Appendix 5: Summary Description Technical Team Tasks (and reports)

Introduction:

The purpose of this appendix is to give a brief summary of the Technical Team's Tasks and the reports that were produced to assist readers in determining where specific information may be, as well as give some brief context to how the tasks were completed. The summary for each task will include a description of the data that was used, the scope and purpose of the task, and the location of the report.

Operating Rules Review

OR1: Plain Language Review

The purpose of the Plain Language Review task was to review the language and data used in the 1989 International Agreement between Canada and the United States (U.S.) (Annex A/B) and make suggested updates as necessary for clarity, relevancy, and completeness.

A previous review was started in 2017 by a Core committee established by the ISRB and was used as the starting point. Several different rounds of review occurred with comments coming from all of the operating agencies (WSA, USACE, and USFWS). A draft was completed on October 17, 2019 and reviewed by the ISRSB technical team as well as some of the original Annex A Core committee members. A side-by-side comparison of the final draft with the original Annex A document with additional edits and text added for clarity was also produced. The final document flagged six outstanding issues for review. The proposed language is withheld from the draft until it is vetted by the IJC or government attorneys.

Report Location: https://ijc.org/en/srsb/side-side-version-comparison-2020-vs-1989-annex-addendum-1989-souris-river-flood-control

Data Collection and Management

DW1: Summarize POS Projects and Report Progress

The Summarize POS Projects and Report Progress task produced the report "A Review of Meteorologic, Hydrologic, and Engineering Studies Complete in the Souris River Basin from 2011 through 2017," which summarized the available studies, data sets and modelling setups completed since 2011 that may be used as reference or background material for tasks outlined in the Work Plan.

Report Location: https://ijc.org/en/srsb/review-meteorologic-hydrologic-and-engineering-studies-completed-souris-river-basin-2011

DW2: Collation and Collection of Bathymetry and LiDAR data

The Collation and Collection of Bathymetry and LiDAR data task involved reviewing the existing bathymetry and obtaining new LiDAR data for Rafferty and Grant Devine Reservoirs. The report produced was titled "Collation and Collection of Bathymetry and LiDAR data for Rafferty Reservoir and

Grant Devine Lake Report". In the future, the bathymetry and LiDAR data combined with some additional data collection may be used to produce new stage-area and stage-capacity curves for the reservoirs and update the existing area capacity curves if needed.

Report Location: https://ijc.org/en/srsb/lidar-survey-metadata-report and

https://ijc.org/en/srsb/collation-and-collection-bathymetry-and-lidar-data-rafferty-reservoir-and-grant-devine-lake

DW3: Review and Update of Hydrometeorological Data Network

The purpose of the DW3 task was to review a 2013 Hydromet Improvement Workshop report and assess which recommendations have been implemented and which priorities are still valid. The objective of the task report "Review and Update of the 2013 Hydrometeorological Data Network Improvement Report" was to identify remaining gaps and to make recommendations for improvements in the hydrologic and meteorological networks.

Report Location: https://ijc.org/en/srsb/review-and-update-2013-hydrometeorological-data-network-improvement-report

DW4: Data Collection for Performance Indicators

The Data Collection for Performance Indicators task involved collecting and harmonizing data, including stakeholder input to evaluate the consequences and benefits of reservoir operation plans, streamflow constraints, and elevation targets. The data collected were developed into performance indicators to help the study team quantify potential effects of river management. In some cases, where detailed quantitative data was not available, qualitative data was used under the assumption the study team would take the source of the data into account when evaluating alternatives.

The main report "DW4-Data Collection for Performance Indicators" covers all of the PI's developed, how they were categorized, and examples for how they were calculated. More details for exact numbers and thresholds used can be found in the appendices.

Report Location: https://ijc.org/en/srsb/data-collection-performance-indicators-report-and-appendices

Hydrology and Hydraulics

HH1: Regional and Reconstructed Hydrology

The Regional and Reconstructed Hydrology task created continuous daily timeseries for the portion of the Souris River Basin between the Canadian headwaters reservoirs and Westhope, North Dakota. The report created was titled "HH1: 2019 Regional & Reconstructed Hydrology". This work was completed by adopting and expanding upon the 2013 Regional and Reconstructed Hydrology of the Souris (Mouse) River Study completed by the USACE. The 2013 analysis consisted of creating a comprehensive streamflow gage inventory of daily timeseries data within the Souris River Basin. Observed data was

used to create continuous, daily timeseries at all major reservoir sites (Rafferty, Grant Devine, Boundary, and Lake Darling), USGS gage sites and Environment Canada gage locations of interest. Records were generated representative of in situ, unregulated and current, regulated (Annex A/B) basin conditions for the period of record between 1946 and 2011.

The regional and reconstructed hydrology task expanded the 2013 analysis and consisted of augmenting the period of record reconstituted as part of the 2013 study to include 1930-1945 and 2012-2017 and explicitly defining critical losses and inputs to the reservoirs. The final HH1 products can be used as inputs to the hydrologic routing models developed for the Plan of Study.

Report Location: https://ijc.org/en/srsb/2019-regional-and-reconstructed-hydrology

HH2: Stochastic Hydrology Dataset

The Stochastic Hydrology task created stochastic streamflow in the Souris River Basin to characterize climate and streamflow and support selection of streamflow traces based on their characterization. The USGS, in cooperation with the North Dakota State Water Commission and the International Joint Commission, used the previously developed unregulated and regulated streamflow models and data for stochastic streamflow in the Souris River Basin. A report was created and is titled “Characterization of Historical and Stochastically Generated Climate and Streamflow Conditions in the Souris River Basin, United States and Canada”.

Stochastic modeling accounts for the frequency of past climatic events and simulates a series of future realizations of climatic inputs with the same probability distribution as the historical record but with climatic events happening in a variety of orders within each realization. These future realizations of the climatic inputs represent all potential outcomes including multiyear wet or dry periods that are more extreme than any wet or dry periods in the historical period of record. Components of the original stochastic hydrology models and their outputs were used in this phase of the study to (1) characterize historical and stochastic climate and streamflow for the Souris River Basin, (2) disaggregate monthly stochastic streamflow spatially and temporally to meet the needs of the Reservoir System Simulation (HEC-RESSIM) model for the Souris River Basin, and (3) discuss selection of disaggregated streamflow traces (simulations) using the characteristics of climate and streamflow.

Report Location: https://pubs.er.usgs.gov/publication/sir20215044

HH3: Artificial Drainage Impacts Review

The Artificial Drainage Impacts Review Task involved summarizing known information about artificial drainage both surface and subsurface in the Souris River Basin. This task was created due to public concerns on the effects of artificial drainage in the Basin, and is the information is important to understand the hydrology of the basin for modelling purposes. The report is titled “HH3: Souris River Basin Artificial Drainage Impacts Review”.

The literature review was conducted by a contracted third party, but the entire process was reviewed by the ISRSB technical team. The literature review included a summary of the drainage legislation and practices within each jurisdiction in the basin, a review of the impacts of artificial drainage on the

hydrology of the basin, quantifying the historical and current extent of drainage in each jurisdiction, and determine the extent artificial drainage has on trans-boundary flows.

Report Location: https://ijc.org/en/srsb/artifical-drainage-report

HH4: Flow Simulation Tools Development (MESH), HH5: Climate Change, and HH9: Model System Integration

Report Location: *Pending report technical review and ISRSB approval*.

HH6: Reservoir Flow Release Model (HEC-RESSIM)

The Reservoir Flow Release Model (HEC-RESSIM) task developed an up-to-date HEC-ResSim model that is able to simulate current operation of Rafferty Reservoir, Boundary Reservoir, Grant Devine Lake, and Lake Darling for the period of record from 1930-2017, and extends from the upstream end of the Canadian reservoirs downstream through Westhope, ND. The model is setup to run using output from the Regional and Reconstructed Hydrology Study (HH1), the USGS Stochastic Model (HH2) and the MESH model (HH4). The objective of the ResSim model is to simulate reservoir operations and hydrologic routing to a degree of detail that is sufficient to reasonably compare existing operations as stated by the *1989 Agreement* with operating plan alternatives proposed as part of the PoS. The report is titled "HH6: Souris River Plan of Study HEC-ResSim Model Report".

Report Location: https://ijc.org/en/srsb/hecres-sim-model-report

HH7: Hydraulic Modelling (HEC-RAS)

The Hydraulic Modelling (Hec-Ras) task was completed mostly outside of the Plan of Study. It updated and improved the HEC-RAS hydraulic model for the reach of the Souris River between Rafferty Reservoir and the mouth with the Assiniboine River near Wawanesa MB. The HEC-RAS models can be used to run scenarios for flow release planning to obtain detailed one and, in specific locations, two dimensional results of water levels within the near channel floodplain. The content of this transmittal package only includes the analysis from Rafferty Reservoir to the ND and Manitoba Border.

Report Location: https://ijc.org/en/srsb/reservoir-flow-release-modelling-hec-ras-report

HH8: PRM Model

The HEC-ResPRM Model task was initial set to develop a HEC-ResPRM model to be used in optimizing flow schemes in the basin. Issues encountered in the modeling process were not able to be resolved within the scope and timeline of the Study. Consideration was given to the limitations of the software, the resource commitment needed for the optimization effort to be completed, and the expectation that given the restricted inputs, results would not provide enough new information to make the investment in further work justified. The decision was made to document the work, and make the current products

available to further studies should they choose to dedicate the time and resources to further pursue an optimization effort. It was noted also that significant upgrades to the software would benefit any optimization effort in the future. The report created for this task was titled "Souris River Plan of Study ResPRM Model (HH8)"

Report Location: https://ijc.org/en/srsb/hec-prm-model-report

HH10: Forecasting Assessment

The HH10 task was split into two subtasks and consequently had two separate reports. The first subtask was an assessment of the quantitative index of basin moisture conditions. The task investigated developing/assessing various basin moisture indices that could enhance operational decision-making regarding spring runoff forecasts and reservoir drawdown in the Souris River Basin. After careful review, the Standardized Precipitation and Evapotranspiration Index (SPEI), which estimates the climate water balance (Precipitation - Evapotranspiration), was considered as the most feasible index for assessing basin moisture conditions. The report is titled "Assessment of a quantitative index of basin moisture conditions"

The second subtask was on forecasting uncertainty. The current operating plan relies heavily on forecasting for the management of the system's reservoirs. Due to the need for these forecasts to be issued months in advance, there is a greater amount of uncertainty since the rate of snowpack accumulation over the remainder of the winter, timing of melt, and melt rate are all highly variable. Since there will always be some error in the forecasts, it would be imprudent to assume "perfect" forecast during the model simulations. The task examined the errors associated with historical forecasts at the key forecast points/durations noted above for the period 2009-2017. Beginning in 2009, the Saskatchewan Water Security Agency (WSA) began coordinating with the US National Weather Service (NWS) on these forecasts, with the final value often being the average of the two forecasts. For that reason, to preserve homogeneity, the period for the assessment has been limited to the 9-year period between 2009 and 2017. The report is titled "Statistical Analysis of Errors Associated with Streamflow Forecasting in the Souris River Basin".

Report Locations: https://ijc.org/en/srsb/forecasting-assessment-reports

Plan Formulation Committee

PF1: Workshops and Engagement

There was no full report completed for this task. See the workshop and engagement section as outlined fully in Section 3 of the Final Report.

PF2: Run and Evaluate Alternatives

The task Run and Evaluate Alternatives simulated alternative operating plans and evaluate the results. The task was divided into five phases. Phase 1 consisted of initial meetings with the Public Advisory Group (PAG) and Resource and Agency Advisor Group (RAAG) as well as a brainstorming

session with the technical team. Phases 2-5 consisted of alternative modeling and analysis. Alternative operating plans/rules were simulated using the HH6 HEC-ResSim model. Alternatives were evaluated using statistical analysis of model results, the Performance Indicators (PIs) developed in the DW4 task, discussions with experts and local stakeholders, and engineering judgement.

The Plan Formulation Committee (PFC) was formed by the Study Board at the beginning of the PF2 task and given the responsibility of developing alternatives and making decisions regarding which alternatives to carry forward for additional analysis or drop from consideration. Following each phase of alternative modeling, the PFC and members of the technical team gathered to present the modeling results and decide which alternatives to carry forward for future study. Findings from each phase of analysis were also presented to the PAG and RAAG, and feedback from each group was gathered and incorporated into the next phase of study. After Phase 5, the PFC recommended five changes to the operating plan be submitted to the IJC for consideration. Detailed technical analysis of these operational changes is included in the Phase 5 technical appendix, and pros and cons of each change are summarized in the study's final report. The report is titled "PF2 HEC-ResSim Alternatives Assessment"

Report Location: https://ijc.org/en/srsb/hec-res-sim-run-and-evaluate-alternatives

PF3: Dam Safety

Dam Safety is outlined in section 8.4 of the Final Report. There are no additional documents related to Dam Safety as a part of the Study.

PF4: Roadmap for taking study product to address other concerns

The report on other concerns touches on apportionment, water quality and aquatic ecosystem health.

Report Location: https://ijc.org/en/srsb/roadmap-taking-study-product-address-other-concerns