# comprehensive Data delivery README FILE

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| **Study Section** | Study 5.6: Water Quality Modeling Study (WQ\_MOD) |
| **Study Component** | 2D Modeling (EFDC) |
| **Prepared By** | Tetra Tech, Inc. |
| **Data Collection and Processing By** | Tetra Tech, Inc. |
| **Field Date Range** | 2013–2017 |

**Introduction:** The overall goal of this effort was to model information on water quality (e.g., temperature, dissolved oxygen, sediment) in areas with the potential to be affected by construction and operation of the proposed Susitna-Watana Hydroelectric Project in Alaska.

This Water Quality Modeling Study (5.6) focuses on predicting the potential impacts of the dam and its proposed operations on water quality through the development of a water quality model. The goal of Study 5.6 is to utilize the extensive information collected from the Baseline Water Quality Study (Study 5.5) to develop a model to evaluate the potential impacts of the proposed Project and operations on various physical parameters within the Susitna River watershed.

The data contents of this folder, “Riverine Model”, contain modeling data specific to the Susitna River.

**Data Summary:** The riverine hydraulic model was calibrated for temperature, dissolved oxygen (DO), and sediment. The “Model Setup” folder contains processed DO, sediment and TSS field data used for model set up. The “GEFDC Grid Generation” folder contains model components (input, output, and data files) used to generate the riverine model computational grid.

The riverine model was run for two scenarios, calibration (pre-) and post-reservoir. Each scenario is noted in the *run name* of the input or output zip folder. *Run name*s are noted as “RivModel\_*scenario*”, where the scenario is the parameter, if applicable, and either “calib” or “post” reservoir.

Model files fall under three different categories: Input files, output files, calibration data, and model executables. Model output parameters at each monitor point or element center are: X Coordinate, Y Coordinate, Bed Elevation, Water Surface Elevation, Depth, Velocity in X Direction, Velocity in Y Direction, Total Velocity Magnitude, Froude Number, and Total Shear Stress. A table summarizing the types of data files in each folder is below.

| **Modeling Category** | **File Type** | **File Name** | **Comments** |
| --- | --- | --- | --- |
| **Common Files** |
| Model Executable | Processor | EFDC\_Susitna.exe | Application |
| Model Executable | Driver | libiomp5md.dll | Application Driver |
| Model Executable | Driver | Libiompstubs5md.lib | Application Driver |
| **Model Set Up** |
| Pre-processing | Excel | 5\_6\_WQ\_ISR5.5WQBaselineProcessedFieldData\_20170630.xlsx | Processed data for EFDC model. |
| Pre-processing | Excel | 5\_6\_WQ\_RiverFlowDOMapping\_20170630.xlsx | File used to map data to correct EFDC cell |
| Pre-processing | Excel | 5\_6\_WQ\_SedimentTimeSeriesData\_20170630.xlsx | Used to create sediment time series for model runs |
| **5\_6\_WQ\_*RunName*Input.zip** |
| Input | Time series forcing and boundary condition | aser.inp | Atmospheric forcing time series files, specifies atmospheric pressure, relative humidity, precipitation, evaporation, solar radiation and cloud cover. Also: talkeetnaArp10-13\_aser.inp, talkeetnaArp73-82\_aser.inp |
| Input | Mapping file for weather data | atmmap.inp |  |
| Input | Initial bed bulk density | bedbdn.inp |  |
| Input | Initial bed dry density | bedddn.inp |  |
| Input | Sediment layer thickness | bedlay.inp |  |
| Input | Horizontal grid specification  | cell.inp | Horizontal cell type identifier file |
| Input | Horizontal grid specification | celllt.inp | Horizontal cell type identifier file for saving mean mass transport |
| Input | Horizontal grid specification | dxdy.inp | File specifying horizontal grid spacing or metrics, depth, bottom elevation, bottom roughness and vegetation classes for either Cartesian or curvilinear-orthogonal horizontal grids. Also: Newdxdy.inp |
| Input | General data and run control | efdc.inp | Master input fileAlso: efdc\_change\_tser\_from\_20\_to\_25\_into\_1.inp, efdc\_only\_first\_series\_in\_tser.inp, efdc\_original\_temp\_bc.inp, efdc\_original\_tser\_dt=2s.inp, efdc\_run1.inp through efdc\_run5.inp, efdc\_ts\_Main.inp through efdc\_ts\_main6.inp |
| Input | Horizontal grid specification | lxly.inp | File specifying horizontal cell center coordinates and cell orientations for either Cartesian or curvilinear-orthogonal gridsAlso: Newlxly.inp |
| Input | Macro algae growth input file | macalgmp.inp |  |
| Input | Initialization and restart  | newsalt.inp | File with initial salinity distribution for cold start, salinity stratified flow |
| Input | Time series forcing and boundary condition | preproj\_sdser01.inp –preproj\_sdser02.inp | Suspended sediment concentration time series file |
| Input | Physical process specification | qctl.inp | Hydraulic control structure characterization file |
| Input | Control structure check | qctlck.inp | Model generated file to check the control structure table setup |
| Input | Time series forcing and boundary condition | qser.inp | Volumetric source-sink time series file.Also: Qser\_hrly\_revriver2014.inp, Qser\_old.inp, Qser\_older\_version.inp, Qser\_toexcel.inp |
| Input | Initialization and restart  | restart.inp | File for restarting a simulation |
| Input | Model output of NEW DXDY FILES  | rstdxdy.inp | Used to incorporate restart depth |
| Input | Restart file | rstwd.inp | Wetting and drying restart file |
| Input | Time series forcing and boundary condition | sdser01.inp – sdser02.inp | Suspended sediment concentration time series file |
| Input | Boundary condition  | sedb.inp | Initial bed cohesive sediment mass fraction |
| Input | Boundary condition | sedb01.inp–sedb-02.inp | Initial bed cohesive sediment mass fraction (Old tested files) |
| Input | Boundary condition | sedw.inp | Initial Sediment concentration in water column |
| Input | Boundary condition | sedw01.inp – sedw-02.inp | Initial Sediment concentration in water column (old files) |
| Input | General data and run control | show.inp | File controlling screen print of conditions in a specified cell during simulation runs. |
| Input | Temperature boundary condition | temp.inp | Initial water temperature |
| Input | Temperature boundary condition | tempb\_RST.inp | Initial temperature at bed layer |
| Input | Time series forcing and boundary condition | tser.inp | Temperature time series file.Also: Tser\_before\_rs-oct2015\_revision.inp, Tser\_older.inp, Tser\_rev.inp, Tser\_rz\_oct2015\_revision\_reassign\_chulitna\_related\_temp.inp, Tser\_time\_series.inp, Tser1.inp, Tser2.inp, Tserold.inp |
| Input | Mapping file for weather data | wndmap.inp | Wind mapping file |
| Input | Control file | wq3dsd.inp | Sediment diagenesis control file |
| Input | Control file | wq3dwc.inp |  Water quality diagenesis control file Also: wq3dwc\_franklake.inp |
| Input | Loading file | wqpsl.inp | Pollutant loading file |
| Input | Time series forcing and boundary condition | wser.inp | Meteorological data, used to specify wind speed and wind direction Also: talkeetnaArp10-13\_wser.inp, talkeetnaArp73-82\_wser.inp |
| **5\_6\_WQ\_*RunName*Output.zip** |
| Output | Diagnostic output | bal2t.out | Balance check files |
| Output | Diagnostic output | bal2terstb.out | Balance check files |
| Output | Diagnostic output | bal2terstt.out | Balance check files |
| Output | Diagnostic output | bal2terstw.out | Balance check files |
| Output | Diagnostic output | bal2tervwt.out | Balance check files |
| Output | Two-dimensional graphics output and visualization | belvcon.out | Two-Dimensional Horizontal Plane Scalar Format |
| Output | Diagnostic output | cflmax.out | Stability check file |
| Output | Crash report | crashst.out |  |
| Output | Pollutant time series output | doxts001.out–doxts022.out | DO Time series output |
| Output | Misc. output | efdc.out | Efdc check file |
| Output | Misc. output | efdclog.out | Efdc log file |
| Output | Results | light.out | Light extinction analysis results |
| Output | Diagnostic output | lijmap.out | 2D cell to 1D order mapping results |
| Output | Pollutant time series output | nhxts001.out–nhxts022.out | Ammonia time series output |
| Output | Misc. output | restart.out | Restart file |
| Output | Restart file | rstwd.out | Wetting and drying restart file |
| Output | Time series output | selts001.out–selts022.out | Water surface elevation time series output file |
| Output | Temperature boundary condition | tembinit.out | Temperature Initial condition output |
| Output | Time series output | temts001.out–temts022.out | Temperature time series output |
| Output | Pollutant time series output | tocts001.out–tocots022.out | TOC time series output |
| Output | 2D velocity output | uvets001.out–uvets022.out |  |
| Output | 2D transport output | uvtts001.out–uvtts022.out |  |
| Output | Wetting and drying log | wetdrychg.out |  |
| Output | Wind shield output | windshelt.out |  |
| Output | Check file output | wq3d.out | Water quality input check output |
| Output | Time series output | wqsdts1.out–wqsdts2.out | WQ sediment diagenesis results time series output |
| Output | Time series output | wqwcts.out | WQ time series output |
| **5\_6\_WQ\_RivModel\_GEFDC Grid Generation.zip**  |
| Input | Horizontal grid specification | dxdy.inp | File specifying horizontal grid spacing or metrics, depth, bottom elevation, bottom roughness and vegetation classes for either Cartesian or curvilinear-orthogonal horizontal grids.  |
| Output | Horizontal grid specification | Dxdy.out | File specifying horizontal grid spacing or metrics, depth, bottom elevation, bottom roughness and vegetation classes for either Cartesian or curvilinear-orthogonal horizontal grids |
| Text |  | Gefdc.txt | Contains a listing of the cell.inp file, the KSGI array specifying interior grid points, the initial x,y grid coordinates, and the final x,y grid coordinates. |
| Output |  | Gefdc.out | Contains a listing of the cell.inp file, the KSGI array specifying interior grid points, the initial x,y grid coordinates, and the final x,y grid coordinates. |
| Output | Drawing interchange format | Grid.dxf | Final grid which can be plotted with any CADD or graphics software capable of importing the dxf format. |
| Output | Drawing interchange format | Init.dxf | Initial grid which can be plotted with any CADD or graphics software capable of importing the dxf format. |
| Output | Horizontal grid specification | lxly.out | File specifying horizontal cell center coordinates and cell orientations for either Cartesian or curvilinear-orthogonal grids |
| Input |  | Salt.inp | A template of the salt.inp input file for the efdc.f code. Salinity values are set to zero and may be filled with data. |
| ***5\_6\_WQ\_RivModel\_TempCalibData* Folder Only** |
| Calibration | Text  | PRM140.txt | Temperature calibration data.Also: PRM142\_3.txt, PRM152\_2.txt, PRM152\_7.txt, PRM183\_1.txt, PRM59\_9.txt, PRM87\_8.txt, PRM88\_3.txt |

Instructions on how to read the TEMPCONH output file

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**Data Organization:** Model files are organized by calibration/pre- and post-reservoir scenarios. Each model scenario has its own subdirectory, which includes all input and output files (included as zip files), and model executables. Riverine modeling files include the following subdirectories:

* Model Setup
	+ 5\_6\_WQ\_ISR5.5WQBaselineProcessedFieldData\_20170630.xlsx
	+ 5\_6\_WQ\_RiverFlowDOMapping\_20170630.xlsx
	+ 5\_6\_WQ\_SedimentTimeSeriesData\_20170630.xlsx
* Post-Reservoir
	+ 5\_6\_WQ\_RivModel\_PostInput
	+ 5\_6\_WQ\_RivModel\_PostOutput
* RiverDO\_Calib
	+ 5\_6\_WQ\_RivModel\_DOCalibInput
	+ 5\_6\_WQ\_RivModel\_DOCalibOutput
* RiverSED\_Calib
	+ 5\_6\_WQ\_RivModel\_SedCalibInput
	+ 5\_6\_WQ\_RivModel\_SedCalibOutput
* RiverTEMP\_Calib
	+ 5\_6\_WQ\_RivModel\_TempCalibData
	+ 5\_6\_WQ\_RivModel\_TempCalibInput
	+ 5\_6\_WQ\_RivModel\_TempCalibOutput
* Susitna\_GEFDC Grid Generation.zip

**Software or Hardware Considerations:** The provided model executables require 64-bit Windows. No software installation is necessary, EFDC is run directly by double-clicking the model executables. All the text input files (\*.inp files) are stored in the same folder with the EFDC executable file. Before running the model, delete the large output files including: SEDCONH.OUT, SNDCONH.OUT, CHLACONH.OUT, and DOCONH.OUT from the output folder. To run EFDC model, simply double-click EXE file to activate the model.

**Online Data Link:** http://gis.suhydro.org/suwareports/SuWa/05-WQ/5.06-WQ\_MOD/Riverine Model

**Online Report Link:** http://www.susitna-watanahydro.org/type/documents/

| Title | Date | Description | Link |
| --- | --- | --- | --- |
| Revised Study Plan Section 5.6, Water Quality Modeling Study | 12/14/2012 | This document presents the plan for this study, including goals, objectives, the study area, and proposed study methods to construct reservoir and riverine models that predict potential changes to water quality in post-Project conditions. | [RSP for Study 05.06](http://www.susitna-watanahydro.org/wp-content/uploads/2012/12/01-RSP-Dec2012_1of8-Sec-1-5-IntrothroughWaterQuality-v2.pdf) |
| FERC Study Plan Determination for Study 5.6 | 4/1/2013 | This document presents FERC approval of Study 5.6, which approved AEA’s Revised Study Plan with recommended adjustments. | [FERC SPD for Study 05.06](http://www.susitna-watanahydro.org/wp-content/uploads/2015/11/20130401_FERC_SPD14remainingStudies.pdf) |
| Draft Initial Study Report for Study 5.6 | 2/3/2014 | This draft of the ISR summarized the study methods and variances during the 2013 study season, and presented preliminary data collected for Study 5.6. This draft ISR was later republished as Part A of the final ISR. | [Draft ISR for Study 05.06](http://www.susitna-watanahydro.org/wp-content/uploads/2014/02/05.6_WQMOD_ISR_Draft.pdf) |
| Riverine Modeling Proof of Concept Meeting: Reservoir and Riverine Water Quality Modeling |  4/15/2014 -4/17/2015 | These presentations demonstrate preliminary parameterization and configuration of the reservoir and water quality models. Draft model output for temperature and dissolved oxygen are presented for from each of the models. Seasonal changes in these water quality parameters are demonstrated for the standard model calibration 50 year data set representing wet, dry, and average past climate periods. | [April 2014 Presentations for Study 05.06 (File 1)](http://www.susitna-watanahydro.org/wp-content/uploads/2014/04/2014_04_15-17TT_Riverine_ReservoirWQM.pdf)[April 2014 Presentations for Study 05.06 (File 2)](http://www.susitna-watanahydro.org/wp-content/uploads/2014/04/2014_04_15-17TT_Riverine_RiverWQM.pdf) |
| Initial Study Report for Study 5.6 | 6/3/2014 | This document is the Initial Study Report (Parts A, B and C) for Study 5.6. Part A republishes the Draft ISR. Part B identifies supplemental information and errata in Part A. Part C presents study modifications and plans for completing the study. | [ISR Part A for Study 05.06](http://www.susitna-watanahydro.org/wp-content/uploads/2014/05/05.6_WQMOD_ISR_PartA.pdf)[ISR Part B for Study 05.06](http://www.susitna-watanahydro.org/wp-content/uploads/2014/06/05.7_MERC_ISR_PartB.pdf)[ISR Part C for Study 05.06](http://www.susitna-watanahydro.org/wp-content/uploads/2014/06/05.7_MERC_ISR_PartC.pdf) |
| Baseline Water Quality Study (Study 5.5) and Water Quality Modeling Study (Study 5.6) Water Quality and Lower River Modeling Technical Memorandum | 9/30/2014 | The riverine model currently extends from the dam site downstream to PRM 29.9. Study 5.6, Part C of the Initial Study Report (ISR) explained that AEA would assess in 2014 whether to extend the water quality modeling downstream of PRM 29.9 (AEA 2014). | [Sept. 2014 TM for Study 5.6](http://www.susitna-watanahydro.org/wp-content/uploads/2014/09/DRAFT-Tech-Memo_Baseline-Water-Quality-Decision-Points.pdf) |
| Initial Study Report Meetings, Water Quality Modeling Study (5.6) | 11/15/2014 | Transcripts and AEA’s agenda and PowerPoint presentations for the ISR meeting for the Water Quality Modeling Study | [Transcripts from ISR Meeting](http://www.susitna-watanahydro.org/wp-content/uploads/2014/11/Oct15_ISR_Meeting_PartA_Transcripts.pdf)[Materials from ISR Meeting](http://www.susitna-watanahydro.org/wp-content/uploads/2014/11/Oct15_ISR_Meeting_PartB_Agenda_Presentations.pdf) |
| 2014 to 2015 Study Implementation Report, Study 5.6, Water Quality Modeling Study  | 11/2015 | AEA’s Study Implementation Report describing current progress on construction and testing of the reservoir and riverine water quality models. | [2014-2015 SIR for Study 05.06 (File 1)](http://www.susitna-watanahydro.org/wp-content/uploads/2015/11/05.6_WQMOD_SIR.pdf)[2014-2015 SIR for Study 05.06 (File 2)](http://www.susitna-watanahydro.org/wp-content/uploads/2015/11/05.6_WQMOD_SIR_AppA.pdf) |

**[[1]](#endnote-1)**

1. **Data Distributor Contact Information:**

Alaska Energy Authority, 813 West Northern Lights Boulevard, Anchorage, AK 99503

Voice: 907-771-3000, Email: SUWAhelp@aidea.org

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