

Input – Forcing Data							
IFS-Fish Model	Dataset	Minimum Spatial Extent	Minimum Spatial Resolution	Minimum Temporal Resolution	Anticipated Source	Desired Level of Accuracy	Comments
Open-water Flow Routing	Channel cross-sections	Channel width to 1.5 year return interval	average 1 transect per mile	N/A	Geovera survey	<0.5 ft bed elevations	
	Floodplain/overbank profiles	model extent		N/A	LiDAR and Geovera surveys	<1 ft floodplain	
	Slope	downstream boundary	N/A		Geovera surveys		
	Range of flows	model extent	N/A	N/A	Brailey surveys		
	50-year continuous flow hourly dam releases	PRM 187		Hourly	HEC-ResSim Operations Model		
Lateral inflow	RM 140.01 to 187.06, RM 102.35 to 140.01	Cross-sections	>= 15 minutes	Uniform input assumption			
2-D Focus Area Fish Habitat	Bathymetry/ topography	Focus Area width up to high flow (1.5 year return interval flow)	10 meter main channel grid, 2 meter fine mesh, 30 m floodplain	Existing and adjusted as needed for yr-25 and yr-50	LiDAR and Geovera survey for existing, TT 1-D and 2-D Geo model to adjust yr-25 and yr-50	<0.75 ft bed, 1.5 ft floodplain	Coarse mesh areas will be less accurate
	Surficial bed material	Channel width up to high flow (1.5 year return interval flow)	variable depending on distribution of bed material	N/A	Survey (R2, MEC, WGD)		Data at lower 7 MR Focus Areas collected Sep 2013
	Fish Cover Characterizations	Channel width up to high flow (1.5 year return interval flow)	2 meter grid size	N/A	Survey (R2, MEC, WGD)		
	Boundary stage:discharge relationship	Downstream boundary	N/A	Potential separate relationships for existing and yr-25 and yr-50	Tt morphology modeling	<0.5 ft	
	2D hydraulic model	Model extent	10 meter main channel grid, 2 meter fine mesh, 30 m floodplain	Existing and adjusted as needed for yr-25 and yr-50	2-D Geo model to adjust yr-25 and yr-50		
	50-year continuous flow hourly dam releases	Susitna River and tributaries in Focus Areas	N/A	hourly mainstem and larger tribs, daily for minor tribs	Reservoir operations, then IFS open-water flow routing, ice flow routing	<15% main channel, <25% minor tribs	
HSC/HSI	HSC Fish (summer)	Macrohabitat	10 meter main channel grid, 2 meter fine mesh	daily depending on species and life stage periodicity	R2 HSC surveys	<0.1 fps, 0.1 depth	
	HSC Fish (winter)	Macrohabitat	10 meter main channel grid, 2 meter fine mesh	daily depending on species and life stage periodicity	R2 Winter Surveys	<0.1 fps, 0.1 depth	
	HSI Stranding & Trapping	Macrohabitat	10 meter main channel grid, 2 meter fine mesh	Hourly	R2 HSC surveys and literature	0.1 depth, 1% slope	
	HSI Macroinvertebrates & Algae	Macrohabitat	10 meter main channel grid, 2 meter fine mesh	daily depending on species and life stage periodicity	River Productivity surveys and literature	<0.1 fps, 0.1 depth	
	HSI Fish Passage	Macrohabitat	variable - polygon based	hourly/daily	R2 literature search	0.1 depth, 1.0 length	
	HSI Water Quality	Focus Area	3000 m ² variable depending on model resolution	hourly/daily	TetraTech Water Quality Modeling	<10%	
1-D Fish Habitat Modeling	Channel cross-sections	Channel width to 1.5 year return interval	average 1 transect per mile	N/A	Geovera survey	<0.5 ft bed elevations	
	Floodplain/overbank profiles	model extent		N/A	LiDAR and Geovera surveys	<1 ft floodplain	
	Slope	downstream boundary	N/A		Geovera surveys		
	Surficial bed material	Channel width up to high flow (1.5 year return interval flow)	variable depending on distribution of bed material	N/A	Survey (Lower River:Golder, Middle River R2, MEC, WGD)		
	Fish Cover Characterizations	Channel width up to high flow (1.5 year return interval flow)	variable depending on distribution of bed material	N/A	Survey (Lower River:Golder, Middle River R2, MEC, WGD)		
	Range of flows	model extent	N/A	N/A	Brailey surveys		
	50-year continuous flow hourly dam releases	PRM 187		Hourly	HEC-ResSim Operations Model		

Input – Parameters							
IFS-Fish Model	Dataset	Minimum Spatial Extent	Minimum Spatial Resolution	Minimum Temporal Resolution	Anticipated Source	Desired Level of Accuracy (optional)	Comments
Open-water Flow Routing	Channel/Floodplain flow resistance	model extent	Cross-sections	N/A	ACOE publications. Field observations, morphology, & calibration.	±20%	
	Expansion/Contraction loss	model extent	Cross-sections	N/A	ACOE recommended values & calibration.		
2-D Focus Area Fish Habitat	Channel flow resistance (Manning's n)	model extent	macrohabitat unit	Modify by season if needed	Surface bed material	10 percent	
	Floodplain flow resistance	model extent	floodplain element	Modify by season if needed	Geomorphology, riparian, ice	20 percent	
	Hydraulic time step	model extent	N/A	Hourly	Reservoir operations, then IFS open-water flow routing, ice flow routing	<15% main channel, <25% minor tribs	
	Water surface elevations	Macrohabitat unit	2-D mesh element	hourly	2-D hydraulic and morphology FA modeling	<0.5 ft	
	Mid-column velocity	model extent	model extent	N/A	2-D hydraulic and morphology FA modeling	<0.1 fps	
	HSI (fish passage, water quality, macroinvertebrates, algae, stranding and trapping)	model extent	2-D mesh element	hourly/daily	HSC, water quality model, River Productivity, literature		
	HSC for species and life stages of interest	model extent	2-D mesh element	Modify by season if needed	R2- HSC	N/A	depth, velocity, substrate, cover, turbidity, upwelling, DO, temperature, conductivity
HSC/HSI	HSC Fish (summer): depth, velocity, substrate, cover, turbidity, VHG	Macrohabitat	2-D mesh element	daily/seasonally	R2 HSC surveys	<0.1 fps, 0.1 depth	
	HSC Fish (winter): depth, velocity, substrate, cover, VHG	Macrohabitat	2-D mesh element	daily/seasonally	R2 Winter Surveys	<0.1 fps, 0.1 depth	
	HSI Stranding & Trapping: bed slope, topography, cover, substrate	Macrohabitat	2-D mesh element	Hourly/seasonally	R2 HSC surveys and literature	0.1 depth, 1% slope	
	HSI Macroinvertebrates & Algae: depth, velocity, substrate	Macrohabitat	2-D mesh element	daily/seasonally	River Productivity surveys and literature	<0.1 fps, 0.1 depth	
	HSI Fish Passage: bathymetry, depth	Macrohabitat	variable - polygon based	hourly/daily	R2 literature search	0.1 depth, 1.0 length	
	HSI Water Quality: temperature, DO, pH, conductivity, macronutrients, organic carbon, alkalinity, Chlorophyll-a	Focus Area	3000 m ² variable depending on model resolution	hourly/daily	TetraTech Water Quality Modeling	<10%	
1-D Fish Habitat Modeling	Channel flow resistance (Manning's n)	model extent	macrohabitat unit	Modify by season if needed	Surface bed material	10 percent	
	Floodplain flow resistance	model extent	floodplain element	Modify by season if needed	Geomorphology, riparian, ice	20 percent	
	Hydraulic time step	model extent	N/A	Hourly	Reservoir operations, then IFS open-water flow routing, ice flow routing	<15% main channel, <25% minor tribs	
	Water surface elevations	Macrohabitat unit	cross-section	hourly	Brailey/Geovera surveying	<0.5 ft	
	Mid-column velocity	model extent	model extent	N/A	Brailey/Golder surveying	<0.1 fps	
	HSI (fish passage, water quality, macroinvertebrates, algae, stranding and trapping)	model extent	2-D mesh element	hourly/daily	HSC, water quality model, River Productivity, literature		
	HSC for species and life stages of interest	model extent	2-D mesh element	Modify by season if needed	R2- HSC	N/A	depth, velocity, substrate, cover, turbidity, upwelling, DO, temperature, conductivity

Input – Calibration Data							
IFS-Fish Model	Dataset	Minimum Spatial Extent	Minimum Spatial Resolution	Minimum Temporal Resolution	Anticipated Source	Desired Level of Accuracy	Comments
Open-water Flow Routing	Stage:Discharge relationships	model extent	Cross-sections	N/A	Brailey/Geovera surveys	<0.3 ft	Steady Flow
	Hydrographs	RM 140.01, RM 87.87		>=15 min			Unsteady Flow
2-D Focus Area Fish Habitat	ADCP velocity magnitude, direction, and flow distribution in wetted portions of FA	model extent	2-D mesh element	N/A	Brailey ADCP		All the 2D fish calibration parameters are used to verify output from the 2D hydraulic modeling to ensure the 2D model adequately represents the observed conditions.
	Water surface elevations	Macrohabitat unit	2-D mesh element	Based on surveyed water surface dates	Geovera surveying, 2014 macrohabitat connectivity surveys, stage recorders	<0.5 ft	
	channel thalweg profiles	model extent	as available	as available	Geovera and Brailey surveying		
	Comparative cross-sections	Cross-sections in and adjacent to FAs	as available for coincident locations	as available	Geovera and Brailey surveying, 1980s data		
HSC/HSI	HSC Fish (summer)	Macrohabitat	10 meter main channel grid, 2 meter fine mesh	daily depending on species and life stage periodicity	R2 HSC surveys		Comparison to 1980's and literature based curve sets
	HSC Fish (winter)	Macrohabitat	10 meter main channel grid, 2 meter fine mesh	daily depending on species and life stage periodicity	R2 Winter Surveys		Comparison to 1980's and literature based curve sets
	HSI Stranding & Trapping	Macrohabitat	10 meter main channel grid, 2 meter fine mesh	Hourly	R2 HSC surveys and literature		Comparison to literature based criteria
	HSI Macroinvertebrates & Algae	Macrohabitat	10 meter main channel grid, 2 meter fine mesh	daily depending on species and life stage periodicity	River Productivity surveys and literature		Comparison to literature based criteria
	HSI Fish Passage	Macrohabitat	variable - polygon based	hourly/daily	R2, literature search		Comparison to literature based criteria
	HSI Water Quality	Focus Area	3000 m ² variable depending on model resolution	hourly/daily	TetraTech Water Quality Modeling		Comparison to spot and continuous monitoring data
1-D Fish Habitat Modeling	Water surface elevations	Macrohabitat unit	cross-sections	Based on surveyed water surface dates	Geovera surveying	<0.5 ft	
	Measured velocities	cross-section	vertical	hourly	Brailey surveying	<0.1 fps	

Output – Predicted Quantities

IFS-Fish Model	Predicted/Simulated Quantity	Spatial Extent	Spatial Resolution	Temporal Resolution	Level of Accuracy	Anticipated User	Comments
Open-water Flow Routing	Simulated water surface elevations	Model extent	Cross-sections	N/A	<0.5ft	1-D Fish Habitat Modeling	Steady Flow
	Peak flows	RM 140.01, RM 87.87		>= 15 minutes	< 10%	1-D Fish Habitat Modeling	Unsteady Flow
2-D Focus Area Fish Habitat	Potential habitat area by 2D simulation flow (square feet)	model extent	macro habitat or mesh element	N/A		Fish habitat time series	
	usable area versus discharge by life stage	model extent	model extent	N/A		habitat time series	
	Habitat (square feet) over time by life stage	model extent	model extent	Hourly		DSS	habitat time series will be one input to the DSS
HSC/HSI	Suitability of microhabitat parameters	Macrohabitat	10 meter main channel grid, 2 meter fine mesh	Hourly	R2 HSC surveys	Habitat model	
	Suitability of microhabitat parameters	Macrohabitat	10 meter main channel grid, 2 meter fine mesh	Hourly		Habitat model	
	Area extent of optional stranding and trapping areas	Macrohabitat	10 meter main channel grid, 2 meter fine mesh	Hourly		Habitat model	
	Suitability of microhabitat parameters	Macrohabitat	10 meter main channel grid, 2 meter fine mesh	N/A		Habitat model	
	Distribution and duration of potential passage areas	Macrohabitat	variable - polygon based	Hourly		Habitat model	
	Distribution and duration of threshold exceedance	Focus Area	3000 m ² variable depending on model resolution	Daily		Habitat model	
1-D Fish Habitat Modeling	Potential habitat area (square feet) by species, lifestage, by macrohabitat unit	model extent	cross-sections, macrohabitat units	Hourly		DSS	

Model Assumptions		
IFS-Fish Model	Assumption	Comment
Open-water Flow Routing	Negligible amount of flow entering simulation reach other than at specific locations.	
	Cross-sectional profiles and channel resistance does change with time or flow.	
2-D Focus Area Fish Habitat	2D model assumes a fixed bed for discrete time steps; year 0, 25, and 50	
HSC/HSI	Site specific HSC curve sets will only be developed for a subset of priority species and life stages	
	Alternative methods (e.g., Guiding, enveloping, Bayesian, expert opinion) will be used for development of some curve sets	
1-D Fish Habitat Modeling	1D model assumes a fixed bed for discrete time steps; year 0, 25, and 50	