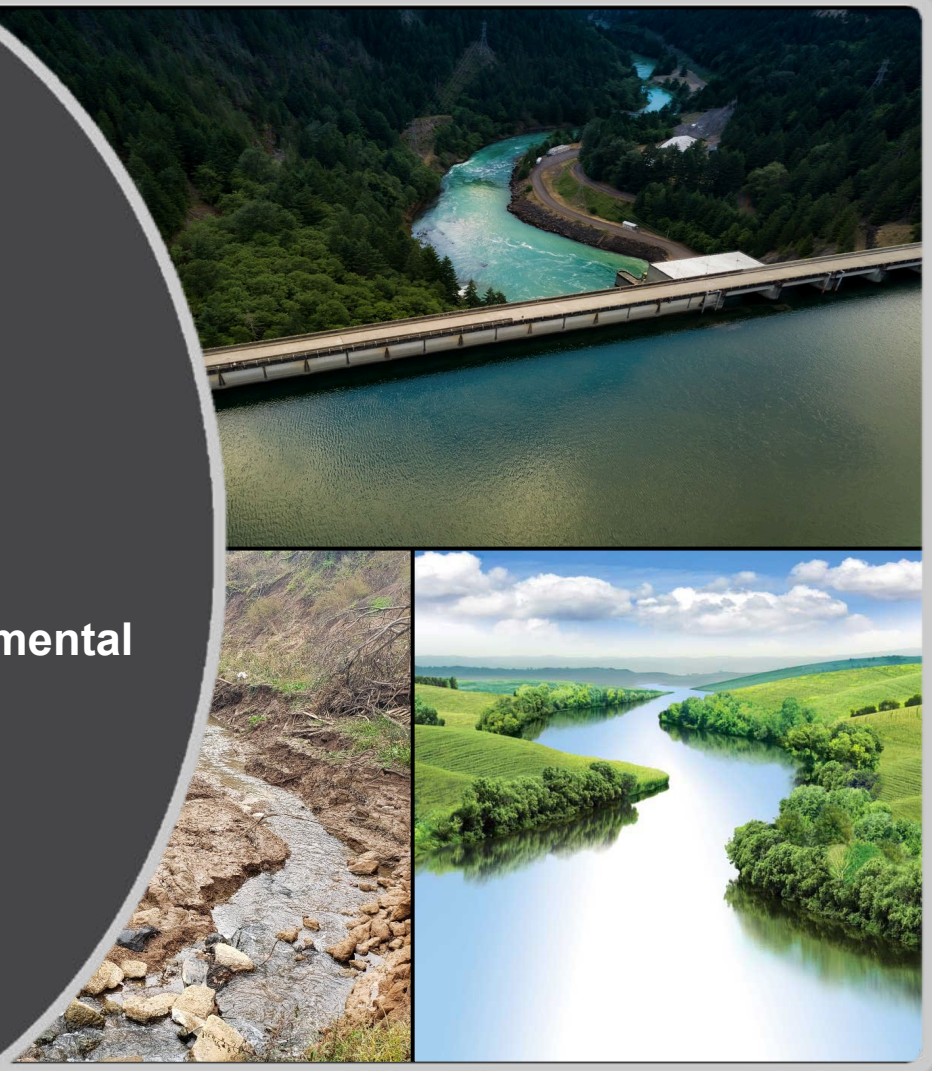
CE-QUAL-W2 MODEL SETUP II
CONTROL FILE

Isaac Mudge, MS
U.S. Army Corps of Engineers, New Orleans District
and
U.S. Army Engineer Research and Development Center, Environmental Laboratory

CE-QUAL-W2 Workshop

July 18 - 20, 2023



What is the control file?

- The control file is a central file that holds most model parameters.
- Information is separated into *cards*. (Punch cards were originally used to input data into computers.)

Cards: How they appear in the manual – 128 Cards

Title (TITLE C)
Grid Dimensions (GRID)
Inflow/Outflow Dimensions (IN/OUTFLOW)
Constituent Dimensions (CONSTITUENTS)
Miscellaneous (MISCELL)
Time Control (TIME CON)
Timestep Control (DLT CON)
Timestep Date (DLT DATE)
Maximum Timestep (DLT MAX)
Timestep Fraction (DLT FRN)
Timestep Limitations (DLT LIMIT)
Branch Geometry (BRANCH G)
Waterbody Definition (LOCATION)
Initial Conditions (INIT CND)
Calculations (CALCULAT)
Dead Sea (DEAD SEA)
Interpolation (INTERPOL)
Heat Exchange (HEAT EXCH)
Ice Cover (ICE COVER)
Transport Scheme (TRANSPORT)
Hydraulic Coefficients (HYD COEF)
Vertical Eddy Viscosity (EDDY VISC)
Number of Structures (N STRUC)
Structure Interpolation (STR INT)
Structure Top Selective Withdrawal Limit (STR TOP)
Structure Bottom Selective Withdrawal Limit (STR BOT)
Sink Type (SINK TYPE)

Structure Elevation (E STRUC)
Structure Width (W STRUC)
Pipes (PIPES)
Upstream Pipe (PIPE UP)
Downstream Pipe (PIPE DOWN)
Spillways (SPILLWAYS)
Upstream Spillways (SPILL UP)
Downstream Spillways (SPILL DOWN)
Spillway Dissolved Gas (SPILL GAS)
Gates (GATES)
Gate Weir (GATE WEIR)
Upstream Gate (GATE UP)
Downstream Gate (GATE DOWN)
Gate Dissolved Gas (GATE GAS)
Pumps 1 (PUMPS 1)
Pumps 2 (PUMPS 2)
Internal Weir Segment Location (WEIR SEG)
Internal Weir Top Layer (WEIR TOP)
Internal Weir Bottom Layer (WEIR BOT)
Withdrawal Interpolation (WD INT)
Withdrawal Segment (WD SEG)
Withdrawal Elevation (WD ELEV)
Withdrawal Top Layer (WD TOP)
Withdrawal Bottom Layer (WD BOT)
Tributary Inflow Placement (TRIB PLACE)
Tributary Interpolation (TRIB INT)
Tributary Segment (TRIB SEG)
Tributary Inflow Top Elevation (TRIB TOP)
Tributary Inflow Bottom Elevation (ELEV BOT)
Distributed Tributaries (DST TRIB)
Hydrodynamic Output Control (HYD PRINT)
Snapshot Print (SNP PRINT)
Snapshot Dates (SNP DATE)
Snapshot Frequency (SNP FREQ)
Snapshot Segments (SNP SEG)
Screen Print (SCR PRNT)
Screen Dates (SCR DATE)
Screen Frequency (SCR FREQ)
Profile Plot (PRF PLOT)
Profile Date (PRF DATE)
Profile Frequency (PRF FREQ)
Profile Segment (PRF SEG)
Spreadsheet Profile Plot (SPR PLOT)
Spreadsheet Profile Date (SPR DATE)
Spreadsheet Profile Frequency (SPR FREQ)
Spreadsheet Profile Segment (SPR SEG)

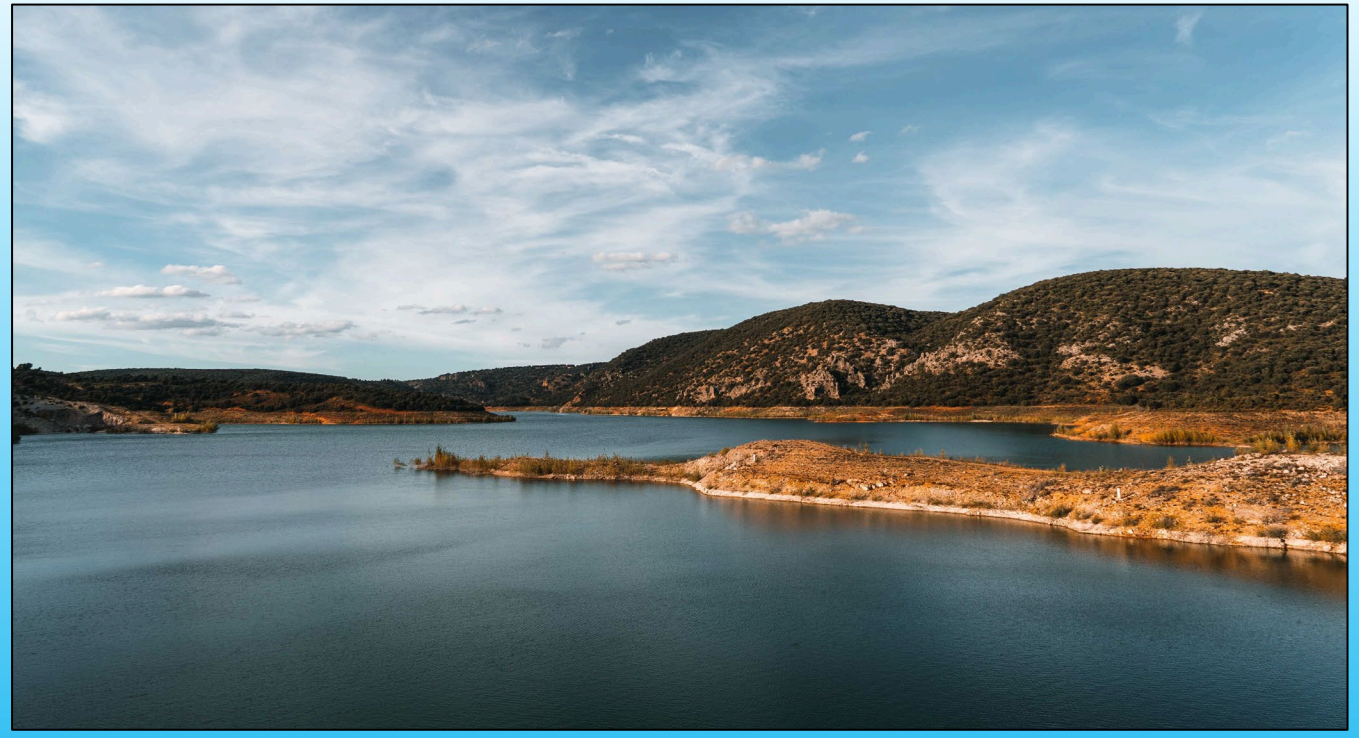
W2 Linkage File Output – (Vector Plot) (VPL PLOT)
Vector Plot Date (VPL DATE)
Vector Plot Frequency (VPL FREQ)
Contour Plot (CPL PLOT)
Contour Plot Dates (CPL DATE)
Contour Plot Frequency (CPL FREQ)
Kinetic Flux Output (FLUXES)
Kinetic Flux Date (KFL DATE)
Kinetic Flux Frequency (FLX FREQ)
Time Series Plot (TSR PLOT)
Time Series Date (TSR DATE)
Time Series Frequency (TSR FREQ)
Time Series Segment (TSR SEG)
Time Series Elevation (TSR ELEV)
Water Level Output (WL OUT)
Flow Balance Output (FB OUT)
N and P Mass Balance Output (NPB OUT)
Withdrawal Output (WITH OUT)
Withdrawal Output Date (WDO DATE)
Withdrawal Output Frequency (WDO FREQ)
Withdrawal Output Segment (WITH SEG)
Restart (RESTART)
Restart Date (RSO DATE)
Restart Frequency (RSO FREQ)
Constituent Computations (CST COMP)
Atmospheric Deposition (ATMDEP)
Active Constituents (CST ACTIVE)
Derived Constituents (CST DERIVE)
Constituent Kinetic Fluxes (CST FLUX)
Constituent Initial Concentration (CST ICON)
Constituent Output (CST PRINT)
Inflow Active Constituent Control (CIN CON)
Tributary Active Constituent Control (CTR CON)
Distributed Trib Active Constituent (CDT CON)
Precipitation Active Constituent Control (CPR CON)
Extinction Coefficient (EX COEF)
Algal Extinction (ALG EX)
Zooplankton Extinction (ZOO EX)
Macrophyte Extinction (MAC EX)
Generic Constituent (GENERIC)
Suspended Solids (S SOLIDS)
Bacteria
H2S
CH4

Fe(II) and FeOOH
Mn(II) and MnO2
Algal Rates (ALGAL RATE)
Algal Temperature Rate Coefficients (ALG TEMP)
Algal Stoichiometry (ALG STOICH)
Epiphyte/Periphyton Control (EPIPHYTE)
Epiphyte/Periphyton Print (EPI PRINT)
Epiphyte/Periphyton Initial Density (EPI INI)
Epiphyte/Periphyton Rate (EPI RATE)
Epiphyte/Periphyton Half-Saturation (EPI HALF)
Epiphyte/Periphyton Temperature Rate Coefficients (EPI TEMP)
Epiphyte/Periphyton Stoichiometry (EPI STOICH)
Zooplankton Rate (ZOOP RATE)
Zooplankton Algal Preference (ZOOP ALGP)
Zooplankton Zooplankton Preference (ZOOP ZOOP)
Zooplankton Temperature Rate Coefficients (ZOOP TEMP)
Zooplankton Stoichiometry (ZOOP STOICH)
Macrophyte Control (MACROPHYT)
Macrophyte Print (MAC PRINT)
Macrophyte Initial Concentration (MAC INI)
Macrophyte Rate (MAC RATE)
Macrophyte Sediments (MAC SED)
Macrophyte Distribution (MAC DIST)
Macrophyte Drag (MAC DRAG)
Macrophyte Temperature Rate Coefficients (MAC TEMP)
Macrophyte Stoichiometry (MAC STOICH)
Dissolved Organic Matter (DOM)
Particulate Organic Matter (POM)
Organic Matter Stoichiometry (OM STOICH)
Organic Matter Temperature Rate Multipliers (OM RATE)
Turbidity and Secchi Disk (TURBSEC)
Carbonaceous Biochemical Oxygen Demand (CBOD)
CBOD Stoichiometry (CBOD STOICH)
Inorganic Phosphorus (PHOSPHOR)
Ammonium (AMMONIUM)
Ammonium Temperature Rate Multipliers (NH4 RATE)
Nitrate (NITRATE)
Nitrate Temperature Rate Multipliers (NO3 RATE)
Silica (SILICA)
Sediment Carbon Dioxide Release (SED CO2)
Oxygen Stoichiometry 1 (STOICH 1)
Oxygen Stoichiometry 2 (STOICH 2)
Oxygen Stoichiometry 3 (STOICH 3)
Oxygen Stoichiometry 4 (STOICH 4)
Oxygen Stoichiometry 5 (STOICH 5)
Oxygen Limit (O2 LIMIT)

Sediment Compartment (SEDIMENT)
SOD Temperature Rate Multipliers (SOD RATE)
Zero-Order Sediment Oxygen Demand (S DEMAND)
Reaeration (REAERAT)
Restart Input Filename (RSI FILE)
Withdrawal Filename (QWD FILE)
Gate Outflow Filename (QGT FILE)
Wind Sheltering Filename (WSC FILE)
Dynamic Shading Filename (SHD FILE)
Bathymetry Filename (BTH FILE)
Meteorology Filename (MET FILE)
Light Extinction Filename (EXT FILE)
Atmospheric Deposition Filename (ATD FILE)
Vertical Profile Filename (VPR FILE)
Longitudinal Profile Filename (LPR FILE)
Branch Inflow Filename (QIN FILE)
Branch Inflow Temperature Filename (TIN FILE)
Branch Inflow Constituent Filename (CIN FILE)
Branch Outflow Filename (QOT FILE)
Tributary Inflow Filename (QTR FILE)
Tributary Inflow Temperature Filename (TTR FILE)
Tributary Inflow Concentration Filename (CTR FILE)
Distributed Tributary Inflow Filename (QDT FILE)
Distributed Tributary Inflow Temperature Filename (TDT FILE)
Distributed Tributary Inflow Concentration Filename (CDT FILE)
Precipitation Filename (PRE FILE)
Precipitation Temperature Filename (TPR FILE)
Precipitation Concentration Filename (CPR FILE)
External Upstream Head Filename (EUH FILE)
External Upstream Head Temperature Filename (TUH FILE)
External Upstream Head Concentration Filename (CUH FILE)
External Downstream Head Filename (EDH FILE)
External Downstream Head Temperature Filename (TDH FILE)
External Downstream Head Concentration Filename (CDH FILE)
Time Series Plot Filename (TSR FILE)
Withdrawal Output Filename (WDO FILE)
Sample Control Input File

What kind of stuff does the control file contain?

1. Physical dimensions (GRID Card)
   - NWB – Number of waterbodies
   - NBR – Number of branches
   - IMX – Maximum number of segments
   - KMX – Maximum number of vertical layers
2. Physical features (INFLOW/OUTFLOW card)
   - NTR – Number of tributaries
   - NST – Number of structures
   - NIW – Number of internal weirs
   - NWD – Number of withdrawals
   - NGT – Number of gates
   - NSP – Number of spillways
   - NPI – Number of pipes
   - NPU – Number of pumps
3. What we are modeling? (CONSTITUENTS card)
   - NGC – Number of generic constituents
   - NSS – Number of suspended solids groups
   - NAL – Number of algal groups
   - NEP – Number of epiphyton groups
   - NBOD – Number of BOD groups
   - NMC – Number of macrophyte groups
   - NZP – Number of zooplankton groups



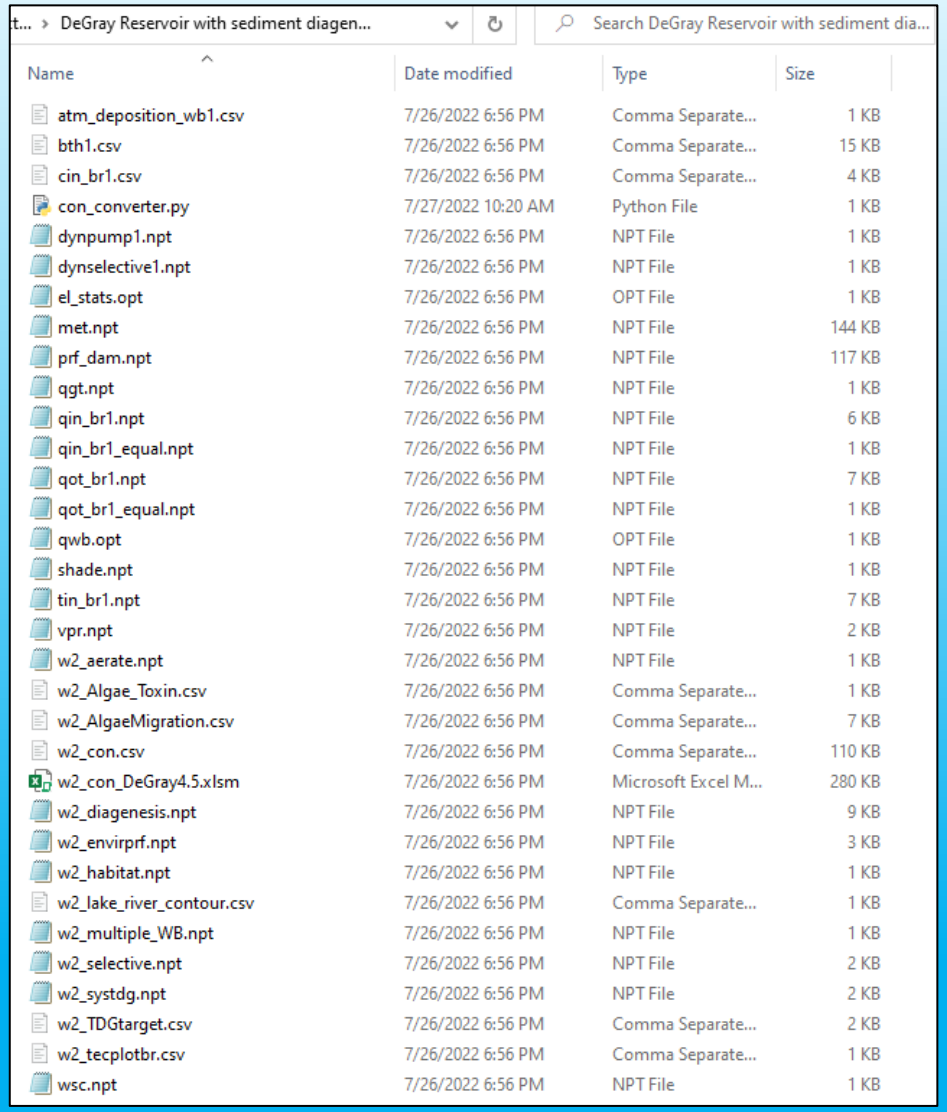
External References:

1. Include file names for input and output files
   - Meteorological input or timeseries output…
2. Have on/off switches for accessory modules
   - Fish habitat, sediment-diagenesis

Time Series Inputs

Boundary conditions, meteorological inputs, etc.

File names - global	**FILE NAMES**	
QWD FILE QWDFN - withdrawals	qwd.npt	
QGT FILE QGTFN - gate	qgt.npt	
WSC FILE WSCFN - wind sheltering	wsc.npt	
SHD FILE SHDFN - shading	shade.npt	
VPLFN - W2 post output, DSI W2Post output file	degray.w2i	
Waterbody Dependent File names	WB1	WB2
BTHFN bathymetry file	bth1.csv	
METFN meteorological file	met.npt	
EXTFN light extinction	ext_1.npt	
ATMDEPFN atmospheric deposition file name	atm_deposition_wb1.csv	
VPRFN vertical profile	vpr.npt	
LPRFN longitudinal profile	lpr.npt	
SNPFN snapshot	snp.opt	
PRFFN profile output	prf.opt	
CPLFN contour plot output	cpl.opt	
SPRFN spreadsheet output	spr.csv	
FLXFN flux output	flx.opt	
Branch Dependent File Names	BR1	BR2
QINFN branch inflow	qin_br1_equal.npt	
TINFN branch temp inflow	tin_br1.npt	
CINFN branch conc inflow	cin_br1.csv	
QOTFN branch structure outflow	qot_br1_equal.npt	
QDTFN Distributed flow file	qin_br1.npt	
TDTFN Distributed temperature file	tdt_br1.npt	
CDTFN Distributed concentration file	cdt_br1.npt	
PREFN Precipitation flow file	pre_br1.npt	
TPRFN Precipitation temperature file	tpr_br1.npt	
CPRFN Precipitation concentration file	cpr_br1.npt	
EUHFN Upstream head file	euh_br1.npt	
TUHFN Upstream temperature file	tuh_br1.npt	
CUHFN Upstream concentration file	cuh_br1.npt	
EDHFN Downstream head file	edh_br1.npt	
TDHFN Downstream temperature file	tdh_br1.npt	
CDHFN Downstream concentration file	cdh_br1.npt	
END OF FILE		



Accessory Modules Controlled in w2_con

- SELECTC suggests outlet controls based on water temperature
- HABITATC calculates volume of fish habitat based on dissolved oxygen
- ENVIRPC calculates amount of time and volume that reservoir meets certain conditions (i.e. constituent within certain range)
- AERATEC allows user to add oxygen mass to simulate aerator
- INITUWL calculates an initial velocity and normal depth for any non-zero slope waterbody
- ORGCC controls whether carbon is used as the metric for organic matter constituents such as LDOM, RDOM, etc.
- SED_DIAG controls flux of constituents and temperature between sediment and waterbody
- AVERTM turns algal vertical migration on/off
- w2_Algae_Toxin.csv – controlled by ON/OFF switch in ACTIVE CONSTITUENT card, ratio of toxin production for different algal types
- atm_deposition_wb1.csv – controlled by ON/OFF switch in ACTIVE CONSTITUENT card, sets atmospheric mass input for various constituents
- w2_tecplotbr.csv – controlled by ON/OFF switch in the CPL PLOT card, controls which branches to output

Accessory Modules Controlled by Presence in File Directory

- w2_constriction.csv – specifies maximum width between segments, affects right-hand-side face – manual part 3, page 316
- w2_particle.csv – specifies parameters to compute particle transport – manual part 3, page 456
- w2_multiple_WB.npt – provides details for running simulations with multiple waterbodies – manual part 3, page 467
- w2_systdg.npt – sets parameters for setting up total dissolved gas modeling – manual part 3, page 345
- w2_TDGTarget.csv – sets spillway operation parameters that adjust based on TDG target – manual part 3, page 349
- w2_lake_river_contour.csv – sets parameters for contour plots that vary over time – manual part 3, page 396

How does a control file look?

- CE-QUAL-W2 Versions 3.7, 4.0, 4.1, and 4.2 all use .npt input files (ASCII files):

w2_con.npt - Notepad

File Edit Format View Help

```
 W2 Model Version 3.72/4.0

TITLE C ..............................TITLE.................................
        Degray Reservoir - March 4 through December 27, 1980
        Degray Reservoir - March 4 through December 27, 1980
        Density placed inflow, point sink outflow
        Default hydraulic coefficients
        Default light absorption/extinction coefficients
        Testing sensitivity of temperature predictions to vertical resolution
        2 m layer heights



GRID          NWB      NBR      IMX      KMX    NPROC  CLOSEC
                1        1       32       36        1     OFF

IN/OUTFL      NTR      NST      NIW      NWD      NGT      NSP      NPI      NPU
                0        1        0        0        0        0        0        0

CONSTITU      NGC      NSS      NAL      NEP     NBOD      NMC      NZP
                3        1        1        1        0        0        1

MISCELL      NDAY SELECTC HABTATC ENVIRPC AERATEC INITUWL
              100     OFF      ON      ON     OFF     OFF

TIME CON  TMSTRT   TMEND    YEAR
         64.5000 358.700    1980

DLT CON       NDT  DLTMIN DLTINTR
                1 1.00000     OFF

DLT DATE     DLTD     DLTD     DLTD     DLTD     DLTD     DLTD     DLTD     DLTD     DLTD
           64.50

DLT MAX    DLTMAX   DLTMAX   DLTMAX   DLTMAX   DLTMAX   DLTMAX   DLTMAX   DLTMAX   DLTMAX
          3600.00
```

.npt file version

- 8-character width per entry

```
INIT CND    TEMPI     ICEI  WTYPEC    GRIDC
WB 1      -1.0000 0.00000   FRESH     RECT

CALCULAT      VBC      EBC      MBC      PQC      EVC      PRC
WB 1          OFF      OFF      OFF       ON      OFF      OFF

DEAD SEA    WINDC     QINC    QOUTC    HEATC
WB 1           ON       ON       ON       ON

INTERPOL    QINIC    DTRIC     HDIC
BR1            ON      OFF      OFF

HEAT EXCH   SLHTC     SROC   RHEVAP    METIC  FETCHC      AFW      BFW      CFW    WINDH
WB 1           ET      OFF      OFF       ON     OFF  9.20000  0.46000  2.00000  10.0000

ICE COVE     ICEC   SLICEC   ALBEDO    HWICE     BICE     GICE   ICEMIN    ICET2
WB 1          OFF   DETAIL  0.25000  10.0000  0.60000  0.07000  0.05000  3.00000

TRANSPOR    SLTRC    THETA
WB 1     ULTIMATE  0.50000

HYD COEF       AX       DX     CBHE     TSED       FI    TSEDF    FRICC       Z0
WB 1      1.00000  1.00000      0.3  14.0000  0.00000  0.00000    CHEZY    0.001

EDDY VISC     AZC    AZSLC    AZMAX      FBC        E    ARODI  STRCKLR  BOUNDFR   TKECAL
WB 1          TKE      IMP  1.00000        3    9.535    0.430     24.0     10.0      IMP

N STRUC      NSTR
BR1             1

STR INT     STRIC    STRIC    STRIC    STRIC    STRIC    STRIC    STRIC    STRIC    STRIC
BR 1           ON

STR TOP     KTSTR    KTSTR    KTSTR    KTSTR    KTSTR    KTSTR    KTSTR    KTSTR    KTSTR
BR1             2
```

Fixed-Width (*.npt) File Version

- Setting which WQ constituents are computed in the model

```
CST COMP      CCC     LIMC      CUF
               ON       ON        3

CST ACTIVE    CAC
TDS            ON
Gen1           ON
Gen2           ON
Gen3           ON
ISS1           ON
PO4            ON
NH4            ON
NO3            ON
DSI           OFF
PSI           OFF
FE             ON
LDOM           ON
RDOM           ON
LPOM           ON
RPOM          OFF
ALG1           ON
DO             ON
TIC            ON
ALK            ON
ZOO1          OFF
LDOM_P        OFF
RDOM_P        OFF
LPOM_P        OFF
RPOM_P        OFF
LDOM_N        OFF
RDOM_N        OFF
LPOM_N        OFF
RPOM_N        OFF
```

Version 5 User Interface

The most up-to-date user interface is an .xslm file (m stands for macro). The macro converts the excel into an .csv file which is readable by the model.

Note COL A and B are not written out to w2_con	**w2_con.csv file format**	CE-QUAL-W2 V	4.5								
		Control File ve	4.5								
Fixed length of file except when more than 5 alg	**TITLE C**	**Title comments: next 10 lines**									
5 macrophytes, 5 structures, 5 periphyton group	Any comment - this is written only to the SNP file	"Bonneville Dam, Columbia River"									
The # of rows though changes with the # of active water quality constituents.		"CRSO TRANSITION MODEL 2011-2015"									
Do not change the file tab name for this sheet since the output file name is tied to the name of t		"NAVD88 -> NGVD29+3.3"									
NWB: # of waterbodies		"GATE GAS GASGTC = ON, SYSTDG is ON"									
NBR: number of branches		"N2, DO --> TDG"									
IMX: maximum number of segments including inactive segments	Export to CSV file	""									
KMX: maximum number of vertical layers including inactive layers (top and bott		""									
NPROC: # of processors (INACTIVE at this time)		""									
CLOSEC: close dialog box after executing if =ON		"Zhong Zhang"									
NTR: number of tributaries		"7/2021"									
NST: maximum # of structures in a branch											
NIW: # of internal weirs	**GRID/NPROC/CLOSE DIALOG BOX**	**NWB**	NBR	IMX	KMX	NPROC	CLOSEC				
NWD: # of withdrawals		1	1	77	56	1	ON				
NGT: # of gates											
NSP: # of spillways	**IN/OUTFLOW**	**NTR**	NST	NIW	NWD	NGT	NSP	NPI	NPU		
NPI: # of pipes		0	0	0	0	20	0	0	0		
NPU: # of pumps or water level control rules											
NGC: # of generic water quality constituents	**CONSTITUENTS**	**NGC**	NSS	NAL	NEP	NBOD	NMC	NZP			
Do not change bolded headers in COL C - these are checked by the program		0	0	0	0	0	0	0			
NDAY:Maximum number of output dates or timestep related changes											
SELECTC:Turn ON/OFF/USGS automatic port selection f	**MISCELLANEOUS**	**NDAY**	SELECTC	HABTATC	ENVIRPC	AERATEC	INITUWL	ORGCC	SED_DIAG		
HABITATC:Turn ON/OFF habitat analyses for fish and eutrophication variables		100	OFF	OFF	OFF	OFF	OFF	OFF	OFF		
ENVIRPC:Turn ON/OFF environmental performance criteria											
AERATEC:Turn ON/OFF aeration to waterbody with diss	**TIME CON**	**TMSTRT**	TMEND	YEAR							
INITUWL:Turn ON/OFF initial water surface slope and v	These are computed from formula in Column A--	40544.000	40909.000	1900							
ORGCC simulates the organic matter as C rather than organic matter											
Fill in these with real dates and the Julian dates	**DLT CON**	**NDLT**	DLTMIN	DLTINTER							
TMSTRT	Time step control parameters	1	1	OFF							
1/1/2011 0:00											

Version 5 User Interface

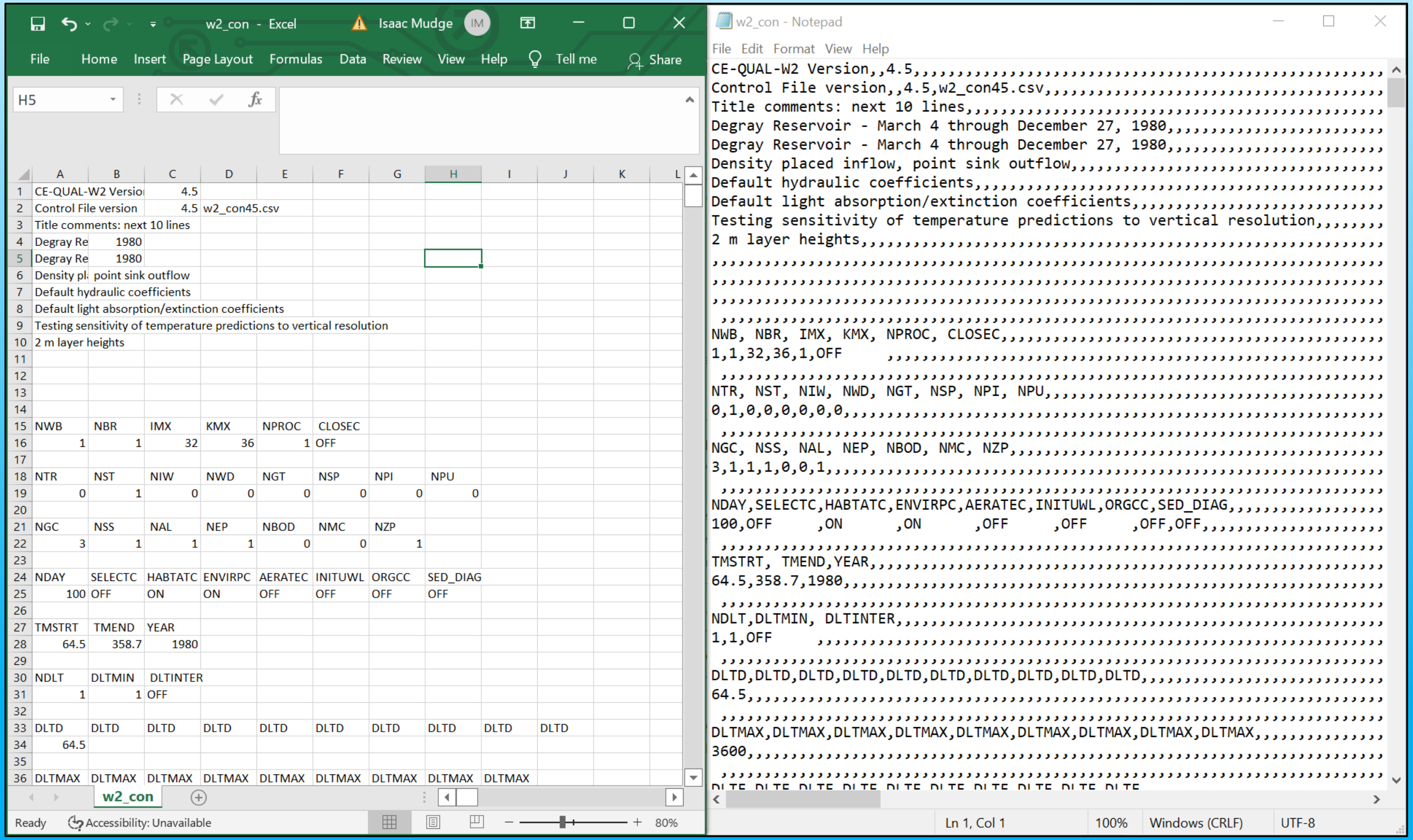
- *.xlsm control file interface for the .csv control file
- Orientation changed from .npt: Parameters now sorted by row; waterbody/branch by columns.

	JBDN downstream branch of waterbody	1				
	INIT CND	WB1	WB2	WB3	WB4	WB5
	T2I - initial temperature oC	-1				
	ICEI - initial ice thickness, m	0				
	WTYPEC - waterbody type FRESH or SALT	FRESH				
	GRIDC - grid RECT or TRAP (not used at present)	RECT				
	CALCULATION	WB1	WB2	WB3	WB4	WB5
	VBC - volume balance computation	ON				
	EBC - energy balance computation	OFF				
	MBC - mass balance computation	ON				
	PQC - Turn ON or OFF placement of inflows by density	ON				
	EVC - Turn ON or OFF evaporation water loss	OFF				
	PRC - Turn ON or OFF precipitation on water surface	OFF				
	DEAD SEA - only for code testing	WB1	WB2	WB3	WB4	WB5
	WINDC- turns ON or OFF all wind	ON				
	QINC- turns ON or OFF all inflows	ON				
	QOUTC-turns ON or OFF all outflows	ON				
	HEATC-turns ON or OFF all surface heat transfer	ON				
	INTERPOLATION	BR1	BR2	BR3	BR4	BR5
	QINIC- interpolate inflows	ON				
	DTRIC-interpolate distributed tributary inflows	OFF				
	HDIC-interpolate elevations for head boundary condition	OFF				
	HEAT EXCHANGE	WB1	WB2	WB3	WB4	WB5
	H SLHTC - Heat computations - Equilibrium (ET) or Term-by-term (TERM)	TERM				
	SROC - Read in Short wave solar radiation ON or OFF	OFF				
	RHEVAP - Use Ryan-Harleman Evap Model - for cooling ponds ON or OFF	OFF				
	METIC - Interpolate meteorological data ON or OFF	ON				

... w2_con.csv | Required Constituent Order | w2_habitat.npt | w2_diagenesis.npt | w2_aerate.npt | ...

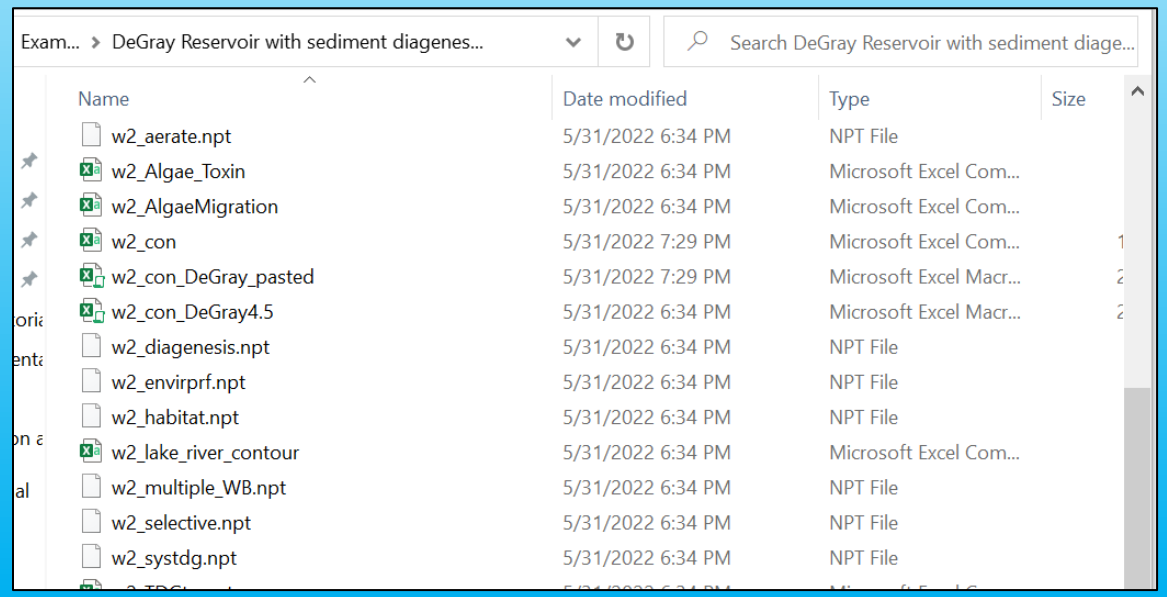
Version 5 User Interface

Both methods read the same .csv file, but notepad will show number of empty rows read in.



Version 5 User Interface

File explorer: where all external file inputs live for a model, including the control file:



Fortran code: assigns CON a file number, checks the name of variable CONFN, and then reads in file number 10 in specific patterns based on whether in .npt or .csv file format.

```
INTEGER         :: CON=10,
```

```
IF(CONFN=='w2_con.npt')THEN

 READ (CON,'(//(:8X,A8,2F8.0,2I8))') (PPUC(JP),   ETPU(JP),   EBPU(JP),   KTPU(JP),    KBPU(JP),   JP=1,NPU)
 READ (CON,'(//(:8X,9I8))')          (IWR(JW),    JW=1,NIW)
 READ (CON,'(//(:8X,9F8.0))')        (EKTWR(JW),   JW=1,NIW)              ! SW 3/18/16
 READ (CON,'(//(:8X,9F8.0))')        (EKBWR(JW),   JW=1,NIW)              ! SW 3/18/16
 READ (CON,'(//(:8X,9A8))')          (WDIC(JW),   JW=1,NWD)
 READ (CON,'(//(:8X,9I8))')          (IWD(JW),    JW=1,NWD)
 READ (CON,'(//(:8X,9F8.0))')        (EWD(JW),    JW=1,NWD)
 READ (CON,'(//(:8X,9I8))')          (KTWD(JW),   JW=1,NWD)
 READ (CON,'(//(:8X,9I8))')          (KBWD(JW),   JW=1,NWD); TRC= '      '  ! SW 9/27/13 INITIALIZATION SINCE ALLOCATION IS TO NTRT
 READ (CON,'(//(:8X,9A8))')          (TRC(JT),    JT=1,NTR)
 READ (CON,'(//(:8X,9A8))')          (TRIC(JT),   JT=1,NTR)
```

```
ELSE    ! w2_con.csv file format

 READ (CON,*) (PPUC(JP),   JP=1,NPU);PPUC=ADJUSTR(PPUC)
 READ (CON,*) (ETPU(JP),   JP=1,NPU)
 READ (CON,*) (EBPU(JP),   JP=1,NPU)
 READ (CON,*) (KTPU(JP),   JP=1,NPU)
 READ (CON,*) (KBPU(JP),   JP=1,NPU)
 READ (CON,*)
 READ (CON,*)

 READ (CON,*)         (IWR(JW),    JW=1,NIW)
 READ (CON,*)        (EKTWR(JW),   JW=1,NIW)
```

Cards: How they appear in the .xlsm – 80 Cards

1	Grid Dimensions	21	Eddy Viscosity	41	Flow Balance Output	61	Algal Rates
2	Inflow/Outflow Dimensions	22	Structures For Each Branch	42	N and P Mass Balance Output	62	Epiphyton
3	Constituent Dimensions	23	Pipes	43	Iron Constituents Output	63	Epiphyton Rates
4	Miscellaneous	24	Spillways	44	Restart	64	Zooplankton Rates
5	Time Control	25	Gates	45	Constituent Computations	65	Macrophytes
6	Timestep Control	26	Pumps	46	Atmospheric Deposition	66	Macrophyte Rates
7	Timestep Date	27	Internal Weir	47	Concentration State Variables	67	Dissolved Organic Matter
8	Maximum Timestep	28	Withdrawal	48	Derived Concentration State Variables	68	Particulate Organic Matter
9	Timestep Fraction	29	Trib Placement	49	Concentration State Variables Flux	69	Organic Matter Stoichiometry
10	Timestep Limitations	30	Distributed Trib	50	Extinction Coefficients	70	Turbidity
11	Branch Grid	31	Hydraulic Print	51	Algal Extinction	71	CBOD
12	Location	32	Snapshot Print	52	Zooplankton Extinction	72	Nutrients
13	Initial Conditions	33	Screen Print	53	Macrophyte Extinction	73	Sediment CO2
14	Calculation	34	Profile Output	54	Generic Constituent	74	Oxygen Limit
15	Dead Sea	35	Spreadsheet Output	55	Suspended Solids	75	SOD Rates
16	Interpolation	36	DSI W2Linkage	56	Bacteria	76	SOD Demand Zero Order
17	Heat Exchange	37	Contour Plot Output	57	Hydrogen Sulfide	77	Reaeration
18	Ice Cover	38	Fluxes	58	Methane	78	File Names – Global
19	Transport Scheme	39	Timeseries Plot Output	59	Iron Constituents	79	Waterbody Dependent File Names
20	Hydraulic Coefficients	40	Water Level Output	60	Manganese Constituents	80	Branch Dependent File Names

- Grid Dimensions
- Inflow/Outflow Dimensions
- Constituent Dimensions
- Miscellaneous
- Time Control
- Timestep Control
- Timestep Date
- Maximum Timestep
- Timestep Fraction
- Timestep Limitations
- Branch Grid
- Location
- Initial Conditions
- Calculation
- Dead Sea
- Interpolation
- Heat Exchange
- Ice Cover
- Transport Scheme
- Hydraulic Coefficients

2	NGC	Integer	Number of generic constituents

- Eddy Viscosity
- Structures For Each Branch
- Pipes
- Spillways
- Gates
- Pumps
- Internal Weir
- Withdrawal
- Trib Placement
- Distributed Trib
- Hydraulic Print
- Snapshot Print
- Screen Print
- Profile Output
- Spreadsheet Output
- DSI W2Linkage
- Contour Plot Output
- Fluxes
- Timeseries Plot Output
- Water Level Output

3	NCPL	Integer	Number of contour plot dates

Flow Balance Output
N and P Mass Balance Output
Iron Constituents Output
Restart
Constituent Computations
Atmospheric Deposition
Concentration State Variables
Derived Concentration State Variables
Concentration State Variables Flux
Extinction Coefficients
Algal Extinction
Zooplankton Extinction
Macrophyte Extinction
Generic Constituent
Suspended Solids
Bacteria
Hydrogen Sulfide
Methane
Iron Constituents
Manganese Constituents

3	NRSO	Integer	Number of restart dates

- Algal Rates
- Epiphyton
- Epiphyton Rates
- Zooplankton Rates
- Macrophytes
- Macrophyte Rates
- Dissolved Organic Matter
- Particulate Organic Matter
- Organic Matter Stoichiometry
- Turbidity
- CBOD
- Nutrients
- Sediment CO2
- Oxygen Limit
- SOD Rates
- SOD Demand Zero Order
- Reaeration
- File Names – Global
- Waterbody Dependent File Names
- Branch Dependent File Names

2	MP	Real	0.005	Stoichiometric equivalent between macrophyte bio-mass and phosphorus

- Grid Dimensions
- Inflow/Outflow Dimensions
- Constituent Dimensions
- Miscellaneous
- Time Control
- Timestep Control
- Timestep Date
- Maximum Timestep
- Timestep Fraction
- Timestep Limitations
- Branch Grid
- Location
- Initial Conditions
- Calculation
- Dead Sea
- Interpolation
- Heat Exchange
- Ice Cover
- Transport Scheme
- Hydraulic Coefficients

2	NDT	Integer	Number of timestep intervals

- Eddy Viscosity
- Structures For Each Branch
- Pipes
- Spillways
- Gates
- Pumps
- Internal Weir
- Withdrawal
- Trib Placement
- Distributed Trib
- Hydraulic Print
- Snapshot Print
- Screen Print
- Profile Output
- Spreadsheet Output
- DSI W2Linkage
- Contour Plot Output
- Fluxes
- Timeseries Plot Output
- Water Level Output

2	PDGTC	Character	DISTR	Specifies how inflows enter the downstream gate segment, DISTR, DENSITY, or SPECIFY

- Flow Balance Output
- N and P Mass Balance Output
- Iron Constituents Output
- Restart
- Constituent Computations
- Atmospheric Deposition
- Concentration State Variables
- Derived Concentration State Variables
- Concentration State Variables Flux
- Extinction Coefficients
- Algal Extinction
- Zooplankton Extinction
- Macrophyte Extinction
- Generic Constituent
- Suspended Solids
- Bacteria
- Hydrogen Sulfide
- Methane
- Iron Constituents
- Manganese Constituents

2	H2SR	Real	Sediment release rate of H2S, a fraction of SOD for the zero order SOD model only [-]

- Algal Rates
- Epiphyton
- Epiphyton Rates
- Zooplankton Rates
- Macrophytes
- Macrophyte Rates
- Dissolved Organic Matter
- Particulate Organic Matter
- Organic Matter Stoichiometry
- Turbidity
- CBOD
- Nutrients
- Sediment CO2
- Oxygen Limit
- SOD Rates
- SOD Demand Zero Order
- Reaeration
- File Names – Global
- Waterbody Dependent File Names
- Branch Dependent File Names

2-10	PREFZ	Real	0.0	Preference factor of zooplankton for zooplankton (dimensionless) from 0 to 1.

- Grid Dimensions
- Inflow/Outflow Dimensions
- Constituent Dimensions
- Miscellaneous
- Time Control
- Timestep Control
- Timestep Date
- Maximum Timestep
- Timestep Fraction
- Timestep Limitations
- Branch Grid
- Location
- Initial Conditions
- Calculation
- Dead Sea
- Interpolation
- Heat Exchange
- Ice Cover
- Transport Scheme
- Hydraulic Coefficients

2	VBC	Character	ON	Volume balance calculation, ON or OFF

- Eddy Viscosity
- Structures For Each Branch
- Pipes
- Spillways
- Gates
- Pumps
- Internal Weir
- Withdrawal
- Trib Placement
- Distributed Trib
- Hydraulic Print
- Snapshot Print
- Screen Print
- Profile Output
- Spreadsheet Output
- DSI W2Linkage
- Contour Plot Output
- Fluxes
- Timeseries Plot Output
- Water Level Output

2	FLXC	Character	OFF	Specifies if information is sent to the kinetic flux output file, ON or OFF

- Flow Balance Output
- N and P Mass Balance Output
- Iron Constituents Output
- Restart
- Constituent Computations
- Atmospheric Deposition
- Concentration State Variables
- Derived Concentration State Variables
- Concentration State Variables Flux
- Extinction Coefficients
- Algal Extinction
- Zooplankton Extinction
- Macrophyte Extinction
- Generic Constituent
- Suspended Solids
- Bacteria
- Hydrogen Sulfide
- Methane
- Iron Constituents
- Manganese Constituents

2	CCC	Character	OFF	Specifies if constituents are computed, ON or OFF

UNCLASSIFIED

- Algal Rates
- Epiphyton
- Epiphyton Rates
- Zooplankton Rates
- Macrophytes
- Macrophyte Rates
- Dissolved Organic Matter
- Particulate Organic Matter
- Organic Matter Stoichiometry
- Turbidity
- CBOD
- Nutrients
- Sediment CO2
- Oxygen Limit
- SOD Rates
- SOD Demand Zero Order
- Reaeration
- File Names – Global
- Waterbody Dependent File Names
- Branch Dependent File Names

2	PO4R	Real	0.001	Sediment release rate of phosphorus, fraction of SOD

- Grid Dimensions
- Inflow/Outflow Dimensions
- Constituent Dimensions
- Miscellaneous
- Time Control
- Timestep Control
- Timestep Date
- Maximum Timestep
- Timestep Fraction
- Timestep Limitations
- Branch Grid
- Location
- Initial Conditions
- Calculation
- Dead Sea
- Interpolation
- Heat Exchange
- Ice Cover
- Transport Scheme
- Hydraulic Coefficients

8	FRICC	Character	CHEZY	Bottom friction solution, MANN or CHEZY

- Eddy Viscosity
- Structures For Each Branch
- Pipes
- Spillways
- Gates
- Pumps
- Internal Weir
- Withdrawal
- Trib Placement
- Distributed Trib
- Hydraulic Print
- Snapshot Print
- Screen Print
- Profile Output
- Spreadsheet Output
- DSI W2Linkage
- Contour Plot Output
- Fluxes
- Timeseries Plot Output
- Water Level Output

2	AZC	Character	TKE	Form of vertical turbulence closure algorithm, NICK, PARAB, RNG, W2, W2N, TKE, or TKE1

- Flow Balance Output
- N and P Mass Balance Output
- Iron Constituents Output
- Restart
- Constituent Computations
- Atmospheric Deposition
- Concentration State Variables
- Derived Concentration State Variables
- Concentration State Variables Flux
- Extinction Coefficients
- Algal Extinction
- Zooplankton Extinction
- Macrophyte Extinction
- Generic Constituent
- Suspended Solids
- Bacteria
- Hydrogen Sulfide
- Methane
- Iron Constituents
- Manganese Constituents

3	SEDRC	Real	OFF	Turns ON or OFF sediment resuspension

- Algal Rates
- Epiphyton
- Epiphyton Rates
- Zooplankton Rates
- Macrophytes
- Macrophyte Rates
- Dissolved Organic Matter
- Particulate Organic Matter
- Organic Matter Stoichiometry
- Turbidity
- CBOD
- Nutrients
- Sediment CO2
- Oxygen Limit
- SOD Rates
- SOD Demand Zero Order
- Reaeration
- File Names – Global
- Waterbody Dependent File Names
- Branch Dependent File Names

9	MINKL	Real	0.0	This is the minimum gas transfer coefficient in units of m/d for LAKES and units of day^{-1} for RIVER/ESTUARY

Model Setup: Control File - Questions?