Pete Ricketts, Governor

DATE: October 6, 2017, revised October 12, 2017

TO: Jennifer Schellpeper, Water Planning Division Manager

FROM: Kari Burgert, IWM Analyst

SUBJECT: Elwood Reservoir and E-65 Canal Recharge Projects
            Impacts to Streamflow in Republican River and Platte
            River Basins

MEMORANDUM

This memorandum summarizes the model runs, analysis, and results in estimating accretions to baseflow in the Republican River and Platte River Basins from recharge projects from Elwood Reservoir and E-65 Canal.

The RRCA groundwater model was used to determine the accretions to baseflow to the Republican Basin. The model runs using the RRCA groundwater model are documented in the report "Description of Methods Used to Develop Augmentation Simulation Data Sets, TB001, TB002, TB003, TB004, and TB005" completed December 20, 2013, for the Department. The entitled Simulation TB003 involves recharge from Elwood Reservoir; and Simulation TB004 involve recharge from E-65 Canal. The spreadsheet "20161209_5RunRRCA_TBNRD_Aug_Summary.xlsx" contains the results of the documented runs which were updated last year for the 5-run accounting method.

The accretions to baseflow in the Platte Basin were determined using the COHYST2010 version 28 groundwater model. The documented version of the model covers the dates from October 1, 1984, to December 31, 2010. The following methodology developed for the RRCA runs was carried out for the COHYST model runs. The baseline was developed with four repeated cycles of conditions from 1995 to 2009 to represent conditions from 2010 to 2069. For each scenario, an additional 5,000 acre-feet per year was seeped from the Elwood Reservoir cells and from the E-65 Canal cells, evenly distributed throughout the year and occurring every five years starting in 2010.

At the end of 2069, cumulative accretion to baseflow in the Republican River basin is approximately 5 and 3% of the total recharge from E-65 Canal and Elwood Reservoir,

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respectively. Cumulative accretion to baseflow in the Platte River basin is approximately 53 and 56% of the total recharge from E-65 Canal and Elwood Reservoir, respectively. See Table 1 and Figures 1 and 2 for annual, five-year, and cumulative summaries.

The COHYST modeled water balance results show that the majority of the recharge contributes to a change in storage for the beginning forty years of the simulation. Cumulative accretion to Platte River basin baseflow begins to exceed the cumulative change in storage in the early 2050s (Figures 3 and 4). Increases in simulated groundwater head for the E-65 Canal and Elwood Reservoir recharge scenarios are presented in Figures 5 and 6, respectively.

Groundwater head increases by a maximum of approximately 1.5 feet in the vicinity of the E-65 Canal recharge project and 3.3 feet in the vicinity of the Elwood Reservoir recharge project during the recharge events. Both scenarios end up with cumulative increases in groundwater head of less than a foot (Figures 5 and 6).

Table 1. Five-year cumulative accretions to Republican and Platte baseflow as absolutes and fractions of cumulative recharge for the E-65 Canal and Elwood Reservoir recharge simulations using the RRCA model, COHYST model, and Jenkins Method spreadsheet.

Year	Cumulative Recharge	RRCA - Republican				COHYST - Platte				Jenkins Method - Platte	
		E-65		Elwood		E-65		Elwood			
		Cumulative Accretion	Percent	Cumulative Accretion	Percent	Cumulative Accretion	Percent	Cumulative Accretion	Percent	Cumulative Accretion	Percent
2010	5,000	0	0.00%	0	0.00%	76	1.52%	56	1.11%	138	2.76%
2014	5,000	11	0.22%	1	0.02%	1,090	21.81%	1,140	22.80%	890	17.81%
2019	10,000	51	0.51%	15	0.15%	2,701	27.01%	2,844	28.44%	2,420	24.20%
2024	15,000	188	1.25%	85	0.57%	4,891	32.61%	5,180	34.54%	4,468	29.79%
2029	20,000	377	1.89%	197	0.99%	7,423	37.12%	7,877	39.38%	6,903	34.51%
2034	25,000	528	2.11%	279	1.12%	9,896	39.58%	10,498	41.99%	9,639	38.56%
2039	30,000	844	2.81%	457	1.52%	12,747	42.49%	13,551	45.17%	12,625	42.08%
2044	35,000	1,186	3.39%	667	1.91%	15,791	45.12%	16,792	47.98%	15,823	45.21%
2049	40,000	1,374	3.44%	779	1.95%	18,694	46.74%	19,909	49.77%	19,208	48.02%
2054	45,000	1,845	4.10%	1,064	2.36%	21,820	48.49%	23,237	51.64%	22,759	50.58%
2059	50,000	2,292	4.58%	1,340	2.68%	25,107	50.21%	26,760	53.52%	26,460	52.92%
2064	55,000	2,555	4.65%	1,505	2.74%	28,226	51.32%	30,142	54.80%		
2069	60,000	3,158	5.26%	1,882	3.14%	31,528	52.55%	33,643	56.07%		

Figure 1. a.) Annual total baseflow response to simulated recharge from Elwood Reservoir and E-65 Canal for the Platte Basin using the COHYST model and Jenkins Method; and b.) cumulative baseflow response to simulated recharge from Elwood Reservoir and E-65 Canal as a percent of the cumulative recharge for the Platte Basin.
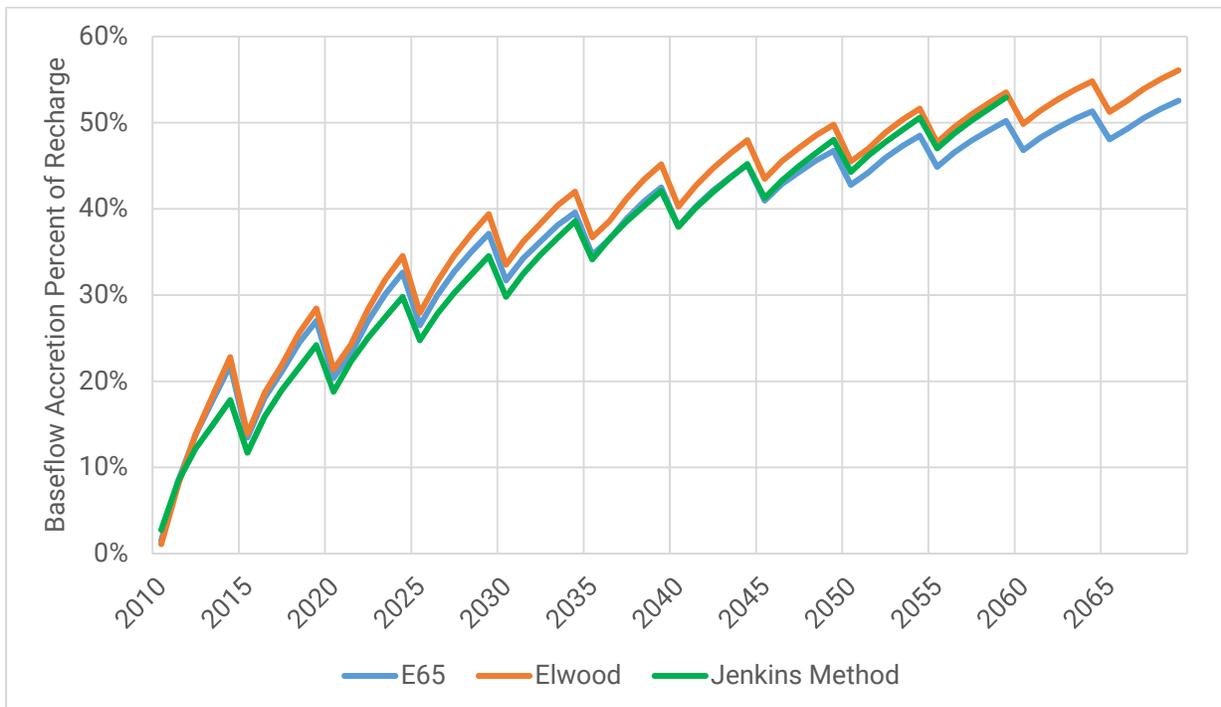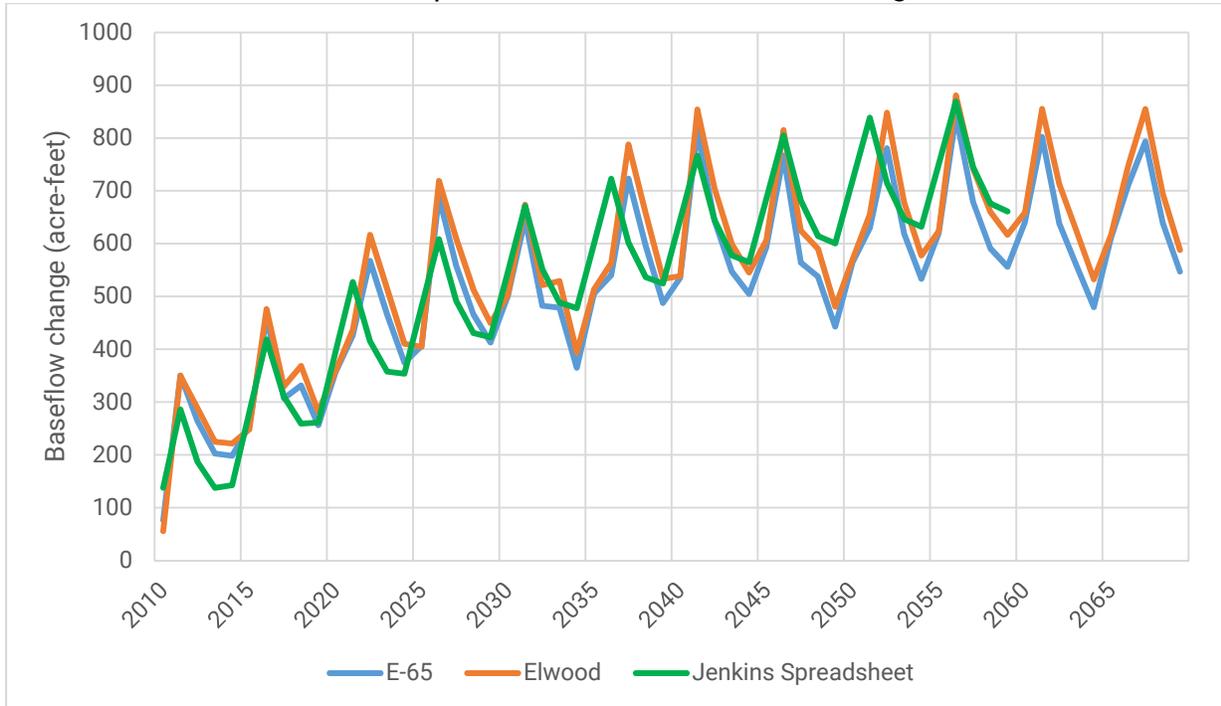
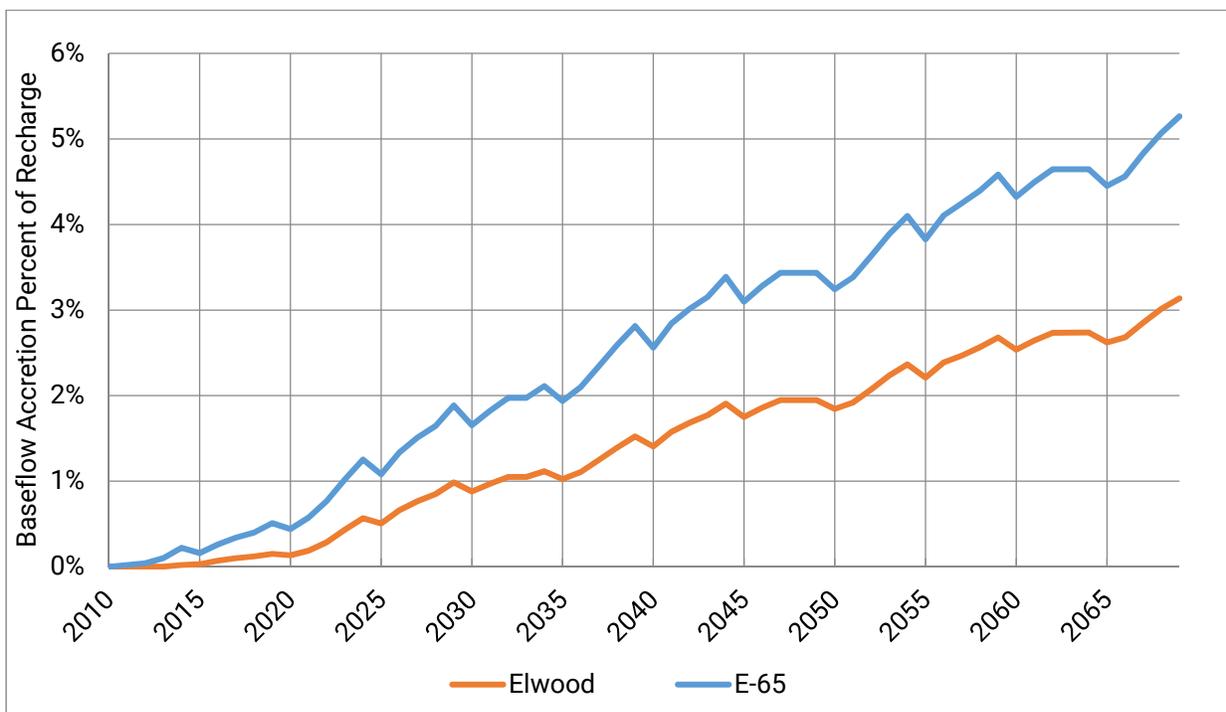Figure 2. a.) Annual total baseflow response to simulated recharge from Elwood Reservoir and E-65 Canal for the Republican Basin using the RRCA model; and b.) Cumulative baseflow response to simulated recharge from Elwood Reservoir and E-65 Canal as a percent of the cumulative recharge for the Republican Basin.
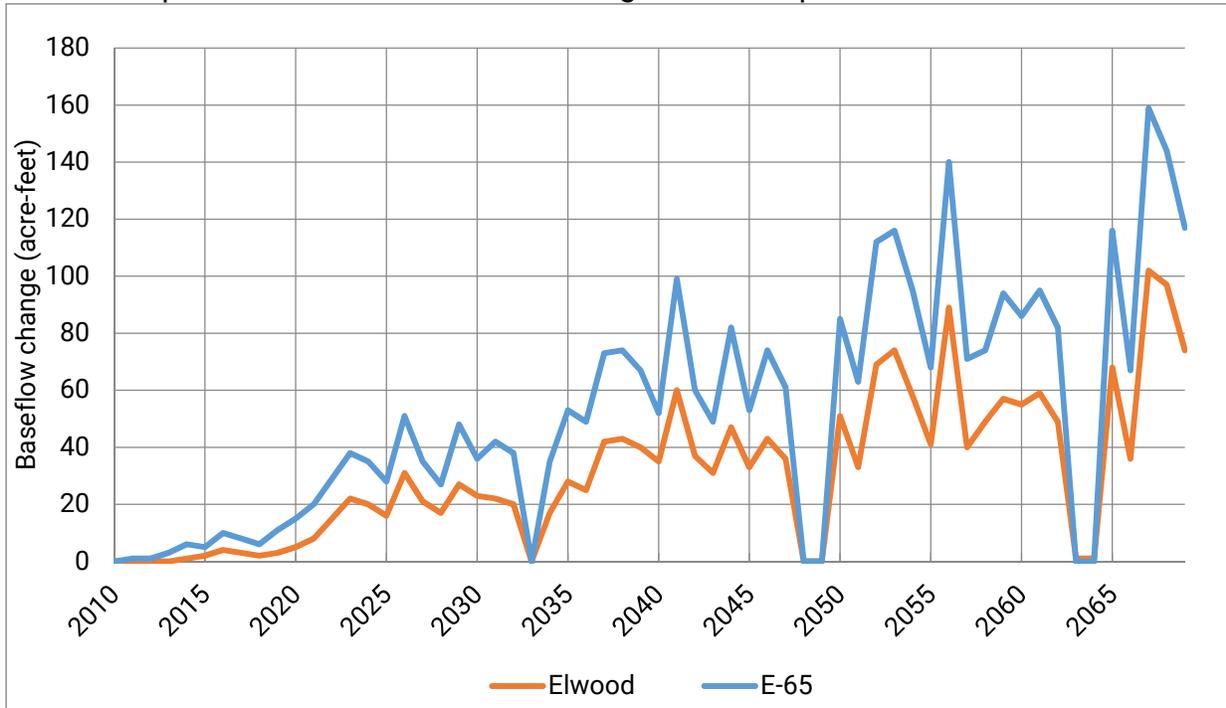
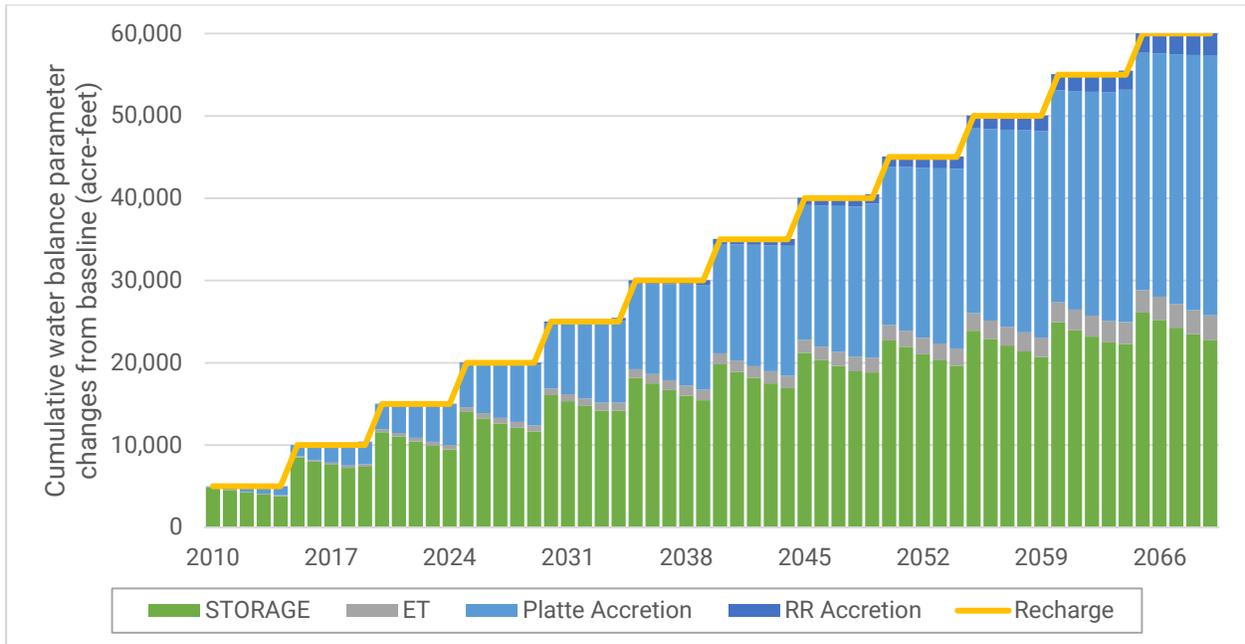Figure 3. Water balance summary for the COHYST run simulating recharge from E-65 Canal.

Figure 4. Water balance summary for the COHYST run simulating recharge from Elwood Reservoir.
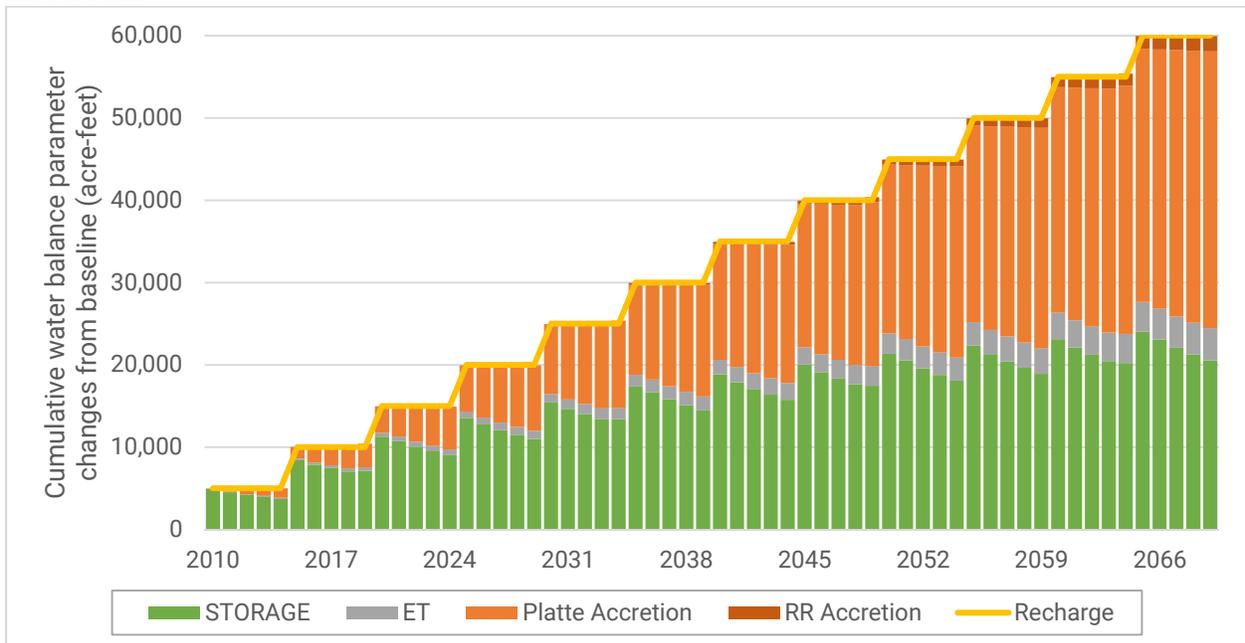
Figure 5. Cumulative change in groundwater head for the E-65 Canal recharge simulation using the COHYST model.
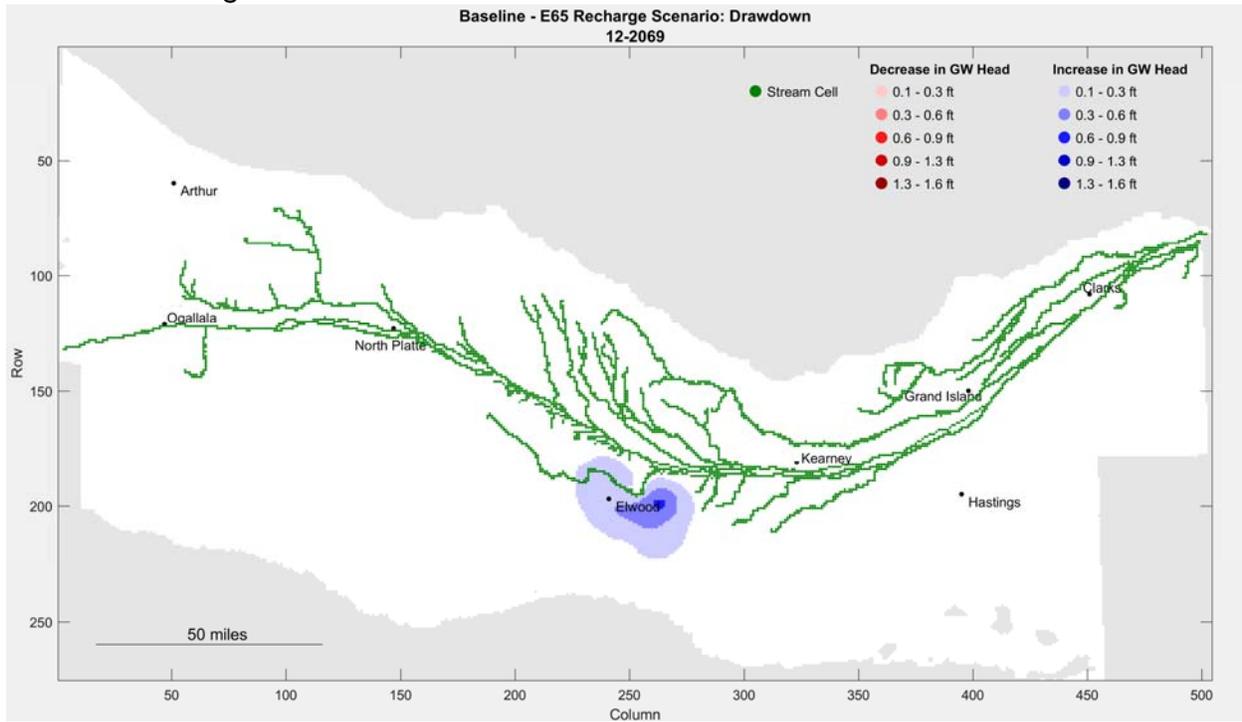

Figure 6. Cumulative change in groundwater head for the Elwood Reservoir recharge simulation using the COHYST model.