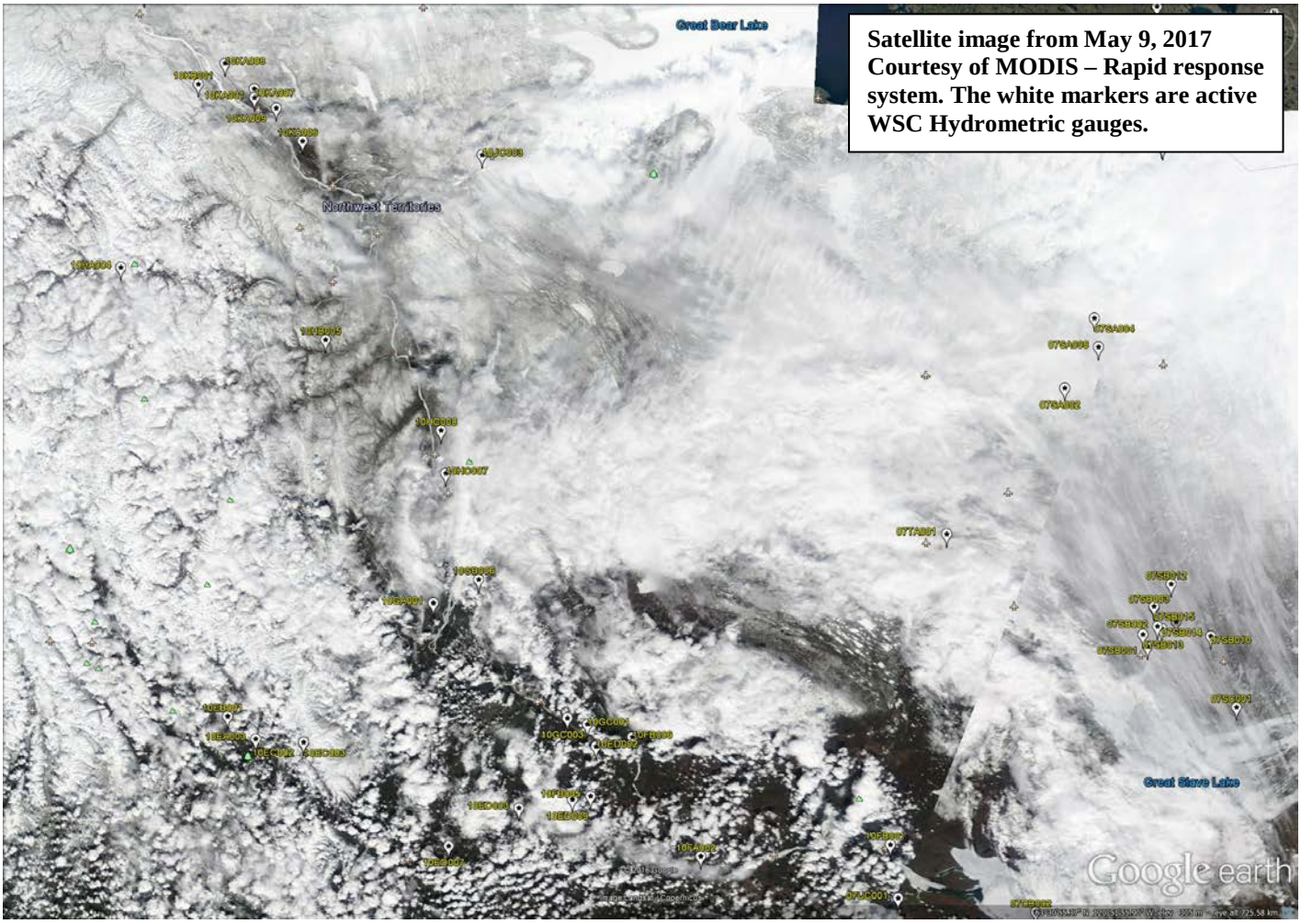
Regional Weather

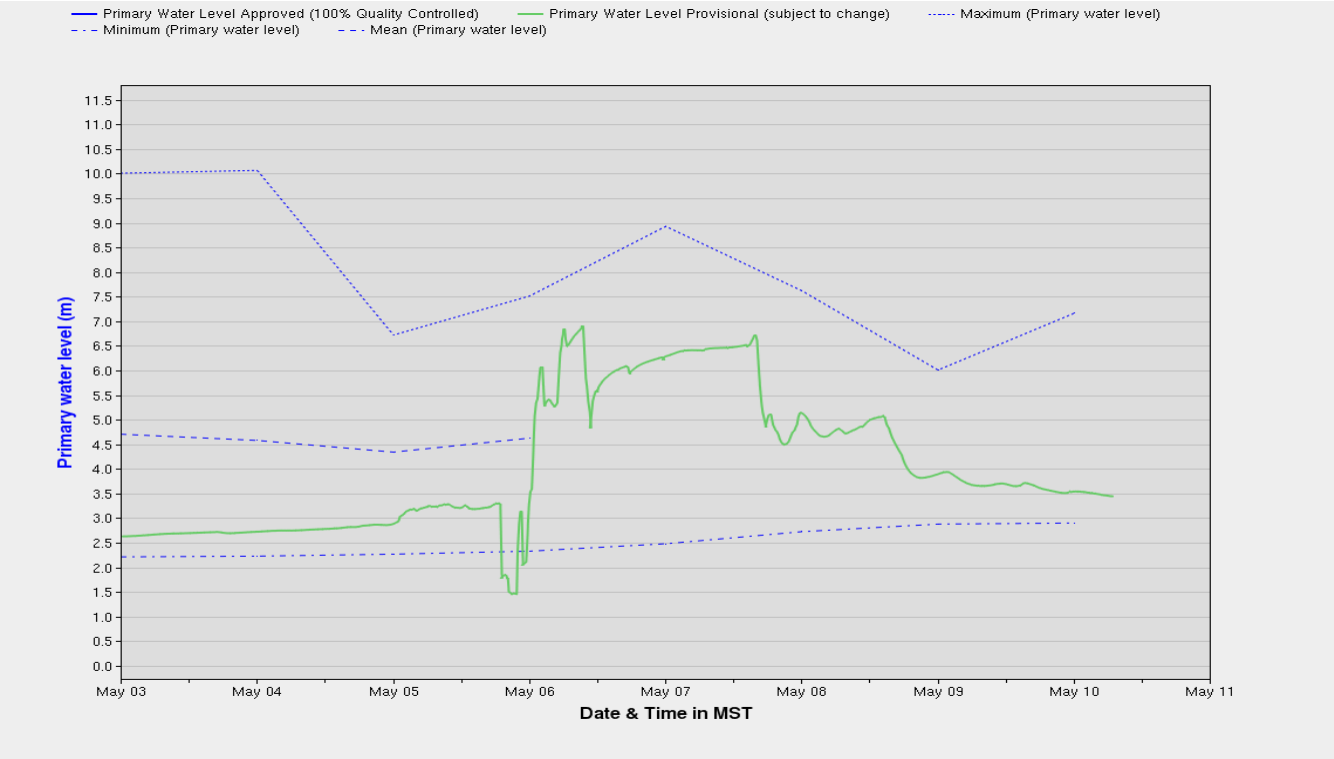
Regional Weather	Today	Thursday	Friday
North Slave	High +11 /Low 0	High +8 /Low 0	High +11/ Low -1
Deh Cho	High +16/ Low +3	High +14/ Low +2	High +16/ Low +6
Sahtu	High +14/ Low +3	High +16/ Low +1	High +19/ Low +4
Delta	High +4/ Low -6	High -2/ Low -6	High 0/ Low -1



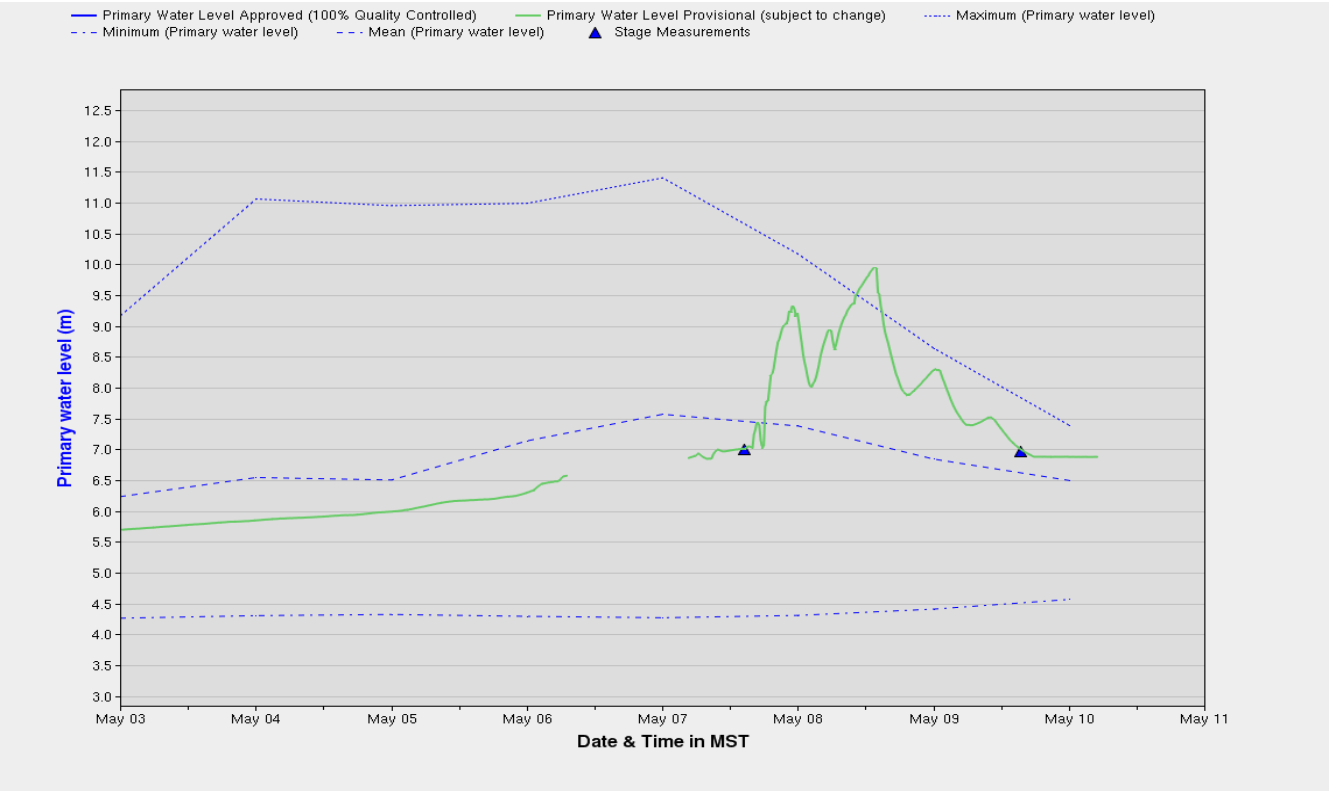
Satellite image from May 9, 2017 Courtesy of MODIS – Rapid response system. The white markers are active WSC Hydrometric gauges.

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Liard River near the Mouth (10ED002) - Current water level is 3.442m.

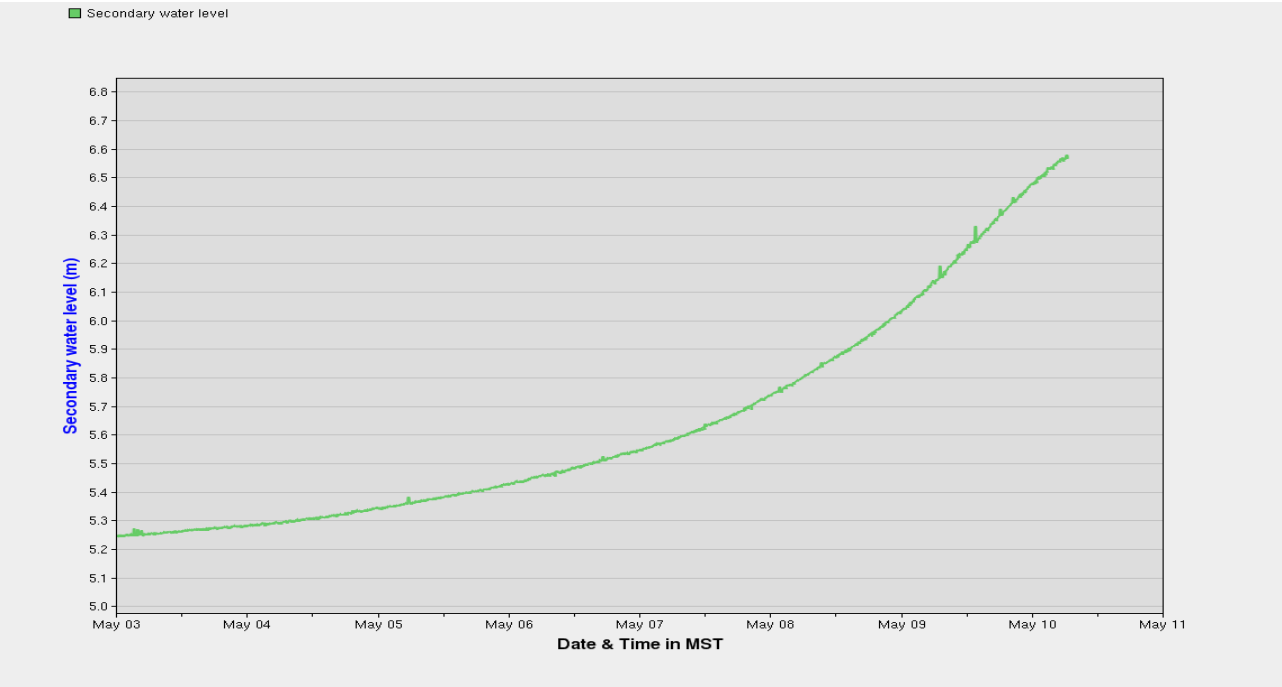


Mackenzie River at Fort Simspon (10GC001) – Current water level is 6.879m. A photo of ice conditions from Wrigley taken by WSC staff in the area can be seen at the end of this report.

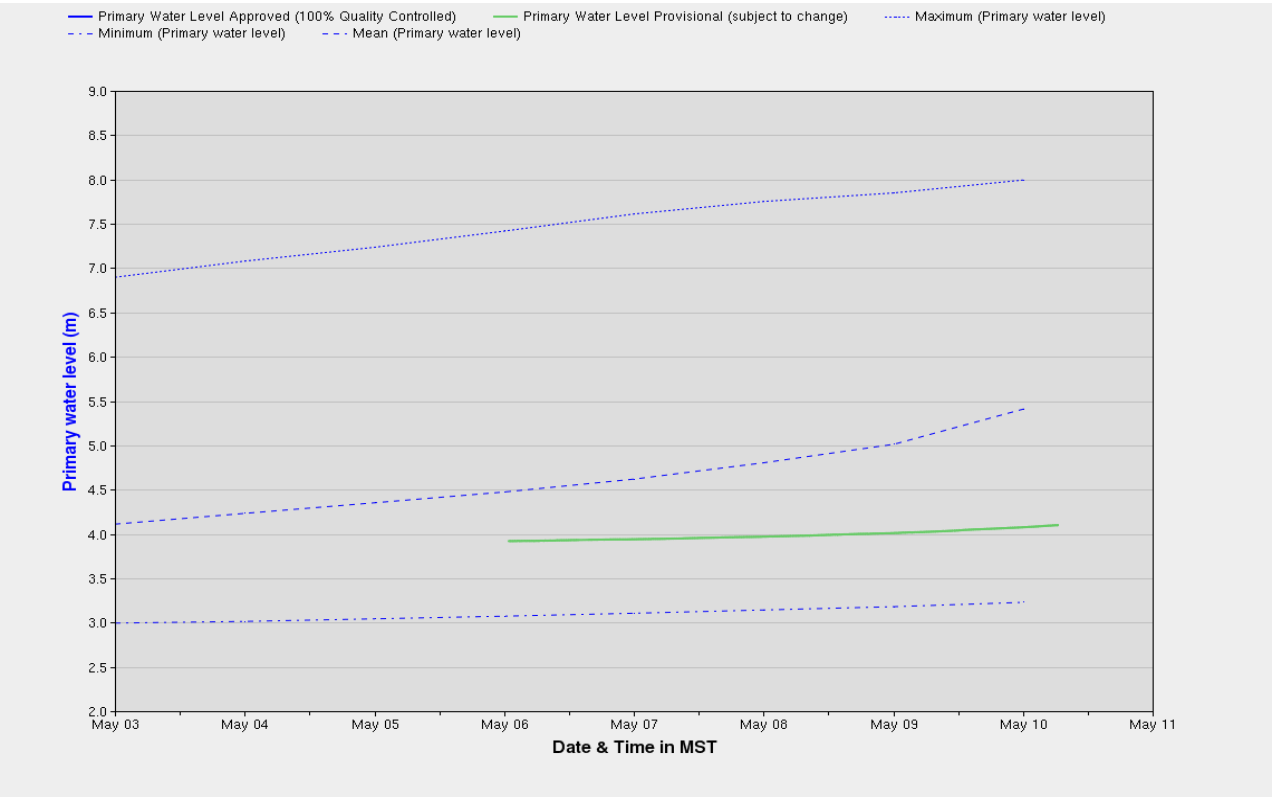


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River at Norman Wells (10KA001) – Current water level is 6.569m. Average breakup level is around 9m with breakup occurring between May 10th- 15th

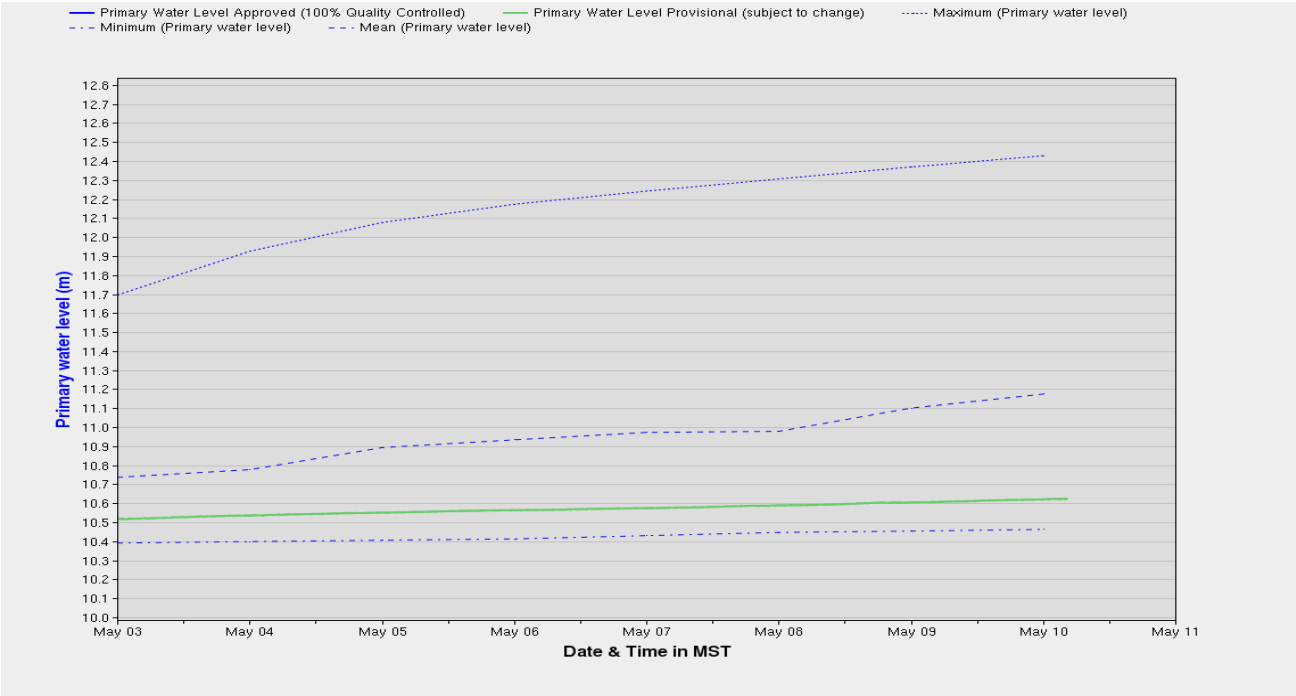


Mackenzie River @ Arctic Red River (10LC014) – Current water level is 4.100m. Average breakup level is between 8-9m occurring around May 18th.

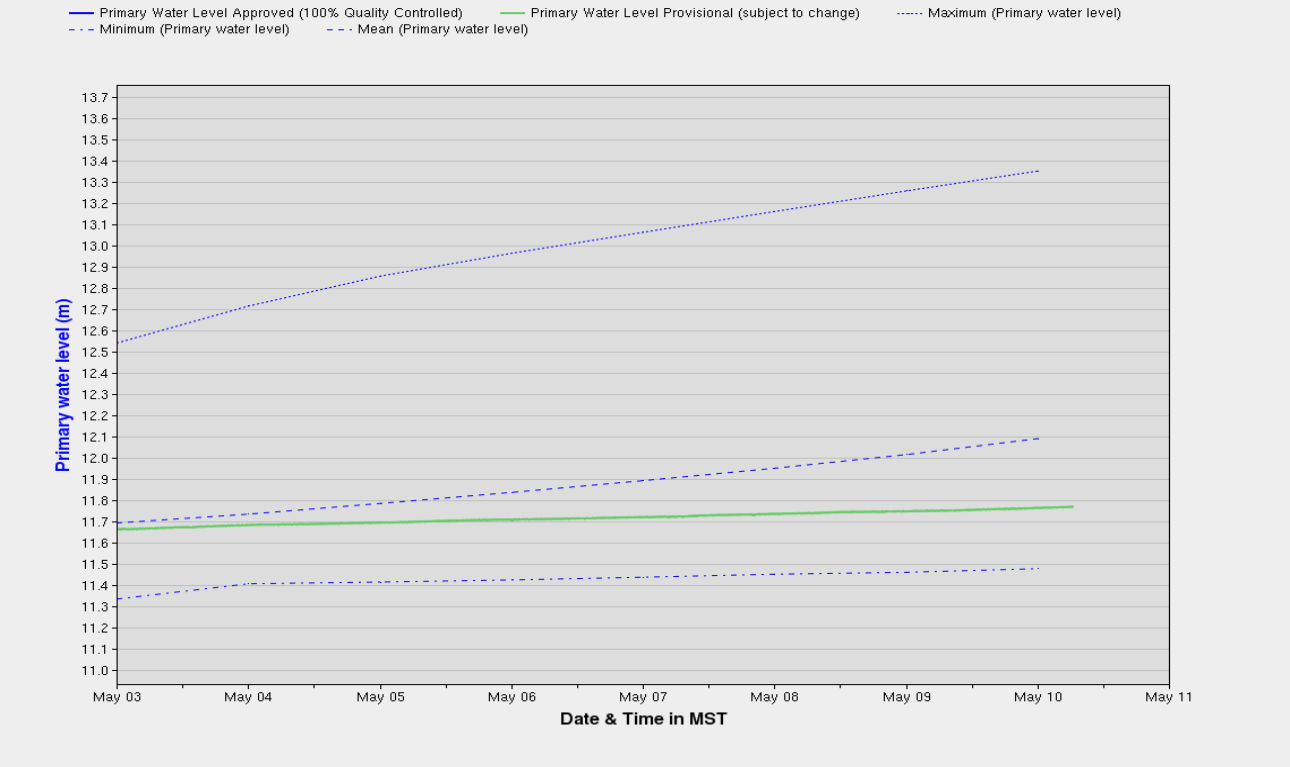


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River (Peel Channel) above Aklavik (10MC003) – Current water level is 10.624m. Average breakup level is between 13-14m occurring sometime between May 25th and 30th.



Mackenzie River (East Channel) at Inuvik (10LC002) - Current water level is 11.768m. Average breakup level is between 12-14m occurring between May 20th and 25th.



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River at Wrigley – Photo taken May 10, 2017

Photo Courtesy of WSC Staff

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Water Survey of Canada
Suite 400, 5019 – 52 Street
Yellowknife, NWT
X1A 2P7

Report for May 11th, 2017

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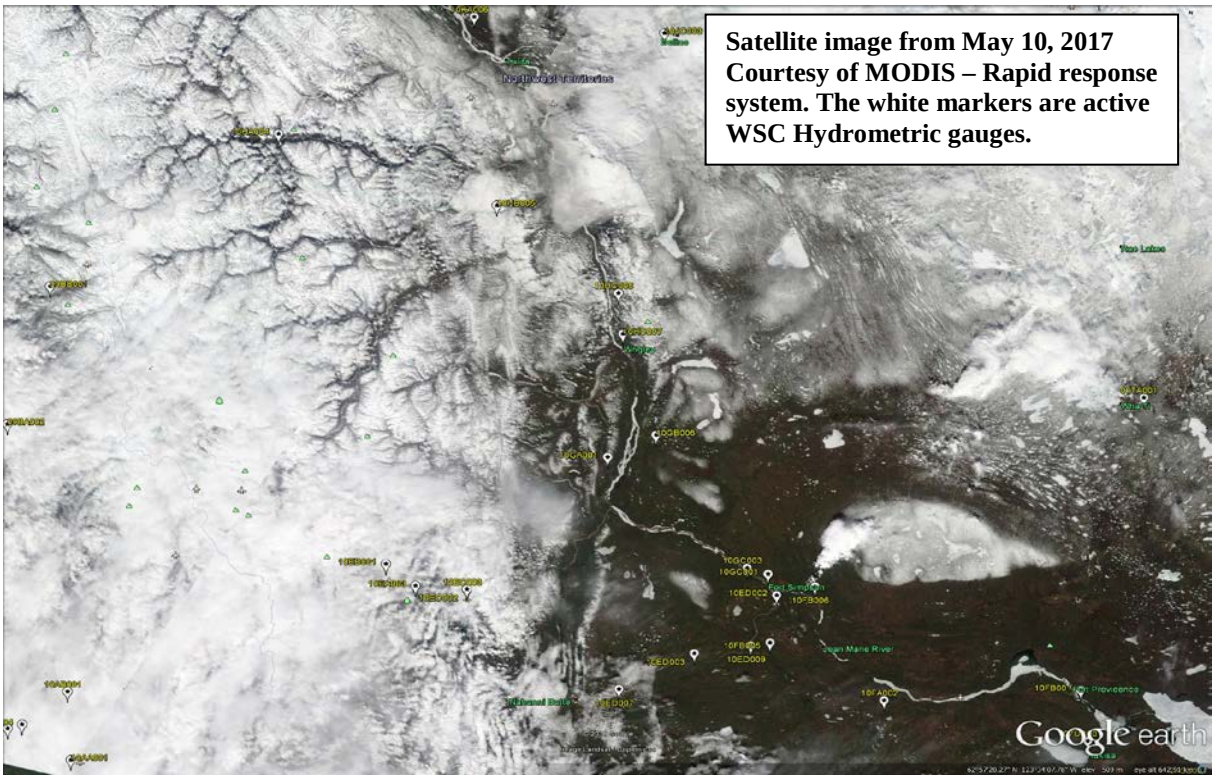
Regional Weather

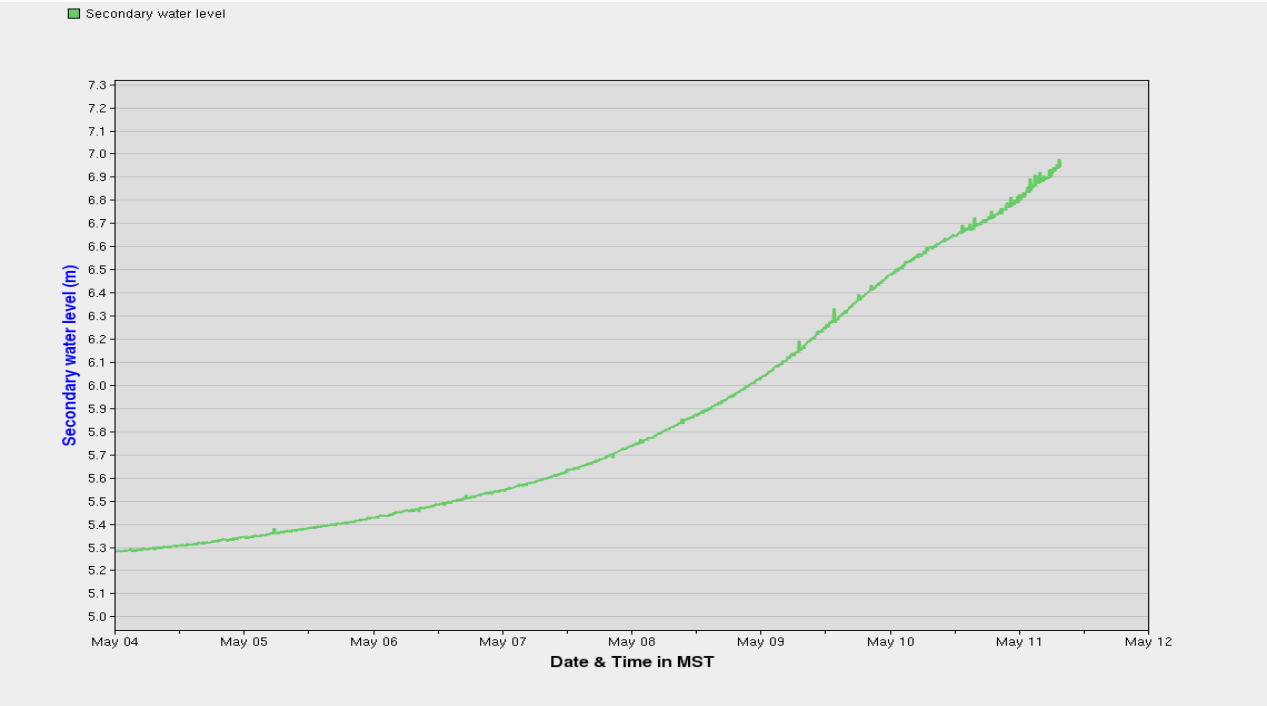
Regional Weather	Today	Friday	Saturday
North Slave	High +9 /Low 0	High +10 /Low 0	High +12/ Low 0
Deh Cho	High +19/ Low +4	High +17/ Low +5	High +17/ Low +5
Sahtu	High +11/ Low -2	High +17/ Low +1	High +20/ Low +3
Delta	High -2/ Low -5	High 0/ Low -2	High +2/ Low 0



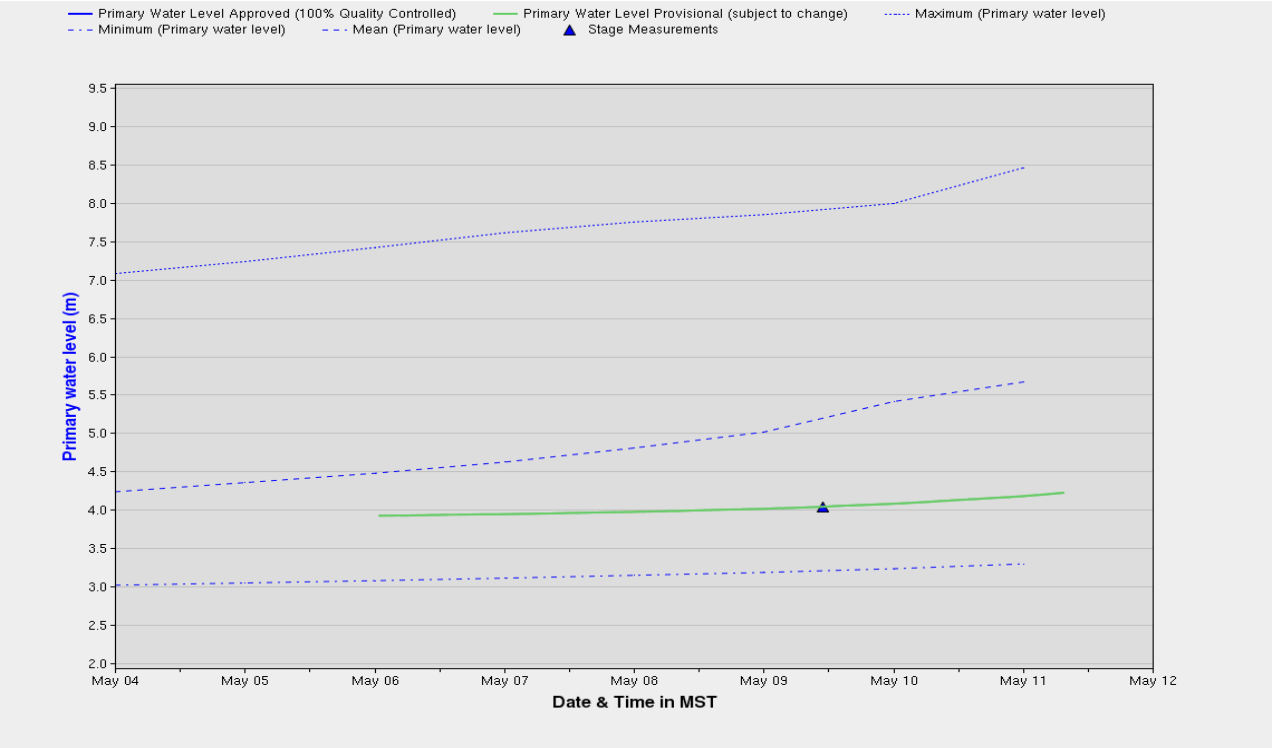
Satellite image from May 10, 2017 Courtesy of MODIS – Rapid response system. The white markers are active WSC Hydrometric gauges.

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River at Norman Wells (10KA001) – Current water level is 6.946m. Average breakup level is around 9m with breakup occurring between May 10th- 15th. Please see photos at the end of this report for current conditions.

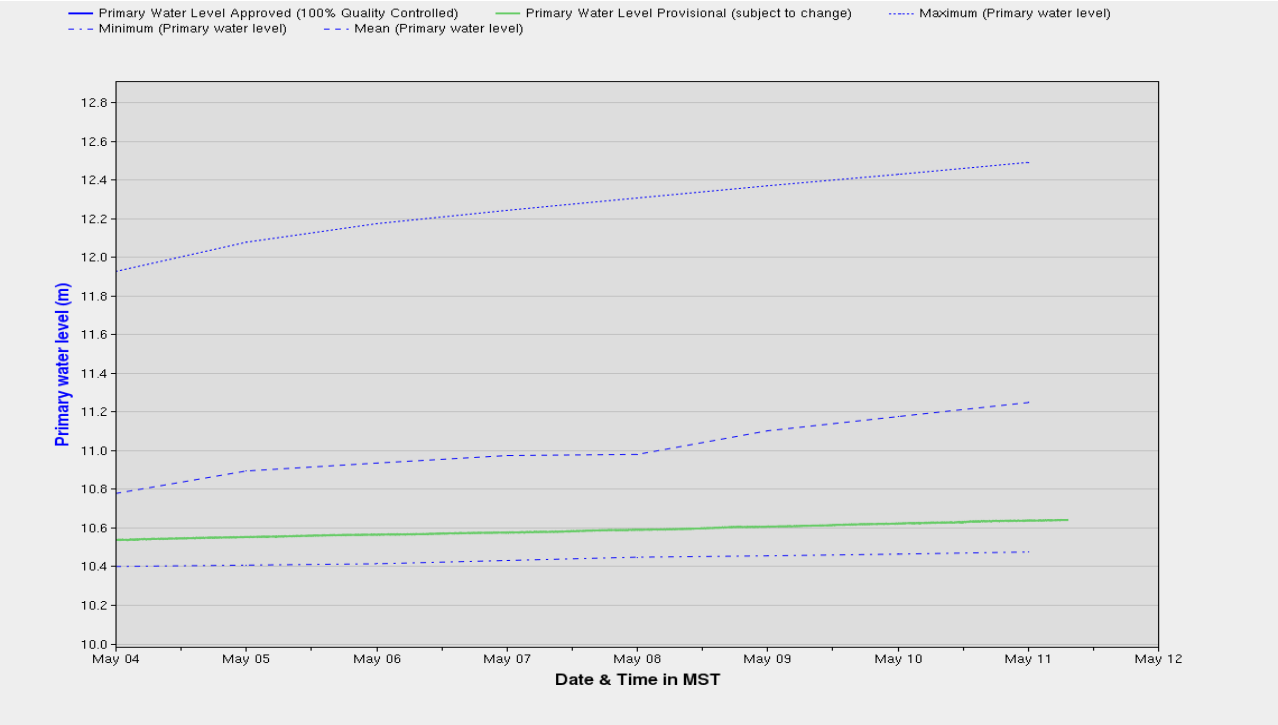


Mackenzie River @ Arctic Red River (10LC014) – Current water level is 4.220m. Average breakup level is between 8-9m occurring around May 18th.

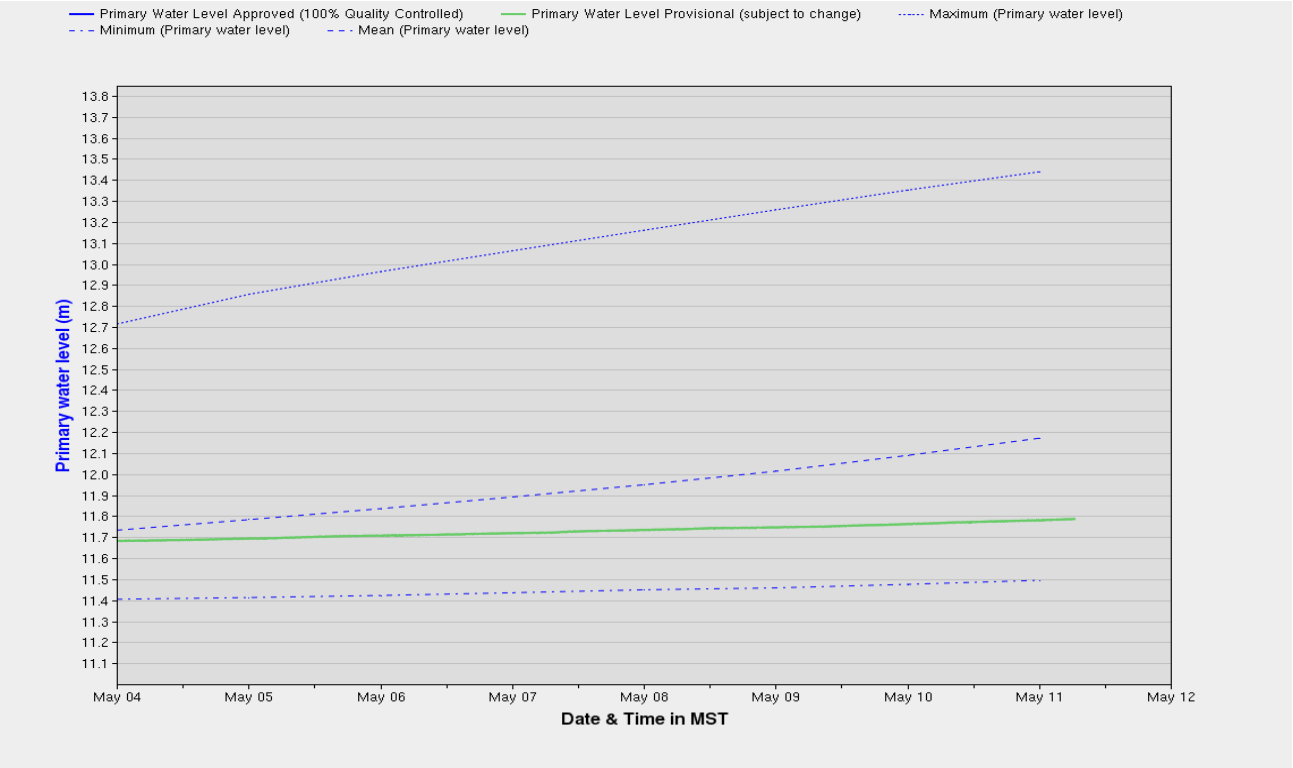


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River (Peel Channel) above Aklavik (10MC003) – Current water level is 10.640m. Average breakup level is between 13-14m occurring sometime between May 25th and 30th.



Mackenzie River (East Channel) at Inuvik (10LC002) - Current water level is 11.787m. Average breakup level is between 12-14m occurring between May 20th and 25th.



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River at Norman Wells – May 11, 2017

Photo Courtesy of Jennifer Waterhouse

Photo Courtesy of Jennifer Waterhouse

Mackenzie River at Norman Wells – May 11, 2017

Photo Courtesy of Jennifer Waterhouse

Environment Canada
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Water Survey of Canada
Suite 400, 5019 – 52 Street
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X1A 2P7

Report for May 12th, 2017

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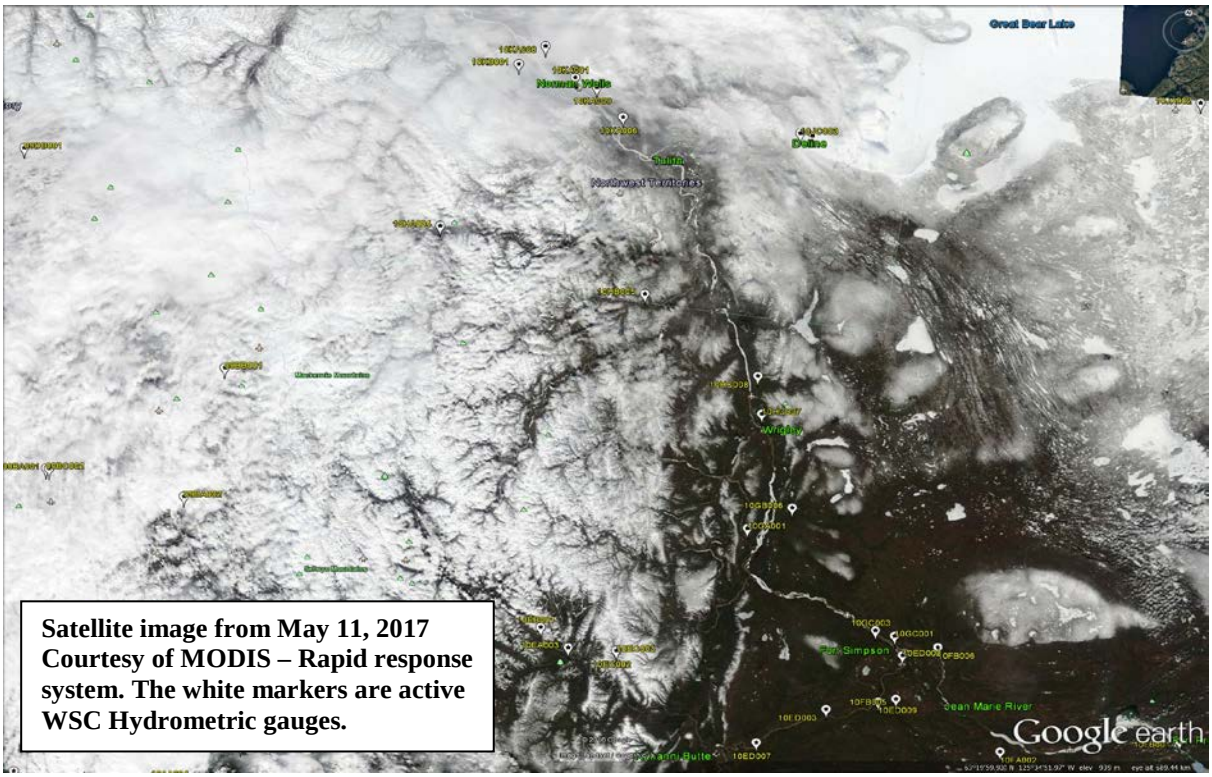
Regional Weather

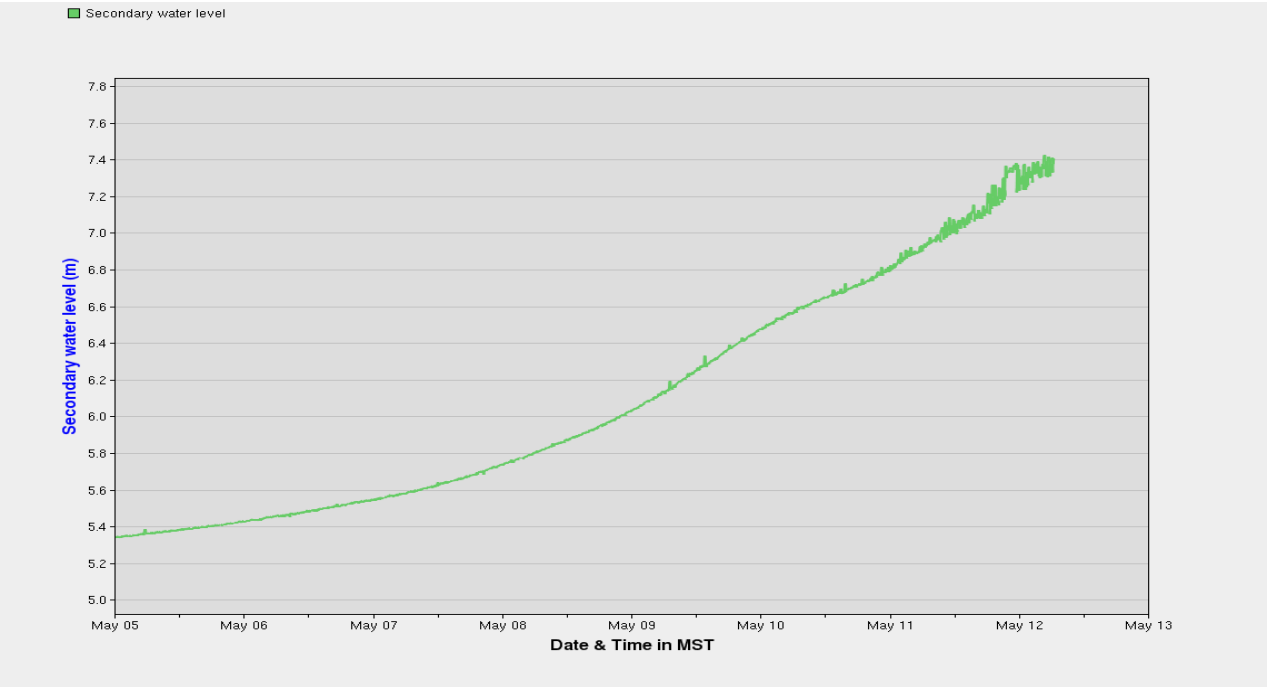
Regional Weather	Today	Saturday	Sunday
North Slave	High +12 /Low 0	High +12 /Low +3	High +13/ Low +3
Deh Cho	High +18/ Low +5	High +16/ Low +7	High +16/ Low +5
Sahtu	High +16/ Low 0	High +20/ Low +5	High +20/ Low +4
Delta	High +1/ Low 0	High +3/ Low 0	High +3/ Low 0



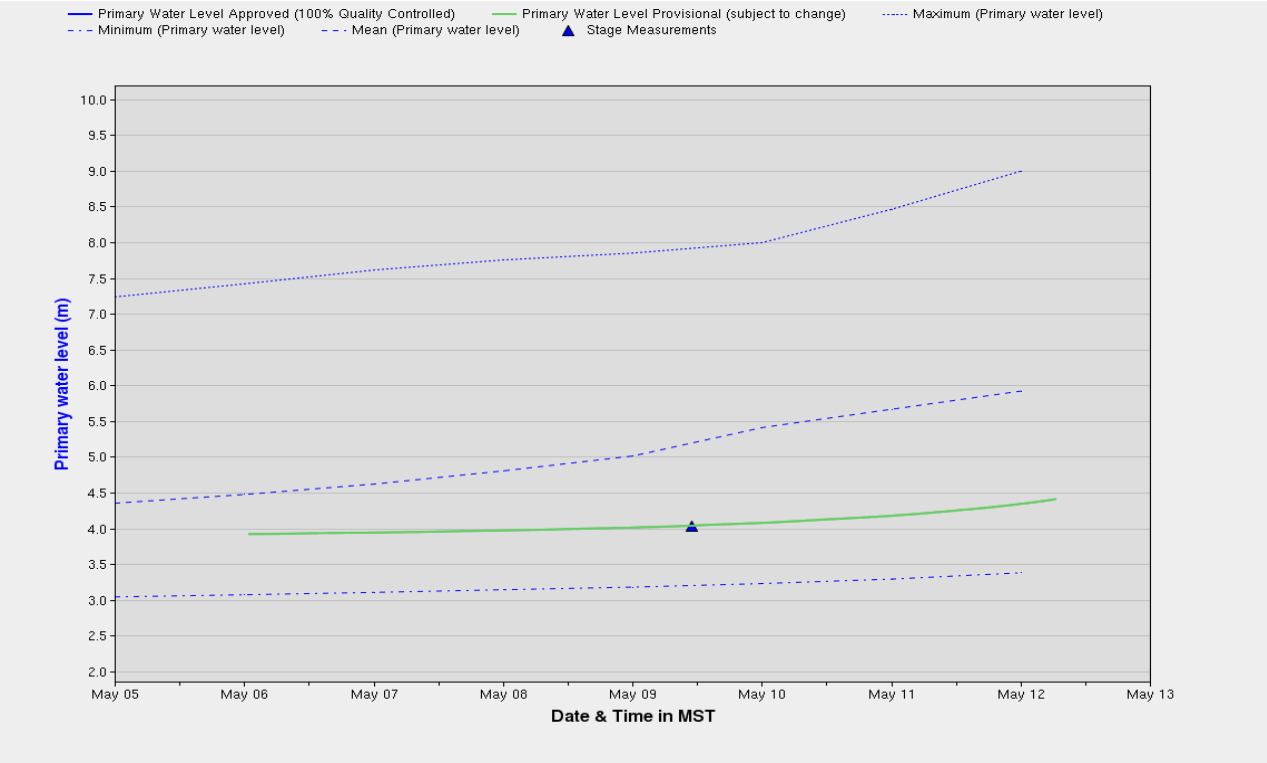
Satellite image from May 11, 2017 Courtesy of MODIS – Rapid response system. The white markers are active WSC Hydrometric gauges.

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River at Norman Wells (10KA001) – Current water level is 7.515m. Average breakup level is around 9m with breakup occurring between May 10th- 15th. Please see photos of current conditions at the end of this report.

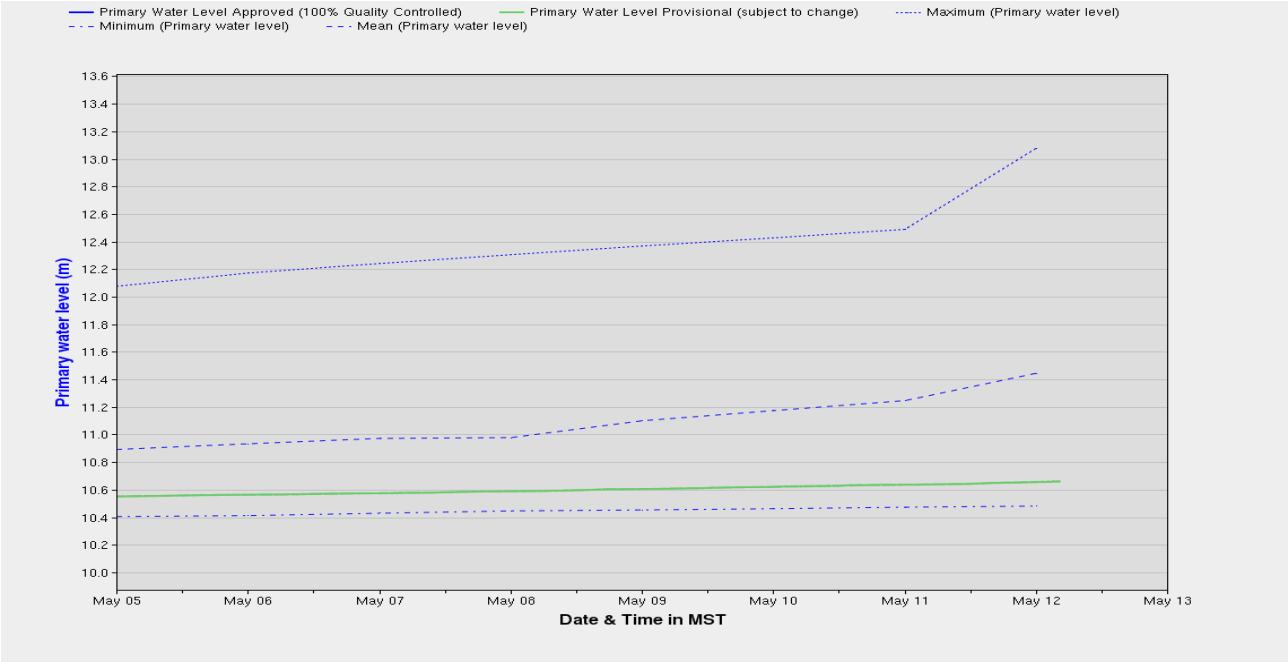


Mackenzie River @ Arctic Red River (10LC014) – Current water level is 4.408m. Average breakup level is between 8-9m occurring around May 18th.

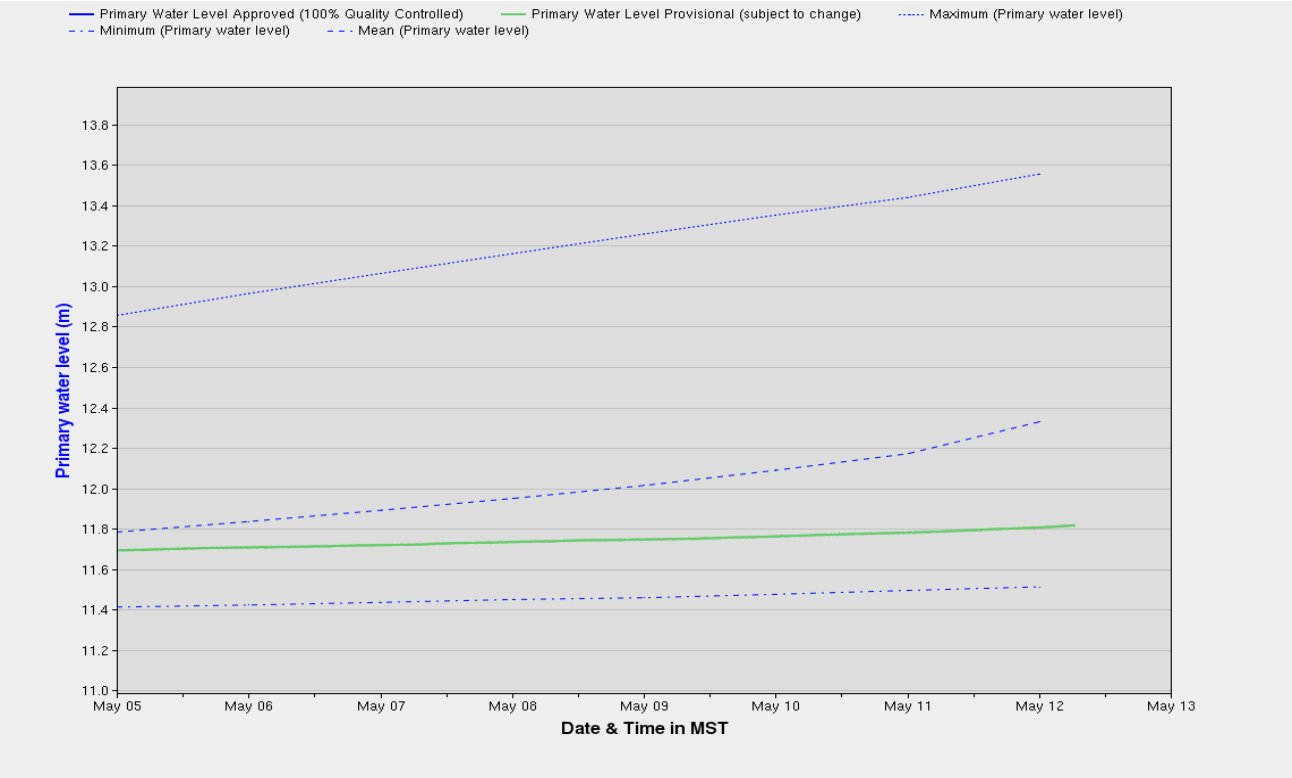


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River (Peel Channel) above Aklavik (10MC003) – Current water level is 10.659m. Average breakup level is between 13-14m occurring sometime between May 25th and 30th.



Mackenzie River (East Channel) at Inuvik (10LC002) - Current water level is 11.818m. Average breakup level is between 12-14m occurring between May 20th and 25th. A photo of conditions from May 11th can be seen at the end of this report.



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River at Norman Wells – May 12, 2017

Photo Courtesy of Jennifer Waterhouse

Photo Courtesy of Jennifer Waterhouse

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River at Norman Wells – May 12, 2017

Photo Courtesy of Jennifer Waterhouse

Mackenzie River (East Channel) at Inuvik – May 11, 2017

Photo Courtesy of Kristian Binder

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

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Environnement

Water Survey of Canada
Suite 400, 5019 – 52 Street
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X1A 2P7

Report for May 15th, 2017

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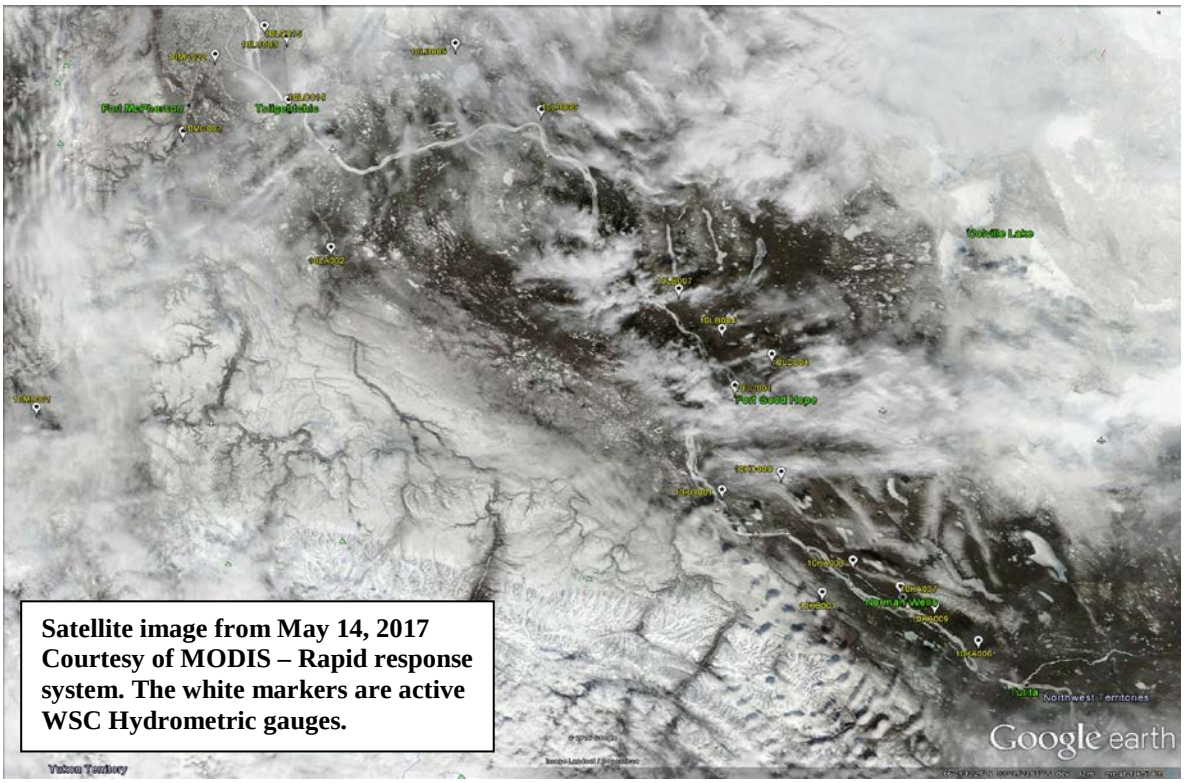
Regional Weather

Regional Weather	Today	Tuesday	Wednesday
North Slave	High +14 /Low 2	High +14 /Low 0	High +13/ Low +3
Deh Cho	High +16/ Low +4	High +19/ Low +6	High +19/ Low +7
Sahtu	High +20/ Low +5	High +18/ Low +5	High +23/ Low +6
Delta	High +2/ Low -1	High +8/ Low +3	High +9/ Low +2



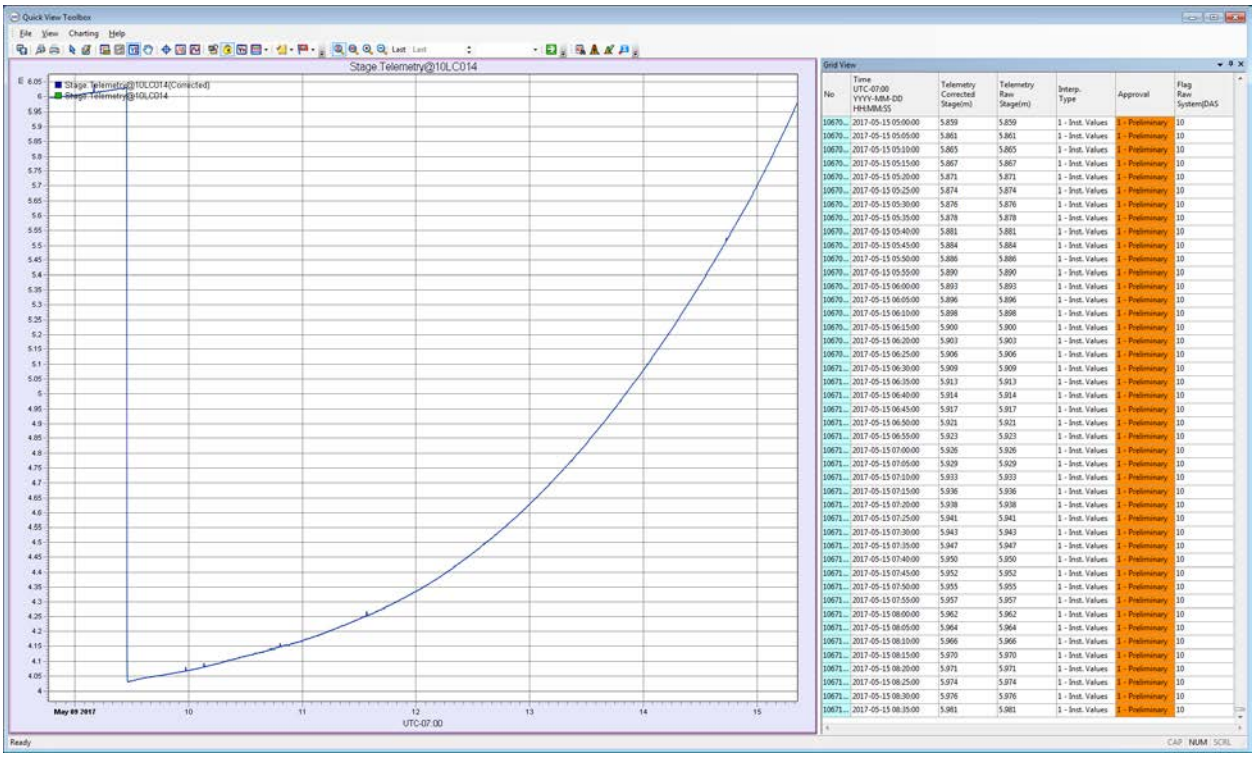
Satellite image from May 14, 2017 Courtesy of MODIS – Rapid response system. The white markers are active WSC Hydrometric gauges.

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Please note: Our realtime website is currently experiencing some technical issues. The graphs provided in today's report are from our computational software.

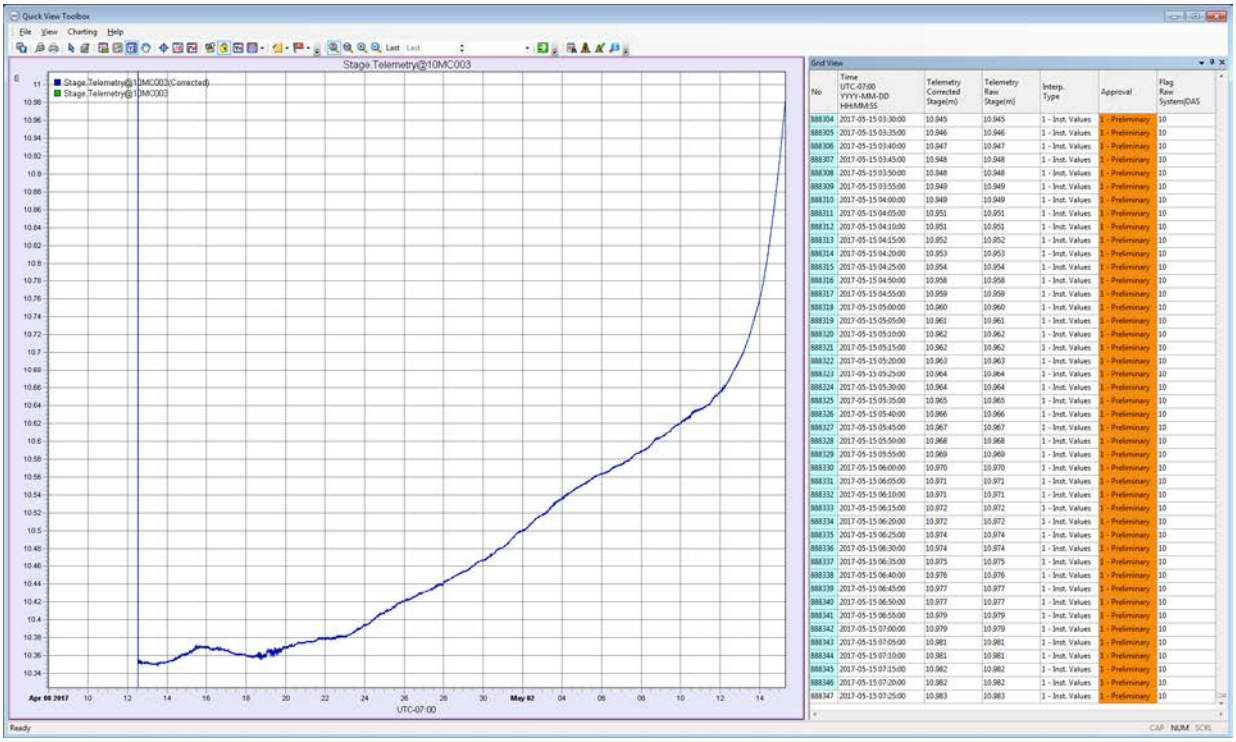
Mackenzie River at Norman Wells (10KA001) – The ice appears to have affected our primary and secondary water level sensors, but our third water level sensor appears be holding. Current water level from our tertiary water level sensor is 13.146m.. Average breakup level is around 9m with breakup occurring between May 10th- 15th. Latest report is that the ice started moving over the weekend. Please see photos of current conditions at the end of this report.

Mackenzie River @ Arctic Red River (10LC014) – Current water level is 5.988m. Average breakup level is between 8-9m occurring around May 18th.

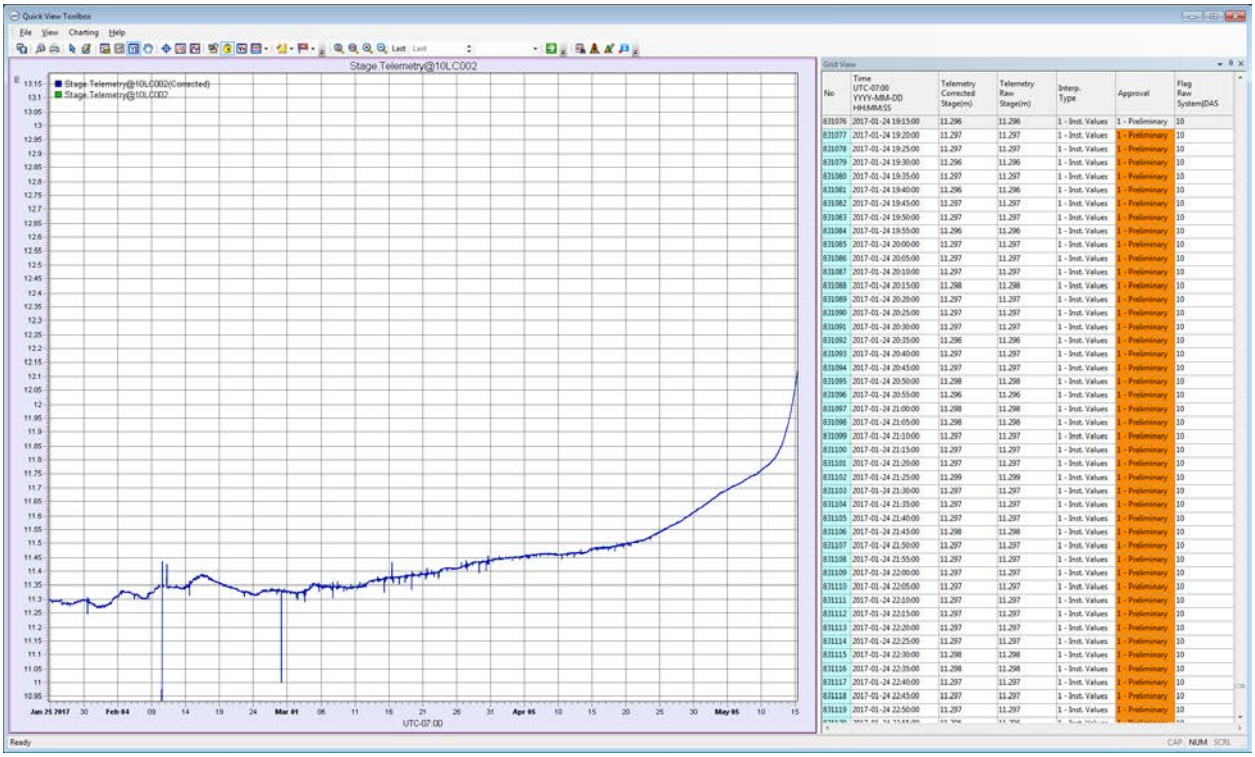


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River (Peel Channel) above Aklavik (10MC003) – Current water level is 10.983m. Average breakup level is between 13-14m occurring sometime between May 25th and 30th.



Mackenzie River (East Channel) at Inuvik (10LC002) - Current water level is 12.123m. Average breakup level is between 12-14m occurring between May 20th and 25th.



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River at Norman Wells – May 15, 2017

Photo Courtesy of Jennifer Waterhouse

Photo Courtesy of Jennifer Waterhouse

Photo Courtesy of Jennifer Waterhouse

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River at Norman Wells – May 14, 2017

Photo Courtesy of Jennifer Waterhouse

Photo Courtesy of Jennifer Waterhouse

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

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Environnement

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Suite 400, 5019 – 52 Street
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Report for May 16th, 2017

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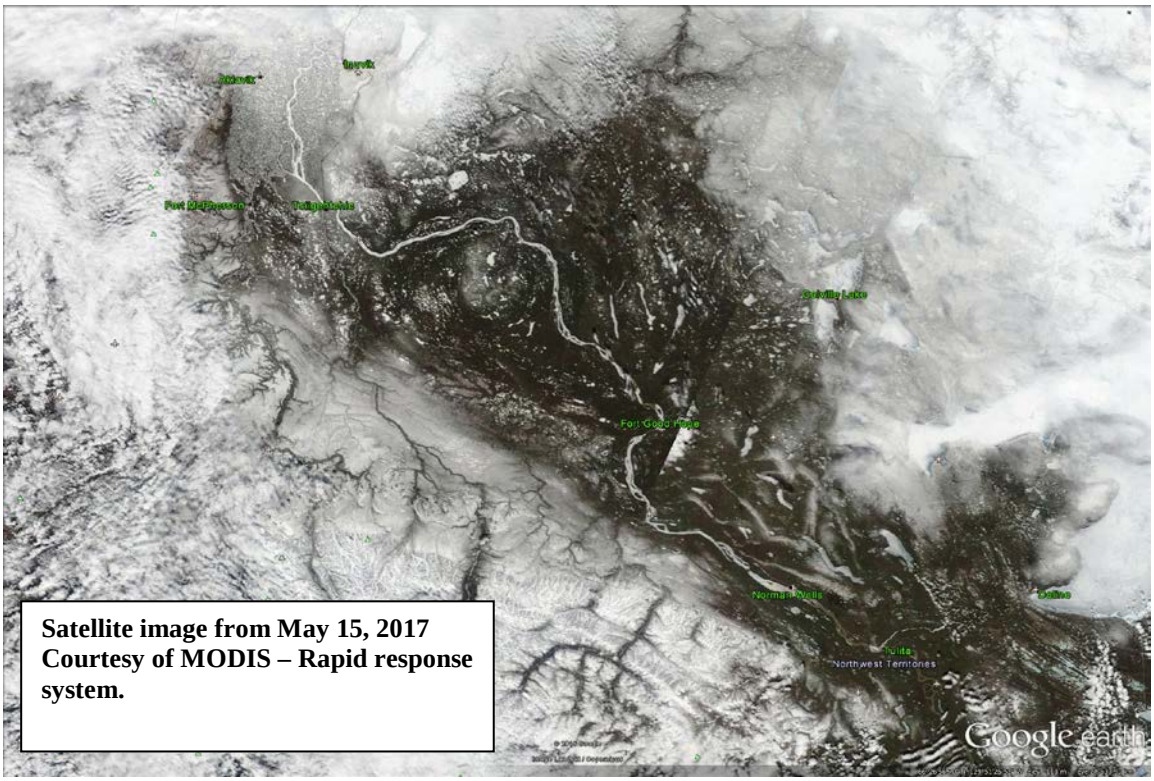
Regional Weather

Regional Weather	Today	Wednesday	Thursday
North Slave	High +15 /Low 0	High +14 /Low +3	High +16/ Low +6
Deh Cho	High +20/ Low +6	High +20/ Low +7	High +18/ Low +6
Sahtu	High +20/ Low +7	High +22/ Low +6	High +23/ Low +8
Delta	High +10/ Low +8	High +5/ Low +1	High +5/ Low -1

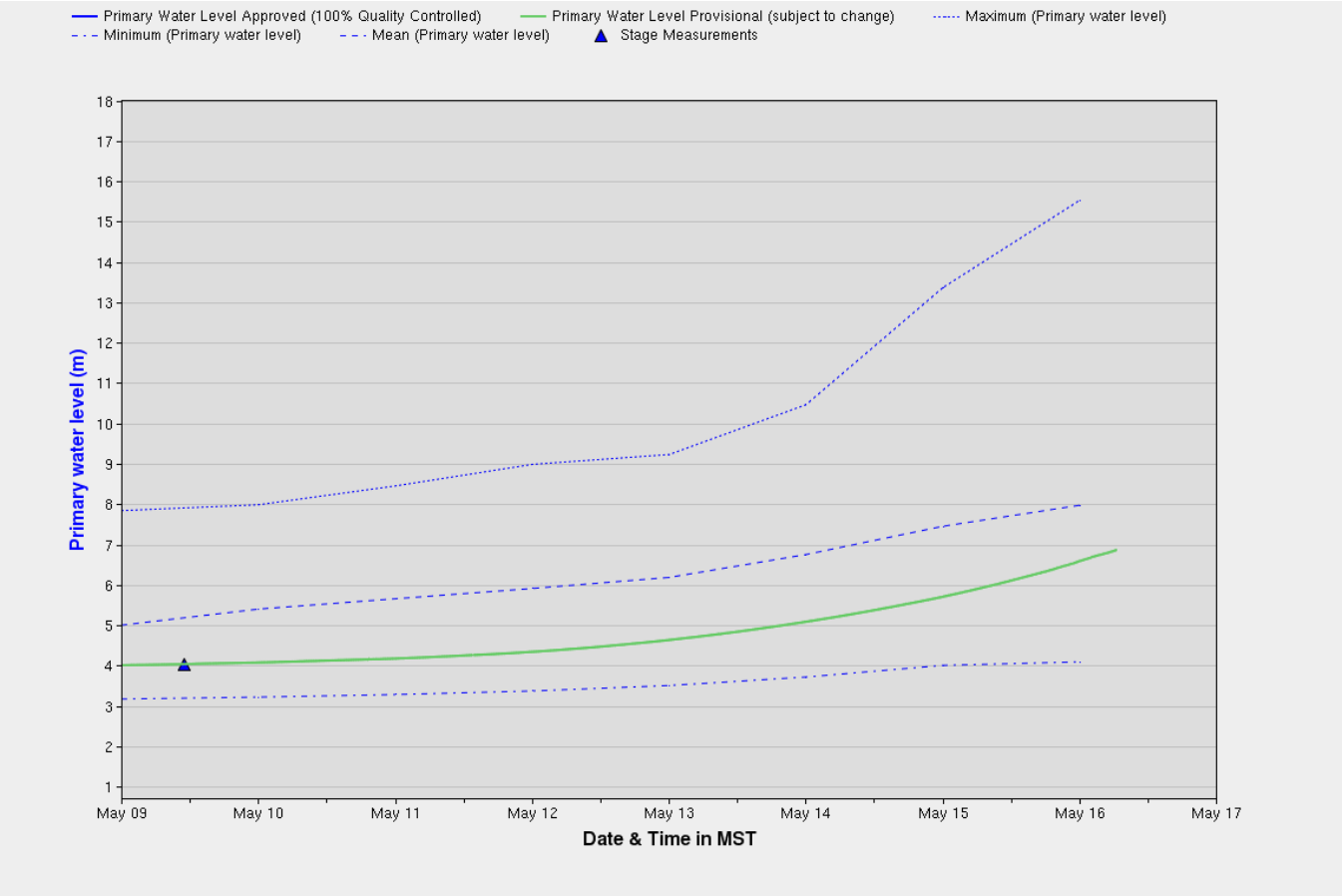


Satellite image from May 15, 2017
Courtesy of MODIS – Rapid response system.

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

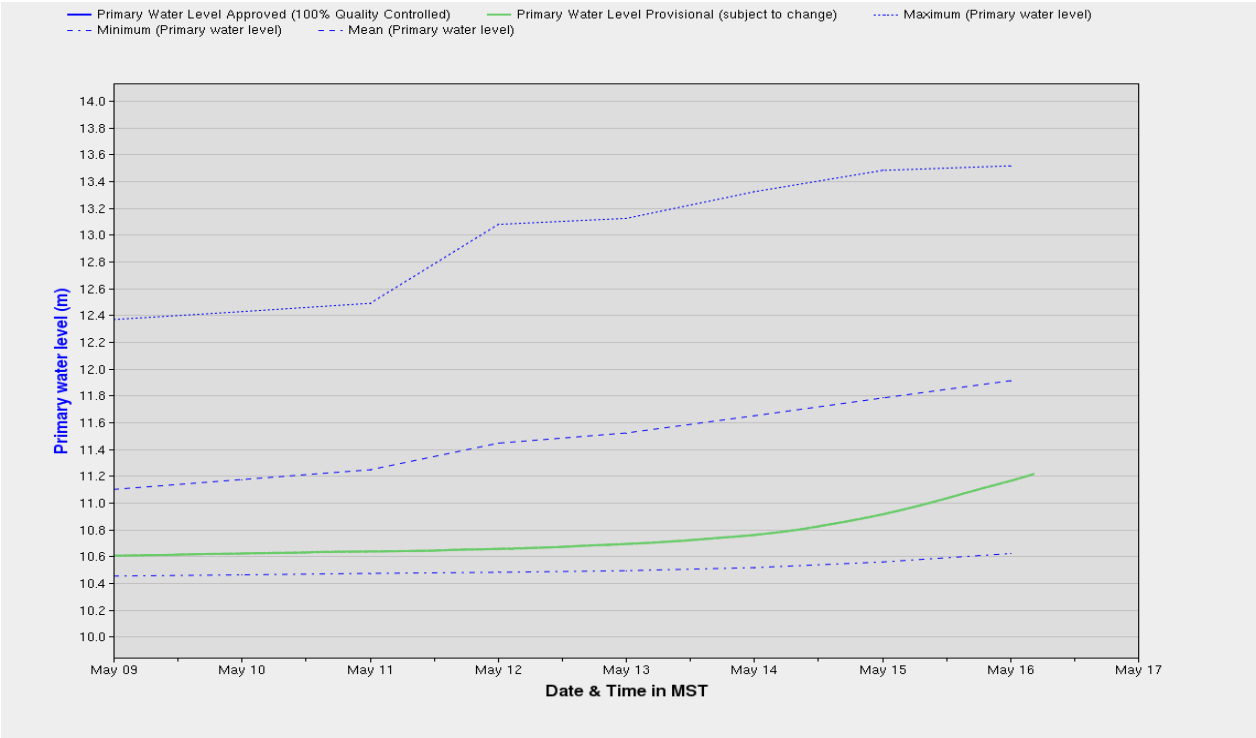
Mackenzie River at Norman Wells (10KA001) – The ice appears to have affected our primary and secondary water level sensors, but our third water level sensor appears be holding. Current water level from our tertiary water level sensor is 14.121m.

Mackenzie River @ Arctic Red River (10LC014) – Current water level is 6.869m. Average breakup level is between 8-9m occurring around May 18th.

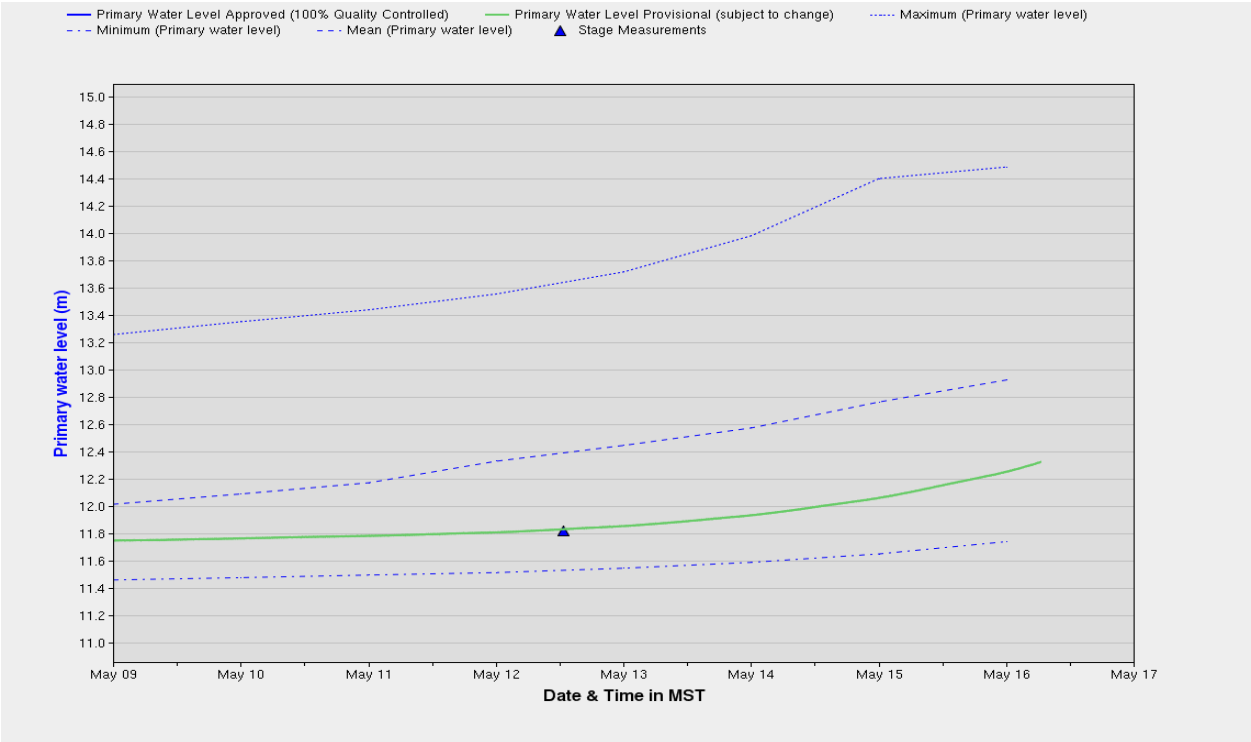


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River (Peel Channel) above Aklavik (10MC003) – Current water level is 11.215m. Average breakup level is between 13-14m occurring sometime between May 25th and 30th.



Mackenzie River (East Channel) at Inuvik (10LC002) - Current water level is 12.324m. Average breakup level is between 12-14m occurring between May 20th and 25th.



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Environment Canada
Environnement

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Report for May 17th, 2017

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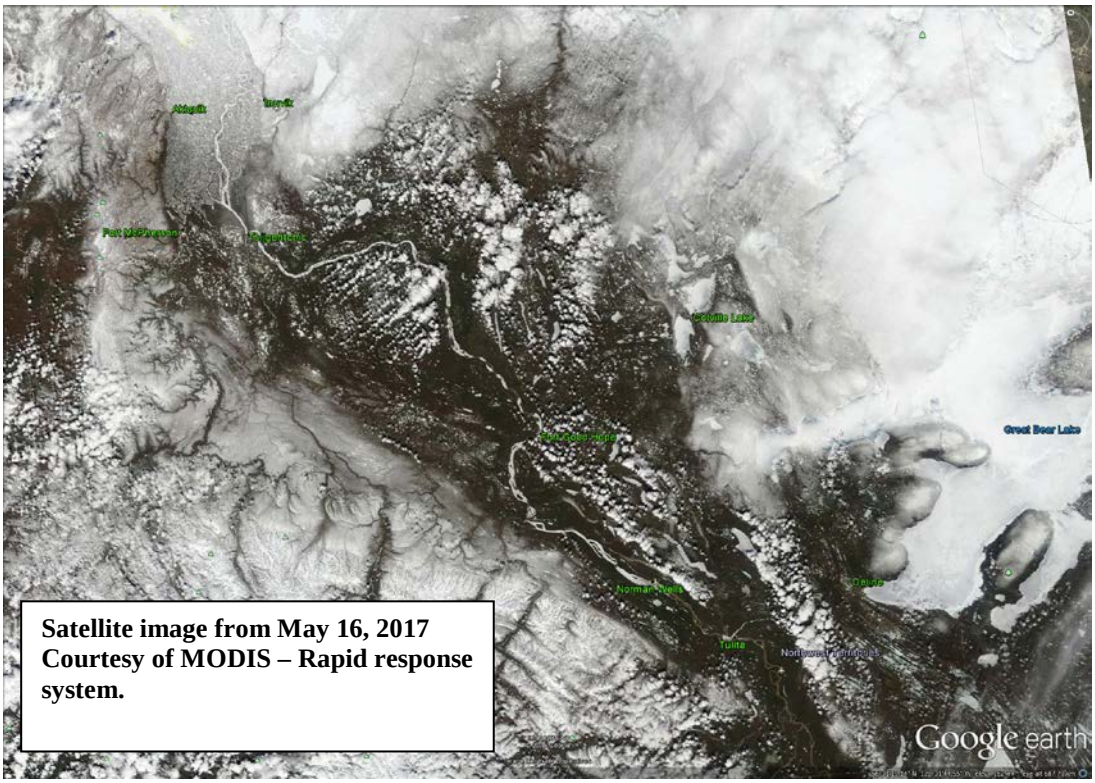
https://www.caccon.org/mackenzie-beaufort-break-up-newsletter/

Regional Weather

Regional Weather	Today	Thursday	Friday
North Slave	High +13 /Low +4	High +16 /Low +7	High +16/ Low +5
Deh Cho	High +20/ Low +7	High +19/ Low +7	High +21/ Low +6
Sahtu	High +22/ Low +8	High +21/ Low +9	High +23/ Low +9
Delta	High +18/ Low 0	High +9/ Low 0	High +3/ Low -2

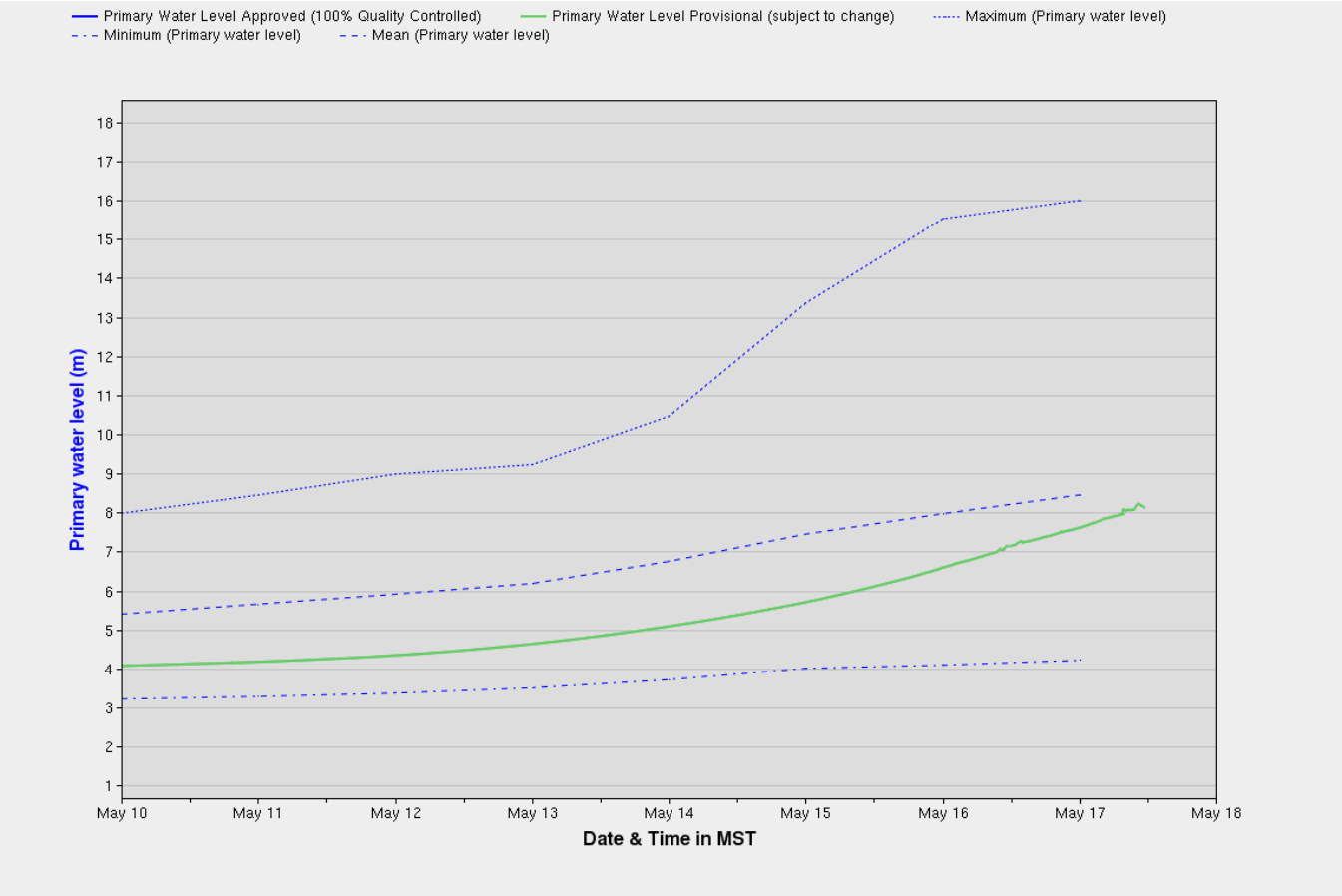


Satellite image from May 16, 2017
Courtesy of MODIS – Rapid response system.

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

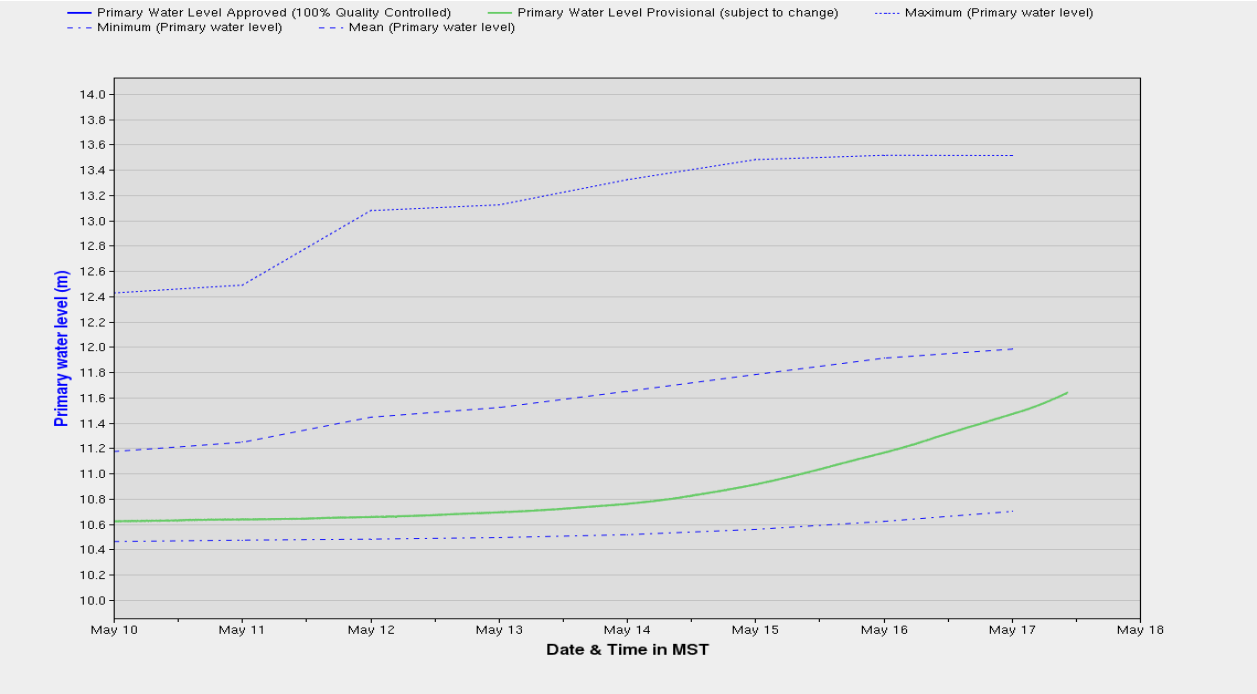
Mackenzie River at Norman Wells (10KA001) – The ice appears to have affected our primary and secondary water level sensors, but our third water level sensor appears be holding. Current water level from our tertiary water level sensor is 13.619m.

Mackenzie River @ Arctic Red River (10LC014) – Current water level is 8.124m. Average breakup level is between 8-9m occurring around May 18th.

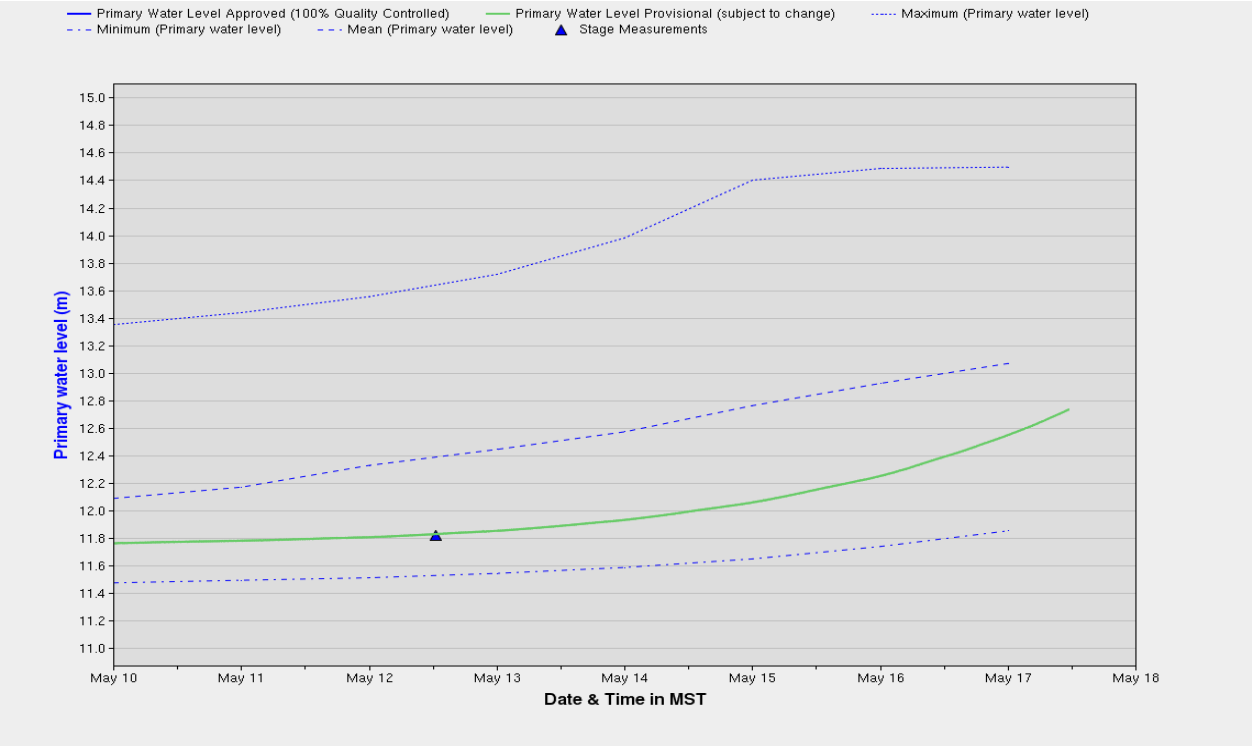


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River (Peel Channel) above Aklavik (10MC003) – Current water level is 11.639m. Average breakup level is between 13-14m occurring sometime between May 25th and 30th.



Mackenzie River (East Channel) at Inuvik (10LC002) - Current water level is 12.737m. Average breakup level is between 12-14m occurring between May 20th and 25th. Please see photos at the end of this report for conditions around Inuvik and East Channel yesterday.



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Airport Lake Inuvik – May 16, 2017

Photo Courtesy of Jen Lam

Mackenzie River (East Channel) at Inuvik – May 16, 2017

Photo Courtesy of Kristian Binder

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Environment Canada
Environnement

Water Survey of Canada
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Report for May 18th, 2017

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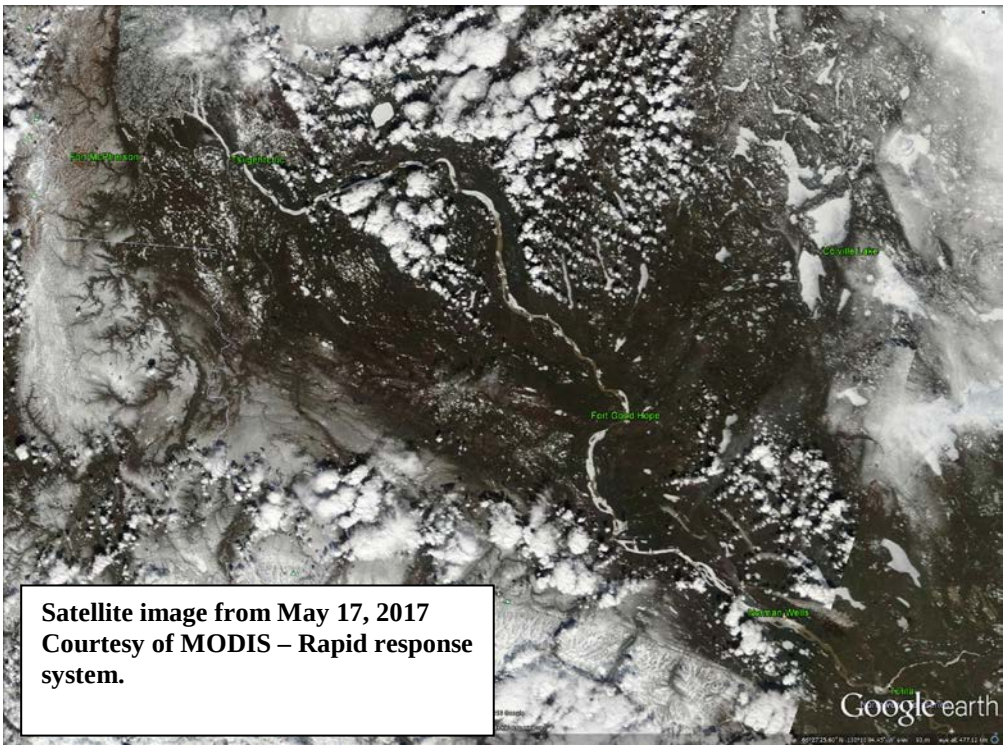
Regional Weather

Regional Weather	Today	Friday	Saturday
North Slave	High +17 /Low +7	High +16 /Low +7	High +18/ Low +6
Deh Cho	High +20/ Low +7	High +18/ Low +6	High +23/ Low +9
Sahtu	High +22/ Low +10	High +18/ Low +7	High +18/ Low +7
Delta	High +15/ Low +3	High +11/ Low +5	High +9/ Low 0



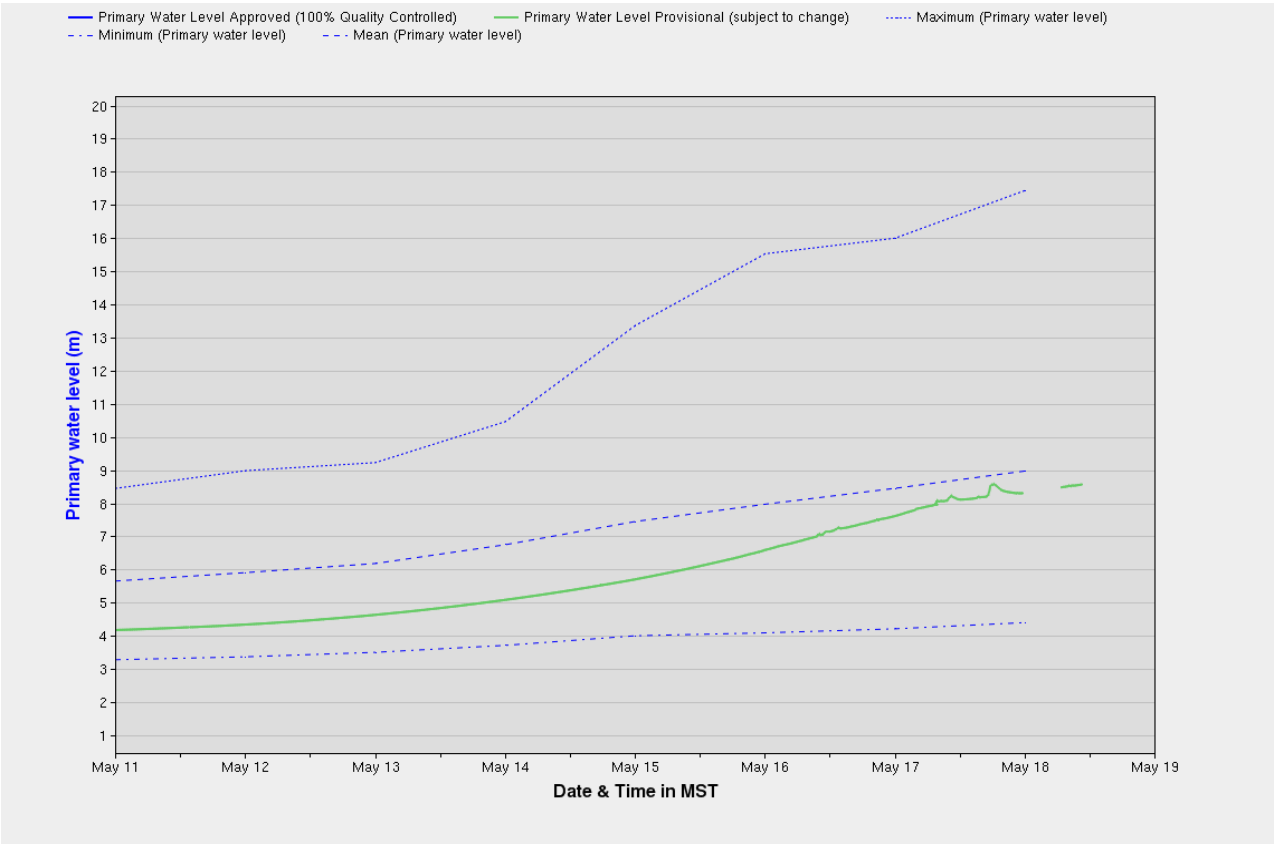
Satellite image from May 17, 2017
Courtesy of MODIS – Rapid response system.

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Photos of breakup in Tulita from Sunday that were featured on CBC NWT's Facebook page can be seen at the end of this report.

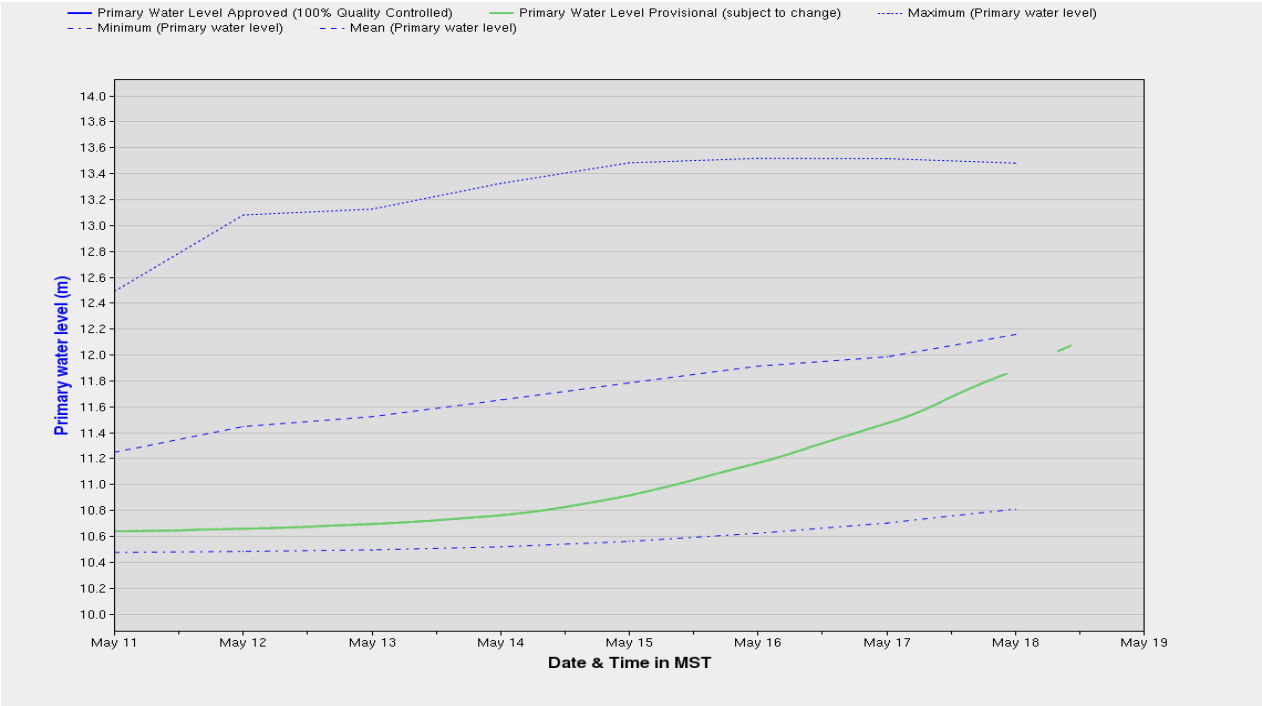
Mackenzie River at Norman Wells (10KA001) – The ice appears to have affected our primary and secondary water level sensors, but our third water level sensor appears be holding. Current water level from our tertiary water level sensor is 13.525m.

Mackenzie River @ Arctic Red River (10LC014) – Current water level is 8.568m. Average breakup level is between 8-9m occurring around May 18th.

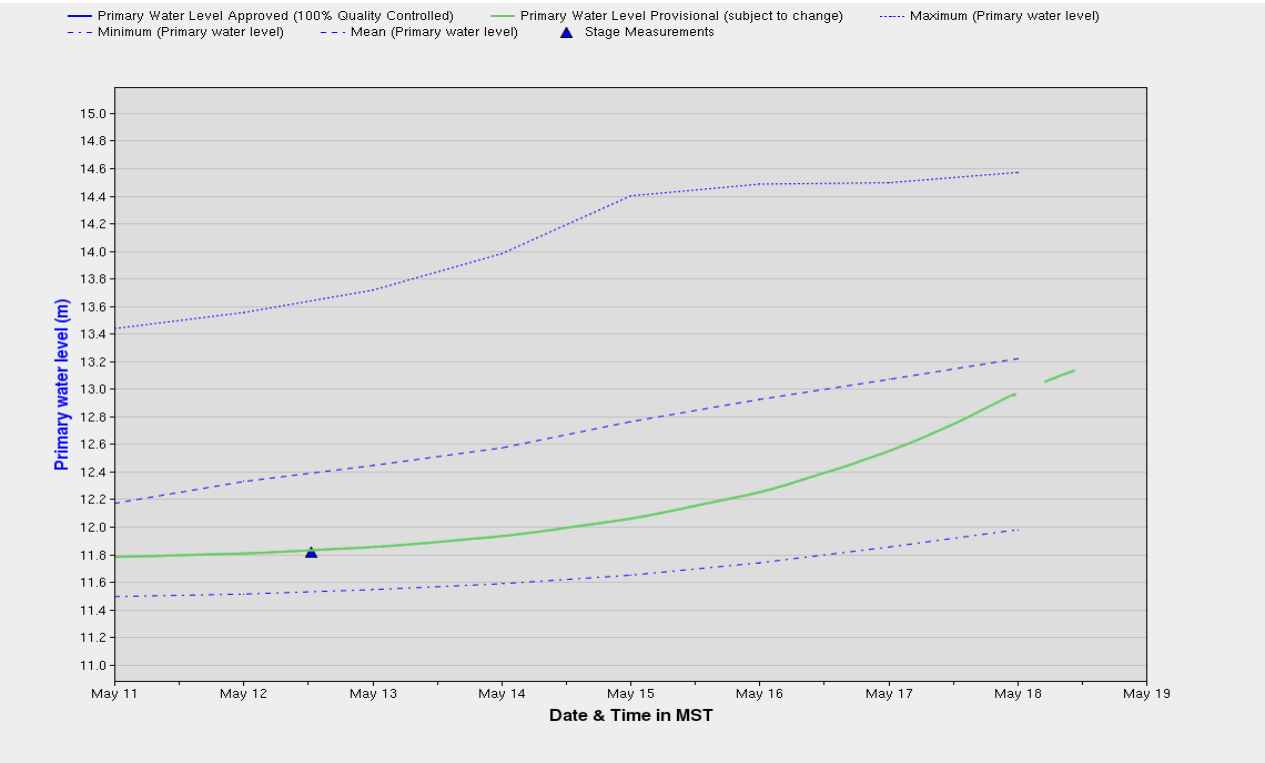


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River (Peel Channel) above Aklavik (10MC003) – Current water level is 12.071m. Average breakup level is between 13-14m occurring sometime between May 25th and 30th.



Mackenzie River (East Channel) at Inuvik (10LC002) - Current water level is 13.132m. Average breakup level is between 12-14m occurring between May 20th and 25th. Please see photos at the end of this report for conditions around Inuvik and East Channel yesterday.



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River (East Channel) at Inuvik – May 17, 2017

Photo Courtesy of Kristian Binder

Mackenzie River at Tulita – May 14, 2017

Photo's Courtesy of Dan St. Jean

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Water Survey of Canada
Suite 400, 5019 – 52 Street
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X1A 2P7

Report for May 19th, 2017

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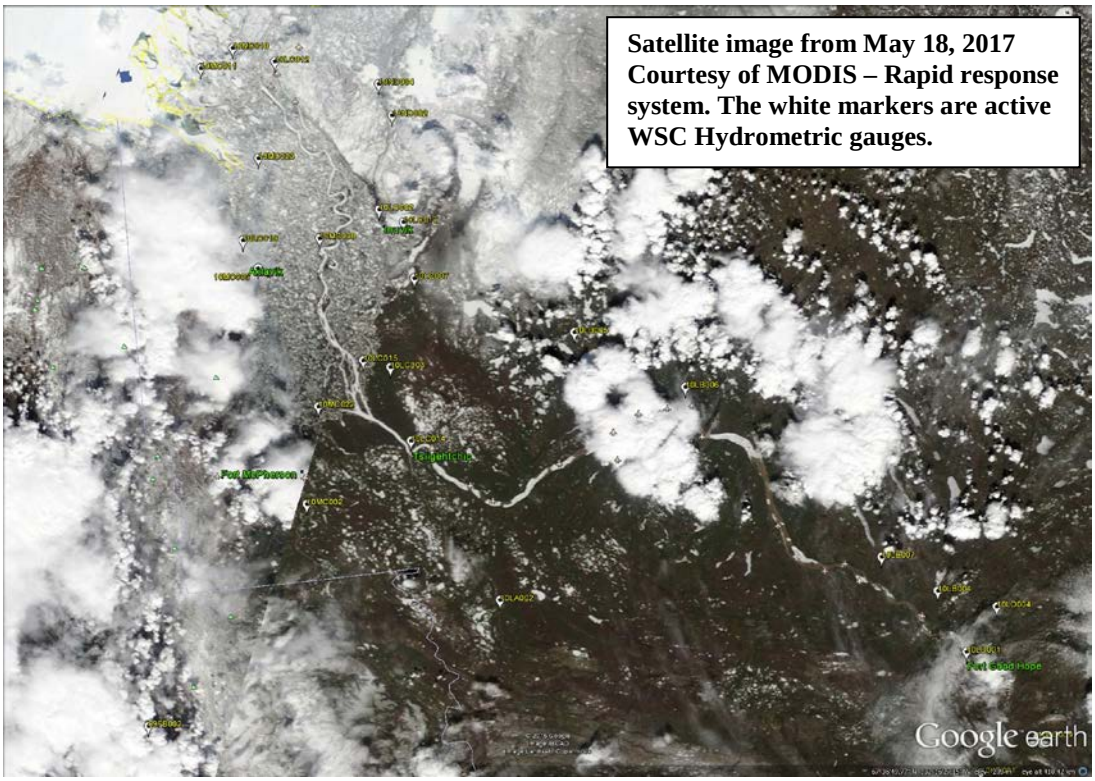
Regional Weather

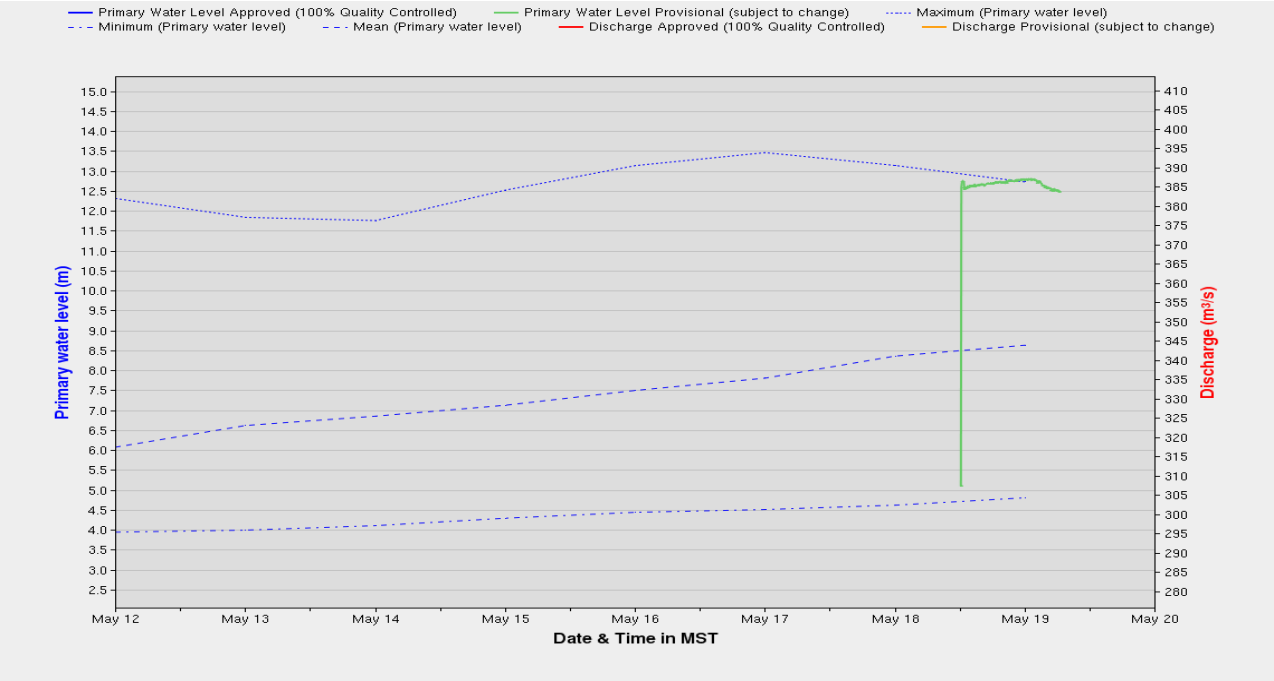
Regional Weather	Today	Saturday	Sunday
North Slave	High +17 /Low +7	High +17 /Low +7	High +17/ Low +9
Deh Cho	High +21/ Low +9	High +23/ Low +11	High +23/ Low +12
Sahtu	High +20/ Low +9	High +20/ Low +8	High +21/ Low +11
Delta	High +11/ Low +5	High +9/ Low 0	High +15/ Low +2



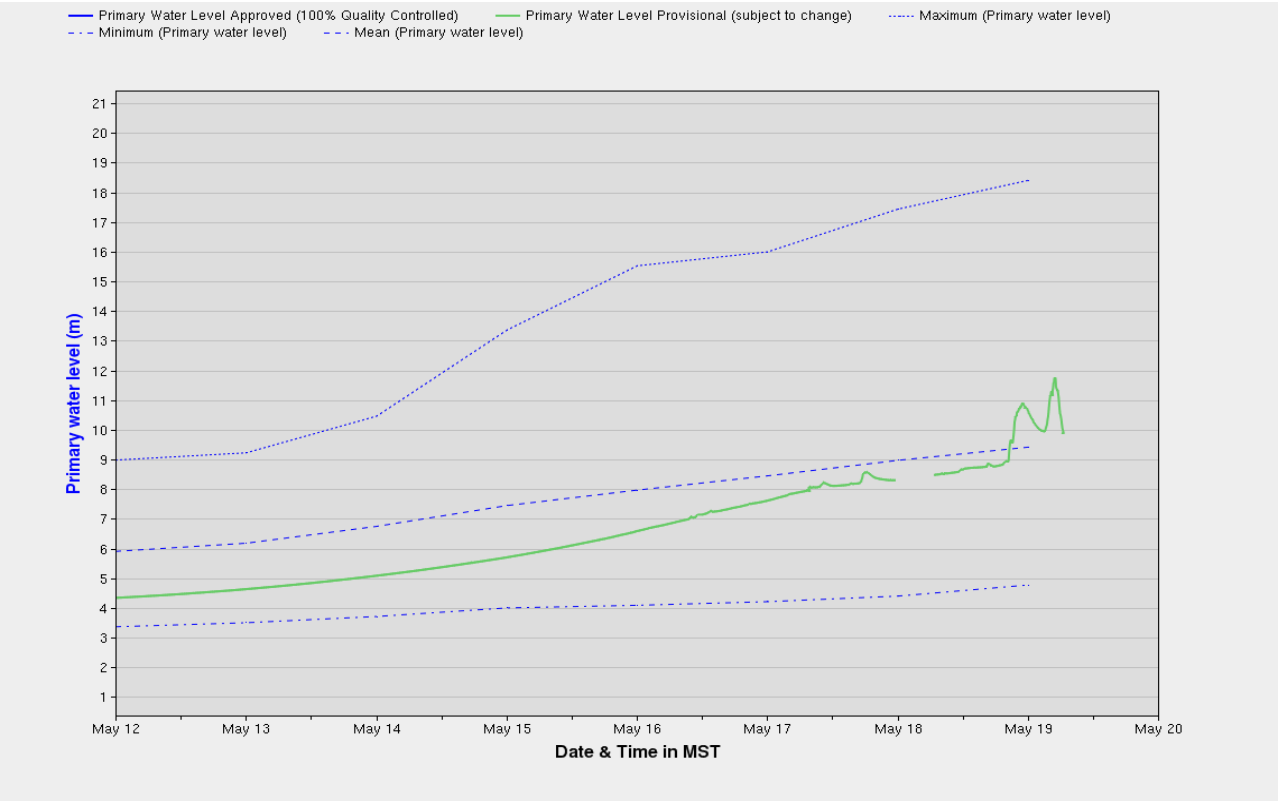
Satellite image from May 18, 2017 Courtesy of MODIS – Rapid response system. The white markers are active WSC Hydrometric gauges.

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Peel River above Fort McPherson (10MC002) – Current water level is 12.448m. Photos of the ice conditions from yesterday can be seen at the end of this report.

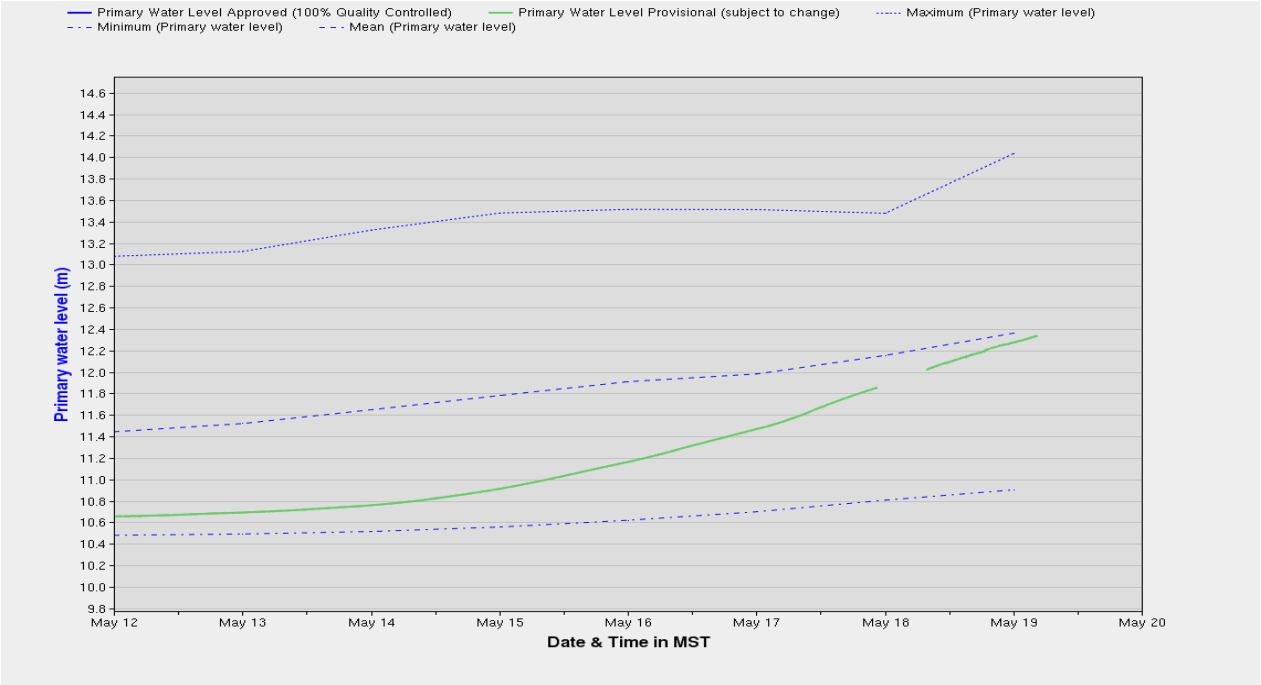


Mackenzie River @ Arctic Red River (10LC014) – Current water level is 10.033m. Average breakup level is between 8-9m occurring around May 18th.

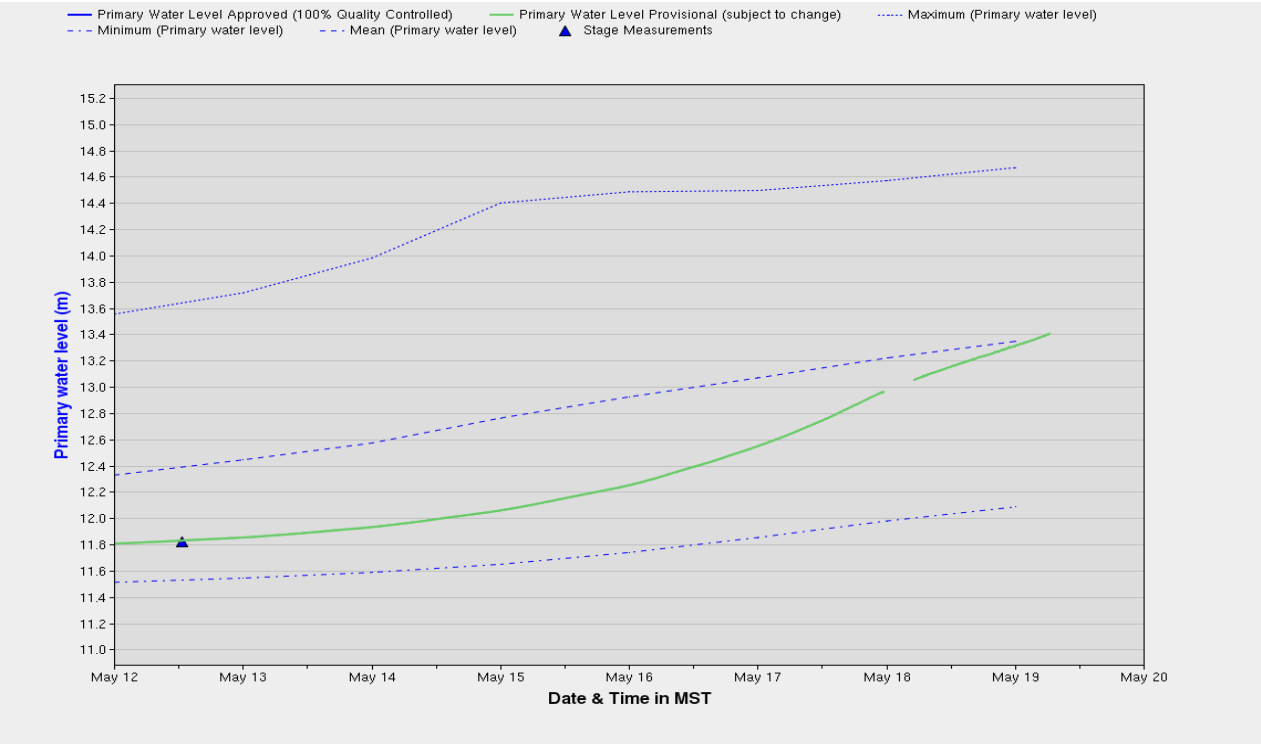


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River (Peel Channel) above Aklavik (10MC003) – Current water level is 12.328m. Average breakup level is between 13-14m occurring sometime between May 25th and 30th.



Mackenzie River (East Channel) at Inuvik (10LC002) - Current water level is 13.406m. Average breakup level is between 12-14m occurring between May 20th and 25th. Please see photos at the end of this report for conditions around Inuvik and East Channel yesterday.



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Peel River above Fort McPherson – May 18, 2017

Photo Courtesy of WSC Staff

Peel River at Frog Creek – May 18, 2017

Photo Courtesy of WSC Staff

Mackenzie River upstream of Arctic Red – May 18, 2017

Photo Courtesy of WSC Staff

Mackenzie River at Confluence of East Channel – May 18, 2017

Photo Courtesy of WSC Staff

Mackenzie River (East Channel) - May 18, 2017

Photo Courtesy of Kristian Binder

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

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Water Survey of Canada
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Yellowknife, NWT
X1A 2P7

Report for May 23rd, 2017

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Regional Weather

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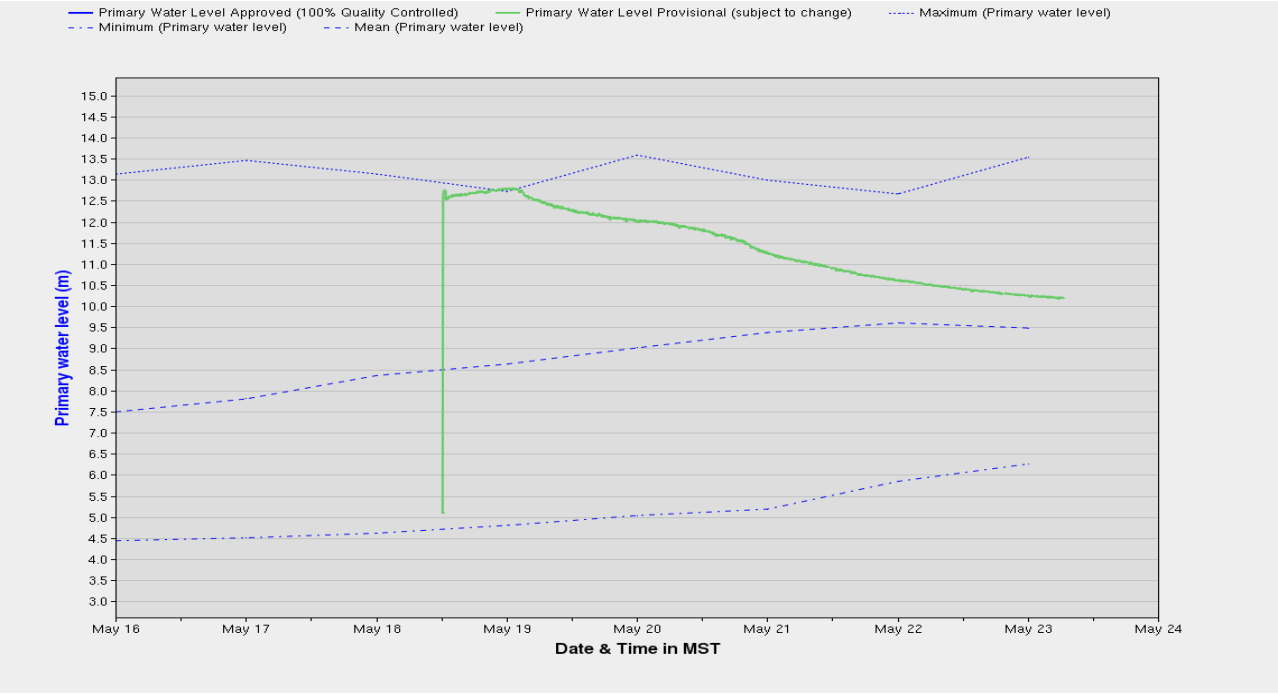
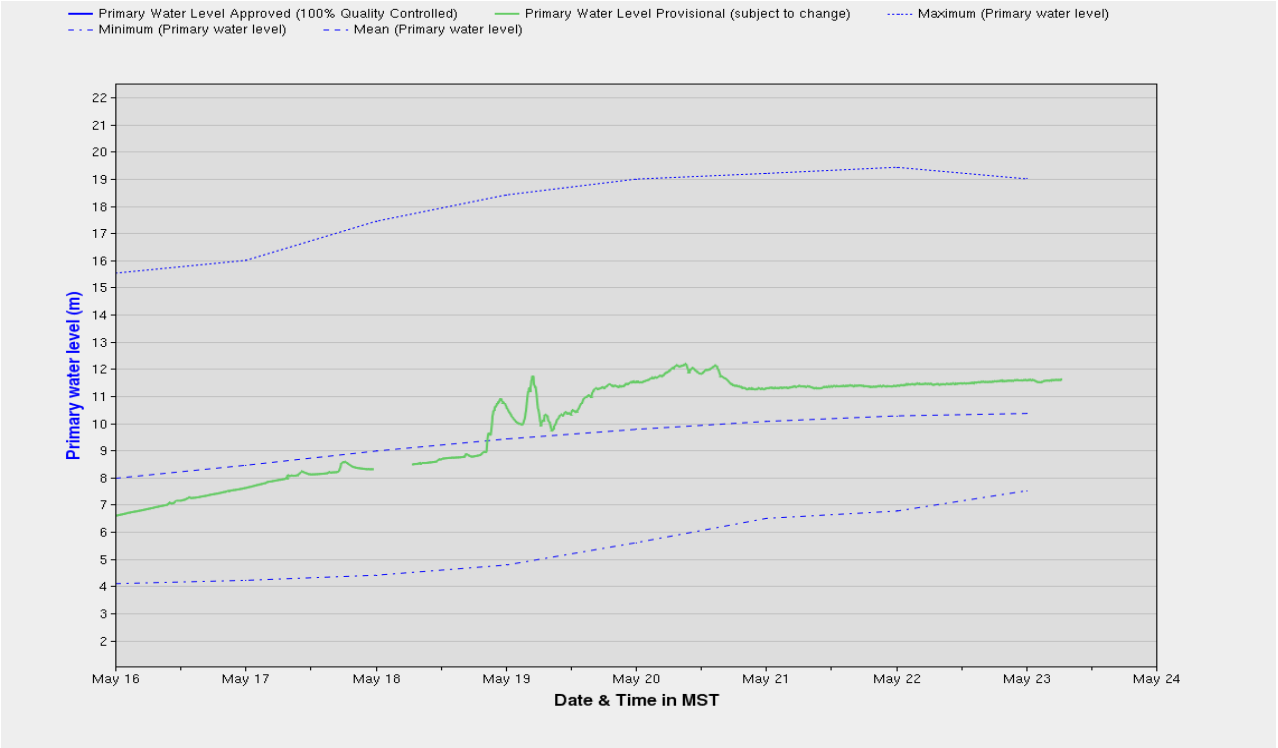
Deh Cho	High +21/ Low +9	High +17/ Low +6	High +23/ Low +9
Sahtu	High +18/ Low +6	High +16/ Low +4	High +20/ Low +8
Delta	High +5/ Low +0	High +11/ Low 3	High +15/ Low +7

Due to cloud cover there is no Satellite image available from yesterday.

Peel River above Fort McPherson (10MC002) – Current water level is 10.206m.

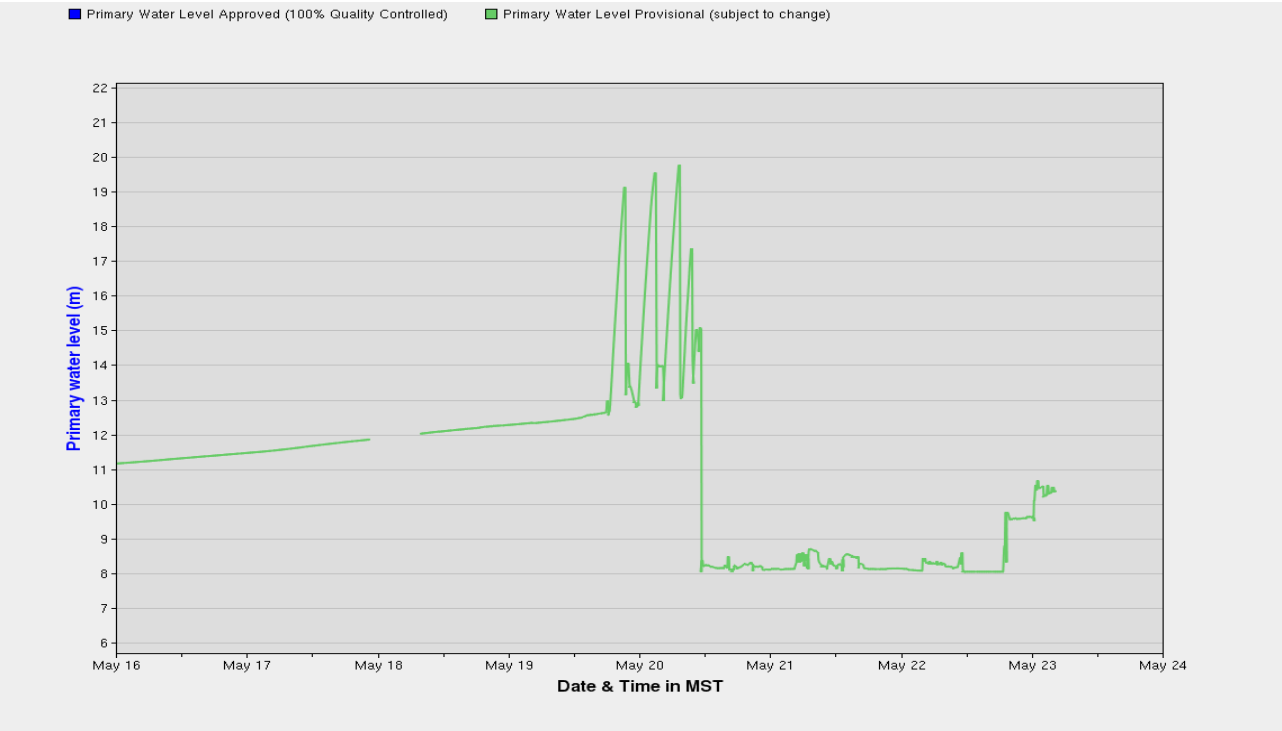


Mackenzie River @ Arctic Red River (10LC014) – Current water level is 11.599m. Average breakup level is between 8-9m occurring around May 18th. A photo from Saturday downstream of Point Separation can be seen at the end of this report.

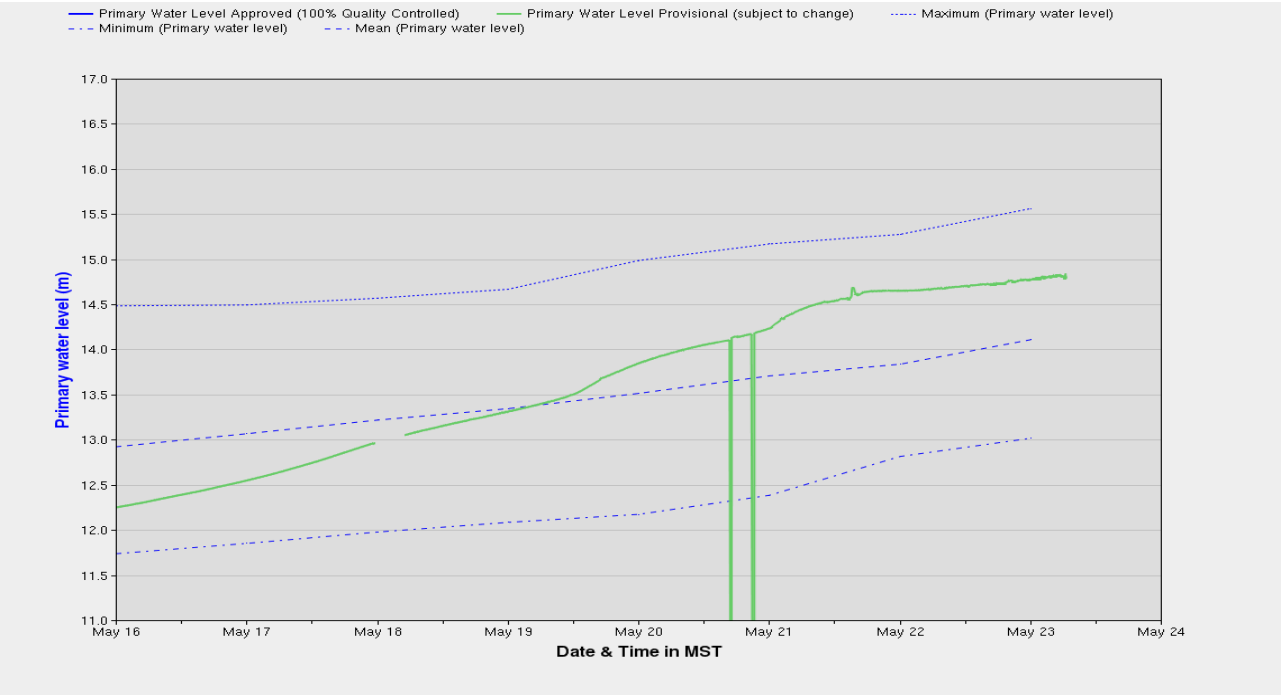


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River (Peel Channel) above Aklavik (10MC003) – Current water level is unavailable. The gauge appears to have been affected by ice. Average breakup level is between 13-14m occurring sometime between May 25th and 30th.



Mackenzie River (East Channel) at Inuvik (10LC002) - Current water level is 14.826m. Average breakup level is between 12-14m occurring between May 20th and 25th. Please see photos at the end of this report for conditions around Inuvik and East Channel over the weekend.



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River downstream of Point Separation – May 20, 2017

Photo Courtesy of Chandra Turner

Mackenzie River East Channel – May 20, 2017

Photo Courtesy of Chandra Turner

Mackenzie River East Channel – May 20, 2017

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

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Environnement

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X1A 2P7

Report for May 24th, 2017

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Regional Weather

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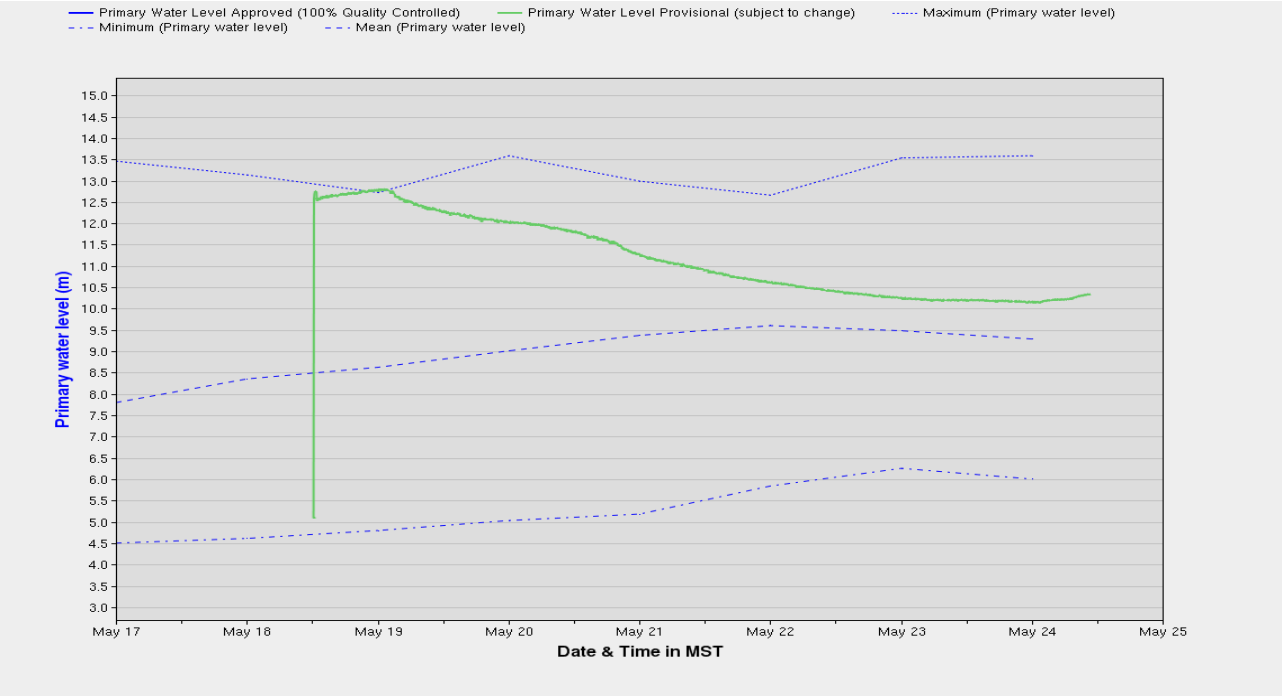
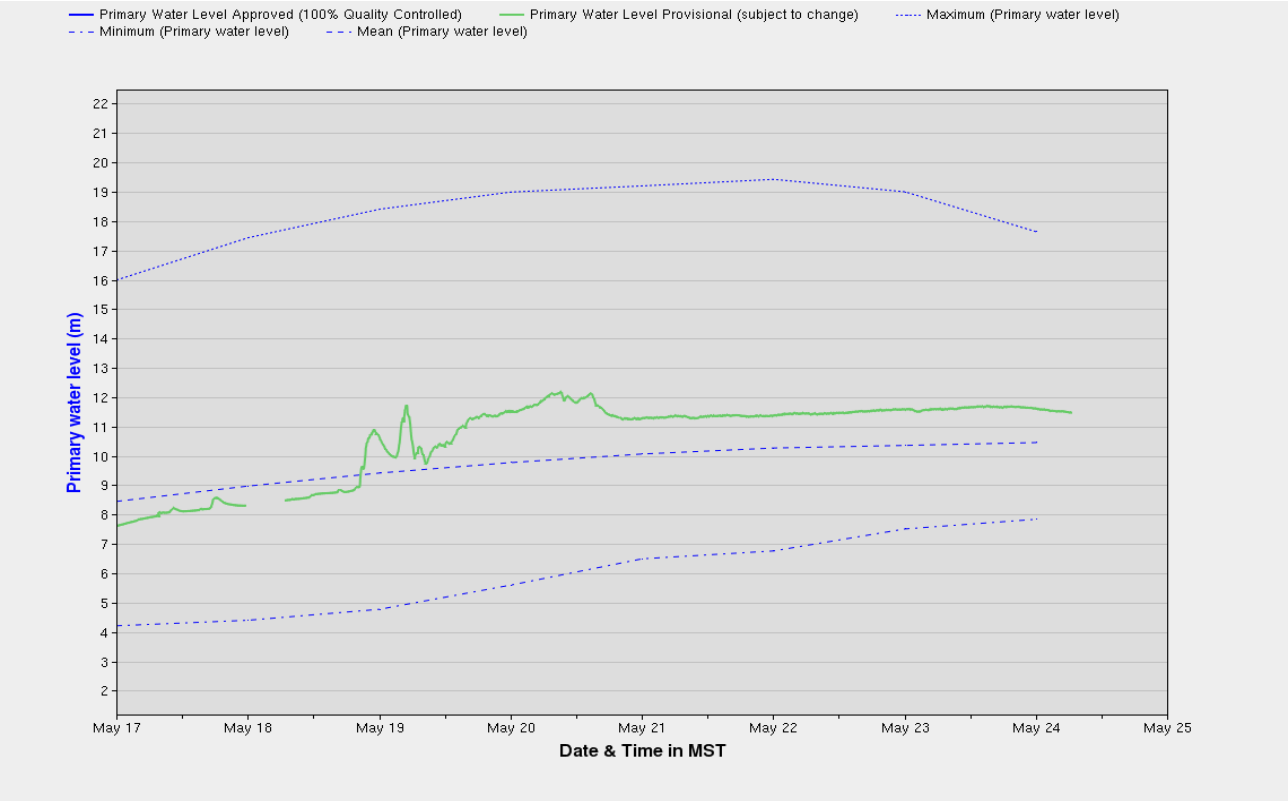
Deh Cho	High +18/ Low +9	High +21/ Low +9	High +26/ Low +10
Sahtu	High +12/ Low +3	High +19/ Low +8	High +16/ Low +6
Delta	High +9/ Low +4	High +16/ Low +3	High +4/ Low 0

Due to cloud cover there is no Satellite image available from yesterday.

Peel River above Fort McPherson (10MC002) – Current water level is 10.346m.

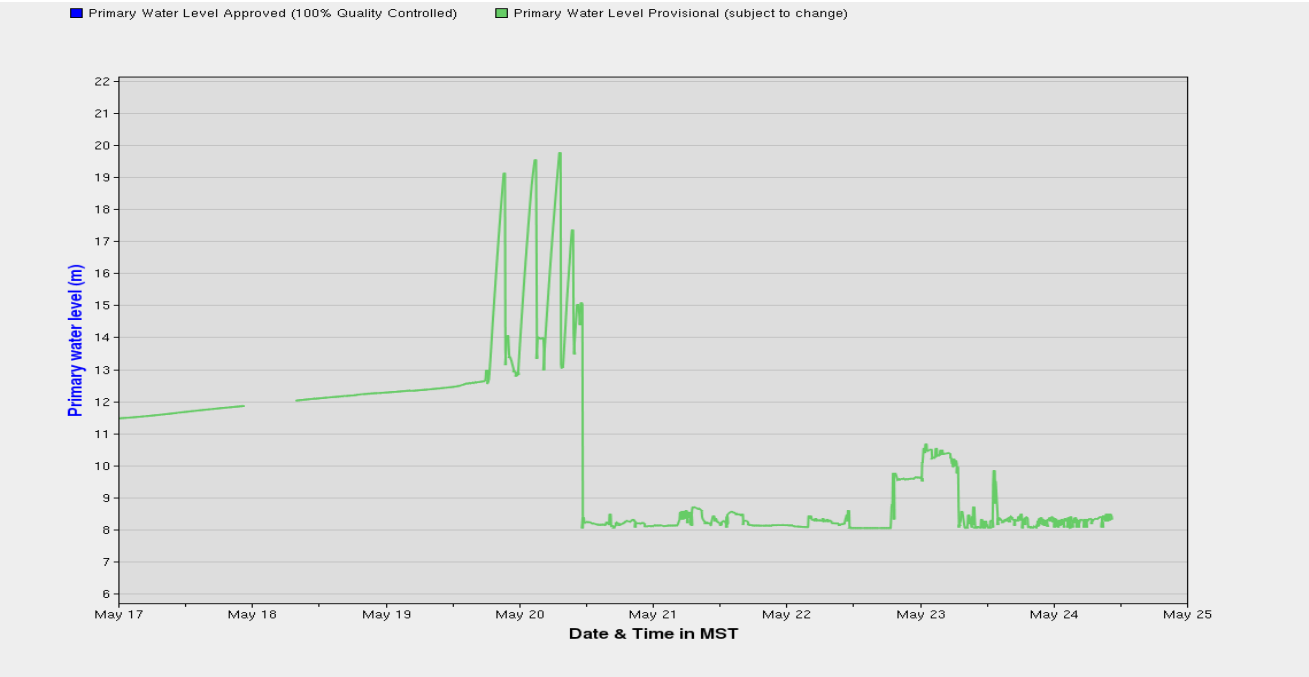


Mackenzie River @ Arctic Red River (10LC014) – Current water level is 11.468m.

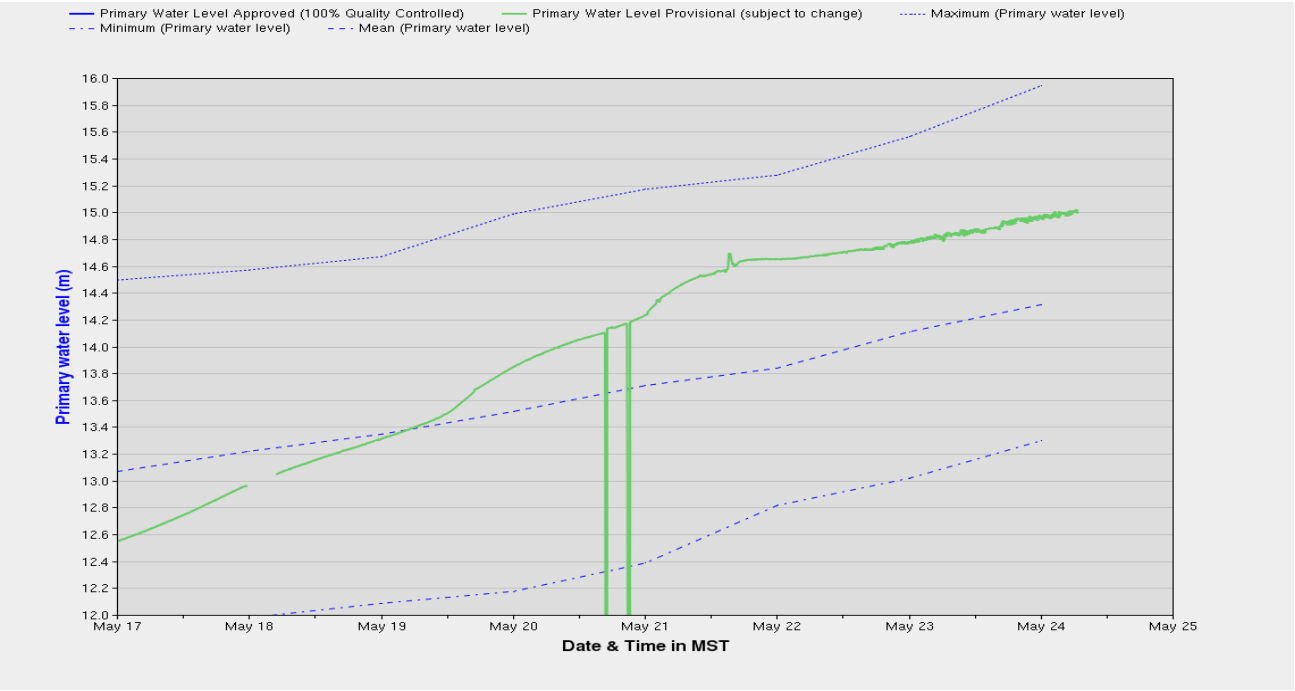


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River (Peel Channel) above Aklavik (10MC003) – Current water level is unavailable. The gauge appears to have been affected by ice. Average breakup level is between 13-14m occurring sometime between May 25th and 30th. See Photo from Monday at the end of this report.



Mackenzie River (East Channel) at Inuvik (10LC002) - Current water level is 14.992m. Average breakup level is between 12-14m occurring between May 20th and 25th. Please see photo at the end of this report for conditions around Inuvik and East Channel.



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River (Peel Channel) at Aklavik – May 22, 2017

Photo Courtesy of Jessie Pascal

Mackenzie River (east Channel) at Inuvik – May 23, 2017

Photo Courtesy of Kristian Binder

Environment Canada
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Report for May 25th, 2017

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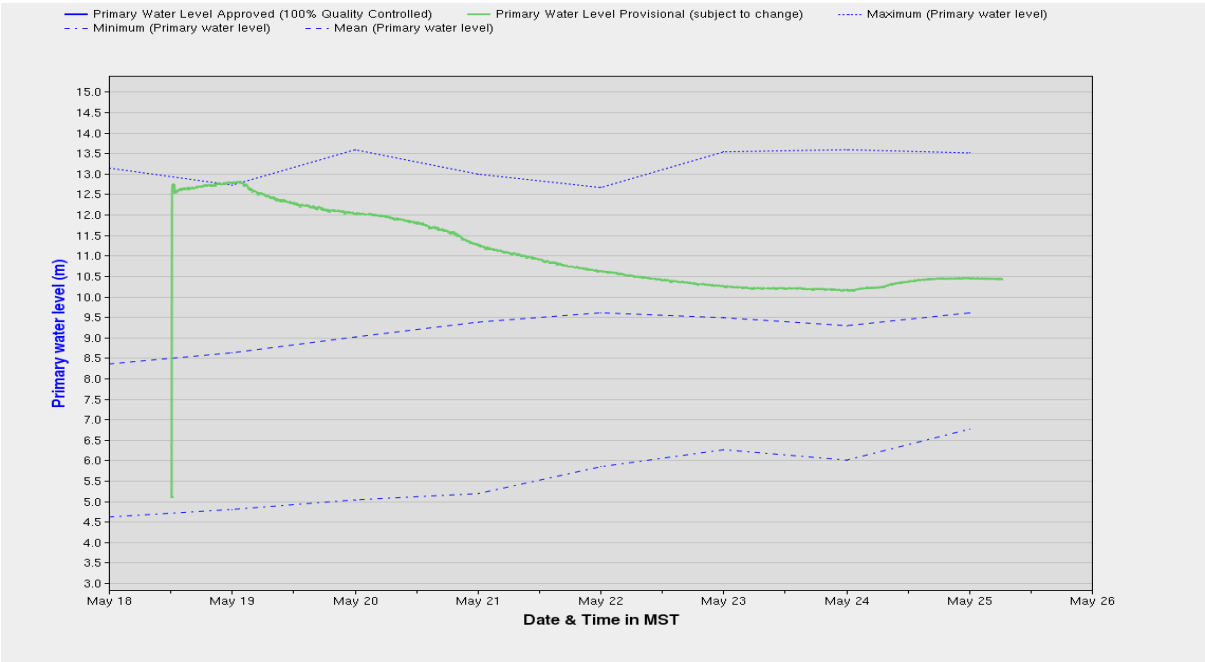
Regional Weather

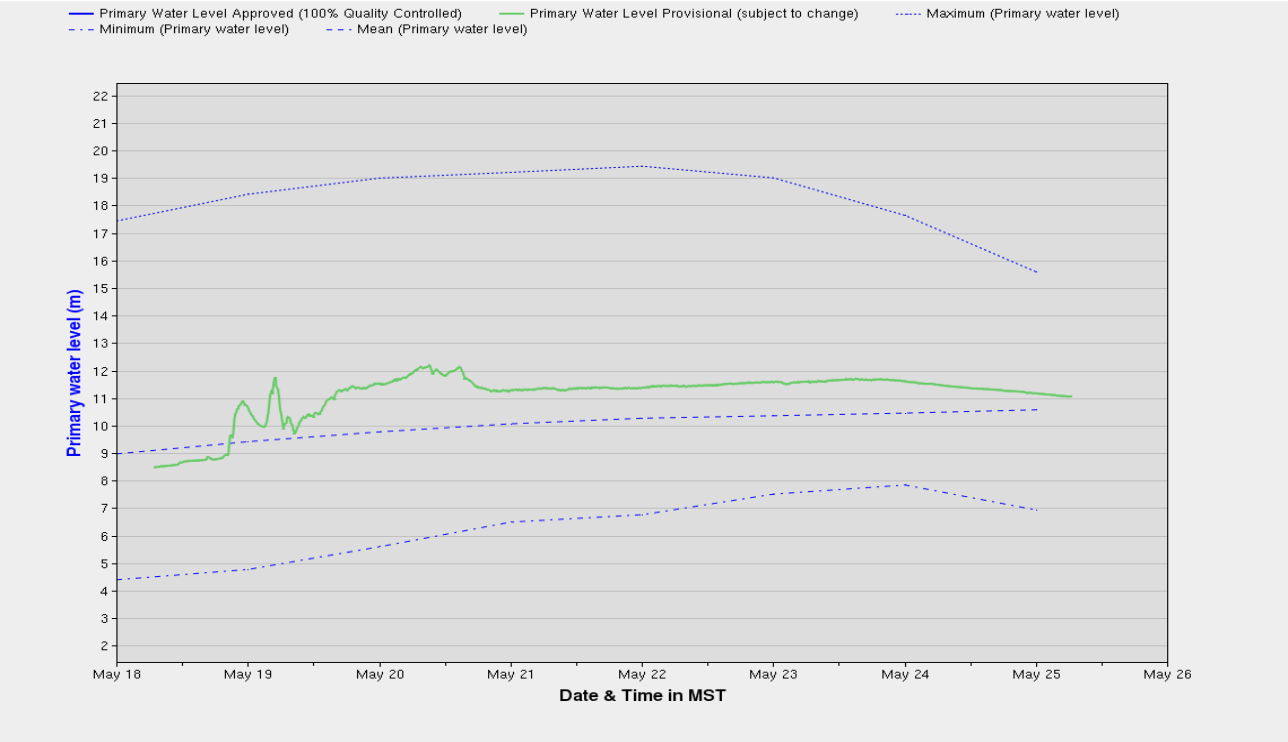
Regional Weather	Today	Friday	Saturday
North Slave	High +12 /Low +5	High +15 /Low +8	High +15/ Low +4
Deh Cho	High +23/ Low +11	High +25/ Low +9	High +21/ Low +8
Sahtu	High +19/ Low +10	High +13/ Low +3	High +14/ Low +2
Delta	High +14/ Low +2	High +3/ Low -1	High +5/ Low -3

Peel River above Fort McPherson (10MC002) – Current water level is 10.423m.

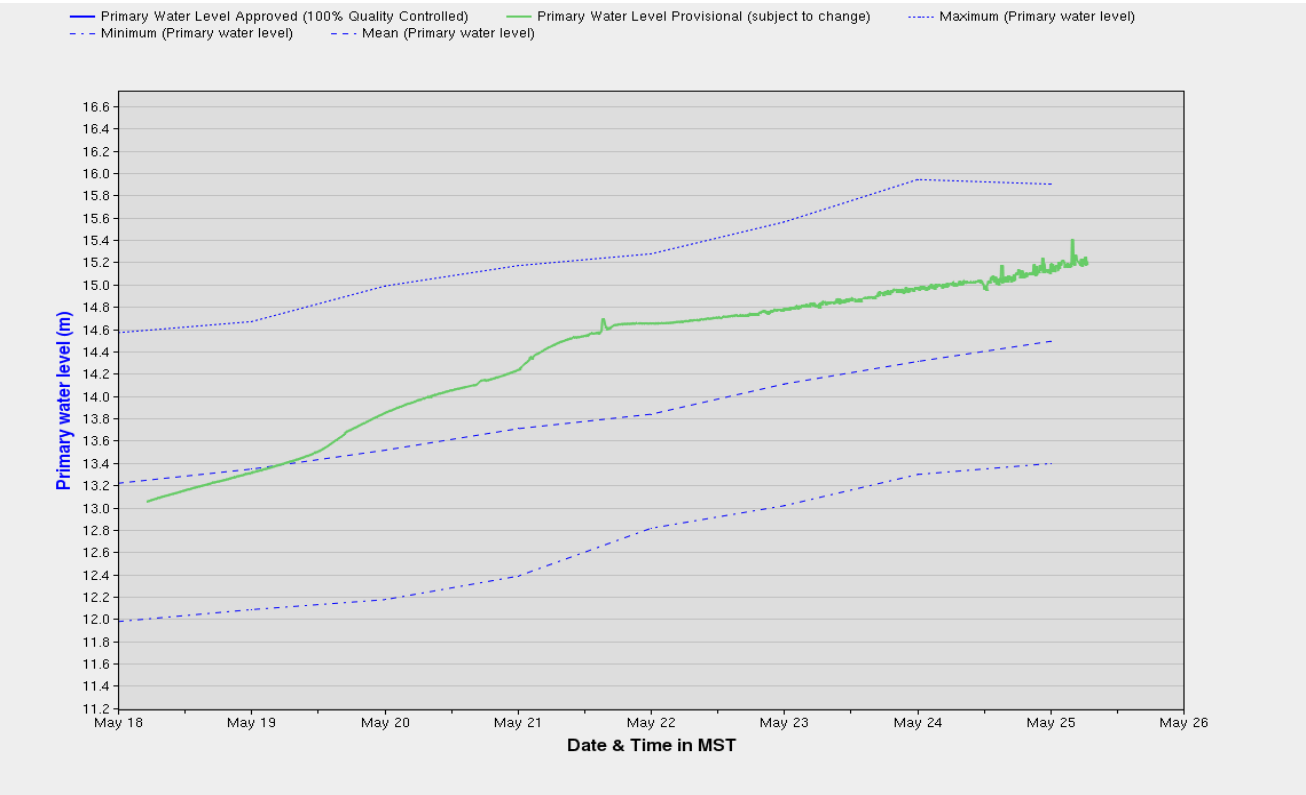


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

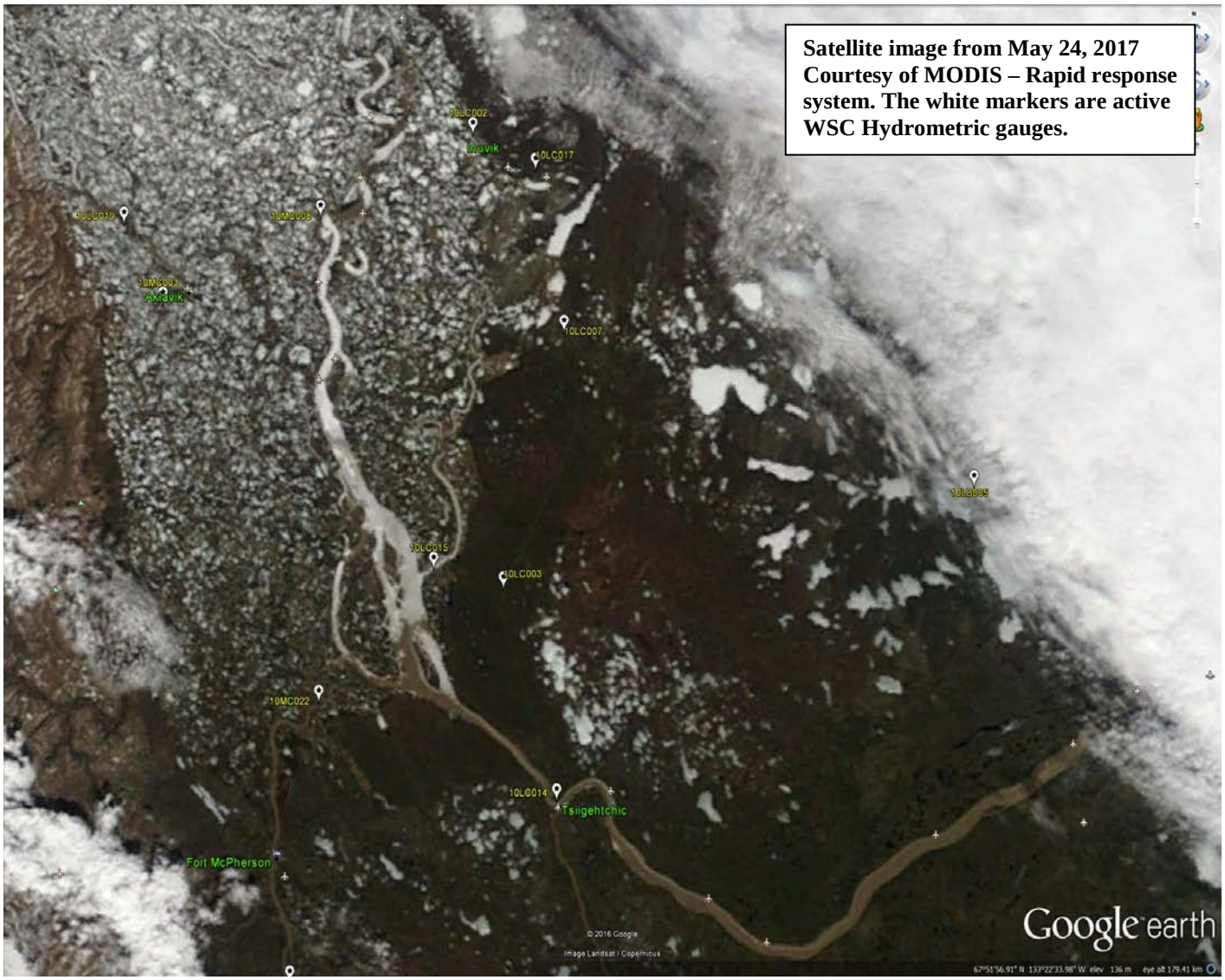
Mackenzie River @ Arctic Red River (10LC014) – Current water level is 11.056m.



Mackenzie River (East Channel) at Inuvik (10LC002) - Current water level is 15.177m. A short video can be seen on the Mackenzie-Beaufort breakup Facebook page of the ice conditions from yesterday. https://www.facebook.com/groups/1745524288993851/



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada



Satellite image from May 24, 2017 Courtesy of MODIS – Rapid response system. The white markers are active WSC Hydrometric gauges.

High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Environment Canada
Environnement

Water Survey of Canada
Suite 400, 5019 – 52 Street
Yellowknife, NWT
X1A 2P7

Report for May 26th, 2017

This will be the last report for the 2017 season. The information presented is reported by Water Survey of Canada (WSC) staff in Ft. Simpson, Inuvik, Yellowknife, and numerous contacts in various communities. Their contributions are gratefully acknowledged. If you have any comments or do not wish to receive further reports, please contact WSC at (867) 669-4774 or FAX (867) 669-4750.

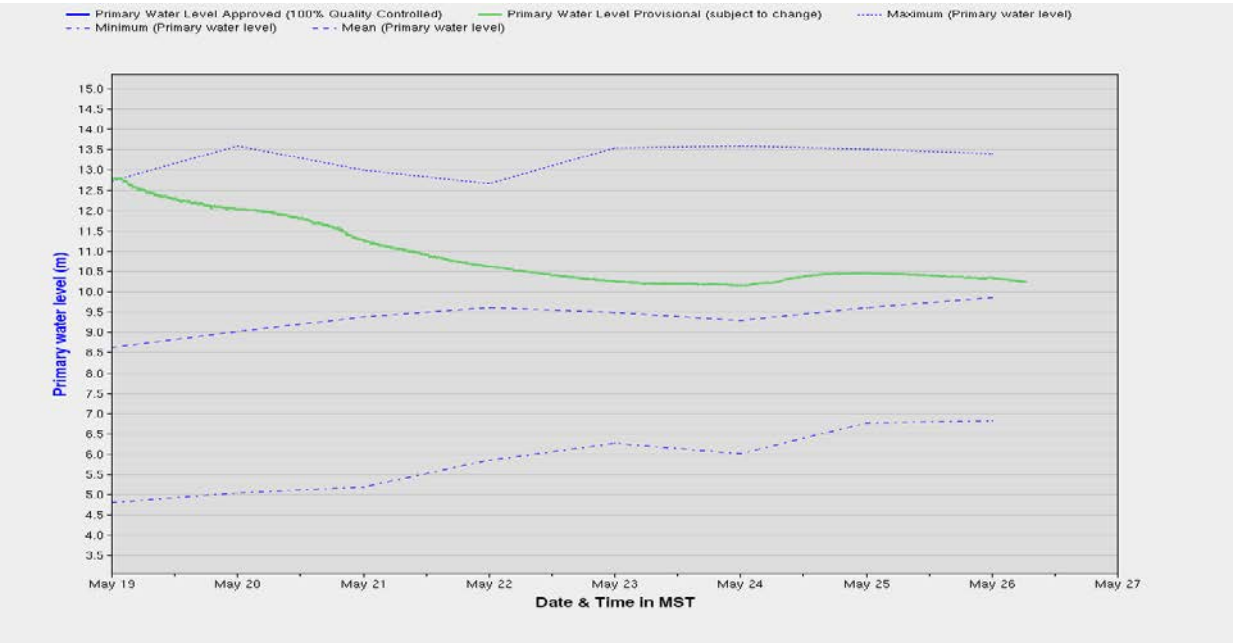
For additional breakup information on the Mackenzie River and the Delta region, please check out the link below to this Facebook group created by the folks at NRCAN. It contains lots of great photos, videos and information posted by local observers.
https://www.facebook.com/groups/1745524288993851/

In addition to the Facebook group they also produce a breakup newsletter for the Mackenzie Delta and Beaufort region which can now be found online through the following link
https://www.caccon.org/mackenzie-beaufort-break-up-newsletter/

Regional Weather

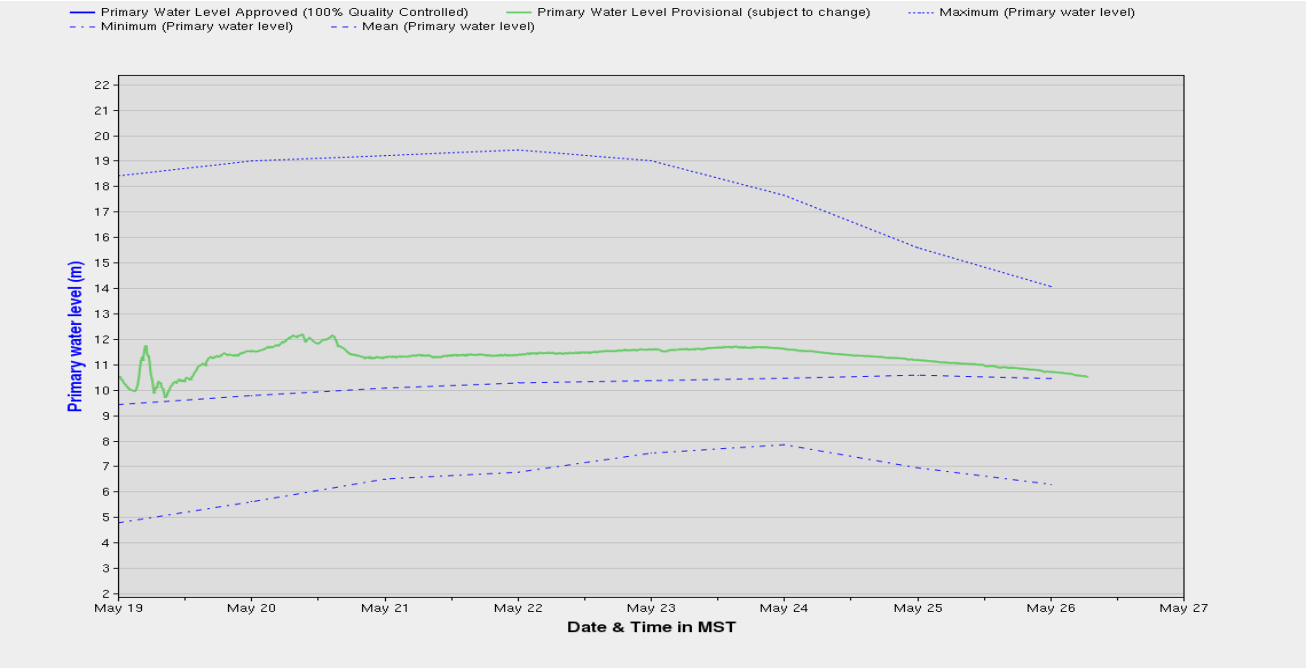
Regional Weather	Today	Saturday	Sunday
North Slave	High +14 /Low +8	High +14 /Low +5	High +17/ Low +7
Deh Cho	High +24/ Low +7	High +22/ Low +8	High +24/ Low +12
Sahtu	High +14/ Low +5	High +16/ Low +5	High +21/ Low +12
Delta	High +5/ Low 0	High +8/ Low +2	High +14/ Low +7

Peel River above Fort McPherson (10MC002) – Current water level is 10.229m.

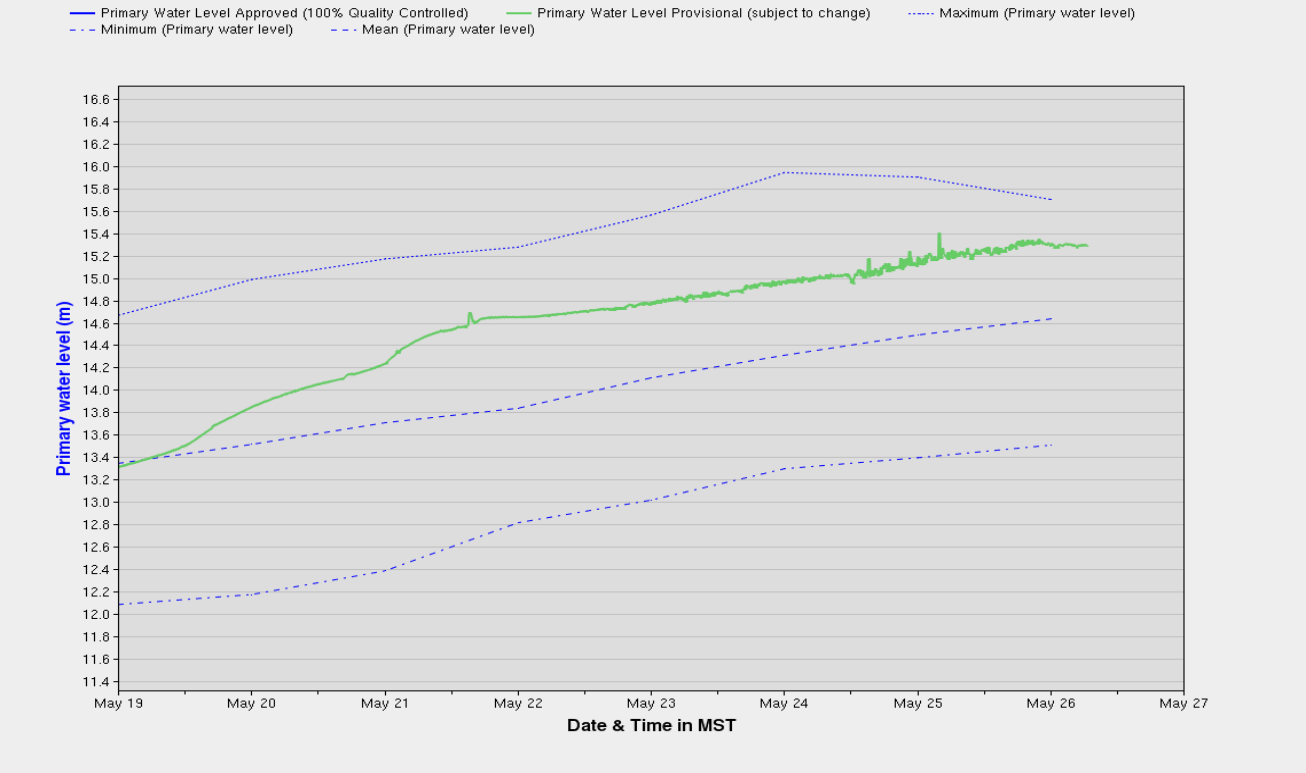


High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River @ Arctic Red River (10LC014) – Current water level is 10.519m.



Mackenzie River (East Channel) at Inuvik (10LC002) - Current water level is 15.295m. See photo of ice conditions from Wednesday at the end of this report.



High Water reports will be made available as conditions dictate.
Prepared by: Angus Pippy, Water Survey of Canada

Mackenzie River (East Channel) at Inuvik – May 24, 2017

This photo was first posted in yesterday's Mackenzie-Beaufort ice breakup newsletter courtesy of Ellen Lea

Appendix B. Bathymetric Survey Equipment

SURVEY LAUNCH

The survey launches and boat captains for this project were supplied by Imperial. The primary launch (Boat 1) is a 7.3 m aluminum vessel equipped with a 250 hp, 4 stroke Suzuki motor equipped with a propeller (Image J).

Image J: Primary Survey Vessel (Imperial Boat 1)

The survey launch was equipped with the required survey gear and all instruments were interfaced into a central control platform running Hypack navigation and control software (Image K and L).

Image K: Survey Gear

Image L: Survey Gear Inside of Boat 1

In order to survey the river bottom in the shallower water areas between Goose Island, Artificial Islands 3 and 4, and between Bear Island and Island 6, a shallow draft 10.5' inflatable boat was used. The small light weight vessel was well suited for the task and easily transported the WSP crew, Imperial captain, and single beam echo sounder and RTK GPS (Image M).

Image M: 10.5' inflatable boat (Boat 2)

In 2016, the R2Sonic 2020 multibeam system was used for the bathymetric survey at Norman Wells. The high frequency of the R2Sonic 2020 allows for accurate and clean data. In order to accommodate the multibeam system a revised fixed mount was fabricated in 2015. Offsets for the bathymetric sensors including the multibeam, IMU, and GPS antennas were accurately measured using conventional survey technology.

NAVIGATION AND POSITIONING

The GPS RTK (Real Time Kinematic) system utilized for the survey consisted of two Leica dual frequency geodetic quality receivers. The system also included a Pacific Crest radio system consisting of a 35 watt base radio and a rover radio. This system provided real-time horizontal and vertical accuracy to tolerances of 10 mm horizontally and 15 mm vertically.

The base receiver and radio gear were set up on a known control point (control point #7009) in the vicinity of the work area.

Northing = 7,241,611.945
Easting = 599,645.968
Elevation (Geodetic) = 51.668m

SONAR SYSTEM

The R2Sonic is a high quality multibeam sonar capable of producing very dense and accurate bathymetric data. Some of the key features of the R2Sonic 2020 are as follows:

- Over 20 x user selectable frequencies from 200 to 400 kHz
- Focused 1° x 1° beam widths
- 60 kHz signal bandwidth over entire frequency range
- True range resolution of 1.25 cm at all frequencies
- Selectable swath coverage from 10° to 160°
- 1 to 100 meter range

The effective swath width of the R2Sonic system is approximately 3 or 4 times the depth of water. The deeper the water, a larger footprint of the river bottom is covered during any one pass.

In addition to the R2Sonic, a 200 kHz Knudsen 1620 single beam echo sounder was used to survey the shallow waters atop the Goose to Island 3, Goose to Island 4, and Bear to Island 6 flowline bundles. The sounder and the GPS RTK were connected to Hypack software for navigation and data acquisition.

MOTION REFERENCE UNIT

The Applanix Pos MV is considered the highest rated MRU on the market today. This motion reference unit is the ‘benchmark’ for which all MRU’s are compared to. The manufacturer’s claimed accuracy is:

- Roll, Pitch Accuracy 0.02°
- Heading accuracy 0.02°
- Velocity accuracy 0.03m/sec

CALIBRATION, ACCURACY AND DATA VALIDATION

The sonar system must be calibrated for roll, pitch and yaw and the calibration values are entered in the Hypack software. Prior to or during the survey activity, the vessel proceeds to an area where there is both a flat seabed and a rapidly changing seabed to accommodate the 'patch' tests. A preset, pre-configured set of procedures are conducted to gain the calibration values which are used for the remainder of the day.

The accuracy of the final elevations from sounding data is dependent on several factors including:

- the accuracy of the sounder hardware
- speed of the survey launch
- attitude of the survey launch
- river current at time of survey
- wind at time of survey

The digital data produced during the survey was reviewed and checked prior to leaving Norman Wells. It was important to check the quality of the sounding data before leaving the field in case of poor or missing data that would have to be re-surveyed.

Appendix C. Bathymetric Drawings (2017)

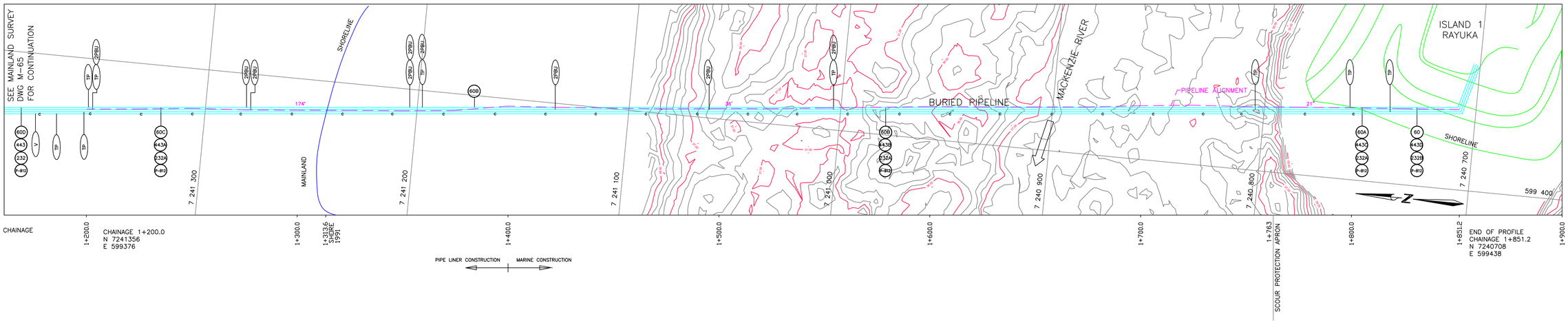
The following bathymetric survey plans were produced:

Table C: List of Bathymetric Survey Drawings

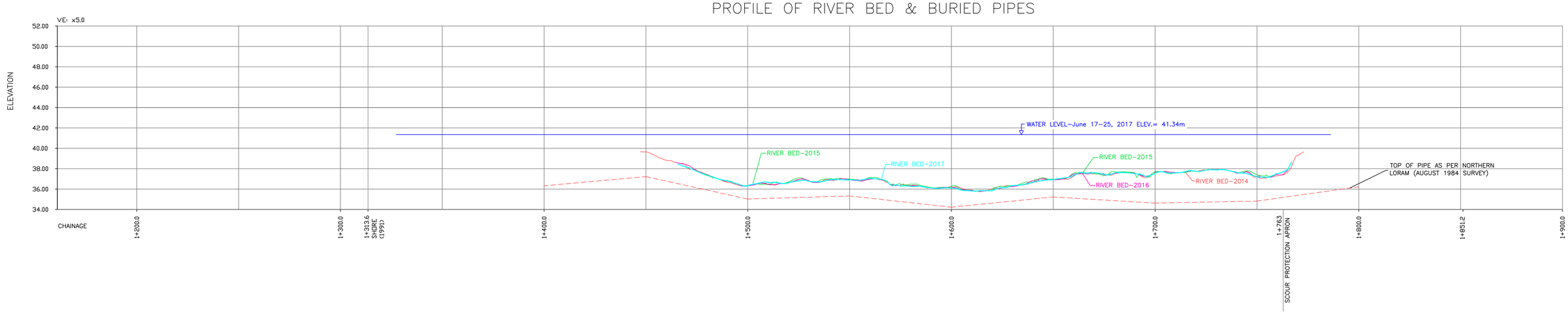
Location	Drawing Number
Island 1 to Mainland flowline	096-0179-700-801 71
Island 2 to Mainland flowline	096-0179-700-801 72
Island 3 to Goose Island flowline	096-0179-700-801 73
Island 3 to Mainland flowline	096-0179-700-801 74
Island 4 to Goose Island flowline	096-0179-700-801 75
Island 5 to Bear Island flowline	096-0179-700-801 76
Island 6 to Bear Island flowline	096-0179-700-801 77
Bear Island to Goose Island flowline	096-0179-700-801 78
Island 1 and surrounding area	096-0179-700-801 79
Island 2 and surrounding area	096-0179-700-801 80
Island 3 and surrounding area	096-0179-700-801 81
Island 4 and surrounding area	096-0179-700-801 82
Island 5 and surrounding area	096-0179-700-801 83
Island 6 and surrounding area	096-0179-700-801 84
River Bed and Island Contours	096-0179-700-801 86
Mainland Dock Area	096-0179-700-801 87
Bear Island to Goose Island Causeway	096-0179-700-801 89

CADD DRAWING NO MANUAL CHANGES | AutoCAD | 096-0179-700-801 71

PIPELINE ALIGNMENT



PROFILE OF RIVER BED & BURIED PIPES



SURVEY CONTROL

No.	DESCRIPTION	NORTHING	EASTING	ELEV.
1000	REBAR @ N.E. OF ISL. 1	7240711.75	599540.89	
1004	REBAR @ N.W. OF ISL. 1	7240729.21	599459.90	
2	REBAR @ N.E. OF ISL. 2	7240301.75	600511.43	
2001	REBAR @ N.W. OF ISL. 2	7240324.34	600431.97	
27	REBAR @ N.W. OF ISL. 3	7240741.90	597423.38	
3000	REBAR @ N.E. OF ISL.3	7240716.18	597500.36	
26	REBAR @ N.W. OF ISL. 4	7240387.54	598100.08	
4000	REBAR @ N.E. OF ISL. 4	7240361.98	598175.94	
22	REBAR @ N.W. OF ISL. 5	7240016.98	598734.63	
5000	REBAR @ N.E. OF ISL. 5	7239993.12	598815.14	
21	REBAR @ N.W. OF ISL. 6	7239631.84	599382.56	
6000	REBAR @ N.E. OF ISL. 6	7239616.68	599465.79	

SUBSTANCE DESCRIPTION

No.	SUBSTANCE DESCRIPTION
	MULTIPHASE LIQUIDS
60	168.3 OE Is.1 to L.P.T.1, Glycol H.T. 60-60A
60A	168.3 OE Is.1 to L.P.T.1, Glycol H.T., Conc Coated 60-60A-60B
60B	168.3 OE Is.1 to L.P.T.1, Conc Coated 60-60A-60B-60C
60C	168.3 OE Is.1 to L.P.T.1, Dbl Sect H.T., Conc Coated 60-60A-60B-60C-60D M-75,65,55 H.T.261
60D	168.3 OE Is.1 to L.P.T.1, Sng Sect H.T. 60-60A-60B-60C-60D-L.P.T.1 M-75,65,55 H.T.261
	GASLIFT
232	88.9 NG (Gas Lift) L.P.T.1 to Is.1 (Buried) 232-232A M-55,65,64
232A	88.9 NG (Gas Lift) L.P.T.1 to Is.1 (Conc Coated) 232-232A-232B M-55,65,64
232B	88.9 NG (Gas Lift) L.P.T.1 to Is.1 (Buried) 232-232A-232B-L.P.T.1
	INJECTION WATER
443	88.9 INJ-SW L.P.T.1 to Is.1, Sng Sect H.T., Liner 443-443A M-55,65,75 H.T.262
443A	88.9 INJ-SW L.P.T.1 to Is.1, Dbl Sect H.T., Conc Coated, Liner 443-443A-443B M-55,65,75 H.T.262
443B	88.9 INJ-SW L.P.T.1 to Is.1, Conc Coated, Liner 443-443A-443B-443C
443C	88.9 INJ-SW L.P.T.1 to Is.1, Glycol H.T., Conc Coated, Liner 443-443A-443B-443C-443D
443D	88.9 INJ-SW L.P.T.1 to Is.1, Glycol H.T., Liner 443-443A-443B-443C-443D-L.P.T.1
	ELECTRICAL DESCRIPTION
P-B12	4160 H.V. From FS-15KV Switch Gear to Is.1 TR-B7 M-55,65,75

PROFILE ALIGNMENT COORDINATES

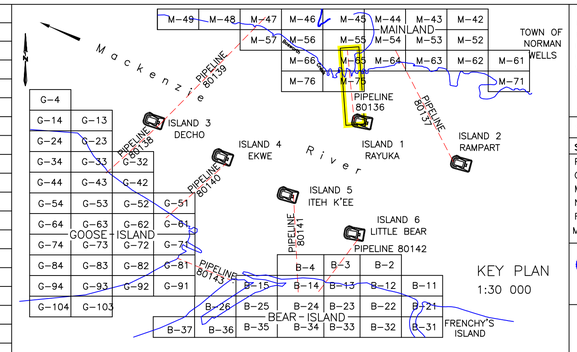
EASTING	NORTHING	
599376.000	7241356.000	START CHAINAGE 1+200.000
599378.450	7241330.830	
599381.120	7241306.470	
599382.783	7241280.956	
599385.000	7241256.880	
599387.300	7241231.860	
599389.510	7241207.170	
599391.970	7241182.390	
599396.470	7241157.620	
599398.220	7241132.800	
599402.340	7241083.120	
599404.860	7241058.020	
599407.190	7241033.180	
599409.890	7241008.400	
599415.390	7240958.570	
599417.640	7240933.640	
599419.980	7240908.890	
599422.370	7240884.060	
599425.310	7240858.970	
599428.020	7240833.790	
599429.700	7240809.420	
599431.820	7240784.450	
599435.910	7240734.650	
599438.000	7240708.000	END CHAINAGE 1+851.2

Alignment includes Winter 1997 pipe locating data.

NOTES

1. RIVER BOTTOM PROFILE FROM 2017 BATHYMETRIC SURVEY PERFORMED JUNE 17 TO JUNE 25, 2017.
2. PIPE PROFILE AND CHAINAGES FROM ESSO DWG. 80054 REV. 8 – TOP OF PIPE AS PER NORTHERN LORAM
   (TOP OF PIPE PROFILE ELEVATION REDUCED 0.776m IN 2008)
3. HORIZONTAL DATUM : NAD27 (SHORAN) – UTM GRID/CM = 129°
4. VERTICAL DATUM – GEODETIC BM 74T016 ELEVATION 60.189
5. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL
6. CONTOUR INTERVAL = 0.25 METRES.

2014 RIVER BED PROFILE SHOWN AS
2015 RIVER BED PROFILE SHOWN AS
2016 RIVER BED PROFILE SHOWN AS
2017 RIVER BED PROFILE SHOWN AS



LEGEND

UTILIDORS SHOWN
ROADS SHOWN
BURIED PIPES SHOWN
BELOW GROUND POWER,TELEPHONE, & COMMUNICATION SHOWN — c — c
VENT SHOWN — V
TRANSITION POINT — TP
PULL BOX SHOWN — PBU
PULL POINT SHOWN — P.P.
PIPE O/S DIA.'S ARE IN MILLIMETERS AND DECIMALS THEREOF

SUBSTANCE/CATEGORY CROSS REFERENCE

SUBSTANCE	CODE	SUBSTANCE	CODE
PROPANE/BUTANE	HV	PRODUCED WATER	SW
CRUDE OIL	CO	FRESH WATER	FW
MULTIPHASE FLUIDS	OE	INJECTION (SW)	INJ-SW
NATURAL/LIFT GAS	NG	INJECTION (FW)	INJ-FW
FUEL GAS	FG	ABANDONED	ABAN
MISCELLANEOUS LIQUIDS	ML	MISCELLANEOUS GASES	MG

Esso Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES
MAINLAND TO ISLAND 1
SURVEY DRAWING

No.	REVISION	No.	REVISION	No.	REVISION	No.	REVISION
6	ADDED 1996 BOTTOM PROFILE JULY 1996: UMA GEOMATICS	6	ADDED 2002 BOTTOM PROFILE AUG. 2002: UMA GEOMATICS	6	ADDED 2009 BOTTOM PROFILE JUNE 2009: MMM Geomatics	6	ADDED 2015 BOTTOM PROFILE AUG. 2015: WSP
5	ADDED 1995 BOTTOM PROFILE JUNE 1995: UMA GEOMATICS	5	ADDED 2001 BOTTOM PROFILE AUG 2001: UMA GEOMATICS	5	ADDED 2008 BOTTOM PROFILE JUNE 2008: MMM Geomatics	5	ADDED 2014 BOTTOM PROFILE AUGUST 2014: MMM Geomatics
4	ADDED 1994 BOTTOM PROFILE JULY 1994: UMA SURVEYS	4	ADDED 2000 BOTTOM PROFILE AUG 2000: UMA GEOMATICS	4	ADDED 2006 BOTTOM PROFILE JUNE 2006: USHER CANADA LTD	4	ADDED 2013 BOTTOM PROFILE AUGUST 2013: MMM Geomatics
3	ADDED 1993 BOTTOM PROFILE JULY 1993: UMA SURVEYS	3	ADDED 1999 BOTTOM PROFILE AUG 1999: UMA GEOMATICS	3	ADDED 2005 BOTTOM PROFILE JUNE 2005: USHER CANADA LTD	3	ADDED 2012 BOTTOM PROFILE AUGUST 2012: MMM Geomatics
2	ADDED 2017 BOTTOM PROFILE SEP. 2017: WSP	2	ADDED 1998 BOTTOM PROFILE JUNE 1998: UMA GEOMATICS	2	ADDED 2004 BOTTOM PROFILE AUG 2004: USHER CANADA LTD	2	ADDED 2011 BOTTOM PROFILE AUGUST 2011: MMM Geomatics
2	ADDED 2016 BOTTOM PROFILE SEP. 2016: WSP	1	ADDED 1997 BOTTOM PROFILE JULY 1997: UMA GEOMATICS	1	ADDED 2003 BOTTOM PROFILE AUG 2003: UMA GEOMATICS	1	ADDED 2010 BOTTOM PROFILE JULY 2010: MMM Geomatics

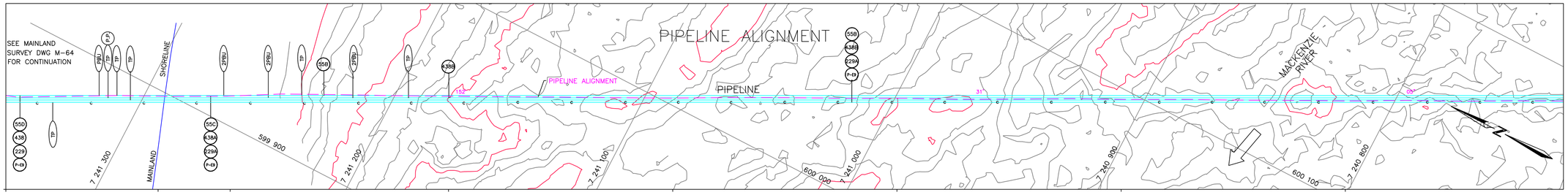
CONTRACTOR NAME: WSP Surveys (AB) Limited Partnership
DATE: 17–10–31
SCALE: H 1:1000 V 1:200

CONTRACTOR DWG NO. : 1196–C
ESSO FILE No. 096–0179–700–801 71

096-0179-700-801 72

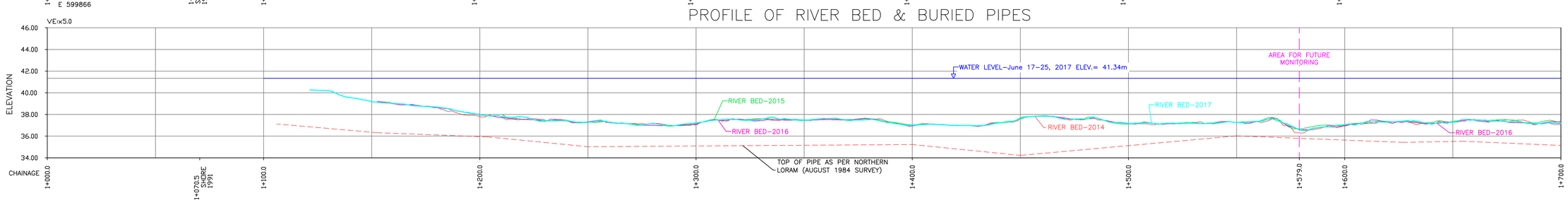
AutoCAD

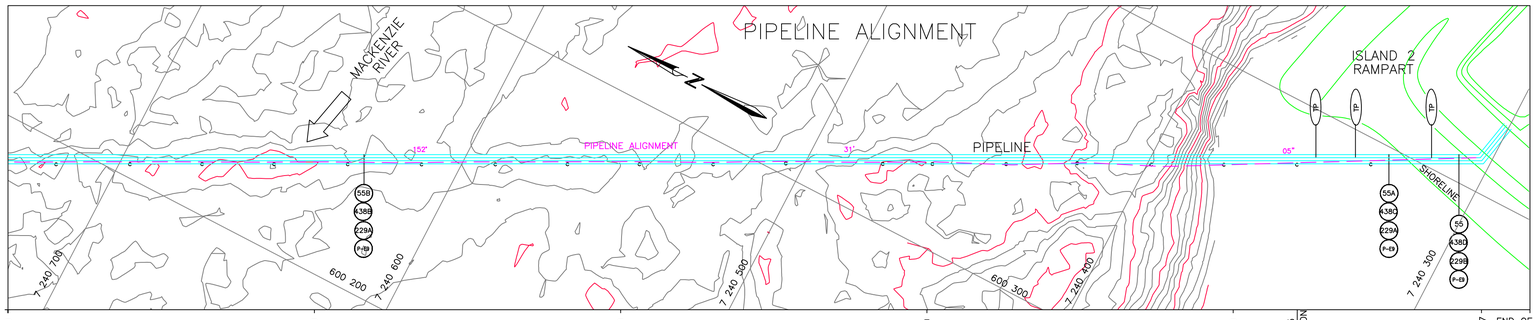
CADD DRAWING NO MANUAL CHANGES



CHAINAGE 1+000.0
N 7241355
E 599866

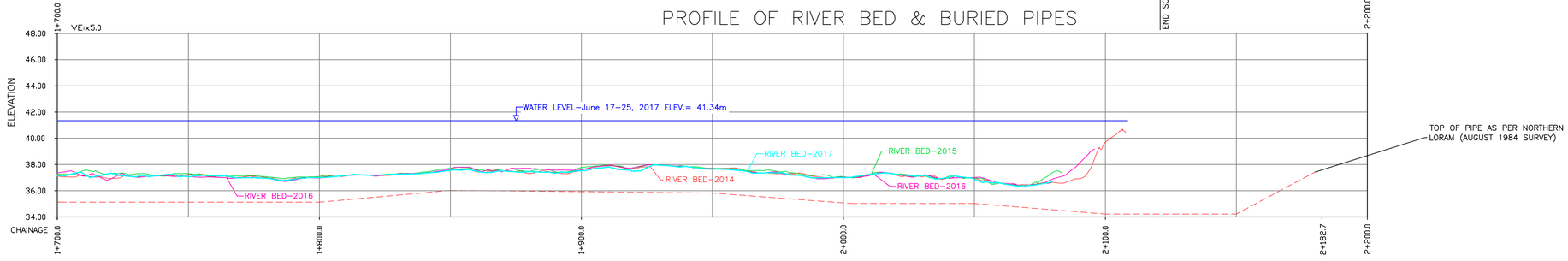
CHAINAGE: 1+000.0, 1+070.5 SHORE 1991, 1+100.0, 1+200.0, 1+300.0, 1+400.0, 1+500.0, 1+600.0





CHAINAGE: 1+700.0, 1+800.0, 1+900.0, 2+000.0, 2+100.0, 2+122.5 END SCOUR APRON, 2+182.7, 2+200.0

END OF PROFILE
CHAINAGE 2+182.7
N 7240305
E 600410



SURVEY CONTROL

No.	DESCRIPTION	NORTHING	EASTING	ELEV.
1000	REBAR @ N.E. OF ISL. 1	7240711.75	599540.89	
1004	REBAR @ N.W. OF ISL. 1	7240729.21	599459.90	
2	REBAR @ N.E. OF ISL. 2	7240301.75	600511.43	
2001	REBAR @ N.W. OF ISL. 2	7240324.34	600431.97	
27	REBAR @ N.W. OF ISL. 3	7240741.90	597423.38	
3000	REBAR @ N.E. OF ISL.3	7240716.18	597500.36	
26	REBAR @ N.W. OF ISL. 4	7240387.54	598100.08	
4000	REBAR @ N.E. OF ISL. 4	7240361.98	598175.94	
22	REBAR @ N.W. OF ISL. 5	7240016.98	598734.63	
5000	REBAR @ N.E. OF ISL. 5	7239993.12	598815.14	
21	REBAR @ N.W. OF ISL. 6	7239631.84	599382.56	
6000	REBAR @ N.E. OF ISL. 6	7239616.68	599465.79	

SUBSTANCE DESCRIPTION

No.	SUBSTANCE DESCRIPTION
	MULTIPHASE LIQUIDS
55	219.1 OE ls.2 to L.P.T.1, Glycol H.T. 55-55A
55A	219.1 OE ls.2 to L.P.T.1, Glycol H.T., Conc Coated 55-55A-55B
55B	219.1 OE ls.2 to L.P.T.1, Conc Coated 55-55A-55B-55C M-64,65,55
55C	219.1 OE ls.2 to L.P.T.1, Dbl Sect H.T., Conc Coated 55-55A-55B-55C-55D M-64,65,55 H.T.263
55D	219.1 OE ls.2 to L.P.T.1, Sng Sect H.T. 55-55A-55B-55C-55D-L.P.T.1 M-64,65,55 H.T.263
	GASLIFT
229	114.3 NG (Gas Lift) L.P.T.1 to ls.2 (Buried) 229-229A M-55,65,64
229A	114.3 NG (Gas Lift) L.P.T.1 to ls.2 (Conc Coated) 229-229A-229B M-55,65,64
229B	114.3 NG (Gas Lift) L.P.T.1 to ls.2 (Buried) 229-229A-229B-L.P.T.1
	INJECTION WATER
438	114.3 INJ-SW L.P.T.1 to ls.2, Sng Sect H.T., Liner 438-438A M-55,65,64 H.T.264
438A	114.3 INJ-SW L.P.T.1 to ls.2, Dbl Sect H.T., Conc Coated, Liner 438-438A-438B M-55,65,64 H.T.264
438B	114.3 INJ-SW L.P.T.1 to ls.2, Conc Coated, Liner 438-438A-438B-438C
438C	114.3 INJ-SW L.P.T.1 to ls.2, Glycol H.T., Conc Coated, Liner 438-438A-438B-438C-438D
438D	114.3 INJ-SW L.P.T.1 to ls.2, Glycol H.T., Liner 438-438A-438B-438C-438D-L.P.T.1
	ELECTRICAL DESCRIPTION
P-E9	4160 H.V. From FS-25KV Switch Gear to ls.2 TR-E5 M-54,64

PROFILE ALIGNMENT COORDINATES

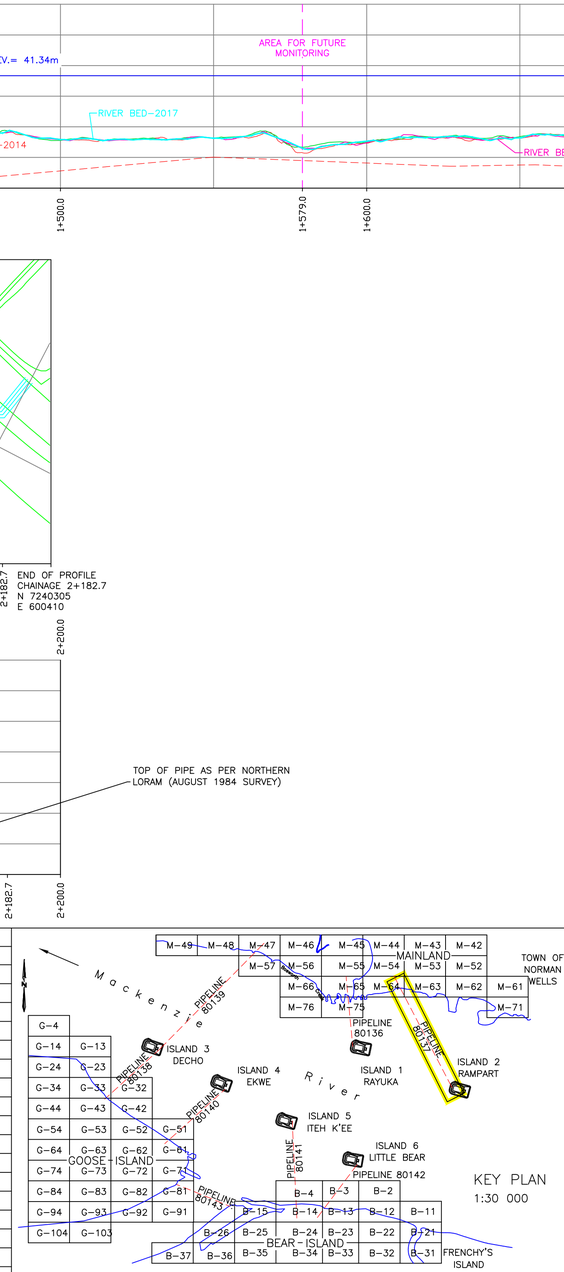
EASTING	NORTHING	
599866.000	7241355.000	START CHAINAGE 1+000.000
599867.750	7241350.020	
599877.070	7241332.840	
599888.830	7241311.060	
599900.050	7241288.670	
599911.540	7241266.730	
599923.760	7241245.240	
599935.170	7241222.640	
599946.190	7241200.430	
599957.710	7241177.750	
599968.910	7241155.590	
599980.380	7241133.100	
599991.630	7241110.940	
600002.980	7241088.660	
600014.910	7241066.250	
600026.790	7241043.290	
600038.900	7241019.240	
600050.790	7240996.510	
600062.340	7240973.070	
600073.970	7240950.940	
600085.570	7240929.100	
600096.790	7240906.500	
600108.190	7240884.690	
600119.470	7240862.340	
600130.870	7240840.070	
600142.390	7240817.410	
600153.930	7240795.670	
600165.200	7240773.220	
600176.830	7240751.230	
600186.326	7240732.711	
600188.291	7240728.880	
600199.801	7240706.940	
600211.441	7240684.550	
600222.851	7240662.280	
600234.411	7240640.240	
600245.651	7240617.900	
600257.421	7240595.870	
600268.931	7240573.770	
600280.381	7240551.930	
600292.091	7240528.740	
600303.921	7240506.690	
600315.191	7240484.280	
600326.881	7240462.120	
600337.481	7240439.550	
600349.651	7240417.660	
600359.971	7240395.040	
600410.000	7240305.0004	END CHAINAGE 2+182.7

Alignment includes Winter 1997 pipe locating data.

NOTES

1. RIVER BOTTOM PROFILE FROM 2017 BATHYMETRIC SURVEY PERFORMED JUNE 17 TO JUNE 25, 2017.
2. PIPE PROFILE AND CHAINAGES FROM ESSO DWG. 80054 REV. 8 – TOP OF PIPE AS PER NORTHERN LORAM
   (TOP OF PIPE PROFILE ELEVATION REDUCED 0.776m IN 2008)
3. HORIZONTAL DATUM : NAD27 (SHORAN) – UTM GRID/CM = 129°
4. VERTICAL DATUM – GEODETIC BM 74T016 ELEVATION 60.189
5. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL
6. CONTOUR INTERVAL = 0.25 METRES.

2014 RIVER BED PROFILE SHOWN AS
2015 RIVER BED PROFILE SHOWN AS
2016 RIVER BED PROFILE SHOWN AS
2017 RIVER BED PROFILE SHOWN AS



KEY PLAN
1:30 000

No.	REVISION	No.	REVISION	No.	REVISION	No.	REVISION
6	ADDED 1996 BOTTOM PROFILE JULY 1996: UMA GEOMATICS	6	ADDED 2002 BOTTOM PROFILE AUG 2002: UMA GEOMATICS	6	ADDED 2009 BOTTOM PROFILE JUNE 2009: MMM Geomatics	6	ADDED 2015 BOTTOM PROFILE AUG. 2015: WSP
5	ADDED 1995 BOTTOM PROFILE JULY 1995: UMA GEOMATICS	5	ADDED 2001 BOTTOM PROFILE AUG 2001: UMA GEOMATICS	5	ADDED 2008 BOTTOM PROFILE JUNE 2008: MMM Geomatics	5	ADDED 2014 BOTTOM PROFILE AUG 2014: MMM Geomatics
4	ADDED 1994 BOTTOM PROFILE JULY 1994: UMA SURVEYS	4	ADDED 2000 BOTTOM PROFILE AUG 2000: UMA GEOMATICS	4	ADDED 2006 BOTTOM PROFILE JUNE 2006: USHER CANADA LIMITED	4	ADDED 2013 BOTTOM PROFILE AUG 2013: MMM Geomatics
3	ADDED 1993 BOTTOM PROFILE JULY 1993: UMA SURVEYS	3	ADDED 1999 BOTTOM PROFILE AUG 1999: UMA GEOMATICS	3	ADDED 2005 BOTTOM PROFILE JUNE 2005: USHER CANADA LIMITED	3	ADDED 2012 BOTTOM PROFILE AUG 2012: MMM Geomatics
2	ADDED 2017 BOTTOM PROFILE SEP. 2017: WSP	2	ADDED 1998 BOTTOM PROFILE JUNE 1998: UMA GEOMATICS	2	ADDED 2004 BOTTOM PROFILE AUG 2004: USHER CANADA LIMITED	2	ADDED 2011 BOTTOM PROFILE AUG 2011: MMM Geomatics
1	ADDED 2016 BOTTOM PROFILE SEP. 2016: WSP	1	ADDED 1997 BOTTOM PROFILE JULY 1997: UMA GEOMATICS	1	ADDED 2003 BOTTOM PROFILE AUG 2003: UMA GEOMATICS	1	ADDED 2010 BOTTOM PROFILE JULY 2010: MMM Geomatics

LEGEND

UTILIDORS SHOWN
ROADS SHOWN
BURIED PIPES SHOWN
BELOW GROUND POWER,TELEPHONE, & COMMUNICATION SHOWN
VENT SHOWN
TRANSITION POINT
PULL BOX SHOWN
PULL POINT SHOWN
PIPE O/S DIA.'S ARE IN MILLIMETERS AND DECIMALS THEREOF

SUBSTANCE/CATEGORY CROSS REFERENCE

SUBSTANCE	CODE	SUBSTANCE	CODE
PROPANE/BUTANE	HV	PRODUCED WATER	SW
CRUDE OIL	CO	FRESH WATER	FW
MULTIPHASE FLUIDS	OE	INJECTION (SW)	INJ-SW
NATURAL/LIFT GAS	NG	INJECTION (FW)	INJ-FW
FUEL GAS	FG	ABANDONED	ABAN
MISCELLANEOUS LIQUIDS	ML	MISCELLANEOUS GASES	MG

Esso Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES
MAINLAND TO ISLAND 2
SURVEY DRAWING

CONTRACTOR NAME:
WSP Surveys (AB)
Limited Partnership

DATE: 17-10-31

SCALE: H 1:1000
V 1:200

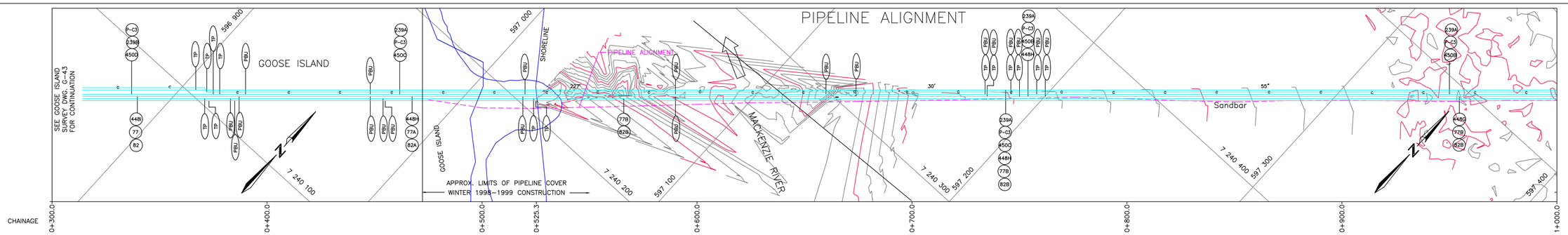
CONTRACTOR DWG NO. : 1197-C

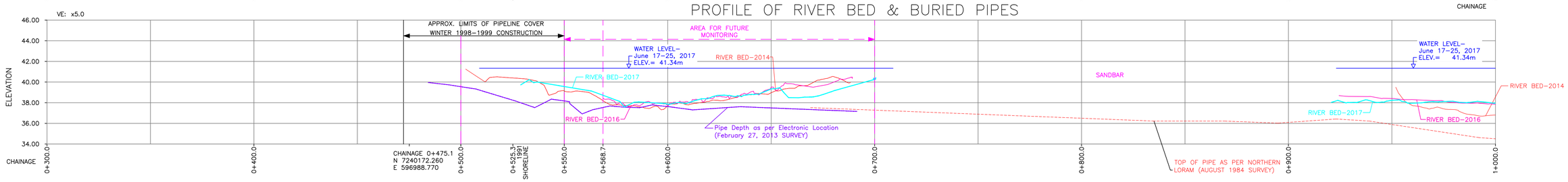
ESSO FILE No.
096-0179-700-801 72

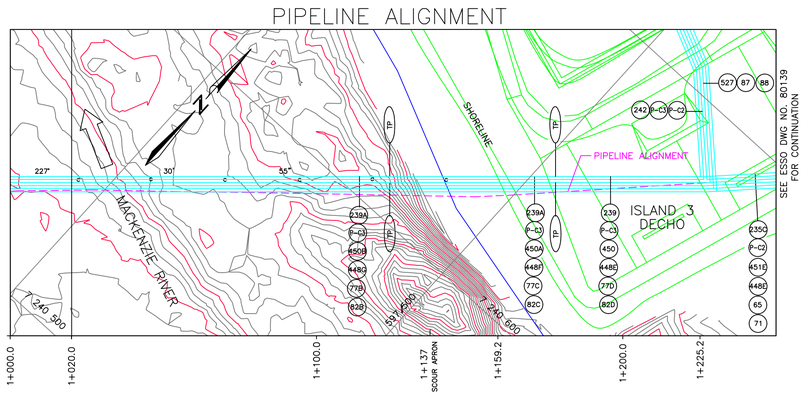
096-0179-700-801 73

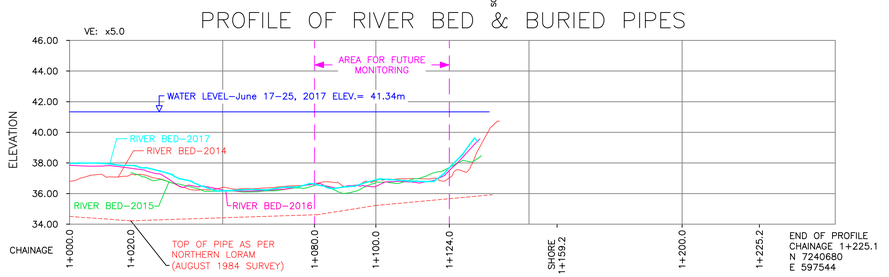
AutoCAD

CADD DRAWING NO MANUAL CHANGES









PROFILE ALIGNMENT COORDINATES		
EASTING	NORTHING	
596988.770	7240172.260	START CHAINAGE 0+475.1
597009.800	7240186.220	
597028.480	7240202.910	
597046.630	7240220.110	
597064.660	7240237.340	
597082.730	7240254.650	
597100.670	7240272.040	
597118.990	7240288.930	
597137.310	7240306.010	
597155.620	7240323.290	
597173.860	7240340.390	
597210.560	7240375.130	
597229.770	7240391.670	
597248.970	7240407.940	
597267.960	7240424.470	
597286.110	7240441.770	
597304.600	7240458.730	
597323.320	7240475.370	
597342.080	7240492.060	
597360.360	7240509.380	
597377.592	7240524.939	
597378.820	7240526.320	
597397.380	7240543.600	
597417.410	7240561.070	
597435.040	7240576.720	
597453.610	7240592.970	
597491.220	7240625.820	
597499.670	7240634.250	
597544.000	7240680.000	END CHAINAGE 1+225.1

Alignment includes Winter 1997 pipe locating data.

SURVEY CONTROL

No.	DESCRIPTION	NORTHING	EASTING	ELEV.
1000	REBAR @ N.E. OF ISL. 1	7240711.75	599540.89	
1004	REBAR @ N.W. OF ISL. 1	7240729.21	599459.90	
2	REBAR @ N.E. OF ISL. 2	7240301.75	600511.43	
2001	REBAR @ N.W. OF ISL. 2	7240324.34	600431.97	
27	REBAR @ N.W. OF ISL. 3	7240741.90	597423.38	
3000	REBAR @ N.E. OF ISL.3	7240716.18	597500.36	
26	REBAR @ N.W. OF ISL. 4	7240387.54	598100.08	
4000	REBAR @ N.E. OF ISL. 4	7240361.98	598175.94	
22	REBAR @ N.W. OF ISL. 5	7240016.98	598734.63	
5000	REBAR @ N.E. OF ISL. 5	7239993.12	598815.14	
21	REBAR @ N.W. OF ISL. 6	7239631.84	599382.56	
6000	REBAR @ N.E. OF ISL. 6	7239616.68	599465.79	

No.	SUBSTANCE DESCRIPTION
	MULTIPHASE LIQUIDS
65	273.1 OE Is.3 to C.P.F. Glycol H.T. 87-65-65A
71	355.6 OE Is.3 to C.P.F. Glycol H.T. 88-71-71A
77	273.1 OE GIT 4 to Is.3 Single Sect H.T. 77A-77B G-54,43,33,32 H.T.354
77A	273.1 OE GIT 4 to Is.3 Single Sect H.T., Conc Coated, 77A-77B-77C G-54,43,33,32 H.T.354
77B	273.1 OE GIT 4 to Is.3 Conc Coated, 77A-77B-77C-77D G-54,43,33,32
77C	273.1 OE GIT 4 to Is.3 Conc Coated, Glycol H.T. 77A-77B-77C-77D
77D	273.1 OE GIT 4 to Is.3 Glycol H.T. 77C-77D-65
82	355.6 OE GIT 4 to Is.3 Single Sect H.T. 82A-82B G-54,43,33,32 H.T.353
82A	355.6 OE GIT 4 to Is.3 Single Sect H.T., Conc Coated, 82A-82B-82C G-54,43,33,32 H.T.353
82B	355.6 OE GIT 4 to Is.3 Conc Coated, 82A-82B-82C-82D G-54,43,33,32
82C	355.6 OE GIT 4 to Is.3 Conc Coated, Glycol H.T. 82A-82B-82C-82D
82D	355.6 OE GIT 4 to Is.3 Glycol H.T. 82C-82D-71
87	168.3 OE Is.3 to C.P.F. Glycol H.T. 87-65-65A
88	168.3 OE Is.3 to C.P.F. Glycol H.T. 88-71-71A
	GASLIFT
235C	168.3 NG (Gas Lift) C.P.F. to Is.3 (Conc Coated) 235-235A-235B-235C-Is.3
239	168.3 NG (Gas Lift) Is.3 to GIT 4 (Buried) 235C-239-239A
239A	168.3 NG (Gas Lift) Is.3 to GIT 4 (Conc Coated) 239-239A-239B
239B	168.3 NG (Gas Lift) Is.3 to GIT 4 (Buried) 239A-239B-GIT 4 G-54,43,33,32
242	88.9 NG (Gas Lift) C.P.F. to Is.3 (Buried) 235C-242-Is.3

No.	SUBSTANCE DESCRIPTION
	INJECTION WATER
448E	219.1 INJ-FW C.P.F. to G.I.T.4, Gly H.T. 448 to 448F
448F	219.1 INJ-FW C.P.F. to G.I.T.4, Gly H.T., Conc Coated 448 to 448G
448G	219.1 INJ-FW C.P.F. to G.I.T.4, Conc Coated 448 to 448H G-32,33,43,54
448H	219.1 INJ-FW C.P.F. to G.I.T.4, Dbl Sect H.T., Conc Coated 448 to 448I G-32,33,43,54 H.T.352
448I	219.1 INJ-FW C.P.F. to G.I.T.4, Sng Sect H.T. 448 to 448I-G.I.T.4 G-32,33,43,54 H.T.352
450	168.3 INJ-SW Is.3 to G.I.T.4, Gly H.T. 451E-450-450A
450A	168.3 INJ-SW Is.3 to G.I.T.4, Gly H.T., Conc Coated 450-450A-450B
450B	168.3 INJ-SW Is.3 to G.I.T.4, Conc Coated 450-450A-450B-450C G-32,33,43,54
450C	168.3 INJ-SW Is.3 to G.I.T.4, Dbl Sect H.T., Conc Coated 450-450A-450B-450C-450D G-32,33,43,54 H.T.351
450D	168.3 INJ-SW Is.3 to G.I.T.4, Sng Sect H.T. 450-450A-450B-450C-450D-G.I.T.4 G-32,33,43,54 H.T.351
451E	168.3 INJ-SW C.P.F. to Is.3, Gly H.T. 451-451A-451B-451C-451D-451E-450
527	88.9 INJ-SW 451E Tee to Is.3, Gly H.T. 451E-527-Is.3
	ELECTRICAL DESCRIPTION
P-C2	4160 H.V. From SB-C1 to SB-C2 (Is.3) M-47,57 Refer to Dwg 096-0100-100-006
P-C3	4160 H.V. From SB-C2 (Is.3) to GIT 4 Trans TR-C18 G-54,43,33,32

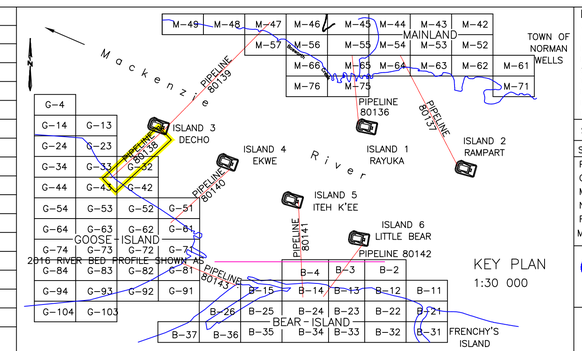
NOTES

1. RIVER BOTTOM PROFILE FROM 2017 BATHYMETRIC SURVEY PERFORMED JUNE 17 TO JUNE 25, 2017.
2. PIPE PROFILE AND CHAINAGES FROM ESSO DWG. 80054 REV. 8 – TOP OF PIPE AS PER NORTHERN LORAM

(TOP OF PIPE PROFILE ELEVATION REDUCED 0.776m IN 2008)

3. HORIZONTAL DATUM : NAD27 (SHORAN) – UTM GRID/CM = 129°
4. VERTICAL DATUM – GEODETIC BM 74T016 ELEVATION 60.189
5. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL
6. CONTOUR INTERVAL = 0.25 METRES.

2014 RIVER BED PROFILE SHOWN AS
2015 RIVER BED PROFILE SHOWN AS
2016 RIVER BED PROFILE SHOWN AS
2017 RIVER BED PROFILE SHOWN AS



LEGEND

- UTILIDORS SHOWN
- ROADS SHOWN
- BURIED PIPES SHOWN
- BELOW GROUND POWER,TELEPHONE, & COMMUNICATION SHOWN
- VENT SHOWN
- TRANSITION POINT
- PULL BOX SHOWN
- PULL POINT SHOWN
- PIPE O/S DIA.'S ARE IN MILLIMETERS AND DECIMALS THEREOF

SUBSTANCE/CATEGORY CROSS REFERENCE

SUBSTANCE	CODE	SUBSTANCE	CODE
PROPANE/BUTANE	HV	PRODUCED WATER	SW
CRUDE OIL	CO	FRESH WATER	FW
MULTIPHASE FLUIDS	OE	INJECTION (SW)	INJ-SW
NATURAL/LIFT GAS	NG	INJECTION (FW)	INJ-FW
FUEL GAS	FG	ABANDONED	ABAN
MISCELLANEOUS LIQUIDS	ML	MISCELLANEOUS GASES	MG

Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

GOOSE TO ISLAND 3 SURVEY DRAWING

No.	REVISION	No.	REVISION	No.	REVISION	No.	REVISION
6	ADDED 1996 BOTTOM PROFILE JULY 1996: UMA GEOMATICS	12	ADDED 2002 BOTTOM PROFILE AUG 2002: UMA GEOMATICS	18	ADDED 2010 BOTTOM PROFILE JULY 2010: MMM Geomatics	24	ADDED 2016 BOTTOM PROFILE SEP. 2016: WSP
5	ADDED 1995 BOTTOM PROFILE JULY 1995: UMA GEOMATICS	11	ADDED 2001 BOTTOM PROFILE AUG 2001: UMA GEOMATICS	17	ADDED 2009 BOTTOM PROFILE JUNE 2009: MMM Geomatics	23	ADDED 2015 BOTTOM PROFILE AUG. 2015: WSP
4	ADDED 1994 BOTTOM PROFILE JULY 1994: UMA SURVEYS	10	ADDED 2000 BOTTOM PROFILE AUG 2000: UMA GEOMATICS	16	ADDED 2008 BOTTOM PROFILE JUNE 2008: MMM Geomatics	22	ADDED 2014 BOTTOM PROFILE AUGUST 2014: MMM Geomatics
3	ADDED 1993 BOTTOM PROFILE JULY 1993: UMA SURVEYS	9	ADDED 1999 BOTTOM PROFILE AUG 1999: UMA GEOMATICS	15	ADDED 2006 BOTTOM PROFILE AUG 2006: USHER CANADA LIMITED	21	ADDED 2013 BOTTOM PROFILE AUGUST 2013: MMM Geomatics
2	REVISED TITLEBLOCK APRIL 12/1993: UMA SURVEYS	8	ADDED 1998 BOTTOM PROFILE JUNE 1998: UMA GEOMATICS	14	ADDED 2005 BOTTOM PROFILE AUG 2005: USHER CANADA LIMITED	20	ADDED 2012 BOTTOM PROFILE AUGUST 2012: MMM Geomatics
25	ADDED 2017 BOTTOM PROFILE SEP. 2017: WSP	7	ADDED 1997 BOTTOM PROFILE JULY 1997: UMA GEOMATICS	13	ADDED 2003 BOTTOM PROFILE AUG 2003: UMA GEOMATICS	19	ADDED 2011 BOTTOM PROFILE AUGUST 2011: MMM Geomatics

CONTRACTOR NAME: WSP Surveys (AB) Limited Partnership

CONTRACTOR DWG NO. : 1198-C

DATE: 17-10-31

SCALE: H 1:1000 V 1:200

ESSO FILE No. 096-0179-700-801 73

096-0179-700-801 74

AutoCAD

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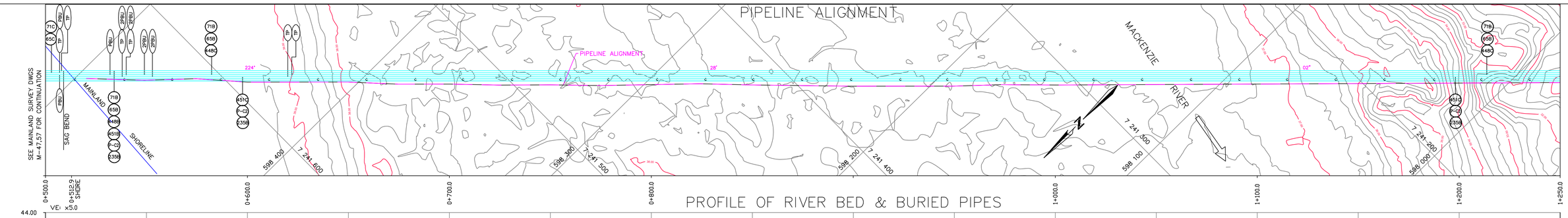
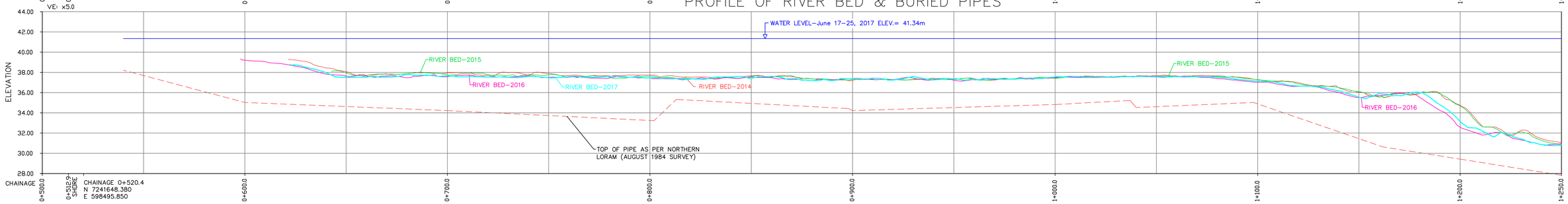
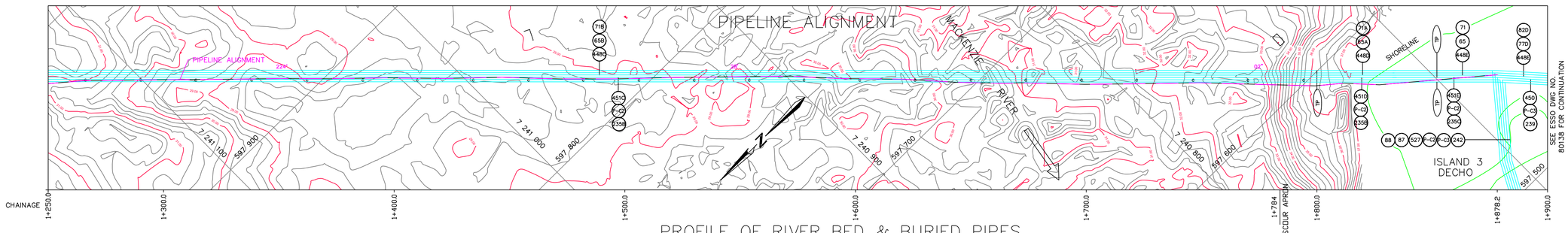
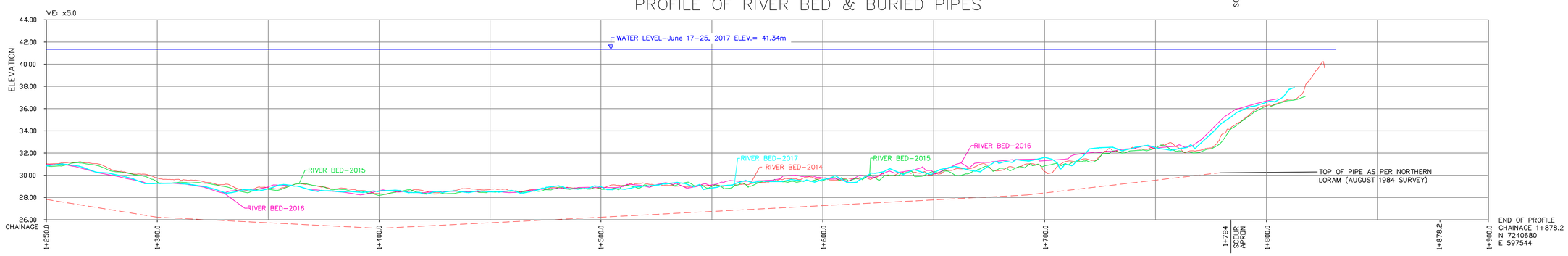








PROFILE ALIGNMENT COORDINATES		
EASTING	NORTHING	
598495.850	7241648.380	START CHAINAGE 0+520.4
598475.110	7241628.550	
598457.710	7241609.840	
598438.670	7241592.860	
598403.750	7241557.440	
598385.410	7241540.300	
598367.680	7241522.290	
598349.580	7241504.620	
598332.560	7241487.170	
598314.730	7241469.560	
598280.730	7241433.800	
598262.530	7241416.200	
598226.770	7241380.770	
598192.130	7241345.600	
598175.540	7241327.750	
598156.300	7241308.460	
597982.226	7241130.140	
597971.800	7241117.670	
597949.660	7241094.730	
597932.480	7241077.010	
597913.010	7241056.780	
597897.760	7241041.380	
597881.390	7241024.240	
597863.170	7241006.150	
597846.060	7240988.010	
597827.820	7240970.570	
597811.330	7240953.780	
597793.290	7240934.600	
597776.080	7240916.650	
597758.910	7240898.900	
597742.580	7240883.830	
597723.440	7240864.790	
597705.960	7240849.010	
597690.990	7240834.450	
597686.830	7240829.890	
597666.560	7240810.270	
597651.540	7240794.700	
597632.180	7240774.430	
597595.980	7240739.610	
597588.020	7240729.860	
597583.310	7240725.520	
597576.780	7240719.460	
597544.000	7240680.000	END CHAINAGE 1+878.2

Alignment includes Winter 1997 pipe locating data.

SURVEY CONTROL				
No.	DESCRIPTION	NORTHING	EASTING	ELEV.
1000	REBAR @ N.E. OF ISL. 1	7240711.75	599540.89	
1004	REBAR @ N.W. OF ISL. 1	7240729.21	599459.90	
2	REBAR @ N.E. OF ISL. 2	7240301.75	600511.43	
2001	REBAR @ N.W. OF ISL. 2	7240324.34	600431.97	
27	REBAR @ N.W. OF ISL. 3	7240741.90	597423.38	
3000	REBAR @ N.E. OF ISL.3	7240716.18	597500.36	
26	REBAR @ N.W. OF ISL. 4	7240387.54	598100.08	
4000	REBAR @ N.E. OF ISL. 4	7240361.98	598175.94	
22	REBAR @ N.W. OF ISL. 5	7240016.98	598734.63	
5000	REBAR @ N.E. OF ISL. 5	7239993.12	598815.14	
21	REBAR @ N.W. OF ISL. 6	7239631.84	599382.56	
6000	REBAR @ N.E. OF ISL. 6	7239616.68	599465.79	

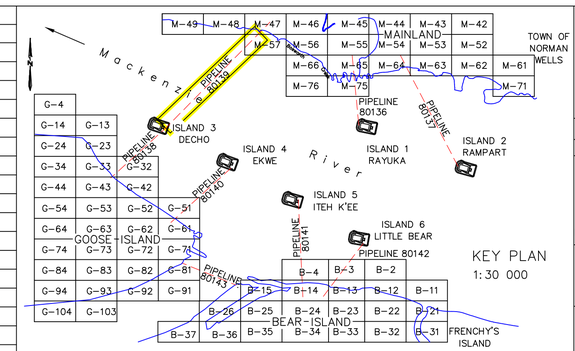
No.	SUBSTANCE DESCRIPTION
	MULTIPHASE LIQUIDS
65	273.1 OE Is.3 to C.P.F. Glycol H.T. 87–65–65A
65A	273.1 OE Is.3 to C.P.F. Glycol H.T., Conc Coated 65–65A–65B
65B	273.1 OE Is.3 to C.P.F. Conc Coated 65–65A–65B–65C M–57,47,46
65C	273.1 OE Is.3 to C.P.F. Sng Sect. H.T. Conc Coated 65–65A–65B–65C–65D M–57,47,46 H.T.224
71	355.6 OE Is.3 to C.P.F. Glycol H.T. 88–71–71A
71A	355.6 OE Is.3 to C.P.F. Glycol H.T., Conc Coated 71–71A–71B
71B	355.6 OE Is.3 to C.P.F. Conc Coated 71–71A–71B–71C M–57,47,46
71C	355.6 OE Is.3 to C.P.F. Dbl Sect. H.T. Conc Coated 71–71A–71B–71C–71D M–57,47,46 H.T.223
77D	273.1 OE GIT 4 to Is.3 Glycol H.T. 77C–77D–65
82D	355.6 OE GIT 4 to Is.3 Glycol H.T. 82C–82D–71
87	168.3 OE Is.3 to C.P.F. Glycol H.T. 87–65–65A
88	168.3 OE Is.3 to C.P.F. Glycol H.T. 88–71–71A
	GASLIFT
235B	168.3 NG (Gas Lift) C.P.F. to Is.3 (Conc Coated) 235–235A–235B–235C M–46,47,57
235C	168.3 NG (Gas Lift) C.P.F. to Is.3 (Conc Coated) 235–235A–235B–235C–Is.3
239	168.3 NG (Gas Lift) Is.3 to GIT 4 (Conc Coated) 235C–239–239A
242	88.9 NG (Gas Lift) C.P.F. to Is.3 (Buried) 235C–242–Is.3
	INJECTION WATER
448B	219.1 INJ–FW C.P.F to G.I.T. 4, Dbl Sect H.T., Conc Coated 448–448A–448B–448C M–46,47,57
448C	219.1 INJ–FW C.P.F. to G.I.T. 4, Conc Coated 448–448A–448B–448C–448D M–46,47
448D	219.1 INJ–FW C.P.F. to G.I.T. 4, Conc Coated, Gly H.T., 448–448A–448B–448C–448D–448E
448E	219.1 INJ–FW C.P.F. to G.I.T. 4, Glycol H.T., 448–448A–448B–448D–448E–527

No.	SUBSTANCE DESCRIPTION
	INJECTION WATER
448E	219.1 INJ–FW C.P.F. to G.I.T. 4, Glycol H.T., 448–448A–448B–448C–448D–448E–448F
451B	168.3 INJ–SW C.P.F. to Is. 3, Dbl Sect H.T., Conc Coated, Liner 451–451A–451B–451C Converted Spare Line H.T.226
451C	168.3 INJ–SW C.P.F. to Is. 3, Conc Coated Liner 451–451A–451B–451C–451D M–46,47,57 Converted Spare Line
451D	168.3 INJ–SW C.P.F. to Is. 3, Conc Coated, Gly H.T., Liner 451–451A–451B–451C–451D–451E Converted Spare Line
451E	168.3 INJ–SW C.P.F. to Is. 3, Glycol H.T., Liner 451–451A–451B–451C–451D–451E–450 Converted Spare Line
450	168.3 INJ–SW Is.3 to GIT 4, Glycol H.T. 451E–450–450A Converted Spare Line
527	88.9 INJ–SW 451E Tee to Is.3, Glycol H.T. 451E–527–Is.3
	ELECTRICAL DESCRIPTION
P–C2	4160 H.V. From SB–C1 to SB–C2 (Is.3) M–47,57 Refer to Dwg 096–0100–100–006
P–C3	4160 H.V. From SB–C2 (Is.3) to GIT 4 Trans TR–C18 G–54,43,33,32

NOTES

1. RIVER BOTTOM PROFILE FROM 2017 BATHYMETRIC SURVEY PERFORMED JUNE 17 TO JUNE 25, 2017.
2. PIPE PROFILE AND CHAINAGES FROM ESSO DWG. 80054 REV. 8 – TOP OF PIPE AS PER NORTHERN LORAM (TOP OF PIPE PROFILE ELEVATION REDUCED 0.776m IN 2008)
3. HORIZONTAL DATUM : NAD27 (SHORAN) – UTM GRID/CM = 129°
4. VERTICAL DATUM – GEODETIC BM 74T016 ELEVATION 60.189
5. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL
6. CONTOUR INTERVAL = 0.25 METRES.

2014 RIVER BED PROFILE SHOWN AS
2015 RIVER BED PROFILE SHOWN AS
2016 RIVER BED PROFILE SHOWN AS
2017 RIVER BED PROFILE SHOWN AS



No.	REVISION	No.	REVISION	No.	REVISION	No.	REVISION
6	ADDED 1996 BOTTOM PROFILE JULY, 1996: UMA GEOMATICS	14	ADDED 2002 BOTTOM PROFILE AUG 2002: UMA GEOMATICS	22	ADDED 2009 BOTTOM PROFILE JUNE 2009: MMM Geomatics	30	ADDED 2015 BOTTOM PROFILE AUG. 2015: WSP
5	ADDED 1995 BOTTOM PROFILE JULY, 1995: UMA GEOMATICS	13	ADDED 2001 BOTTOM PROFILE AUG 2001: UMA GEOMATICS	21	ADDED 2008 BOTTOM PROFILE JUNE 2008: MMM Geomatics	29	ADDED 2014 BOTTOM PROFILE AUG 2014: MMM GEOMATICS
4	ADDED 1994 BOTTOM PROFILE JULY, 1994: UMA SURVEYS	12	ADDED 2000 BOTTOM PROFILE AUG 2000: UMA GEOMATICS	20	ADDED 2006 BOTTOM PROFILE JUNE 2006: USHER CANADA LIMITED	28	ADDED 2013 BOTTOM PROFILE AUG 2013: MMM GEOMATICS
3	ADDED 1993 BOTTOM PROFILE JULY, 1993: UMA SURVEYS	11	ADDED 1999 BOTTOM PROFILE AUG 1999: UMA GEOMATICS	19	ADDED 2005 BOTTOM PROFILE JUNE 2005: USHER CANADA LIMITED	27	ADDED 2012 BOTTOM PROFILE AUG 2012: MMM GEOMATICS
2	ADDED 2017 BOTTOM PROFILE SEP. 2017: WSP	10	ADDED 1998 BOTTOM PROFILE JUNE, 1998: UMA GEOMATICS	18	ADDED 2004 BOTTOM PROFILE AUG 2004: USHER CANADA LIMITED	26	ADDED 2011 BOTTOM PROFILE AUG 2011: MMM GEOMATICS
1	ADDED 2016 BOTTOM PROFILE SEP. 2016: WSP	7	ADDED 1997 BOTTOM PROFILE JULY, 1997: UMA GEOMATICS	17	ADDED 2003 BOTTOM PROFILE AUG 2003: UMA GEOMATICS	25	ADDED 2010 BOTTOM PROFILE JULY 2010: MMM GEOMATICS

LEGEND

- UTILIDORS SHOWN
- ROADS SHOWN
- BURIED PIPES SHOWN
- BELOW GROUND POWER,TELEPHONE, & COMMUNICATION SHOWN — e e
- VENT SHOWN — V
- TRANSITION POINT — TP
- PULL BOX SHOWN — PBU
- PULL POINT SHOWN — P.P.
- PIPE O/S DIA.'S ARE IN MILLIMETERS AND DECIMALS THEREOF

SUBSTANCE/CATEGORY CROSS REFERENCE

SUBSTANCE	CODE	SUBSTANCE	CODE
PROPANE/BUTANE	HV	PRODUCED WATER	SW
CRUDE OIL	CO	FRESH WATER	FW
MULTIPHASE FLUIDS	OE	INJECTION (SW)	INJ–SW
NATURAL/LIFT GAS	NG	INJECTION (FW)	INJ–FW
FUEL GAS	FG	ABANDONED	ABAN
MISCELLANEOUS LIQUIDS	ML	MISCELLANEOUS GASES	MG

Esso Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES
MAINLAND TO ISLAND 3
SURVEY DRAWING

CONTRACTOR NAME: WSP Surveys (AB) Limited Portnership

DATE: 17–10–31

SCALE: H 1:1000 V 1:200

CONTRACTOR DWG NO. : 1199–C

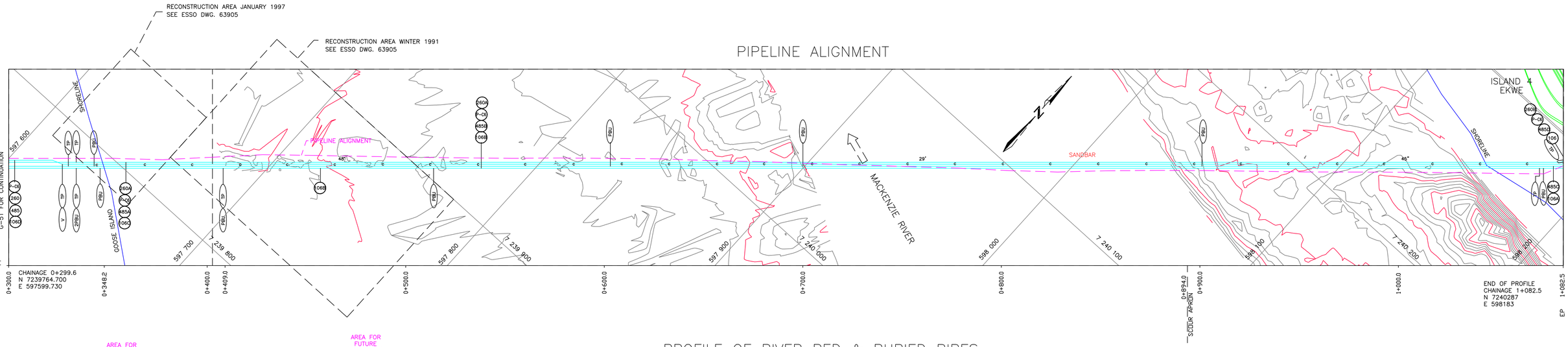
ESSO FILE No. 096–0179–700–801 74

096-0179-700-801 75

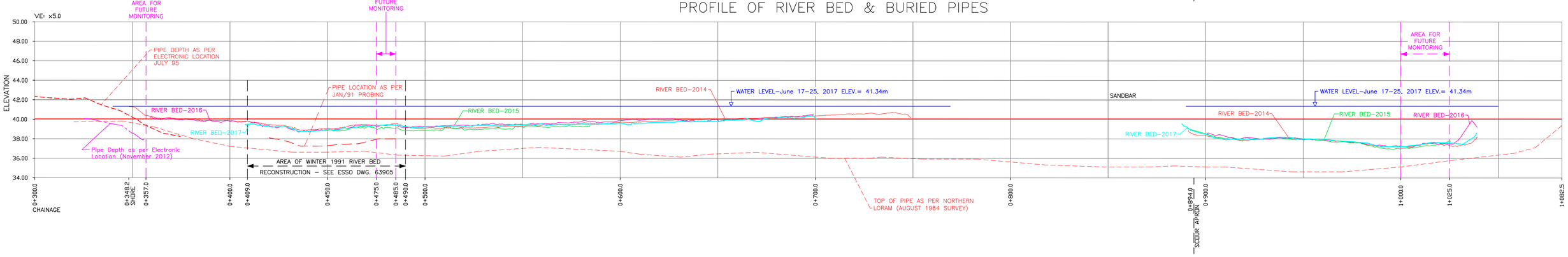
AutoCAD

CADD DRAWING NO MANUAL CHANGES

PIPELINE ALIGNMENT



PROFILE OF RIVER BED & BURIED PIPES



SURVEY CONTROL				
No.	DESCRIPTION	NORTHING	EASTING	ELEV.
1000	REBAR @ N.E. OF ISL. 1	7240711.75	599540.89	
1004	REBAR @ N.W. OF ISL. 1	7240729.21	599459.90	
2	REBAR @ N.E. OF ISL. 2	7240301.75	600511.43	
2001	REBAR @ N.W. OF ISL. 2	7240324.34	600431.97	
27	REBAR @ N.W. OF ISL. 3	7240741.90	597423.38	
3000	REBAR @ N.E. OF ISL.3	7240716.18	597500.36	
26	REBAR @ N.W. OF ISL. 4	7240387.54	598100.08	
4000	REBAR @ N.E. OF ISL. 4	7240361.98	598175.94	
22	REBAR @ N.W. OF ISL. 5	7240016.98	598734.63	
5000	REBAR @ N.E. OF ISL. 5	7239993.12	598815.14	
21	REBAR @ N.W. OF ISL. 6	7239631.84	599382.56	
6000	REBAR @ N.E. OF ISL. 6	7239616.68	599465.79	

No.	SUBSTANCE DESCRIPTION
	MULTIPHASE LIQUIDS
106	219.1 OE Is.4 to GIT 4, Glycol H.T. 106-106A
106A	219.1 OE Is.4 to GIT 4, Glycol H.T., Conc Coated 106-106A-106B
106B	219.1 OE Is.4 to GIT 4, Conc Coated 106-106A-106B-106C
106C	219.1 OE Is.4 to GIT 4, Sng Sect H.T., Conc Coated 106-106A-106B-106C-106D G-51,61,62,72,63,64,54 H.T.356
106D	219.1 OE Is.4 to GIT 4, Sng Sect H.T. 106-106A-106B-106C-106D-GIT 4 G-51,61,62,72,63,64,54 H.T.356
	GASLIFT
260	88.9 NG (Gas Lift) GIT 4 to Is.4 (Buried) 260-260A G-51,62,72,63,64,54
260A	88.9 NG (Gas Lift) GIT 4 to Is.4 (Conc Coated) 260-260A-260B G-51,62,72,63,64,54
260B	88.9 NG (Gas Lift) GIT 4 to Is.4 (Buried) 260-260A-260B-Is.4
	INJECTION WATER
485	88.9 INJ-SW GIT 4 to Is.4, Sng Sect H.T., Liner 485-485A G-51,62,72,63,64,54 H.T.355
485A	88.9 INJ-SW GIT 4 to Is.4, Sng Sect H.T., Conc Coated, Liner G-51,62,72,63,64,54 H.T.355
485B	88.9 INJ-SW GIT 4 to Is.4, Conc Coated, Liner 485-485A-485B-485C G-51,62,72,63,64,54
485C	88.9 INJ-SW GIT 4 to Is.4, Glycol H.T., Conc Coated, Liner 485-485A-485B-485C-485D
485D	88.9 INJ-SW Is.4 Is.4, Glycol H.T., Liner 485-485A-485B-485C-485D-Is. 4
	ELECTRICAL DESCRIPTION
P-C6	4160 H.V. GIT 4 5Kv Switch Gear Is.4 Tr-C3 G-51,62,72,63,64,54

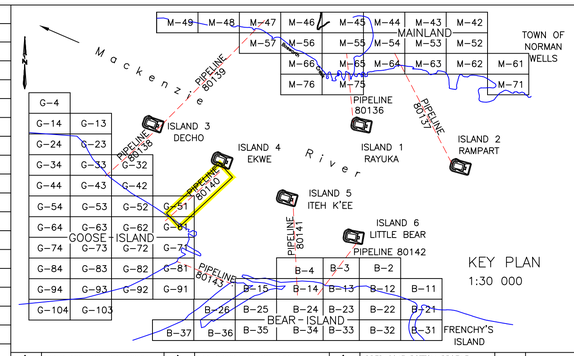
PROFILE ALIGNMENT COORDINATES		
EASTING	NORTHING	
597599.730	7239764.700	START CHAINAGE 0+299.6
597620.330	7239783.340	
597638.850	7239800.100	
597657.950	7239816.460	
597675.810	7239834.160	
597693.470	7239852.120	
597712.360	7239868.620	
597750.070	7239901.480	
597768.890	7239918.080	
597787.670	7239934.740	
597806.100	7239951.640	
597843.510	7239984.930	
597862.720	7240001.070	
597881.690	7240017.520	
597900.880	7240033.650	
597919.950	7240049.830	
597939.050	7240066.100	
597958.080	7240082.260	
597977.390	7240098.090	
597996.440	7240114.330	
598014.690	7240131.690	
598033.130	7240148.630	
598051.700	7240165.310	
598070.430	7240181.730	
598089.120	7240198.220	
598098.390	7240206.570	
598107.670	7240214.920	
598126.290	7240231.630	
598144.980	7240248.190	
598163.770	7240264.700	
598178.650	7240277.920	
598183.000	7240287.000	END CHAINAGE 1+082.5

Alignment includes Winter 1997 pipe locating data.

NOTES

1. RIVER BOTTOM PROFILE FROM 2017 BATHYMETRIC SURVEY PERFORMED JUNE 17 TO JUNE 25, 2017.
2. PIPE PROFILE AND CHAINAGES FROM ESSO DWG. 80054 REV. 8 – TOP OF PIPE AS PER NORTHERN LORAM (TOP OF PIPE PROFILE ELEVATION REDUCED 0.776m IN 2008)
3. HORIZONTAL DATUM : NAD27 (SHORAN) – UTM GRID/CM = 129°
4. VERTICAL DATUM – GEODETIC BM 74T016 ELEVATION 60.189
5. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL
6. CONTOUR INTERVAL = 0.25 METRES.

2014 RIVER BED PROFILE SHOWN AS
2015 RIVER BED PROFILE SHOWN AS
2016 RIVER BED PROFILE SHOWN AS
2017 RIVER BED PROFILE SHOWN AS



No.	REVISION	No.	REVISION	No.	REVISION	No.	REVISION
7	ADDED 1997 BOTTOM PROFILE JULY, 1997: UMA GEOMATICS	14	ADDED 2005 BOTTOM PROFILE AUG 2005: USHER CANADA LIMITED	21	ADDED 2013 BOTTOM PROFILE AUGUST 2013: MMM Geomatics		
6	ADDED 1996 BOTTOM PROFILE JULY, 1996: UMA GEOMATICS	13	ADDED 2003 BOTTOM PROFILE AUG 2003: UMA GEOMATICS	20	ADDED 2012 BOTTOM PROFILE AUGUST 2012: MMM Geomatics		
5	ADDED 1995 BOTTOM PROFILE JULY, 1995: UMA GEOMATICS	12	ADDED 2002 BOTTOM PROFILE AUG 2002: UMA GEOMATICS	19	ADDED 2011 BOTTOM PROFILE AUGUST 2011: MMM Geomatics		
4	ADDED 1994 BOTTOM PROFILE JULY, 1994: UMA SURVEYS	11	ADDED 2001 BOTTOM PROFILE AUG 2001: UMA GEOMATICS	18	ADDED 2010 BOTTOM PROFILE JULY 2010: MMM Geomatics	25	ADDED 2017 BOTTOM PROFILE SEP. 2017: WSP
3	ADDED 1993 BOTTOM PROFILE JULY, 1993: UMA SURVEYS	10	ADDED 2000 BOTTOM PROFILE AUG 2000: UMA GEOMATICS	17	ADDED 2009 BOTTOM PROFILE JUNE 2009: MMM Geomatics	24	ADDED 2016 BOTTOM PROFILE SEP. 2016: WSP
2	REVISED TITLEBLOCK APRIL 12/1993: UMA SURVEYS	9	ADDED 1999 BOTTOM PROFILE AUG, 1999: UMA GEOMATICS	16	ADDED 2008 BOTTOM PROFILE JUNE 2008: MMM Geomatics	23	ADDED 2015 BOTTOM PROFILE AUG. 2015: WSP
1	CONVERTED TO AUTOCAD SEP/92 LINE #'S ADDED; UMA SURVEYS	8	ADDED 1998 BOTTOM PROFILE JUNE, 1998: UMA GEOMATICS	15	ADDED 2006 BOTTOM PROFILE AUG 2006: USHER CANADA LIMITED	22	ADDED 2014 BOTTOM PROFILE AUG 2014: MMM Geomatics

LEGEND

UTILIDORS SHOWN
ROADS SHOWN
BURIED PIPES SHOWN
BELOW GROUND POWER,TELEPHONE, & COMMUNICATION SHOWN
VENT SHOWN — V
TRANSITION POINT — TP
PULL BOX SHOWN — PBU
PULL POINT SHOWN — P.P.
PIPE O/S DIA'S ARE IN MILLIMETERS AND DECIMALS THEREOF

SUBSTANCE/CATEGORY CROSS REFERENCE

SUBSTANCE	CODE	SUBSTANCE	CODE
PROPANE/BUTANE	HV	PRODUCED WATER	SW
CRUDE OIL	CO	FRESH WATER	FW
MULTIPHASE FLUIDS	OE	INJECTION (SW)	INJ-SW
NATURAL/LIFT GAS	NG	INJECTION (FW)	INJ-FW
FUEL GAS	FG	ABANDONED	ABAN
MISCELLANEOUS LIQUIDS	ML	MISCELLANEOUS GASES	MG

Esso Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

GOOSE TO ISLAND 4 SURVEY DRAWING

CONTRACTOR NAME: WSP Surveys (AB) Limited Partnership

DATE: 17-10-31

SCALE: H 1:1000 V 1:200

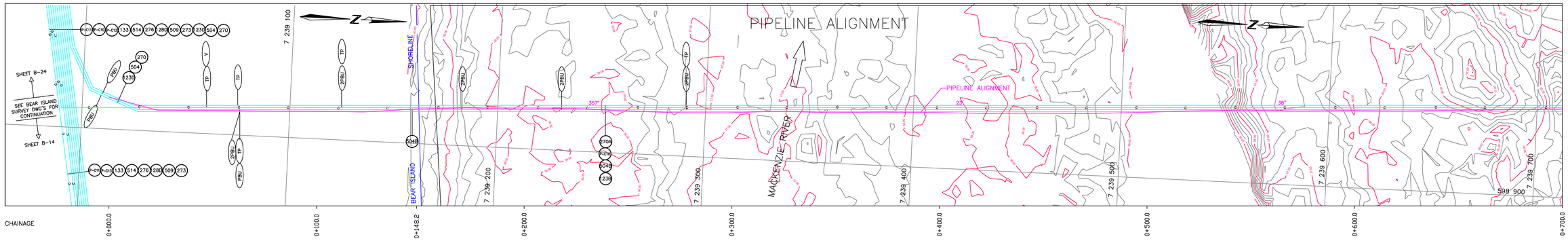
CONTRACTOR DWG NO. : 1200-C

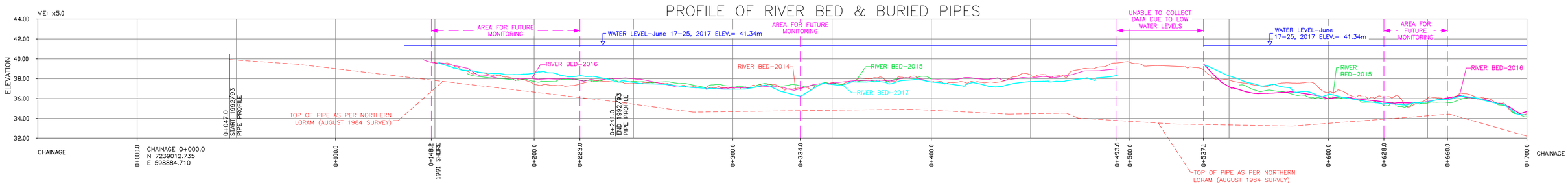
ESSO FILE No. 096-0179-700-801 75

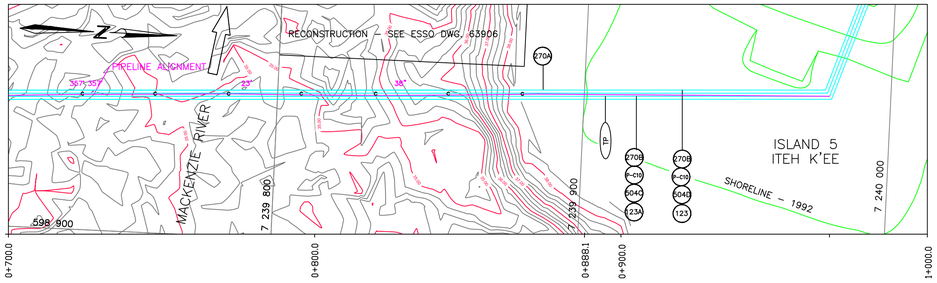
096-0179-700-801 76

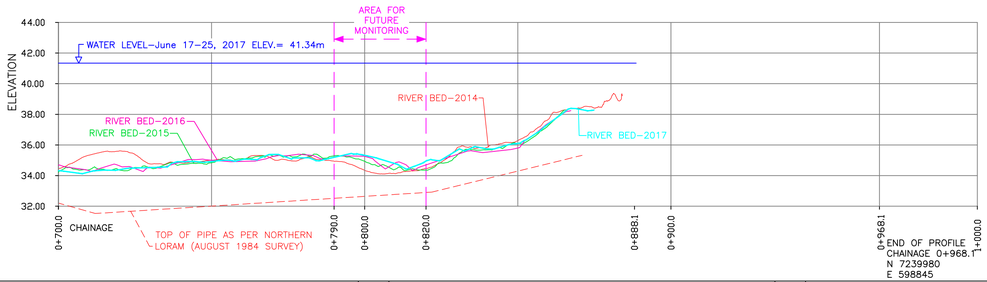
AutoCAD

CADD DRAWING NO MANUAL CHANGES









PROFILE ALIGNMENT COORDINATES		
EASTING	NORTHING	
598884.710	7239012.735	START CHAINAGE 0+000.000
598889.860	7239036.320	
598888.710	7239061.550	
598887.910	7239085.780	
598886.820	7239110.580	
598886.050	7239135.440	
598883.480	7239160.310	
598881.680	7239185.260	
598881.060	7239210.410	
598879.520	7239235.430	
598879.560	7239259.790	
598879.320	7239284.800	
598878.200	7239310.010	
598876.280	7239334.880	
598875.790	7239359.970	
598874.330	7239384.860	
598873.360	7239409.840	
598872.610	7239434.770	
598871.350	7239459.860	
598870.310	7239484.780	
598868.570	7239509.940	
598866.610	7239535.040	
598865.090	7239560.020	
598864.320	7239585.090	
598862.950	7239610.190	
598861.950	7239635.260	
598860.400	7239660.400	
598859.020	7239685.300	
598857.480	7239710.330	
598857.363	7239712.223	
598855.944	7239735.330	
598854.714	7239760.360	
598853.404	7239785.410	
598852.614	7239810.250	
598851.594	7239835.450	
598850.244	7239860.180	
598848.764	7239885.080	
598845.000	7239980.000	END CHAINAGE 0+968.1
Alignment includes Winter 1997 pipe locating data.		

SURVEY CONTROL				
No.	DESCRIPTION	NORTHING	EASTING	ELEV.
1000	REBAR @ N.E. OF ISL. 1	7240711.75	599540.89	
1004	REBAR @ N.W. OF ISL. 1	7240729.21	599459.90	
2	REBAR @ N.E. OF ISL. 2	7240301.75	600511.43	
2001	REBAR @ N.W. OF ISL. 2	7240324.34	600431.97	
27	REBAR @ N.W. OF ISL. 3	7240741.90	597423.38	
3000	REBAR @ N.E. OF ISL.3	7240716.18	597500.36	
26	REBAR @ N.W. OF ISL. 4	7240387.54	598100.08	
4000	REBAR @ N.E. OF ISL. 4	7240361.98	598175.94	
22	REBAR @ N.W. OF ISL. 5	7240016.98	598734.63	
5000	REBAR @ N.E. OF ISL. 5	7239993.12	598815.14	
21	REBAR @ N.W. OF ISL. 6	7239631.84	599382.56	
6000	REBAR @ N.E. OF ISL. 6	7239616.68	599465.79	

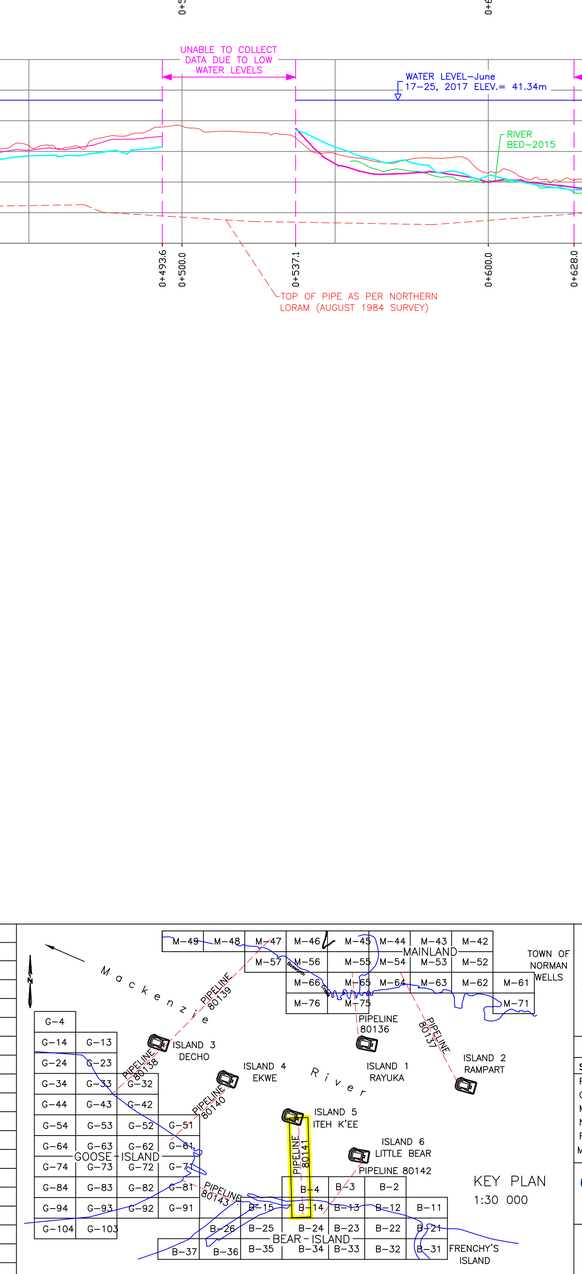
No.	SUBSTANCE DESCRIPTION
	MULTIPHASE LIQUIDS
123	219.1 OE Is.5 to BIT 4, Glycol H.T. 123–123A
123A	219.1 OE Is.5 to BIT 4, Glycol H.T., Conc Coated 123–123A–123B
123B	219.1 OE Is.5 to BIT 4, Conc Coated 123–123A–123B–123C B–14,24,25
123C	219.1 OE Is.5 to BIT 4, Dbl Sect H.T., Conc Coated 123–123A–123B–123C–123D B–14,24,25 H.T.443
123D	219.1 OE Is.5 to BIT 4, Sng Sect H.T. 123–123A–123B–123C–123D–BIT 4 B–14,24,25 H.T.443
128D	168.3 OE Is.6 to BIT 4, Sng Sect H.T. 128–128A–128B–128C–128D–BIT 4 B–3,13,14,24,25 H.T.441
133	219.1 OE BIT 3 to BIT 4, Sng Thermon H.T. B–22,23,13,14,24,25 H.T.428
	GASLIFT
270	88.9 NG (Gas Lift) BIT 4 to Is.5 (Buried) 270–270A B–14,24
270A	88.9 NG (Gas Lift) BIT 4 to Is.5 (Conc Coated) 270–270A–270B B–14,24
270B	88.9 NG (Gas Lift) BIT 4 to Is.5 (Buried) 270–270A–270B–Is.5
273	88.9 NG (Gas Lift) BIT 4 to Is.6 (Buried) 273–273A B–25,24,14,13,3
276	88.9 NG (Gas Lift) BIT 4 to BIT 3, (Buried) B–22,23,13,14,24,25
	INJECTION WATER
504	88.9 INJ–FW BIT 4 to Is.5, Sng Sect H.T. 504–504A B–14,24 H.T.444
504A	88.9 INJ–FW BIT 4 to Is.5, Dbl Sect H.T., Conc Coated 504–504A–504B B–14,24 H.T.444
504B	88.9 INJ–FW BIT 4 to Is.5, Conc Coated 504–504A–504B–504C B–14,24
504C	88.9 INJ–FW BIT 4 to Is.5, Glycol H.T., Conc Coated 504–504A–504B–504C–504D
504D	88.9 INJ–FW Is.5 Is.5, Glycol H.T. 504–504A–504B–504C–504D–Is.5
509	88.9 INJ–FW BIT 4 to Is.6, Sng Sect H.T. 509–509A B–25,24,14,13,3 H.T.442
514	88.9 INJ–FW BIT4 to BIT 3, Sng Thermon H.T. B–22,23,13,14,24,25 H.T.429

No.	SUBSTANCE DESCRIPTION
	ELECTRICAL DESCRIPTION
P–C10	4160 H.V. BIT 4 5Kv Switch Gear Is.5 Tr–C5 B–14,24
P–C11	4160 H.V. BIT 4 5Kv Switch Gear Is.6 Tr–C6 B–25,24,1413,3
P–C13	4160 H.V. BIT 4 5Kv Switch Gear BIT 3 5Kv Switch Gear B–25,24,23,22,13

NOTES

1. RIVER BOTTOM PROFILE FROM 2017 BATHYMETRIC SURVEY PERFORMED JUNE 17 TO JUNE 25, 2017.
2. PIPE PROFILE AND CHAINAGES FROM ESSO DWG. 80054 REV. 8 – TOP OF PIPE AS PER NORTHERN LORAM (TOP OF PIPE PROFILE ELEVATION REDUCED 0.776m IN 2008)
3. HORIZONTAL DATUM : NAD27 (SHORAN) – UTM GRID/CM = 129°
4. VERTICAL DATUM – GEODETIC BM 74T016 ELEVATION 60.189
5. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL
6. CONTOUR INTERVAL = 0.25 METRES.

2014 RIVER BED PROFILE SHOWN AS
2015 RIVER BED PROFILE SHOWN AS
2016 RIVER BED PROFILE SHOWN AS
2017 RIVER BED PROFILE SHOWN AS



No.	REVISION	No.	REVISION	No.	REVISION	No.	REVISION
6	ADDED 1996 BOTTOM PROFILE JULY, 1996: UMA GEOMATICS	5	ADDED 2002 BOTTOM PROFILE AUG. 2002: UMA GEOMATICS	4	ADDED 2009 BOTTOM PROFILE JUNE 2009: MMM Geomatics	3	ADDED 2015 BOTTOM PROFILE AUG. 2015: WSP
5	ADDED 1995 BOTTOM PROFILE JULY, 1995: UMA GEOMATICS	4	ADDED 2001 BOTTOM PROFILE AUG 2001: UMA GEOMATICS	3	ADDED 2008 BOTTOM PROFILE JUNE 2008: MMM Geomatics	2	ADDED 2014 BOTTOM PROFILE AUG 2014: MMM Geomatics
4	ADDED 1994 BOTTOM PROFILE JULY, 1994: UMA SURVEYS	3	ADDED 2000 BOTTOM PROFILE AUG 2000: UMA GEOMATICS	2	ADDED 2006 BOTTOM PROFILE JUNE 2006: USHER CANADA LIMITED	1	ADDED 2013 BOTTOM PROFILE AUG 2013: MMM Geomatics
3	ADDED 1993 BOTTOM PROFILE JULY, 1993: UMA SURVEYS	2	ADDED 1999 BOTTOM PROFILE AUG 1999: UMA GEOMATICS	1	ADDED 2005 BOTTOM PROFILE JUNE 2005: USHER CANADA LIMITED	0	ADDED 2012 BOTTOM PROFILE AUG 2012: MMM Geomatics
2	ADDED 2017 BOTTOM PROFILE SEP. 2017: WSP	1	ADDED 1998 BOTTOM PROFILE JUNE, 1998: UMA GEOMATICS	0	ADDED 2004 BOTTOM PROFILE AUG 2004: USHER CANADA LIMITED	0	ADDED 2011BOTTOM PROFILE AUG 2011: MMM Geomatics
1	ADDED 2016 BOTTOM PROFILE SEP. 2016: WSP	0	ADDED 1997 BOTTOM PROFILE JULY, 1997: UMA GEOMATICS	0	ADDED 2003 BOTTOM PROFILE AUG 2003: UMA GEOMATICS	0	ADDED 2010 BOTTOM PROFILE JULY 2010: MMM Geomatics

LEGEND

UTILIDORS SHOWN
ROADS SHOWN
BURIED PIPES SHOWN
BELOW GROUND POWER,TELEPHONE, & COMMUNICATION SHOWN
VENT SHOWN
TRANSITION POINT
PULL BOX SHOWN
PULL POINT SHOWN
PIPE O/S DIA'S ARE IN MILLIMETERS AND DECIMALS THEREOF

SUBSTANCE/CATEGORY CROSS REFERENCE

SUBSTANCE	CODE	SUBSTANCE	CODE
PROPANE/BUTANE	HV	PRODUCED WATER	SW
CRUDE OIL	CO	FRESH WATER	FW
MULTIPHASE FLUIDS	OE	INJECTION (SW)	INJ–SW
NATURAL/LIFT GAS	NG	INJECTION (FW)	INJ–FW
FUEL GAS	FG	ABANDONED	ABAN
MISCELLANEOUS LIQUIDS	ML	MISCELLANEOUS GASES	MG

Esso Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

BEAR TO ISLAND 5

SURVEY DRAWING

CONTRACTOR NAME: WSP Surveys (AB) Limited Partnership

DATE: 17–10–31

SCALE: H 1:1000 V 1:200

CONTRACTOR DWG NO. : 1201–C

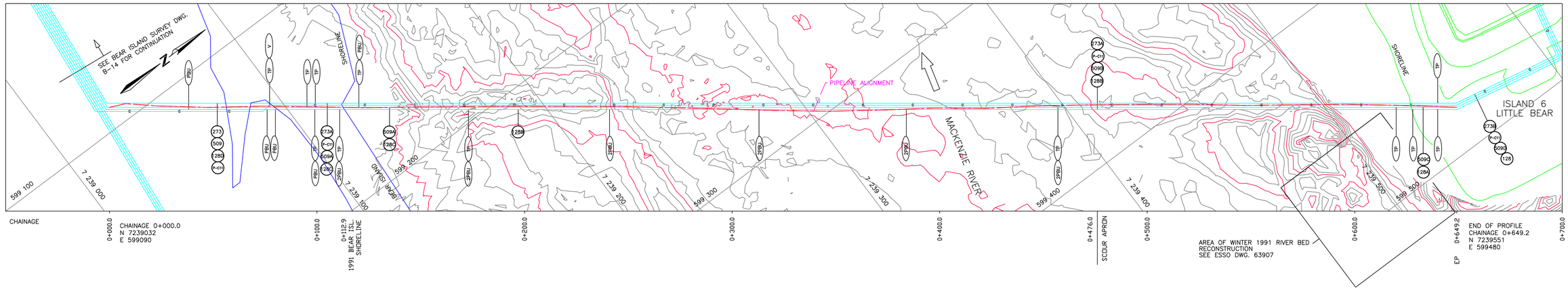
ESSO FILE No. 096–0179–700–801 76

096-0179-700-801 77

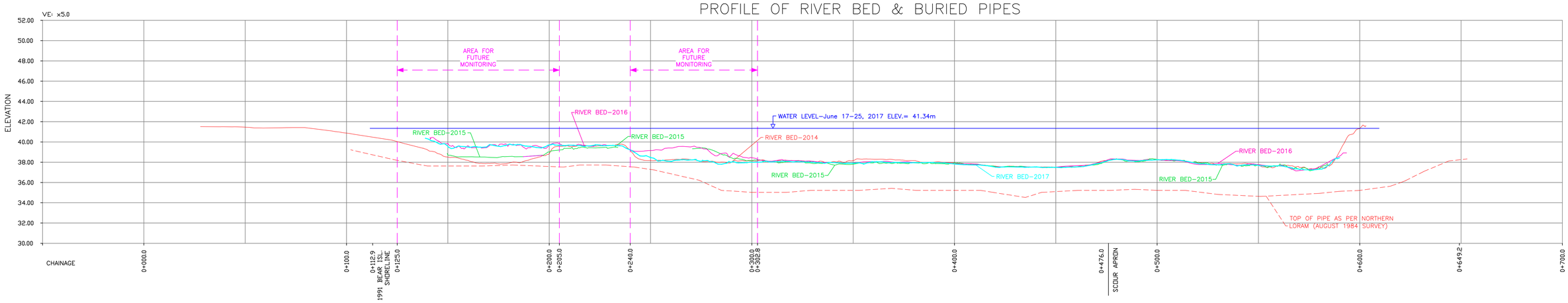
AutoCAD

DRAWING NO MANUAL CHANGES

CADD



PROFILE OF RIVER BED & BURIED PIPES



SURVEY CONTROL					No.	SUBSTANCE DESCRIPTION
No.	DESCRIPTION	NORTHING	EASTING	ELEV.		**MULTIPHASE LIQUIDS**
1000	REBAR @ N.E. OF ISL. 1	7240711.75	599540.89		128	168.3 OE Is.6 to BIT 4, Glycol H.T. 128-128A
1004	REBAR @ N.W. OF ISL. 1	7240729.21	599459.90		128A	168.3 OE Is.6 to BIT 4, Glycol H.T., Conc Coated 128-128A-128B
2	REBAR @ N.E. OF ISL. 2	7240301.75	600511.43		128B	168.3 OE Is.6 to BIT 4, Conc Coated 128-128A-128B-128C B-3,13,14,24,25
2001	REBAR @ N.W. OF ISL. 2	7240324.34	600431.97		128C	168.3 OE Is.6 to BIT 4, Dbl Sect H.T., Conc Coated 128-128A-128B-128C-128D B-3,13,14,24,25 H.T.441
27	REBAR @ N.W. OF ISL. 3	7240741.90	597423.38		128D	168.3 OE Is.6 to BIT 4, Sng Sect H.T. 128-128A-128B-128C-128D-BIT 4 B-3,13,14,24,25 H.T.441
3000	REBAR @ N.E. OF ISL.3	7240716.18	597500.36			**GASLIFT**
26	REBAR @ N.W. OF ISL. 4	7240387.54	598100.08		273	88.9 NG (Gas Lift) BIT 4 to Is.6 (Buried) 273-273A B-25,24,14,13,3
4000	REBAR @ N.E. OF ISL. 4	7240361.98	598175.94		273A	88.9 NG (Gas Lift) BIT 4 to Is.6 (Conc Coated) 273-273A-273B B-25,24,14,13,3
22	REBAR @ N.W. OF ISL. 5	7240016.98	598734.63		273B	88.9 NG (Gas Lift) BIT 4 to Is.6 (Buried) 273-273A-273B-Is.6
5000	REBAR @ N.E. OF ISL. 5	7239993.12	598815.14			**INJECTION WATER**
21	REBAR @ N.W. OF ISL. 6	7239631.84	599382.56		509	88.9 INJ-FW BIT 4 to Is.6, Sng Sect H.T. 509-509A B-25,24,14,13,3 H.T.442
6000	REBAR @ N.E. OF ISL. 6	7239616.68	599465.79		509A	88.9 INJ-FW BIT 4 to Is.6, Dbl Sect H.T., Conc Coated 504-504A-504B B-25,24,14,13,3 H.T.442
					509B	88.9 INJ-FW BIT 4 to Is.6, Conc Coated 509-509A-509B-509C B-25,24,14,13,3
					509C	88.9 INJ-FW BIT 4 to Is.6, Glycol H.T., Conc Coated 509-509A-509B-509C-509D
					509D	88.9 INJ-FW BIT 4 to Is.6, Glycol H.T. 509-509A-509B-509C-509D-Is.6
						ELECTRICAL DESCRIPTION
					P-C11	4160 H.V. BIT 4 5Kv Switch Gear Is.6 Tr-C6 B-25,24,1413,3

PROFILE ALIGNMENT COORDINATES		
EASTING	NORTHING	
599090.000	7239032.000	START CHAINAGE 0+000.000
599093.250	7239039.250	
599103.320	7239050.850	
599118.870	7239070.340	
599133.430	7239090.700	
599149.930	7239112.080	
599163.950	7239130.100	
599178.670	7239150.250	
599193.510	7239170.290	
599208.340	7239190.310	
599223.420	7239210.200	
599238.330	7239230.020	
599253.750	7239249.580	
599269.330	7239269.230	
599285.010	7239288.900	
599290.520	7239296.040	
599294.190	7239300.800	
599300.310	7239308.730	
599314.720	7239328.900	
599329.050	7239349.520	
599344.090	7239369.280	
599358.010	7239389.800	
599372.550	7239409.930	
599387.300	7239429.980	
599402.270	7239450.020	
599417.930	7239469.890	
599432.740	7239490.140	
599447.530	7239510.210	
599462.960	7239529.870	
599468.430	7239536.780	
599480.000	7239551.000	END CHAINAGE 0+649.2

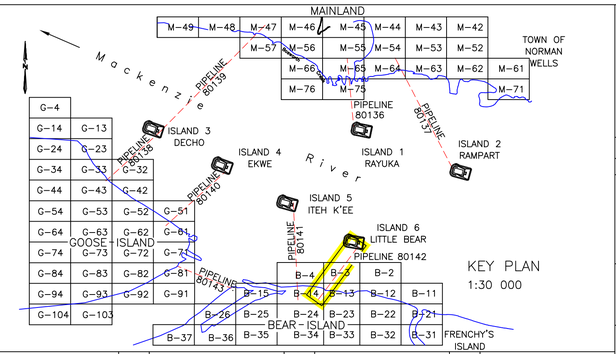
Alignment includes Winter 1997 pipe locating data.

NOTES

1. RIVER BOTTOM PROFILE FROM 2017 BATHYMETRIC SURVEY PERFORMED JUNE 17 TO JUNE 25, 2017.
2. PIPE PROFILE AND CHAINAGES FROM ESSO DWG. 80054 REV. B – TOP OF PIPE AS PER NORTHERN LORAM (TOP OF PIPE PROFILE ELEVATION REDUCED 0.776m IN 2008)
3. HORIZONTAL DATUM : NAD27 (SHORAN) – UTM GRID/CM = 129°
4. VERTICAL DATUM – GEODETIC BM 74T016 ELEVATION 60.189
5. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL
6. CONTOUR INTERVAL = 0.25 METRES.

LEGEND

- 2014 RIVER BED PROFILE SHOWN AS
- 2015 RIVER BED PROFILE SHOWN AS
- 2016 RIVER BED PROFILE SHOWN AS
- 2017 RIVER BED PROFILE SHOWN AS



LEGEND

UTILIDORS SHOWN
ROADS SHOWN
BURIED PIPES SHOWN
BELOW GROUND POWER,TELEPHONE, & COMMUNICATION SHOWN
VENT SHOWN
TRANSITION POINT
PULL BOX SHOWN
PULL POINT SHOWN
PIPE O/S DIA.'S ARE IN MILLIMETERS AND DECIMALS THEREOF

SUBSTANCE/CATEGORY CROSS REFERENCE			
SUBSTANCE	CODE	SUBSTANCE	CODE
PROPANE/BUTANE	HV	PRODUCED WATER	SW
CRUDE OIL	CO	FRESH WATER	FW
MULTIPHASE FLUIDS	OE	INJECTION (SW)	INJ-SW
NATURAL/LIFT GAS	NG	INJECTION (FW)	INJ-FW
FUEL GAS	FG	ABANDONED	ABAN
MISCELLANEOUS LIQUIDS	ML	MISCELLANEOUS GASES	MG

Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

BEAR TO ISLAND 6 SURVEY DRAWING

No.	REVISION	No.	REVISION	No.	REVISION		
7	ADDED 1997 BOTTOM PROFILE JULY, 1997: UMA GEOMATICS	4	ADDED 2005 BOTTOM PROFILE JUNE 2005: USHER CANADA LIMITED	1	ADDED 2013 BOTTOM PROFILE AUG 2013: MMM Geomatics		
6	ADDED 1996 BOTTOM PROFILE JULY, 1996: UMA GEOMATICS	3	ADDED 2003 BOTTOM PROFILE AUG 2003: UMA GEOMATICS	1	ADDED 2012 BOTTOM PROFILE AUG 2012: MMM Geomatics		
5	ADDED 1995 BOTTOM PROFILE JULY, 1995: UMA GEOMATICS	2	ADDED 2002 BOTTOM PROFILE AUG 2002: UMA GEOMATICS	1	ADDED 2011 BOTTOM PROFILE AUG 2011: MMM Geomatics		
4	ADDED 1994 BOTTOM PROFILE JULY, 1994: UMA SURVEYS	1	ADDED 2001 BOTTOM PROFILE AUG 2001: UMA GEOMATICS	8	ADDED 2010 BOTTOM PROFILE JULY 2010: MMM Geomatics	5	ADDED 2017 BOTTOM PROFILE SEP. 2017: WSP
3	ADDED 1993 BOTTOM PROFILE JULY, 1993: UMA SURVEYS	10	ADDED 2000 BOTTOM PROFILE AUG 2000: UMA GEOMATICS	7	ADDED 2009 BOTTOM PROFILE JUNE 2009: MMM Geomatics	4	ADDED 2016 BOTTOM PROFILE SEP. 2016: WSP
2	REVISED TITLEBLOCK APRIL 12/93: UMA SURVEYS	9	ADDED 1999 BOTTOM PROFILE AUG 1999: UMA GEOMATICS	6	ADDED 2008 BOTTOM PROFILE JUNE 2008: MMM Geomatics	3	ADDED 2015 BOTTOM PROFILE AUG. 2015: WSP
1	CONVERTED TO AUTOCAD SEP/92 LINE #'S ADDED; UMA SURVEYS	8	ADDED 1998 BOTTOM PROFILE JUNE, 1998: UMA GEOMATICS	5	ADDED 2006 BOTTOM PROFILE JUNE 2006: USHER CANADA LIMITED	2	ADDED 2014 BOTTOM PROFILE AUG 2014: MMM Geomatics

CONTRACTOR NAME: WSP Surveys (AB) Limited Partnership

DATE: 17-10-31

SCALE: H 1:1000 V 1:200

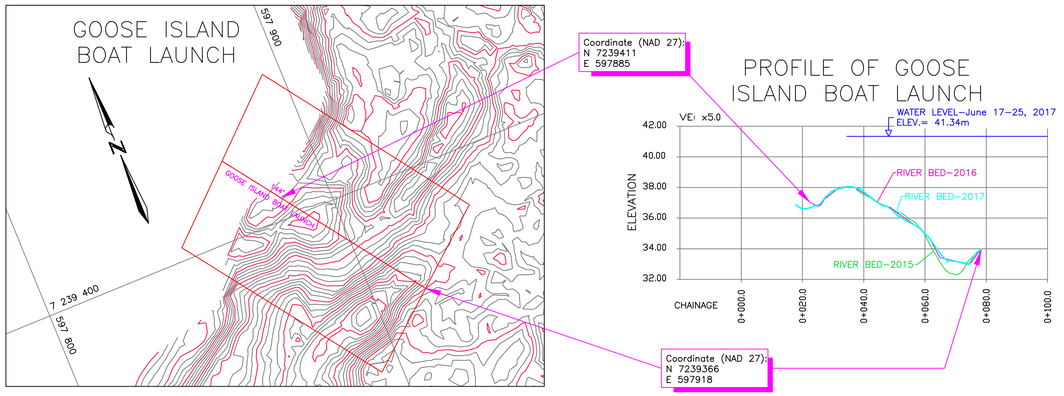
CONTRACTOR DWG NO. : 1202-C

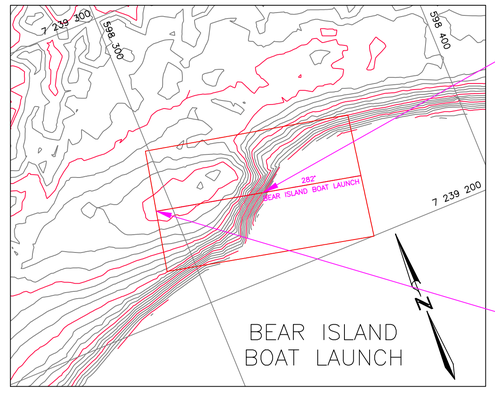
ESSO FILE No. 096-0179-700-801 77

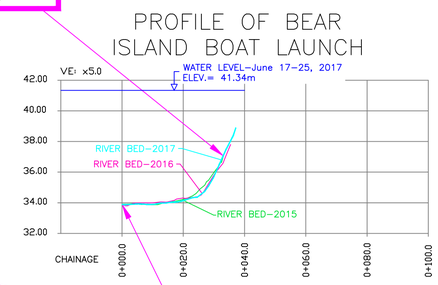
096-0179-700-801 78

AutoCAD

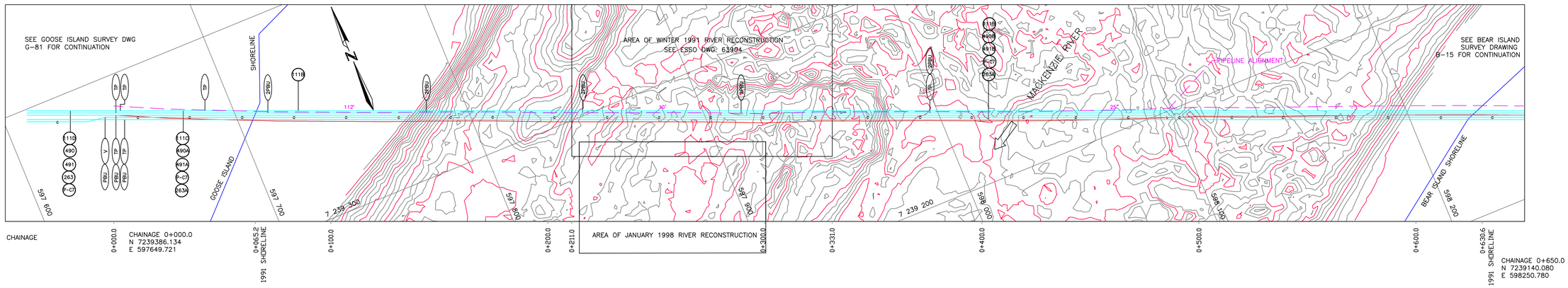
CADD DRAWING NO MANUAL CHANGES



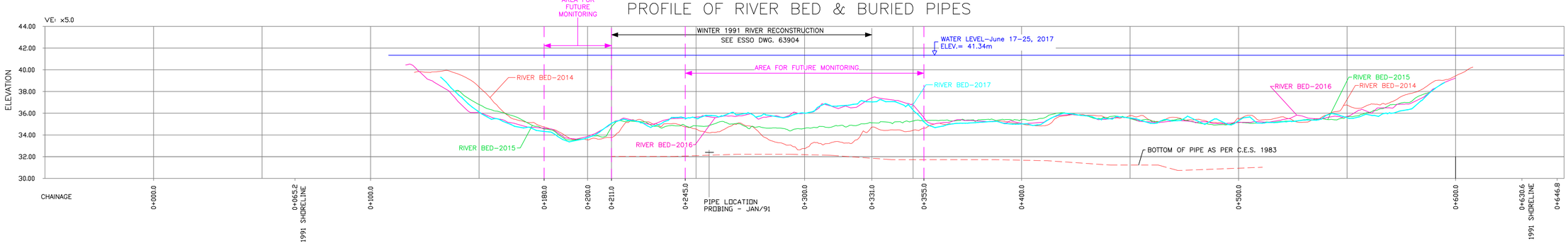




PIPELINE ALIGNMENT



PROFILE OF RIVER BED & BUIED PIPES



SURVEY CONTROL

No.	DESCRIPTION	NORTHING	EASTING	ELEV.
1000	REBAR @ N.E. OF ISL. 1	7240711.75	599540.89	
1004	REBAR @ N.W. OF ISL. 1	7240729.21	599459.90	
2	REBAR @ N.E. OF ISL. 2	7240301.75	600511.43	
2001	REBAR @ N.W. OF ISL. 2	7240324.34	600431.97	
27	REBAR @ N.W. OF ISL. 3	7240741.90	597423.38	
3000	REBAR @ N.E. OF ISL.3	7240716.18	597500.36	
26	REBAR @ N.W. OF ISL. 4	7240387.54	598100.08	
4000	REBAR @ N.E. OF ISL. 4	7240361.98	598175.94	
22	REBAR @ N.W. OF ISL. 5	7240016.98	598734.63	
5000	REBAR @ N.E. OF ISL. 5	7239993.12	598815.14	
21	REBAR @ N.W. OF ISL. 6	7239631.84	599382.56	
6000	REBAR @ N.E. OF ISL. 6	7239616.68	599465.79	

No.	SUBSTANCE DESCRIPTION	
	MULTIPHASE LIQUIDS	
111B	273.1 OE BIT 4 TO GIT 4, Conc Coated 111A–111B–111C	B–25,15,80143,G–81,72,73,63,53,54
111C	273.1 OE BIT 4 TO GIT 4, Conc Coated, Dbl Sect H.T.	111A–111B–111C–111D H.T.358 B–25,15,80143,G–81,72,73,63,53,54
111D	273.1 OE BIT 4 TO GIT 4, Sng Sect H.T.	111A–111B–111C–111D–GIT 4 H.T.358 B–25,15,80143,G–81,72,73,63,53,54
	GAS LIFT	
263	114.3 NG (Gas Lift) GIT 4 to BIT 4, (Buried) 263–263A	G–54,53,63,73,72,81,80143, B–15,25
263A	114.3 NG (Gas Lift) GIT 4 to BIT 4, (Conc Coated)	263–263A–263B G–54,53,63,73,72,81,80143, B–15,25
	INJECTION WATER	
490	168.3 INJ–FW GIT 4 to BIT 4, Sng Sect H.T. 490–490A	G–54,53,63,73,72,81,80143, B–15,25
490A	168.3 INJ–FW GIT 4 to BIT 4, Dbl Sect H.T., Conc Coated	490–490A–490B G–54,53,63,73,72,81,80143, B–15,25
490B	168.3 INJ–FW GIT 4 to BIT 4, Conc Coated	490–490A–490B–490C G–54,53,63,73,72,81,80143, B–15,25
491	168.3 INJ–FW GIT 4 to BIT 4, Sng Sect H.T. 491–491A	H.T.359 G–54,53,63,73,72,81, 80143,B–15,25
491A	168.3 INJ–FW GIT 4 to BIT 4, Dbl Sect H.T., Conc Coated	491–491A–491B B–15,25 H.T.359 G–54,53,63,73,72,81, 80143,
491B	168.3 INJ–FW GIT 4 to BIT 4, Conc Coated	491–491A–491B–491C G–54,53,63,73,72,81,80143, B–15,25
	ELECTRICAL DESCRIPTION	
P–C7	From GIT 4 5 Kv Switch Gear to Bit 4 5 Kv Switch Gear	G–54,53,63,73,72,81,80143, B–15,25

PROFILE ALIGNMENT COORDINATES

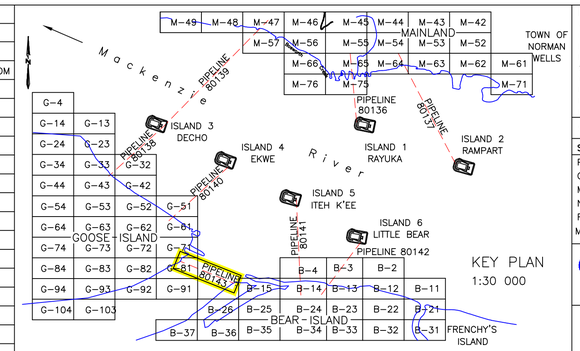
EASTING	NORTHING	
597649.721	7239386.134	START CHAINAGE 0+000.000
597671.510	7239375.720	
597694.360	7239365.650	
597717.320	7239355.580	
597740.330	7239346.000	
597763.530	7239336.350	
597786.920	7239327.070	
597809.940	7239317.690	
597832.860	7239307.890	
597856.150	7239298.350	
597879.180	7239288.940	
597902.340	7239279.360	
597925.180	7239269.500	
597948.810	7239260.830	
597971.850	7239251.360	
597995.020	7239242.080	
598018.150	7239232.440	
598041.300	7239223.030	
598064.660	7239213.950	
598088.100	7239205.000	
598111.620	7239196.410	
598134.900	7239186.640	
598158.230	7239177.540	
598181.400	7239168.400	
598204.620	7239159.090	
598227.940	7239149.630	
598250.780	7239140.080	END CHAINAGE 0+650.0

Alignment includes Winter 1997 pipe locating data.

NOTES

1. RIVER BOTTOM PROFILE FROM 2017 BATHYMETRIC SURVEY PERFORMED JUNE 17 TO JUNE 25, 2017.
2. PIPE PROFILE AND CHAINAGES FROM ESSO DWG. 80056 REV. 8 – BOTTOM OF PIPE AS PER CANADIAN ENG. SURVEYS DRAWINGS OF 1983 (PIPE PROFILE ELEVATION REDUCED 0.776m IN 2008)
3. HORIZONTAL DATUM : NAD27 (SHORAN) – UTM GRID/CM = 129°
4. VERTICAL DATUM – GEODETIC BM 74T016 ELEVATION 60.189
5. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL
6. CONTOUR INTERVAL = 0.25 METRES.

2014 RIVER BED PROFILE SHOWN AS
2015 RIVER BED PROFILE SHOWN AS
2016 RIVER BED PROFILE SHOWN AS
2017 RIVER BED PROFILE SHOWN AS



KEY PLAN
1:30 000

No.	REVISION	No.	REVISION	No.	REVISION	No.	REVISION
6	ADDED 1996 BOTTOM PROFILE JULY 1996: UMA GEOMATICS	4	ADDED 2002 BOTTOM PROFILE AUG 2002: UMA GEOMATICS	4	ADDED 2009 BOTTOM PROFILE JUNE 2009: MMM Geomatics	4	ADDED 2015 BOTTOM PROFILE GOOSE ISLAND BOAT LAUNCH PROFILE & BEAR ISLAND PROFILE AUG. 2015: WSP
5	ADDED 1995 BOTTOM PROFILE JULY 1995: UMA GEOMATICS	3	ADDED 2001 BOTTOM PROFILE AUG 2001: UMA GEOMATICS	3	ADDED 2008 BOTTOM PROFILE JUNE 2008: MMM Geomatics	3	ADDED 2014 BOTTOM PROFILE AUG 2014: MMM Geomatics
4	ADDED 1994 BOTTOM PROFILE JULY 1994: UMA SURVEYS	2	ADDED 2000 BOTTOM PROFILE AUG 2000: UMA GEOMATICS	2	ADDED 2006 BOTTOM PROFILE JUNE 2006: USHER CANADA LIMITED	2	ADDED 2013 BOTTOM PROFILE AUG 2013: MMM Geomatics
3	ADDED 1993 BOTTOM PROFILE JULY 1993: UMA SURVEYS	1	ADDED 1999 BOTTOM PROFILE AUG 1999: UMA GEOMATICS	1	ADDED 2005 BOTTOM PROFILE JUNE 2005: USHER CANADA LIMITED	1	ADDED 2012 BOTTOM PROFILE AUG 2012: MMM Geomatics
2	ADDED 2017 BOTTOM PROFILE SEP 2017: WSP	0	ADDED 1998 BOTTOM PROFILE JUNE 1998: UMA GEOMATICS	0	ADDED 2004 BOTTOM PROFILE AUG 2004: USHER CANADA LIMITED	0	ADDED 2011 BOTTOM PROFILE AUG 2011: MMM Geomatics
1	ADDED 2016 BOTTOM PROFILE SEP 2016: WSP	1	ADDED 1997 BOTTOM PROFILE JULY 1997: UMA GEOMATICS	1	ADDED 2003 BOTTOM PROFILE AUG 2003: UMA GEOMATICS	1	ADDED 2010 BOTTOM PROFILE JULY 2010: MMM Geomatics

LEGEND

UTILIDORS SHOWN
ROADS SHOWN
BURIED PIPES SHOWN
BELOW GROUND POWER,TELEPHONE, & COMMUNICATION SHOWN
VENT SHOWN
TRANSITION POINT
PULL BOX SHOWN
PULL POINT SHOWN
PIPE O/S DIA'S ARE IN MILLIMETERS AND DECIMALS THEREOF

SUBSTANCE/CATEGORY CROSS REFERENCE

SUBSTANCE	CODE	SUBSTANCE	CODE
PROPANE/BUTANE	HV	PRODUCED WATER	SW
CRUDE OIL	CO	FRESH WATER	FW
MULTIPHASE FLUIDS	OE	INJECTION (SW)	INJ–SW
NATURAL/LIFT GAS	NG	INJECTION (FW)	INJ–FW
FUEL GAS	FG	ABANDONED	ABAN
MISCELLANEOUS LIQUIDS	ML	MISCELLANEOUS GASES	MG

Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

GOOSE TO BEAR SURVEY PLAN

CONTRACTOR NAME:
WSP Surveys (AB) Limited Partnership

DATE: 17–10–31

SCALE: H 1:1000 V 1:200

CONTRACTOR DWG NO. : 1203–C

ESSO FILE No.

096–0179–700–801 78

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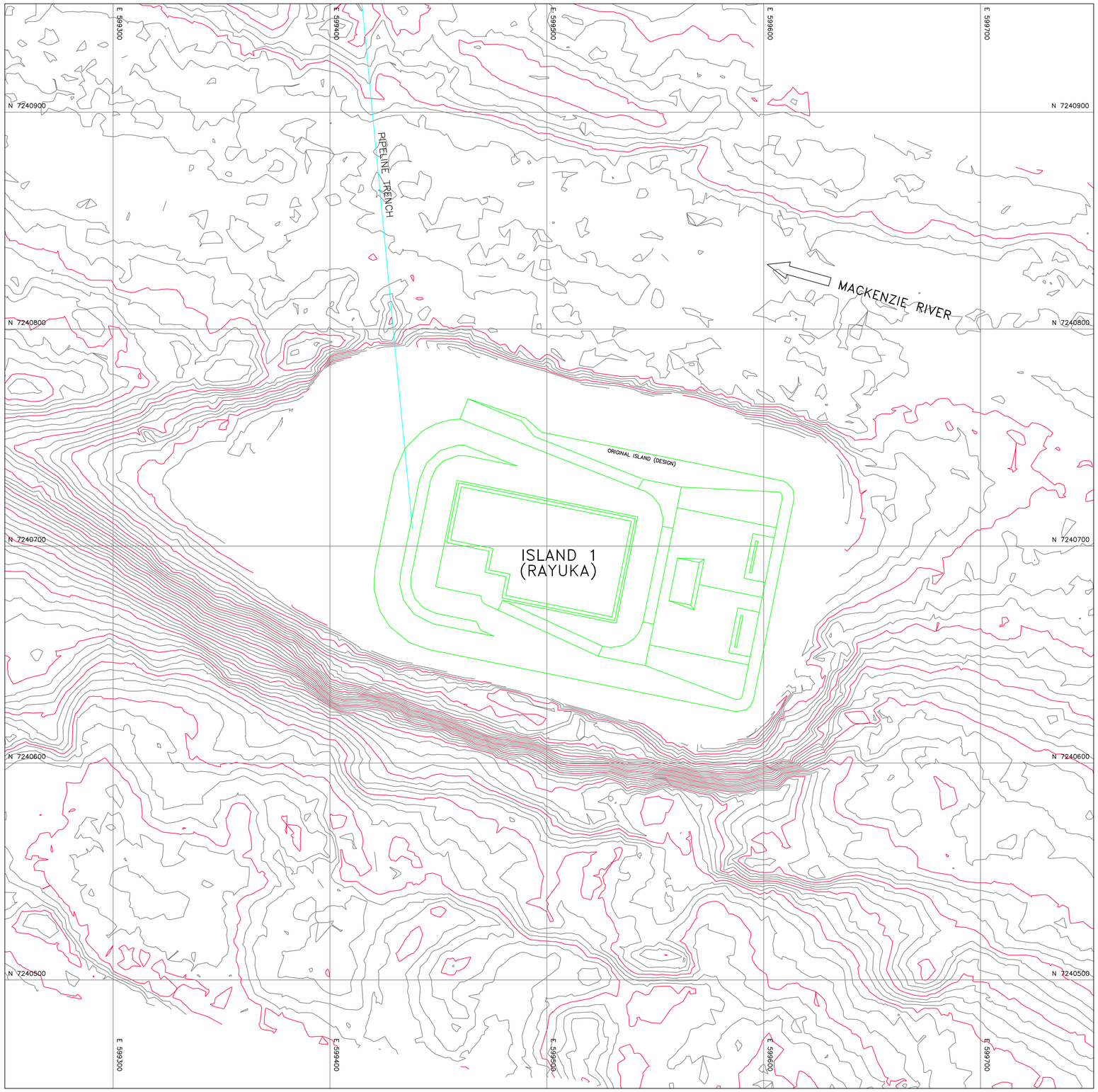

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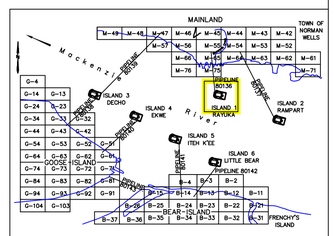


KEY PLAN
1:50 000

NOTES

1. CONTOUR INTERVAL = 0.25 METRES.
2. BATHYMETRIC SURVEY PERFORMED BETWEEN JUNE 17 TO JUNE 25, 2017.
3. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL.
4. HORIZONTAL DATUM: NAD27(SHORAN)-UTM GRID/CM = 129°
5. VERTICAL DATUM: GEODETIC BM 74T016 ELEVATION = 60.189m

LEGEND

11	2003 SURVEY CONTOURS AUG 2003: UMA GEOMATICS	22	2015 SURVEY CONTOURS AUG. 2015: WSP
10	2002 SURVEY CONTOURS AUG 2002: UMA GEOMATICS	21	2014 SURVEY CONTOURS AUGUST 2014: MMM Geomatics
9	2001 SURVEY CONTOURS AUG 2001: UMA GEOMATICS	20	2013 SURVEY CONTOURS AUGUST 2013: MMM Geomatics
8	2000 SURVEY CONTOURS AUG 2000: UMA GEOMATICS	19	2012 SURVEY CONTOURS AUGUST 2012: MMM Geomatics
7	1999 SURVEY CONTOURS AUG 1999: UMA GEOMATICS	18	2011 SURVEY CONTOURS AUGUST 2011: MMM Geomatics
6	1998 SURVEY CONTOURS JUNE 1998: UMA GEOMATICS	17	2010 SURVEY CONTOURS JULY 2010: MMM Geomatics
5	1997 SURVEY CONTOURS AUGUST 1997: UMA GEOMATICS	16	2009 SURVEY CONTOURS JUNE 2009: MMM Geomatics
4	1996 SURVEY CONTOURS JULY 1996: UMA GEOMATICS	15	2008 SURVEY CONTOURS JUNE 2008: MMM Geomatics
3	1995 SURVEY CONTOURS JULY 1995: UMA GEOMATICS	14	2006 SURVEY CONTOURS JUNE 2006: USHER CANADA LIMITED
2	2017 SURVEY CONTOURS SEP. 2017: WSP	13	2005 SURVEY CONTOURS JULY 2005: USHER CANADA LIMITED
1	2016 SURVEY CONTOURS SEP. 2016: WSP	12	2004 SURVEY CONTOURS AUG.2004:USHER CANADA LIMITED
No.	REVISION	No.	REVISION

Esso Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

ISLAND 1 & SURROUNDING AREA

SURVEY PLAN

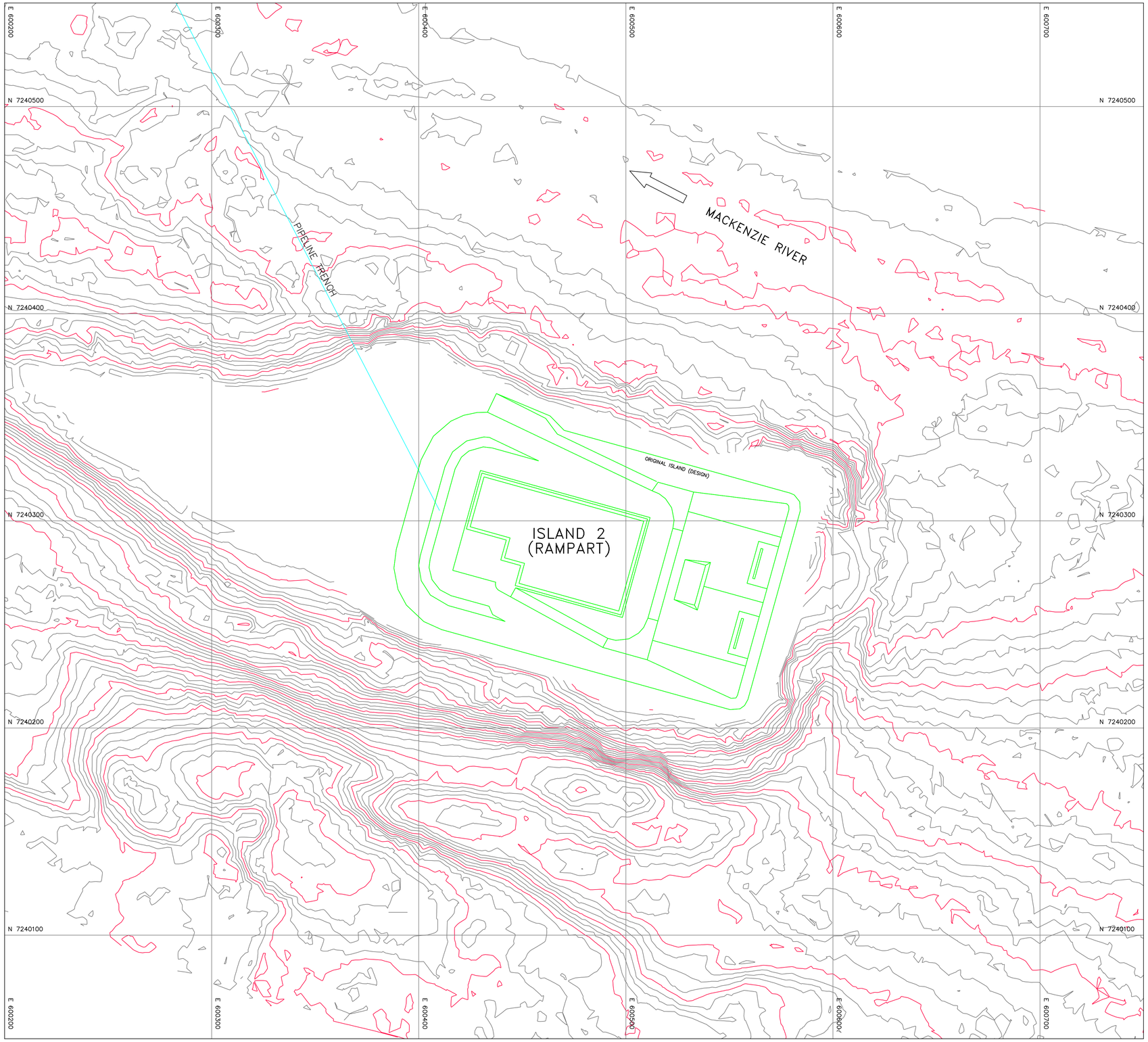
CONTRACTOR NAME: WSP Surveys (AB) Limited Partnership	CONTRACTOR DWG NO. : 1204-C
DATE: 17-10-31	ESSO FILE No.
SCALE: 1:1000	096-0179-700-801 79

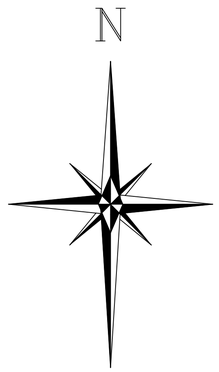
096-0179-700-801 80

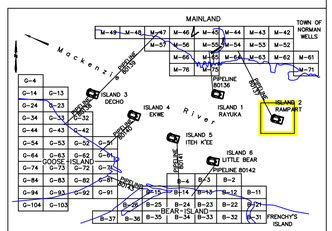
AutoCAD

DRAWING NO MANUAL CHANGES

CADD







KEY PLAN
1:50 000

NOTES

1. CONTOUR INTERVAL = 0.25 METRES.
2. BATHYMETRIC SURVEY PERFORMED BETWEEN JUNE 17 TO JUNE 25, 2017.
3. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL.
4. HORIZONTAL DATUM: NAD27(SHORAN)–UTM GRID/CM = 129°
5. VERTICAL DATUM: GEODETIC BM 74T016 ELEVATION = 60.189m

LEGEND

1	2003 SURVEY CONTOURS AUG 2003: UMA GEOMATICS	2	2015 SURVEY CONTOURS AUG. 2015: WSP
10	2002 SURVEY CONTOURS AUG 2002: UMA GEOMATICS	21	2014 SURVEY CONTOURS AUGUST 2014: MMM Geomatics
9	2001 SURVEY CONTOURS AUG 2001: UMA GEOMATICS	20	2013 SURVEY CONTOURS AUGUST 2013: MMM Geomatics
8	2000 SURVEY CONTOURS AUG 2000: UMA GEOMATICS	19	2012 SURVEY CONTOURS AUGUST 2012: MMM Geomatics
7	1999 SURVEY CONTOURS AUG 1999: UMA GEOMATICS	18	2011 SURVEY CONTOURS AUGUST 2011: MMM Geomatics
6	1998 SURVEY CONTOURS JUNE 1998: UMA GEOMATICS	17	2010 SURVEY CONTOURS JULY 2010: MMM Geomatics
5	1997 SURVEY CONTOURS AUGUST 1997: UMA GEOMATICS	16	2009 SURVEY CONTOURS JUNE 2009: MMM Geomatics
4	1996 SURVEY CONTOURS JULY 1996: UMA GEOMATICS	15	2008 SURVEY CONTOURS JUNE 2008: MMM Geomatics
3	1995 SURVEY CONTOURS JULY 1995: UMA GEOMATICS	14	2006 SURVEY CONTOURS JUNE 2006: USHER CANADA LIMITED
24	2017 SURVEY CONTOURS SEP. 2017: WSP	13	2005 SURVEY CONTOURS JULY 2005: USHER CANADA LIMITED
23	2016 SURVEY CONTOURS SEP. 2016: WSP	12	2004 SURVEY CONTOURS AUG 2004:USHER CANADA LIMITED
No.	REVISION	No.	REVISION

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IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

ISLAND 2 & SURROUNDING AREA

SURVEY DRAWING

CONTRACTOR NAME: WSP Surveys (AB) Limited Partnership	CONTRACTOR DWG NO. : 1205–C
DATE: 17–10–31	ESSO FILE No.
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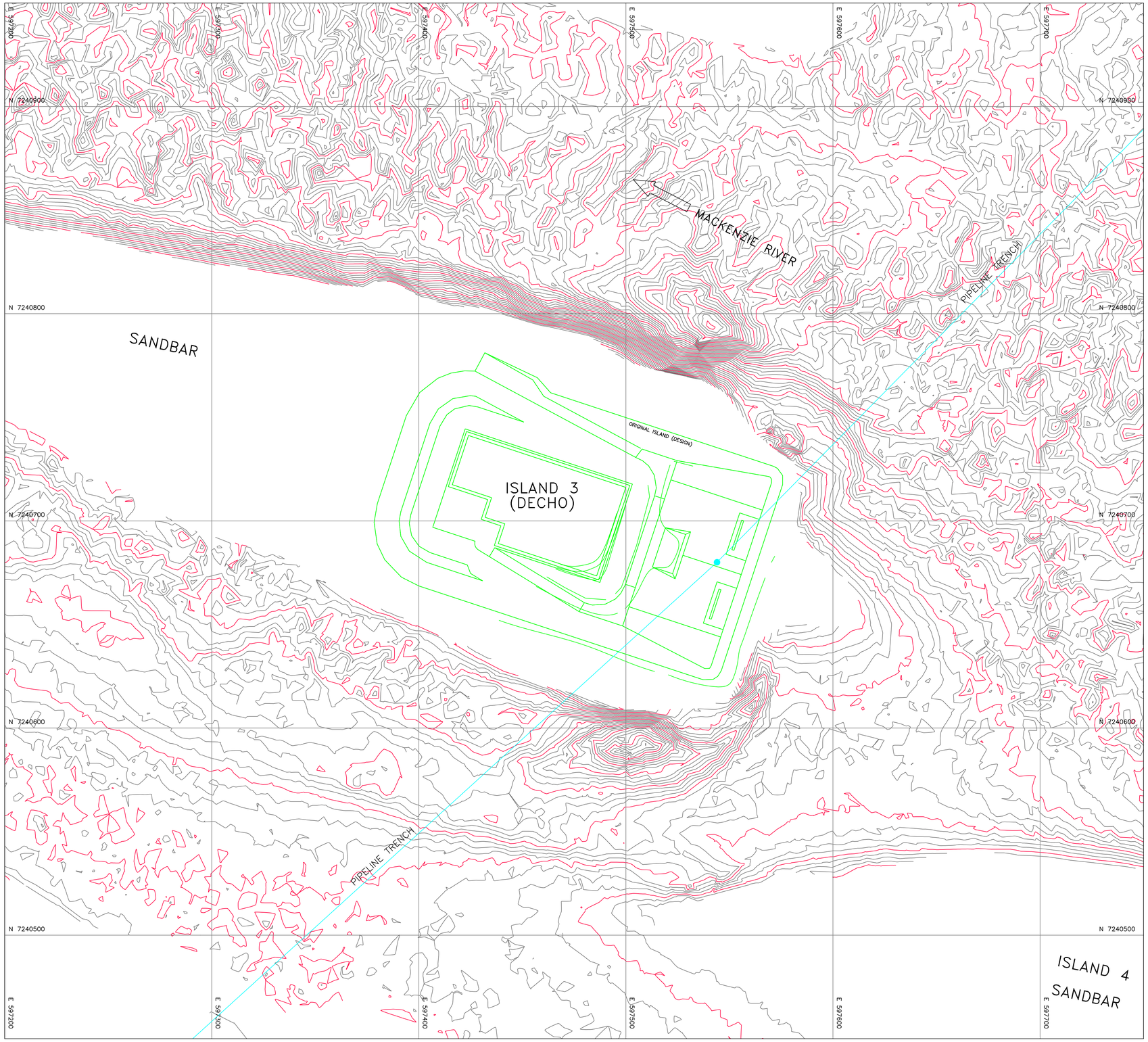

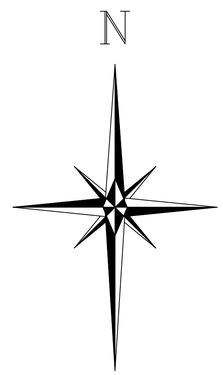

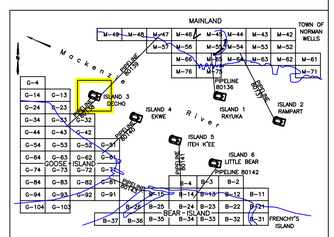

KEY PLAN
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NOTES

1. CONTOUR INTERVAL = 0.25 METRES.
2. BATHYMETRIC SURVEY PERFORMED BETWEEN JUNE 17 TO JUNE 25, 2017.
3. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL.
4. HORIZONTAL DATUM: NAD27(SHORAN)-UTM GRID/cm = 129'
5. VERTICAL DATUM: GEODETIC BM 74T016 ELEVATION = 60.189m

LEGEND

1	2003 SURVEY CONTOURS AUG 2003: UMA GEOMATICS	2	2015 SURVEY CONTOURS AUG. 2015: WSP
1	2002 SURVEY CONTOURS AUG 2002: UMA GEOMATICS	1	2014 SURVEY CONTOURS AUGUST 2014: MMM Geomatics
5	2001 SURVEY CONTOURS AUG 2001: UMA GEOMATICS	2	2013 SURVEY CONTOURS AUGUST 2013: MMM Geomatics
5	2000 SURVEY CONTOURS AUG 2000: UMA GEOMATICS	3	2012 SURVEY CONTOURS AUGUST 2012: MMM Geomatics
7	1999 SURVEY CONTOURS AUG 1999: UMA GEOMATICS	8	2011 SURVEY CONTOURS AUGUST 2011: MMM Geomatics
6	1998 SURVEY CONTOURS JUNE 1998: UMA GEOMATICS	1	2010 SURVEY CONTOURS JULY 2010: MMM Geomatics
5	1997 SURVEY CONTOURS AUGUST 1997: UMA GEOMATICS	6	2009 SURVEY CONTOURS JUNE 2009: MMM Geomatics
4	1996 SURVEY CONTOURS JULY 1996: UMA GEOMATICS	5	2008 SURVEY CONTOURS JUNE 2008: MMM Geomatics
3	1995 SURVEY CONTOURS JULY 1995: UMA GEOMATICS	4	2006 SURVEY CONTOURS JUNE 2006: USHER CANADA LIMITED
2	2017 SURVEY CONTOURS SEP. 2017: WSP	3	2005 SURVEY CONTOURS JULY 2005: USHER CANADA LIMITED
2	2016 SURVEY CONTOURS SEP. 2016: WSP	2	2004 SURVEY CONTOURS AUG 2004:USHER CANADA LIMITED
No.	REVISION	No.	REVISION

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IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

ISLAND 3 & SURROUNDING AREA

SURVEY DRAWING

CONTRACTOR NAME: WSP Surveys (AB) Limited Partnership	CONTRACTOR DWG NO. : 1206-C
DATE: 17-10-31	ESSO FILE No.
SCALE: 1:1000	096-0179-700-801 81

096-0179-700-801 82

AutoCAD

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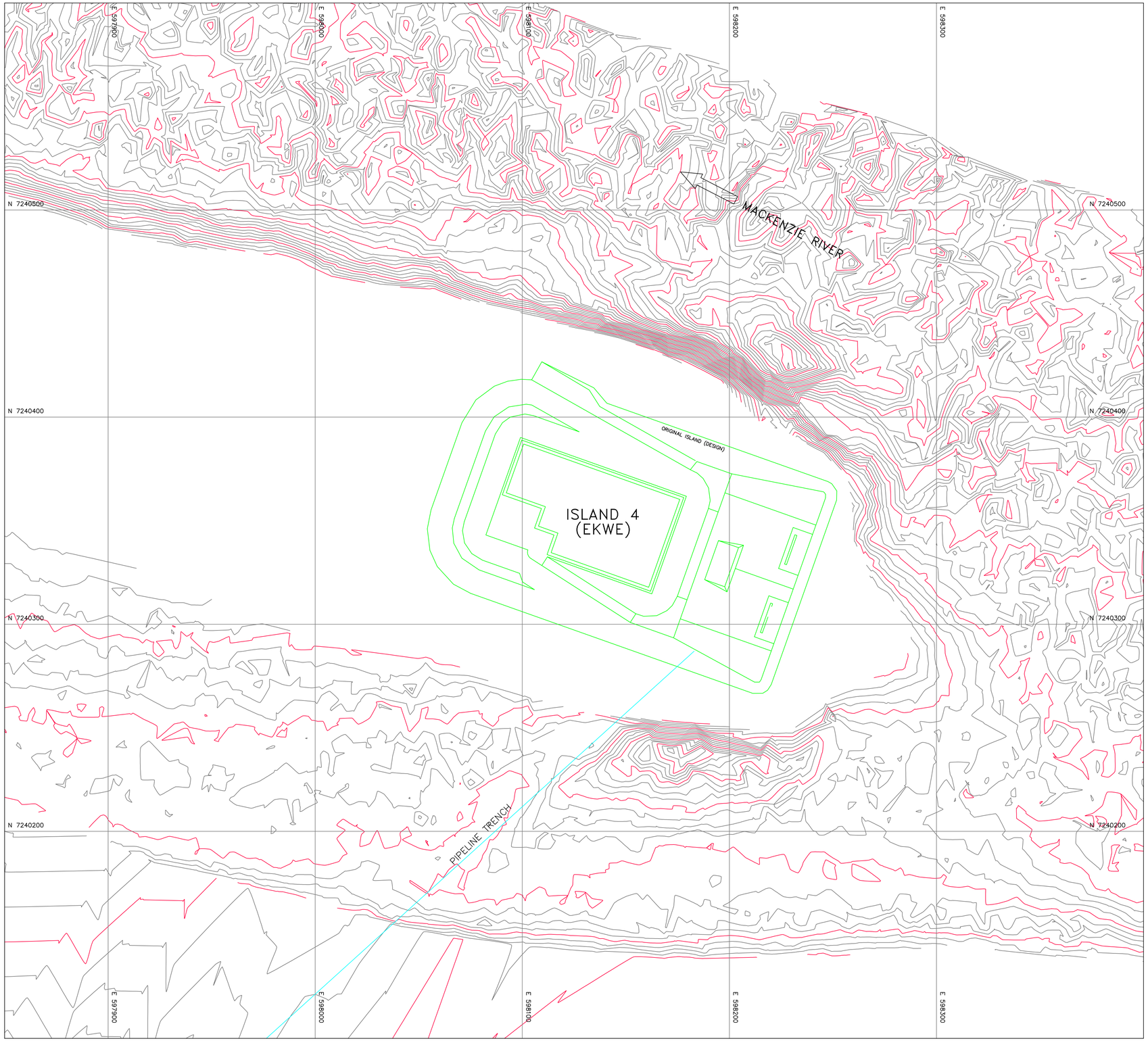

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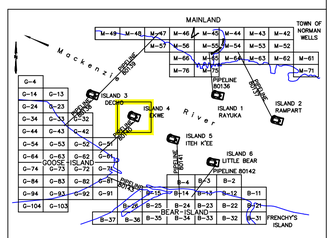

KEY PLAN
1:50 000

NOTES

1. CONTOUR INTERVAL = 0.25 METRES.
2. BATHYMETRIC SURVEY PERFORMED BETWEEN JUNE 17 TO JUNE 25, 2017.
3. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL.
4. HORIZONTAL DATUM: NAD27(SHORAN)–UTM GRID/CM = 129°
5. VERTICAL DATUM: GEODETIC BM 74T016 ELEVATION = 60.189m

LEGEND

1	2003 SURVEY CONTOURS AUG 2003: UMA GEOMATICS	22	2015 SURVEY CONTOURS AUG. 2015: WSP
10	2002 SURVEY CONTOURS AUG 2002: UMA GEOMATICS	21	2014 SURVEY CONTOURS AUGUST 2014: MMM Geomatics
9	2001 SURVEY CONTOURS AUG 2001: UMA GEOMATICS	20	2013 SURVEY CONTOURS AUGUST 2013: MMM Geomatics
8	2000 SURVEY CONTOURS AUG 2000: UMA GEOMATICS	19	2012 SURVEY CONTOURS AUGUST 2012: MMM Geomatics
7	1999 SURVEY CONTOURS AUG 1999: UMA GEOMATICS	18	2011 SURVEY CONTOURS AUGUST 2011: MMM Geomatics
6	1998 SURVEY CONTOURS JUNE 1998: UMA GEOMATICS	17	2010 SURVEY CONTOURS JULY 2010: MMM Geomatics
5	1997 SURVEY CONTOURS AUGUST 1997: UMA GEOMATICS	16	2009 SURVEY CONTOURS JUNE 2009: MMM Geomatics
4	1996 SURVEY CONTOURS JULY 1996: UMA GEOMATICS	15	2008 SURVEY CONTOURS JUNE 2008: MMM Geomatics
3	1995 SURVEY CONTOURS JULY 1995: UMA GEOMATICS	14	2006 SURVEY CONTOURS JUNE 2006: USHER CANADA LIMITED
24	2017 SURVEY CONTOURS SEP. 2017: WSP	13	2005 SURVEY CONTOURS JULY 2005: USHER CANADA LIMITED
23	2016 SURVEY CONTOURS SEP. 2016: WSP	12	2004 SURVEY CONTOURS AUG 2004:USHER CANADA LIMITED
No.	REVISION	No.	REVISION

Esso Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

ISLAND 4 & SURROUNDING AREA

SURVEY DRAWING

CONTRACTOR NAME: WSP Surveys (AB) Limited Partnership	CONTRACTOR DWG NO. : 1207–C
DATE: 17–10–31	ESSO FILE No.
SCALE: 1:1000	096–0179–700–801 82

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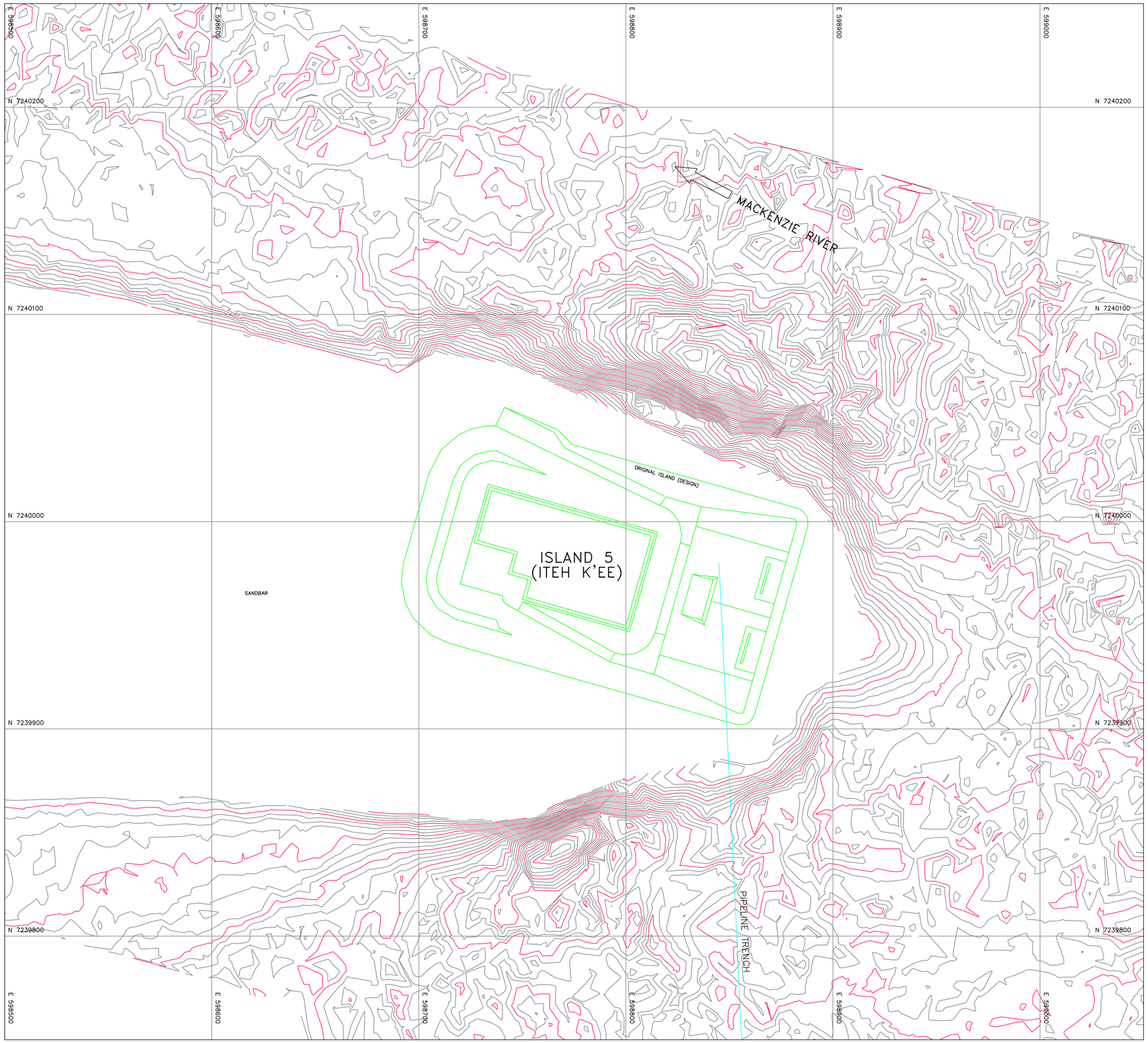

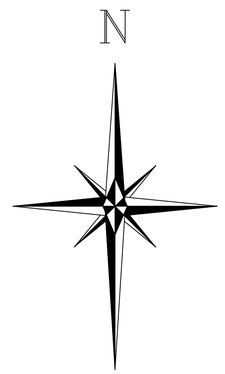

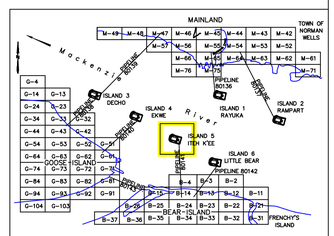

KEY PLAN
1:50 000

NOTES

1. CONTOUR INTERVAL = 0.25 METRES.
2. BATHYMETRIC SURVEY PERFORMED BETWEEN JUNE 17 TO JUNE 25, 2017.
3. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL.
4. HORIZONTAL DATUM: NAD27 SHORAN-UTM GRID/CM = 129°
5. VERTICAL DATUM: GEODETIC BM 74T016 ELEVATION = 60.189m

LEGEND

11	2003 SURVEY CONTOURS AUG 2003: UMA GEOMATICS	25	2015 SURVEY CONTOURS AUG. 2015: WSP
10	2002 SURVEY CONTOURS AUG 2002: UMA GEOMATICS	24	2014 SURVEY CONTOURS AUGUST 2014: MMM Geomatics
9	2001 SURVEY CONTOURS AUG 2001: UMA GEOMATICS	23	2013 SURVEY CONTOURS AUGUST 2013: MMM Geomatics
8	2000 SURVEY CONTOURS AUG 2000: UMA GEOMATICS	22	2012 SURVEY CONTOURS AUGUST 2012: MMM Geomatics
7	1999 SURVEY CONTOURS AUG 1999: UMA GEOMATICS	21	2011 SURVEY CONTOURS AUGUST 2011: MMM Geomatics
6	1998 SURVEY CONTOURS JUNE 1998: UMA GEOMATICS	20	2010 SURVEY CONTOURS JULY 2010: MMM Geomatics
5	1997 SURVEY CONTOURS AUGUST 1997: UMA GEOMATICS	19	2009 SURVEY CONTOURS JUNE 2009: MMM Geomatics
4	1996 SURVEY CONTOURS JULY 1996: UMA GEOMATICS	18	2008 SURVEY CONTOURS JUNE 2008: MMM Geomatics
3	1995 SURVEY CONTOURS JULY 1995: UMA GEOMATICS	17	2006 SURVEY CONTOURS JUNE 2006: USHER CANADA LIMITED
26	2017 SURVEY CONTOURS SEP. 2017: WSP	16	2005 SURVEY CONTOURS JULY 2005: USHER CANADA LIMITED
27	2016 SURVEY CONTOURS SEP. 2016: WSP	15	2004 SURVEY CONTOURS AUG 2004:USHER CANADA LIMITED
No.	REVISION	No.	REVISION

Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

ISLAND 5 & SURROUNDING AREA

SURVEY DRAWING

CONTRACTOR NAME: WSP Surveys (AB) Limited Partnership	CONTRACTOR DWG NO. : 1208-C
DATE: 17-10-31	ESSO FILE No.
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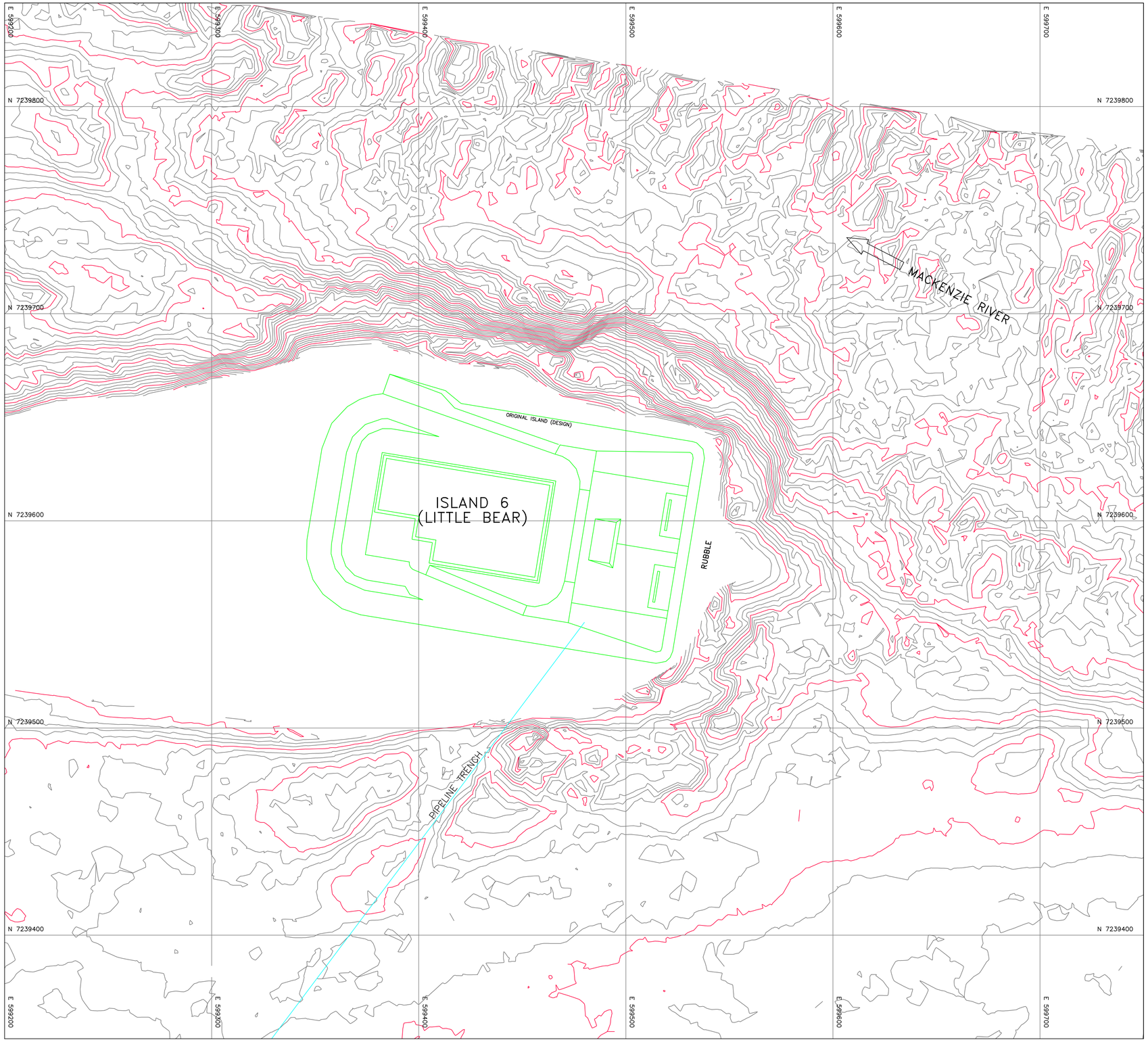

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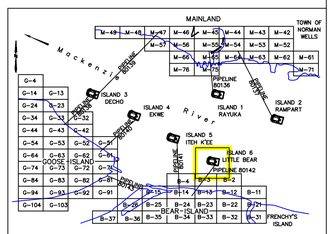

KEY PLAN
1:50 000

NOTES

1. CONTOUR INTERVAL = 0.25 METRES.
2. BATHYMETRIC SURVEY PERFORMED BETWEEN JUNE 17 TO JUNE 25, 2017.
3. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL.
4. HORIZONTAL DATUM: NAD27(SHORAN)-UTM GRID/CM = 129°
5. VERTICAL DATUM: GEODETIC BM 74T016 ELEVATION = 60.189m

LEGEND

1	2003 SURVEY CONTOURS AUG 2003: UMA GEOMATICS	2	2015 SURVEY CONTOURS AUG. 2015: WSP
10	2002 SURVEY CONTOURS AUG 2002: UMA GEOMATICS	21	2014 SURVEY CONTOURS AUGUST 2014: MMM Geomatics
9	2001 SURVEY CONTOURS AUG 2001: UMA GEOMATICS	20	2013 SURVEY CONTOURS AUGUST 2013: MMM Geomatics
8	2000 SURVEY CONTOURS AUG 2000: UMA GEOMATICS	19	2012 SURVEY CONTOURS AUGUST 2012: MMM Geomatics
7	1999 SURVEY CONTOURS AUG 1999: UMA GEOMATICS	18	2011 SURVEY CONTOURS AUGUST 2011: MMM Geomatics
6	1998 SURVEY CONTOURS JUNE 1998: UMA GEOMATICS	17	2010 SURVEY CONTOURS JULY 2010: MMM Geomatics
5	1997 SURVEY CONTOURS AUGUST 1997: UMA GEOMATICS	16	2009 SURVEY CONTOURS JUNE 2009: MMM Geomatics
4	1996 SURVEY CONTOURS JULY 1996: UMA GEOMATICS	15	2008 SURVEY CONTOURS JUNE 2008: MMM Geomatics
3	1995 SURVEY CONTOURS JULY 1995: UMA GEOMATICS	14	2006 SURVEY CONTOURS JUNE 2006: USHER CANADA LIMITED
23	1994 SURVEY CONTOURS SEP. 2017: WSP	13	2005 SURVEY CONTOURS JULY 2005: USHER CANADA LIMITED
22	2016 SURVEY CONTOURS SEP. 2016: WSP	12	2004 SURVEY CONTOURS AUG 2004:USHER CANADA LIMITED
No.	REVISION	No.	REVISION

Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

ISLAND 6 & SURROUNDING AREA

SURVEY DRAWING

CONTRACTOR NAME: WSP Surveys (AB) Limited Partnership	CONTRACTOR DWG NO. : 1209-C
DATE: 17-10-31	ESSO FILE No.
SCALE: 1:1000	096-0179-700-801 84

096-0179-700-801 86

AutoCAD

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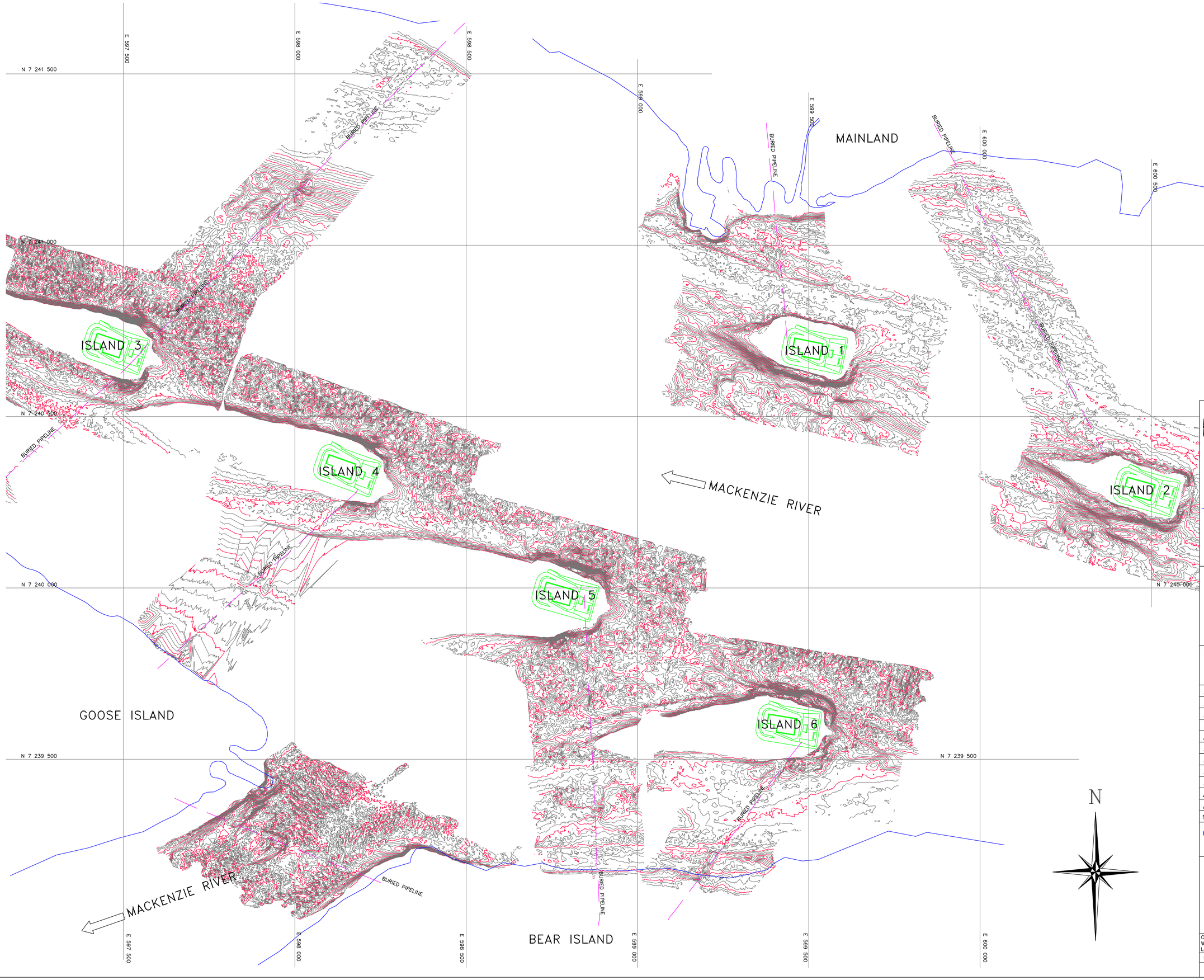

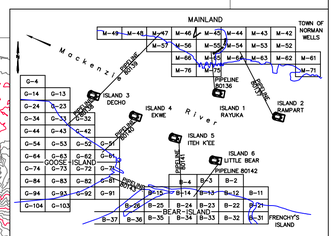

KEY PLAN
1:50 000

NOTES

1. BATHYMETRIC SURVEY PERFORMED BETWEEN JUNE 17 TO JUNE 25, 2017.
2. WATER LEVEL DETERMINED DIRECTLY FROM RTK OBSERVATIONS ON SURVEY VESSELL.
3. HORIZONTAL DATUM: NAD 27(SHORAN)–UTM GRID/cm=129°
4. VERTICAL DATUM: GEODETIC BM 74T016 ELEVATION = 60.189

LEGEND

1	2003 SURVEY POINTS AUG 2003: UMA GEOMATICS	2	2016 SURVEY POINTS SEP. 2016: WSP
1	2002 SURVEY POINTS AUG 2002: UMA GEOMATICS	2	2015 SURVEY POINTS AUG. 2015: WSP
1	2001 SURVEY POINTS AUG 2001: UMA GEOMATICS	2	2014 SURVEY POINTS AUGUST 2014: MMM GEOMATICS
1	2000 SURVEY POINTS AUG 2000: UMA GEOMATICS	2	2013 SURVEY POINTS AUGUST 2013: MMM GEOMATICS
1	1999 SURVEY POINTS AUG 1999: UMA GEOMATICS	2	2012 SURVEY POINTS AUGUST 2012: MMM GEOMATICS
1	1998 SURVEY POINTS JUNE 1998: UMA GEOMATICS	2	2011 SURVEY POINTS AUGUST 2011: MMM GEOMATICS
1	1997 SURVEY POINTS JULY 1996: UMA GEOMATICS	2	2010 SURVEY POINTS JULY 2010: MMM GEOMATICS
1	1996 SURVEY POINTS JULY 1996: UMA GEOMATICS	2	2009 SURVEY POINTS JUNE 2009: MMM GEOMATICS
1	1995 SURVEY POINTS JULY 1995: UMA GEOMATICS	2	2008 SURVEY POINTS JUNE 2008: MMM GEOMATICS
1	1994 SURVEY POINTS JULY 1994: UMA SURVEYS	2	2006 SURVEY POINTS JUNE 2006: USHER CANADA LIMITED
2	2017 SURVEY POINTS SEP. 2017: WSP	2	2005 SURVEY POINTS JUNE 2005: USHER CANADA LIMITED
No.	REVISION	No.	REVISION

Esso Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

RIVER BED AND ISLAND CONTOURS

SURVEY DRAWING

CONTRACTOR NAME: WSP Surveys (AB) Limited Partnership	CONTRACTOR DWG NO. : 1213–C
DATE: 17–10–31	ESSO FILE No.
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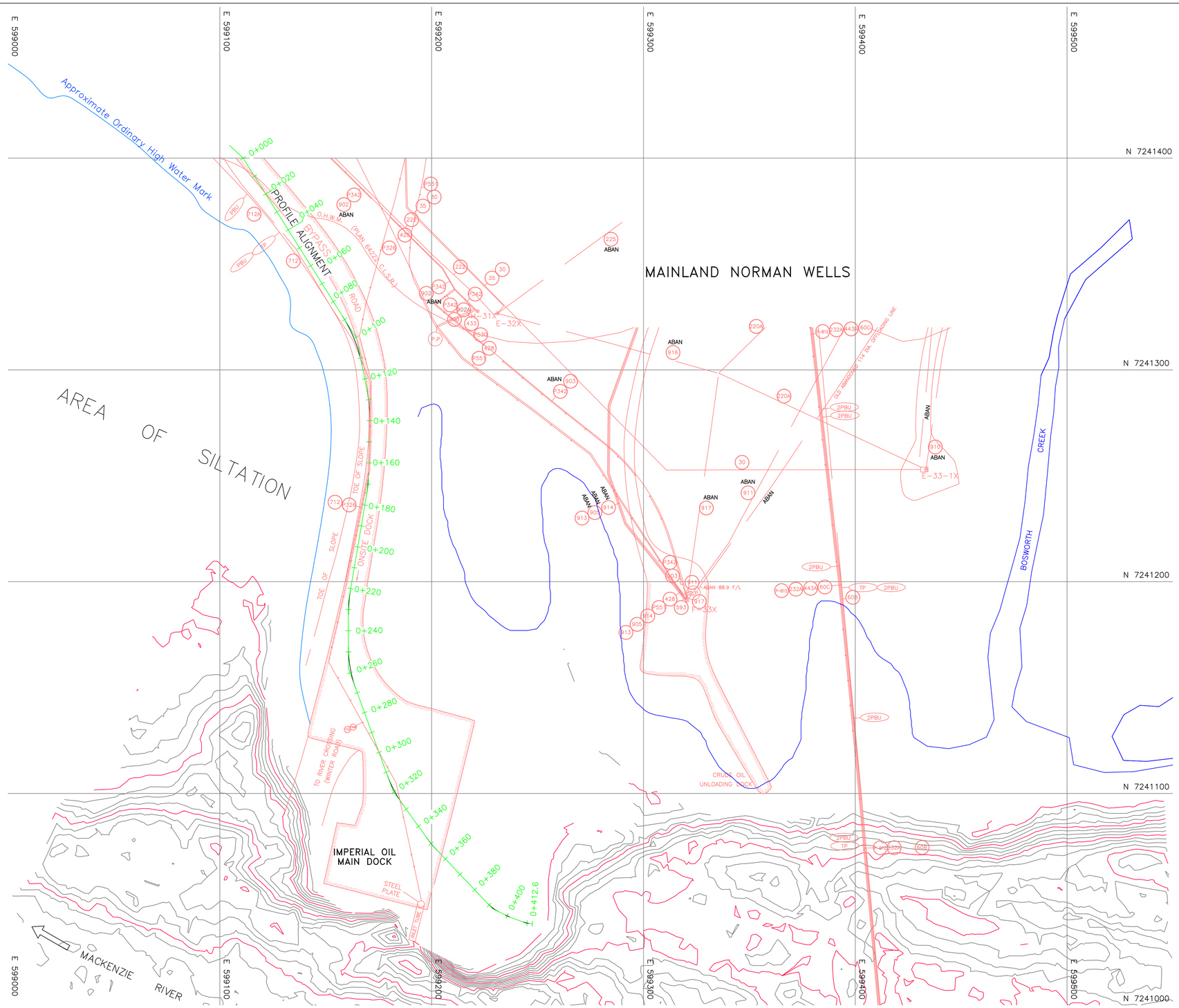

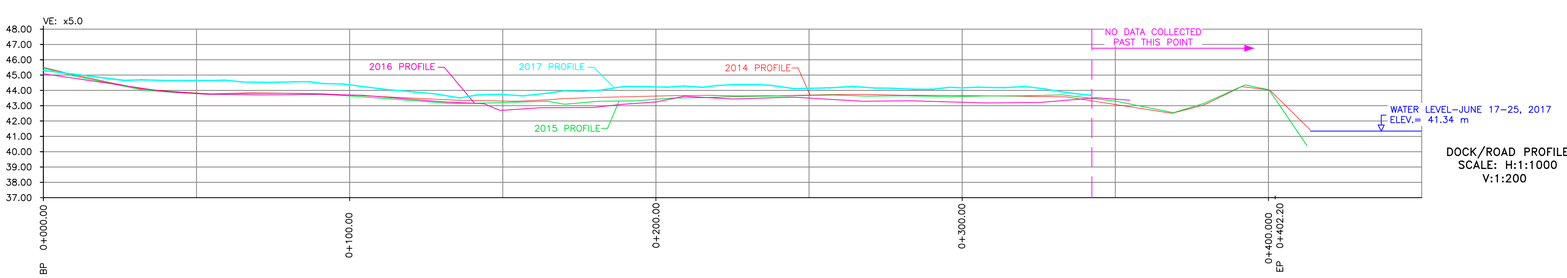

DOCK/ROAD PROFILE
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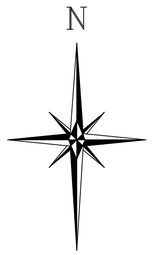
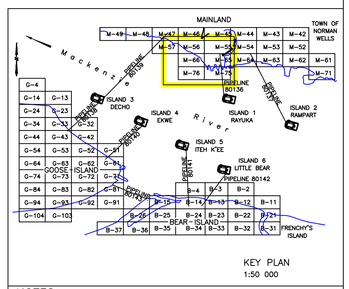




KEY PLAN
1:50 000

NOTES

1. CONTOUR INTERVAL = 0.25 METRES.
2. BATHYMETRIC SURVEY PERFORMED BETWEEN JUNE 17 TO JUNE 25, 2017.
3. WATER LEVEL = 41.34 m (JUNE 17–25, 2017)
4. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL.
5. HORIZONTAL DATUM: NAD27(SHORAN)–UTM GRID/CM = 129°
6. VERTICAL DATUM: GEODETIC BM 74T016 ELEVATION = 60.189m
7. PIPELINE ALIGNMENT SURVEYED BETWEEN JUNE 17 TO JUNE 25, 2017.

LEGEND

- 2014 ROAD CENTERLINE PROFILE
- 2015 ROAD CENTERLINE PROFILE
- 2016 ROAD CENTERLINE PROFILE
- 2017 ROAD CENTERLINE PROFILE

No.	REVISION	No.	REVISION
12	2004 SURVEY CONTOURS AUG 2004: USHER CANADA LIMITED	22	2016 SURVEY PROFILE SEP. 2016: WSP
11	2003 SURVEY CONTOURS/PROFILE AUG 2003: UMA GEOMATICS	21	2015 SURVEY PROFILE AUG. 2015: WSP
10	2002 SURVEY CONTOURS/PROFILE AUG 2002: UMA GEOMATICS	20	2014 SURVEY CONTOURS AUGUST 2014: MMM GEOMATICS
9	2001 SURVEY CONTOURS/PROFILE AUG 2001: UMA GEOMATICS	19	2013 SURVEY CONTOURS AUGUST 2013: MMM GEOMATICS
8	2000 SURVEY CONTOURS/PROFILE AUG 2000: UMA GEOMATICS	18	2012 SURVEY CONTOURS AUGUST 2012: MMM GEOMATICS
7	1999 SURVEY CONTOURS/PROFILE AUG 1999: UMA GEOMATICS	17	2011 SURVEY CONTOURS AUGUST 2011: MMM GEOMATICS
6	1998 SURVEY CONTOURS/PROFILE JUNE 1998: UMA GEOMATICS	16	2010 SURVEY CONTOURS AUGUST 2010: MMM GEOMATICS
5	1997 SURVEY CONTOURS/PROFILE JULY 1997: UMA GEOMATICS	15	2009 SURVEY CONTOURS JUNE 2009: MMM GEOMATICS
4	1996 SURVEY CONTOURS/PROFILE JULY 1996: UMA GEOMATICS	14	2009 SURVEY CONTOURS JUNE 2009: MMM GEOMATICS
3	1995 SURVEY CONTOURS/PROFILE JULY 1995: UMA GEOMATICS	13	2008 SURVEY CONTOURS JUNE 2008: MMM GEOMATICS
2	1994 SURVEY CONTOURS/PROFILE JULY 1994: UMA SURVEYS	12	2006 SURVEY CONTOURS JUNE 2006: USHER CANADA LIMITED
23	2017 SURVEY CONTOURS/PROFILE SEP. 2017: WSP	1	2005 SURVEY CONTOURS JULY 2005: USHER CANADA LIMITED

ROAD PROFILE ALIGNMENT COORDINATES

EASTING	NORTHING	
7241400.000	599111.029	START CHAINAGE 0+000
7241391.394	599116.437	
7241381.849	599122.435	
7241372.684	599128.195	
7241363.396	599134.031	
7241353.622	599140.173	
7241342.847	599146.944	
7241333.305	599152.941	
7241323.558	599159.066	
7241314.711	599164.625	
7241293.559	599168.857	
7241283.412	599170.888	
7241272.325	599170.657	
7241261.930	599170.440	
7241251.502	599170.223	
7241245.853	599170.105	
7241234.977	599168.266	
7241223.162	599166.268	
7241210.737	599164.167	
7241199.388	599162.248	
7241190.297	599160.711	
7241177.776	599160.711	
7241158.998	599160.711	
7241148.907	599164.395	
7241136.750	599168.832	
7241123.265	599173.755	
7241111.842	599177.924	
7241101.096	599181.847	
7241090.336	599189.584	
7241076.056	599199.852	
7241062.537	599212.701	
7241055.395	599219.489	
7241045.632	599228.768	
7241042.087	599235.774	
7241038.802	599244.598	
7241038.512	599247.564	END CHAINAGE 0+412.6

Esso Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES
IMPERIAL OIL MAINLAND DOCK
SURVEY DRAWING

CONTRACTOR NAME:
WSP Surveys (AB) Limited Partnership

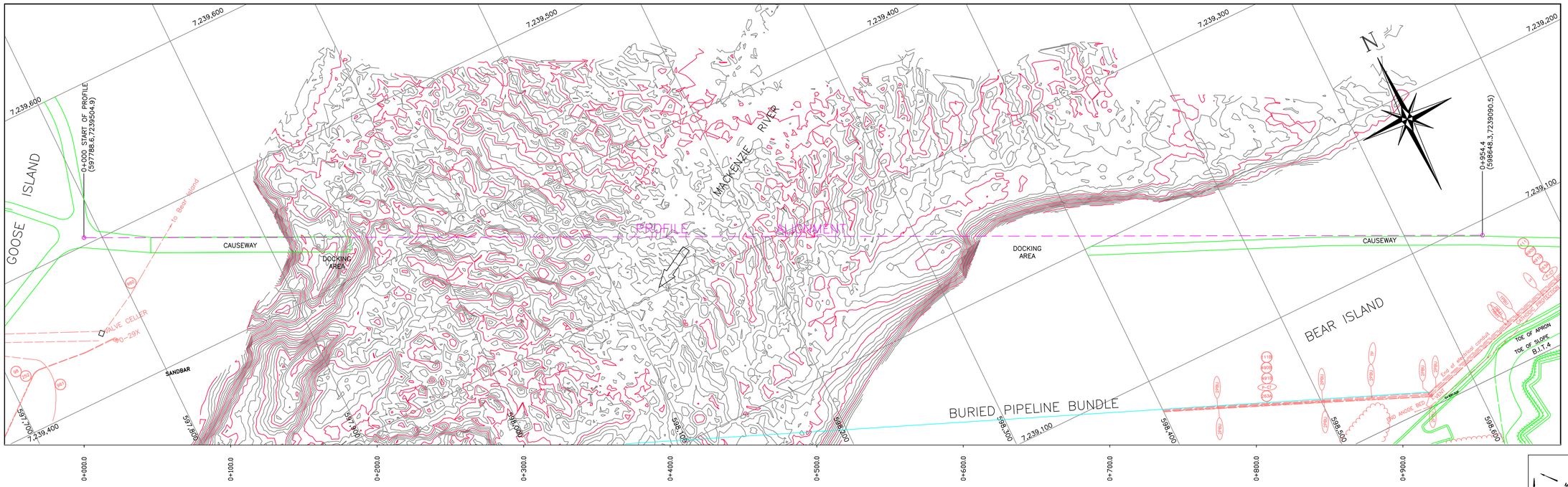
DATE: 17–10–31

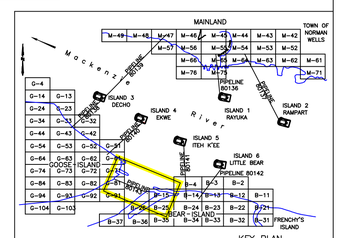
SCALE: 1:2000

CONTRACTOR DWG NO. : 1214–C

ESSO FILE No.
096–0179–700–801 87

CADD DRAWING NO MANUAL CHANGES | AutoCAD | 096-0179-700-801 89





KEY PLAN
1:50 000

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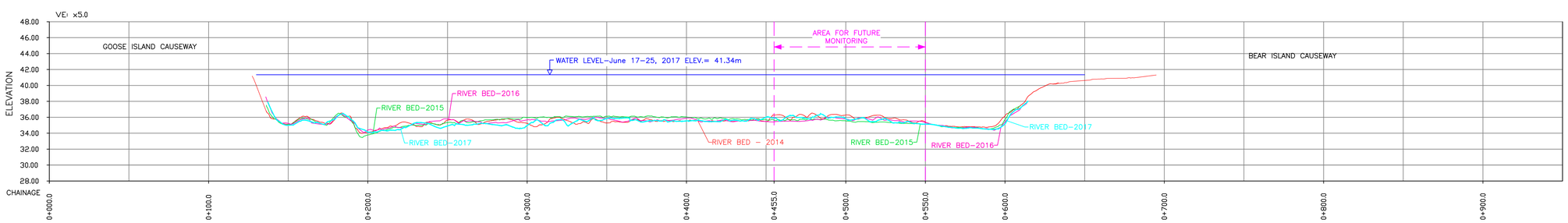

PROFILE OF RIVER BED

LEGEND

- 2014 RIVER BED PROFILE
- 2015 RIVER BED PROFILE
- 2016 RIVER BED PROFILE
- 2017 RIVER BED PROFILE

No.	REVISION	No.	REVISION
1	2003 SURVEY CONTOURS AUG 2003: UMA GEOMATICS	22	ADDED 2015 BOTTOM PROFILE AUG. 2015: WSP
10	2002 SURVEY CONTOURS AUG 2002: UMA GEOMATICS	21	ADDED 2014 BOTTOM PROFILE AUG 2014: MMM Geomatics
9	2001 SURVEY CONTOURS AUG 2001: UMA GEOMATICS	20	ADDED 2013 BOTTOM PROFILE AUG 2013: MMM Geomatics
8	2000 SURVEY CONTOURS AUG 2000: UMA GEOMATICS	19	ADDED 2012 BOTTOM PROFILE AUG 2012: MMM Geomatics
7	1999 SURVEY CONTOURS AUG 1999: UMA GEOMATICS	18	ADDED 2011 BOTTOM PROFILE AUG 2011: MMM Geomatics
6	1998 SURVEY CONTOURS JUNE 1998: UMA GEOMATICS	17	ADDED 2010 BOTTOM PROFILE JULY 2010: MMM Geomatics
5	1997 SURVEY CONTOURS JULY 1997: UMA GEOMATICS	16	ADDED 2009 BOTTOM PROFILE JUNE 2009: MMM Geomatics
4	1996 SURVEY CONTOURS JULY 1996: UMA GEOMATICS	15	ADDED 2008 BOTTOM PROFILE JUNE 2008: MMM Geomatics
3	1995 SURVEY CONTOURS JULY 1995: UMA GEOMATICS	14	2006 SURVEY CONTOURS JUNE 2006: USHER CANADA LIMITED
24	ADDED 2017 BOTTOM PROFILE SEP. 2017: WSP	13	2005 SURVEY CONTOURS JUNE 2005: USHER CANADA LIMITED
23	ADDED 2016 BOTTOM PROFILE SEP. 2016: WSP	12	2004 SURVEY CONTOURS AUG 2004:USHER CANADA LIMITED

Esso Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

GOOSE TO BEAR CAUSEWAY

SURVEY DRAWING

CONTRACTOR NAME: WSP Surveys (AB) Limited Partnership	CONTRACTOR DWG NO. : 1215-C
DATE: 17-10-31	ESSO FILE No.
SCALE: H 1:1500 V 1:300	096-0179-700-801 89