Appendix O

Whipple Creek Watershed-Scale Stormwater Plan Report

Cost Estimates

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Introduction

Conceptual-level cost estimates were prepared for the Whipple Creek Watershed-scale Stormwater Plan Report.

Costs for stormwater facilities were based on model outputs of hypothetical facilities, which likely would not be feasible as modeled. The cost estimates are therefore used primarily to estimate the relative magnitude of costs for different strategies contemplated by the report.

Capital cost estimates rely on the county's recent historical costs for land, engineering design, construction, and operation & maintenance. Costs are estimated independently for each strategy. Costs for each future scenario would include the costs of each component strategy.

The sum of one-time capital costs for all strategies is $347 million. Operation and maintenance of structural facilities is estimated at $4 million annually at full implementation. All costs are in 2017 dollars.

Cost Estimate Assumptions

Property Acquisition Assumptions

Model output for stormwater facilities – bioretention and detention ponds – included pond surface area. Land needs were estimated for bioretention facilities and detention ponds. Land needs were not estimated for easements relating to riparian restoration.

Land Costs

Land costs were provided by Clark County and were divided into urban land costs within the Vancouver Urban Growth Area and rural land costs outside of it. Based on Clark County Assessor data, urban land cost was assumed to be $2,308,680/acre, and rural land cost was assumed to be $430,000/acre.

Bioretention Land Needs and Costs

Bioretention land needs were estimated to be 1.1 times the pond surface to account for side slopes, curbs/walls, and setbacks. Bioretention was assumed to occur in county-owned rights-of-way and thus land costs were assumed to be zero.

Detention Ponds Land Needs and Costs

Detention pond land needs were estimated to be 1.8 times the pond surface to account for side slopes, grading, buffers, setbacks, access roads, and fencing. These factors were provided by Clark County based on engineering experience and judgement.

Condemnation Costs

Detention pond land costs were assumed to include both the cost of purchasing private property for all ponds and the costs of condemnation. Based on a report by the Center for Transportation Research at The University of Texas at Austin, using a sample of public works projects from around the country, on average 15% of acquired parcels go through condemnation.

Based on the County's real property acquisitions for the NE 10th Avenue road project and research into common legal costs of condemnation, condemnation costs were assumed to increase land costs by 33% and to incur legal costs of $30,000 per condemned parcel.

To estimate the number of parcels needed for detention ponds by sub-basin, the minimum number of parcels was assumed to be the minimum of either two per sub-basin or the total modeled detention pond surface area divided by 0.75 acres per pond. Number of condemned parcels was assumed to be the greater of one parcel per sub-basin or 15% of needed parcels.

Condemnation costs were only calculated based on pond surface area, not the entire amount of property acquired.

Riparian Restoration (Shade Strategy)

Riparian restoration was assumed to be 75 feet on each side of the channel to be shaded. Land was assumed to be privately owned and restored under an easement or to be publicly owned. Costs of easements were rolled up into the county's estimation of capital costs and were not estimated separately.

Channel Restoration

Costs of easement or land acquisition for channel restoration were rolled up into the county's estimation of capital costs and were not estimated separately.

Capital Cost Assumptions

Capital costs were estimated as the one-time costs for engineering design and construction. Capital construction costs were provided by Clark County based on recent projects and engineering judgement.

Bioretention

Capital costs for hypothetical bioretention were estimated at $2,178,000 per acre of modeled pond surface area.

Detention Ponds

Capital costs for hypothetical detention ponds were estimated at $300,000 per acre of modeled pond surface area.

Riparian Restoration (Shade Strategy)

Riparian restoration costs were estimated at $700,000 per mile of stream based on costs of the county's Capital Construction Program. For riparian restoration to add shade, estimates of one-time capital costs included land acquisition (easements), outreach, and a four-year maintenance program for plant establishment.

Channel Restoration

Channel restoration costs were estimated at $3,300,000 per stream mile based on costs of the county's Upper Whipple Creek Restoration project. Estimates of one-time capital costs included land acquisition (easements).

Operating Costs

Ongoing operating costs were estimated for bioretention and detention ponds. Annual operating costs were provided by Clark County based on recent budgets and assumed a facility lifecycle of 30 years.

Annual operating costs for bioretention were estimated at $82,764 per acre. Annual operating costs for detention ponds were estimated at $8,712 per acre.

No ongoing operating costs were estimated for riparian restoration (beyond the initial four-year plan establishment period included as a one-time capital cost) or for channel restoration.

For the financial model, operating costs were assumed to be zero from years one through five and to accrue equally each year thereafter for 25 years.

Revenue Basis Assumptions

This memo briefly summarizes the assumptions and methodology used for estimating the increase in equivalent residential units (ERUs) in the Whipple Creek watershed.

In Clark County, ERUs are the basis for calculating stormwater fees. As Whipple Creek develops in accordance with assumptions in the watershed-scale stormwater plan, ERUs will increase and stormwater fee revenue generated in the watershed will consequently increase over time.

One ERU is 3,500 square feet (SF) of hard surface (roof, driveway, roadway, etc.). To estimate the maximum possible increase in ERUs at full build-out under the current county Comprehensive Plan, the estimated increase in impervious/hard surfaces which was input into the hydrology model for full build-out of the Vancouver UGA in the Whipple Creek watershed was divided by 3,500 SF.

Maximum potential increases in ERUs were used in the financial analysis, in which is Appendix P of the watershed-scale plan.

Cost Estimates

Costs for each strategy are presented for each modeling sub-basins established for the Whipple Creek hydrology model.

Costs of Full Build-out Baseline Model (Future Scenario 1)

Future Scenario 1, the full build-out baseline, is implemented by private developers and has no new costs for the County.

Costs of Urban Structural Retrofits in UGA (Future Scenario 2)

Urban Structural Retrofits were modeled in Future Scenario 2 (FS2) of the plan.

The retrofits resulted in 29 acres of bioretention (at pond surface) and 38 acres of detention pond (at pond surface).

A conceptual-level cost estimate of FS2, below, does not include capital planning to identify and study feasibility of individual projects, nor does it attempt to anticipate a realistic number of facilities that would provide the modeled treatment and hydrology benefits.

Table 1: Conceptual Cost Estimate for Urban Structural Retrofits (FS2)

			Capital Costs ($Millions)				O&M Costs ($Millions)
Sub-basin	**Bioretention Surface (ac)**	**Detention Pond Surface (ac)**	**Bio-retention**	**Detention**	**Land Acquisition**	**Total One-Time Capital Costs**	**Annual**
WC 5	1.43	3.14	$3.12	$0.94	$15.47	$19.53	$0.15
WC 5A	9.7	12.23	$21.13	$3.67	$60.21	$85.01	$0.91
WC 6	2.07	3.86	$4.51	$1.16	$19.01	$24.68	$0.21
WC 6A	2.07	3.4	$4.51	$1.02	$16.75	$22.28	$0.20
WC 6B	1.16	1.53	$2.53	$0.46	$7.55	$10.54	$0.11
WC 7	0.7	1.5	$1.53	$0.45	$7.41	$9.38	$0.07
WC 7A	0.52	1.11	$1.13	$0.33	$5.49	$6.96	$0.05
WC 7B	1.16	1.61	$2.53	$0.48	$7.95	$10.96	$0.11
WC 7C	1.43	1.26	$3.12	$0.38	$6.23	$9.72	$0.13
WC 7D	1.55	1.6	$3.38	$0.48	$7.90	$11.75	$0.14
WC 75	1.16	1.31	$2.53	$0.39	$6.47	$9.39	$0.11
WC 8	2.81	2.35	$6.12	$0.71	$11.59	$18.41	$0.25
WC 9	1.32	1.57	$2.88	$0.47	$7.75	$11.10	$0.12
WC 9A	1.49	2.01	$3.25	$0.60	$9.91	$13.76	$0.14
Total	**29**	**38**	**$62.23**	**$11.54**	**$189.69**	**$263.46**	**$2.70**

Riparian Restoration for Full Shade (Future Scenario 3)

Riparian restoration to achieve full shade was modeled in Future Scenario 3 (FS3). It assumed riparian restoration would span 75 feet on each side of an unshaded stream channel. 3.79 miles of channel were estimated to be eligible for riparian restoration.

A conceptual-level cost estimate did not include capital planning to identify and study feasibility of individual projects. Four years of anticipated maintenance for plant establishment were incorporated into a one-time capital cost.

Table 2: Conceptual Cost Estimate for Riparian Restoration for Full Shade (FS3)

Sub-basin	Stream Length (mi)	Percent Shaded - Existing Conditions	Stream Length with Shade BMP Applied in Scenario 3 (mi)	Total Cost (Millions) (1)
GL	0.773	99.9%	0.000	$0.00
WC 1	1.264	50.0%	0.632	$0.44
WC 1A	0.977	99.9%	0.000	$0.00
WC 2	1.095	50.0%	0.548	$0.38
WC 3	1.045	50.0%	0.523	$0.37
WC 3A	0.786	99.9%	0.000	$0.00
WC 4	1.080	50.0%	0.540	$0.38
WC 4A	2.118	99.9%	0.000	$0.00
WC 5	0.608	50.0%	0.304	$0.21
WC 5A	0.703	99.9%	0.000	$0.00
WC 6	0.733	50.0%	0.367	$0.26
WC 6A	0.752	99.9%	0.000	$0.00
WC 6B	0.100	99.9%	0.000	$0.00
WC 7	0.578	50.0%	0.289	$0.20
WC 7A	0.481	99.9%	0.000	$0.00
WC 7B	0.142	99.9%	0.000	$0.00
WC 7C	0.085	99.9%	0.000	$0.00
WC 7D	0.100	99.9%	0.000	$0.00
WC 75	0.194	99.9%	0.000	$0.00
WC 8	1.167	50.0%	0.584	$0.41
WC 9	0.832	99.9%	0.000	$0.00
WC 9A	0.283	99.9%	0.000	$0.00
PC 1	1.030	99.9%	0.000	$0.00
PC 1A	0.507	99.9%	0.000	$0.00
PC 1B	0.548	99.9%	0.000	$0.00
PC 2	0.208	90.0%	0.000	$0.00
PC 2A	1.266	90.0%	0.000	$0.00
Total			**3.79**	**$2.65**

Costs of Rural Structural Retrofits (Future Scenario 4)

Rural Structural Retrofits were modeled outside of the UGA in Future Scenario 4 (FS4).

Retrofits resulted in 14 acres of bioretention (at pond surface) and 21 acres of detention pond (at pond surface).

A conceptual-level cost estimate, below, did not include capital planning to identify and study feasibility of individual projects, nor did it attempt to anticipate a realistic number of facilities that would provide the modeled treatment and hydrology benefits.

Table 3: Conceptual Cost Estimate for Rural Structural Retrofits (FS4)

			Capital Costs ($Millions)				O&M Costs ($Millions)
Sub-basin	Bioretention Surface Area (ac)	Detention Pond Surface Area (ac)	Bio-retention	Detention	Land Acquisition	Total One-Time Capital Costs	Annual
GL	1.38	2.71	$3.01	$0.81	$2.51	$6.33	$0.14
WC 1	2.07	4.5	$4.51	$1.35	$4.15	$10.01	$0.21
WC 1A	1.06	1.33	$2.31	$0.40	$1.25	$3.96	$0.10
WC 2	2	2.74	$4.36	$0.82	$2.54	$7.72	$0.19
WC 3	0.39	0.85	$0.85	$0.26	$0.81	$1.91	$0.04
WC 3A	0.83	1.48	$1.81	$0.44	$1.39	$3.64	$0.08
WC 4	0.7	1.28	$1.53	$0.38	$1.20	$3.11	$0.07
WC 4A	1.16	1.08	$2.53	$0.32	$1.02	$3.87	$0.11
PC 1	0.29	0.46	$0.63	$0.14	$0.45	$1.22	$0.03
PC 1A	0.52	0.59	$1.13	$0.18	$0.57	$1.88	$0.05
PC 1B	0.39	0.3	$0.85	$0.09	$0.31	$1.24	$0.04
PC 2	1.43	1.32	$3.12	$0.40	$1.24	$4.75	$0.13
PC 2A	1.74	2.07	$3.79	$0.62	$1.93	$6.34	$0.16
Total	**14**	**21**	**$30.41**	**$6.21**	**$19.36**	**$55.98**	**$1.34**

Channel Restoration Program

The Channel Restoration Program could consider channel restoration on up to eight miles of main stem Whipple Creek. Only stream miles on the main stem were considered eligible.

The conceptual-level cost estimate did not include capital planning to identify and study benefits and feasibility of individual projects.

Table 4: Conceptual Cost Estimate for Channel Restoration Program

Sub-basin	Stream Reach No.	Stream Length (mi)	Channel Restoration Stream Length (mi)	Channel Restoration Capital Cost
GL	100	0.773	0.773	$2.55
WC 1	110	1.264	1.264	$4.17
WC 2	120	1.095	1.095	$3.61
WC 3	130	1.045	1.045	$3.45
WC 4	140	1.080	1.080	$3.56
WC 5	150	0.608	0.608	$2.01
WC 6	160	0.733	0.733	$2.42
WC 7	170	0.578	0.578	$1.91
Total			**7.176**	**$23.68**