Source: MCES, 2010 Sand Creek Total Suspended Solids Model and Analysis of Potential Management Practices: Report Synopsis of both pictures

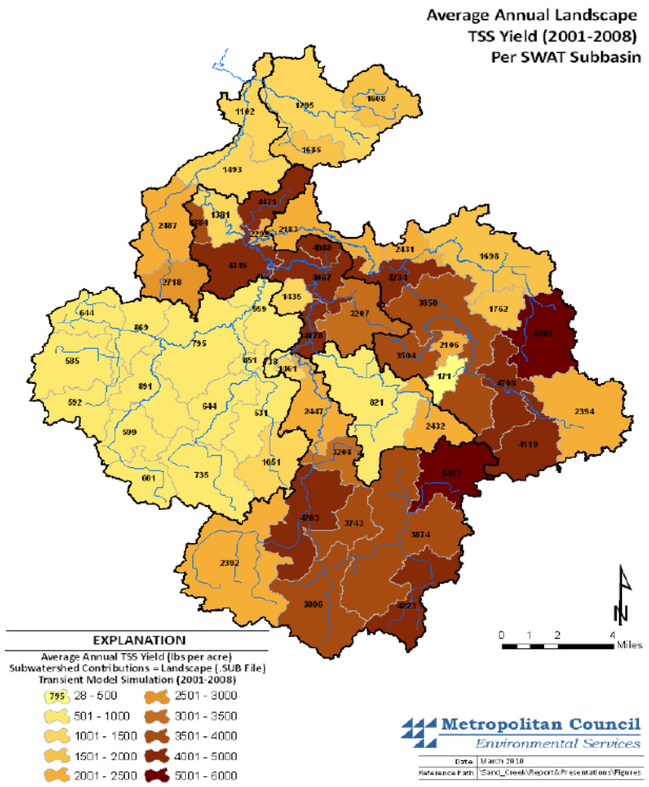

Figure 6.14: Average Annual Landscape TSS Yield per Subwatershed (2001-2008)

Calibrated model predictions landscape yield… mulitple years of simulation

NOTES AND LINKS

Priority areas for near channel sediment controls Middle Sand Creek watershed
Priority areas for rnoff reduction Upper Sand Creek, Upper Porter Creek, Porter Creek subwatershed and areas directly tributary to ravines in the Picha and Middle Sand Creek subwatersheds
Priority areas for grade control Middel Sand Creek, Upper Porter Creek, Upper Sand Creek subwatersheds; and bluff areas in Lower Sand Creek and Picha Creek subwatershed

Further refinement of near channel capital projects documented in Sand Creek Near Channel Sediment Reduction:
Feasibility Report, 2015 by Intervluve, Inc. 2015 Sand Creek Near Channel Sediment Feasibility Report
Analysis of management scenarios completed as part of the MCES study with results used to develop subwatershed specific management targets/approaches in the follwong two studies
Scott WMO, 2010: Sand Creek Watershed TMDL and Impaired Waters Resource Investigations: Volume 1 - Sand Creek Impaired Waters Diagnostic Study 2010 Volume 1 Sand Creek Watershed TMDL
Scott WMO, 2010: Sand Creek Watershed TMDL and Impaired Waters Resource Investigations: Volume 2 - Sand Creek Impaired Water Feasibility Study 2010 Volume 2 Sand Creek Watershed TMDL
Strategies, or subwatershed Plans, from the above Sand Creek Vol 1 and 2 studies have been incorporated into the Scott Watershed Management Organization Comprehensive Water Resources Management Plan 2009 as amended; Strategy 2.3.1: Cost Share and Incentive Program for Existing Land Uses
Strategy 2.3.2: Targeted Project Implementation and Capital Projects
Strategy 2.3.6: Fish IBI Improvements
Strategy 2.3.7: Sand Creek Sediment Reduction
Strategy 2.3.10: Cedar Lake Watershed
Link 2009 to 2018 Comprehensive Water Resource Management Plan Amend 4

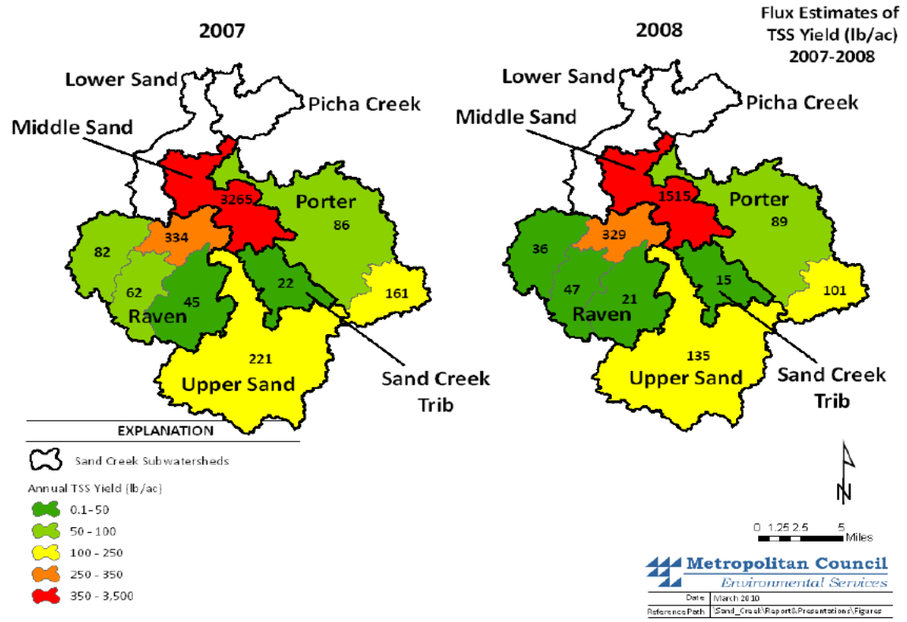

Figure 4.5: Estimated Areal TSS Loads (lb/ac) per Sand Creek Subwatershed for 2007-2008

FLUX model calcualated loads from specific monitoring years
Results would reflect sedimentation and provide net results at subwatershed outlets

Source: Scott WMO, 2010. Sand Creek Watershed TMDL and Impaired Waters Resource Investigation: Volume 1 - Sand Creek Imparied Waters Diagnostic Study

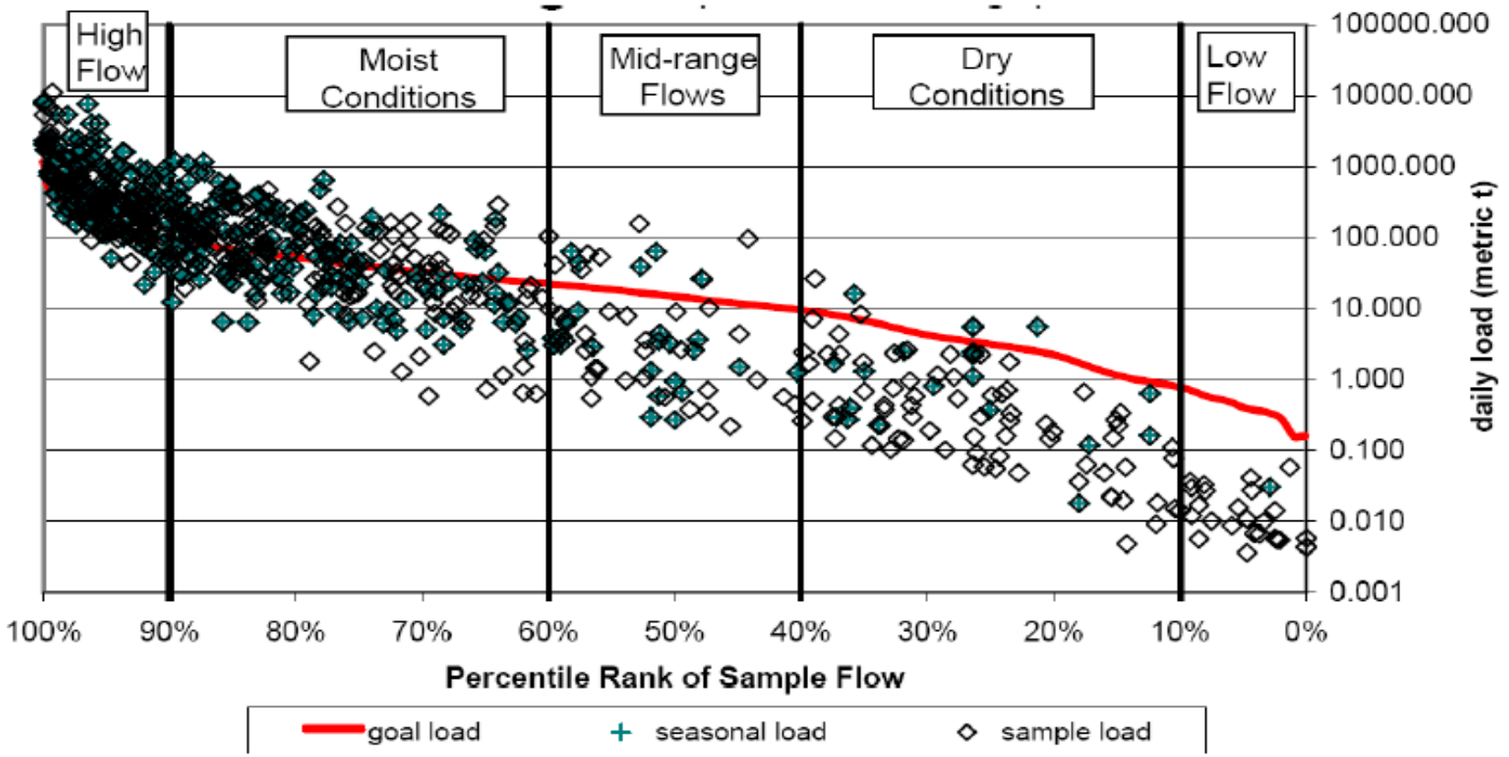

Figure 4-9. Sand Creek @ Jordan (282) Load Duration Curve, 1990-2008

For TSS

GOALS

High Flow Goal = 300 Mton/d 330 Ton/d

Existing high flow exceedence	1000	Mton/d	1100	Ton/d
Reduction needed	700	Mton/d	770	Ton/d
Mid or Moist Flow Goal=	80	Mton/day	88	Ton/d
Existing mid flow exceedence	100	Mton/day	110	Ton/d
	20	Mton/day	22	Ton/d

Annualize Load for comparison to annual BMP load reductions

High Flow 10% of time	Ave daily load approx =	800	Mton/d	
		36.5	days	
		29200	Mton/d	
	Total load during high flows	32120	Ton/d	
		64240000	Lbs/d	
	Total annual load*	70610000		
	% load during high flows	91%		
Mid Flow 30% of time	Ave daily load approx =	80	Mton/d	
		109.5	days	
		8760	Mton/d	
	Total load during mid flows	9636	Ton/d	
		19272000	Lbs/d	
	% load during mid flows	27%		

*Source: MCES, 2010 Sand Creek Total Suspended Solids Model and Analysis of Potential Management Practices: Report Synopsis Table MCES-3B
Average annual simulated load at Middle Sand Creek Outlet

Sand Creek 319 Load Reduction Calculations for Sediment and Phosphorus

Apr-16

Yield from IF Near Channel Feasibility Study 2015, 85% to 90% reductions for Near Channel stabilization per Inter Fluve
Table of Near Channel Project Sites yellow highlight for the six priority sites. Xanadu-Highway 8 site elimiated due to high total cost >$3million
3 base sites already funded include 210th St W - North, 210th St W - South, and Xandu-Sawmill.
Next priorities include Sawmill Lane and Helena - Broadway.

Site	Sed Yield (CY/YR)	90% Reduction Estimate (CY)*	85% Reduction Estimate (CY)*	Cost-Benefit Ratio		Erosion (CY/YR)	90% Reduction Estimate (CY)*	85% Reduction Estimate (CY)*	Cost-Benefit Ratio
Ridgeview Cir	1,070.0	24,075.0	22,737.5			1,241.0	27,922.5	26,371.3	
Hwy 189 - North	954.0	21,465.0	20,272.5			4,507.0	101,407.5	95,773.8	
Hwy 8- Xandu	**807.0**	**18,157.5**	**17,148.8**	**$188.93**		**1,060.0**	**23,850.0**	**22,525.0**	**$143.84**
Sawmill - Naylor	788.0	17,730.0	16,745.0			1,046.0	23,535.0	22,227.5	
Golfview - Hwy 21	441.0	9,922.5	9,371.3			771.0	17,347.5	16,383.8	
Lower Picha Ravine	370.0	8,325.0	7,862.5			1,900.0	42,750.0	40,375.0	
210th St W - North	**291.0**	**6,547.5**	**6,183.8**	**$57.18**		**331.0**	**7,447.5**	**7,033.8**	**$50.27**
Delmar - Hwy 21	276.0	6,210.0	5,865.0			853.0	19,192.5	18,126.3	
Helena - Broadway	**204.0**	**4,590.0**	**4,335.0**	**$57.72**		**309.0**	**6,952.5**	**6,566.3**	**$38.10**
Sawmill Lane	**189.0**	**4,252.5**	**4,016.3**	**$60.46**		**280.0**	**6,300.0**	**5,950.0**	**$40.81**
Xanadu - Sawmill	**80.0**	**1,800.0**	**1,700.0**	**$83.14**		**127.0**	**2,857.5**	**2,698.8**	**$52.37**
Marden Ct	5.0	112.5	106.3			13.0	292.5	276.3	
Camber Ave	4.0	90.0	85.0			6.0	135.0	127.5	
Green Ash Ct	53.0	1,192.5	1,126.3			443.0	9,967.5	9,413.8	
210th St W - South	**102.0**	**2,295.0**	**2,167.5**	**$99.48**		**263.0**	**5,917.5**	**5,588.8**	**$38.58**
Hwy 189 - South	483.0	10,867.5	10,263.8			2,093.0	47,092.5	44,476.3	

*Assumes 25 year life expectancy
Assume 1CY Soil = 1 Ton

	Costs Per IF Near Channel Feasiblity Study adjusted for additional tree cost	
Helena -Broadv	$250,204.00	
Sawmill Lane	$242,817.00	
W. 210th Soutl	$215,625.00	
W. 210th Nortl	$353,568.00	
Xanadu - Sawm	$141,343.00	$1,203,557.00
Hwy. 8 - Xanad	$3,239,898.00	

Estimated Total Load Reducitons and Cost for EPA GRANT

		Overall Project TSS ton/yr	Overall Project TP lbs/yr	Overall Project TSS $/ton	Overall Project TP $/lbs	EPA $s only TSS ton/yr	EPA $s only TP lbs	EPA $s only TSS $/ton	EPA $s only TP $/lbs
TACS Program Estimates, average 2012 - 2015 acutal program costs (including staffing) of $46/lb TP (over 10 years)									
	BMPS	1123.913043	1236.304348	$ 41.82	$ 46.00	956.5217391	1052.173913	$ 41.82	$ 46.00
Cover Crops Estimates	Incentive of $30/yr for 3 years			$ 85,000.00	944.44 acres	$30/yr incentive for 3 years		$ 50,000.00	555.56 acres
	Assume low net areal loading Upper Sand Creek MCES 2008 estimate =				131 lbs/ac/yr	(reflects actual measured w/sedimentation)			
	Assume high net areal loading Middle Sand Creek MCES 2007 =				221 lbs/ac/yr	(reflects actual measured w/sedimentation)			
	Assumed reduction			30% low	to 50% high				
	years	3							
	High efficien	52.18	57.40	$ 542.99	$ 493.62	30.69	33.76	$ 542.99	$ 493.62
	Low efficienc	18.56	20.41	$ 1,526.72	$ 1,387.93	10.92	12.01	$ 1,526.72	$ 1,387.93
Capital Projects Estimates									
	Low efficiency: assume 85% reduction, additional siste is sawmill and Ehlena Broadway, 1.1 lbs p per ton sediment, 25 year life								
	3 base sites	402.1	442.255	$ 70.69	$ 77.76				
	Add'l site 1	160.7	176.715	$ 60.46	$ 66.50	160.7	176.715	$ 27.39	$ 30.13
	Add'l site 2	173.4	190.74	$ 57.72	$ 63.49	173.4	190.74	$ 25.37	$ 27.91
	combined 1	562.7	618.97	$ 67.77	$ 74.55				
	combined 2	736.1	809.71	$ 65.40	$ 71.94				
	High Efficiency: assume 85% reduction, additional siste is sawmill and Ehlena Broadway, 1.1 lbs p per ton sediment, 25 year life								
	3 base sites	425.7	468.27	$ 66.76	$ 73.44				
	Add'l site 1	170.1	187.11	$ 57.10	$ 62.81	170.1	187.11	$ 25.87	$ 28.45
	Add'l site 2	183.6	201.96	$ 54.51	$ 59.96	183.6	201.96	$ 23.97	$ 26.36
	combined 1	595.8	655.38	$ 64.00	$ 70.41				
	combined 2	779.4	857.34	$ 61.77	$ 67.95				

		Tons	lbs	$/Ton Sediment	$/lb TP
BMPS	30 to 35 structural and 20 to 25 ac nonstructural				
Cost Efectiveness Overall for EPA	High Effectiveness	13673.55072	15040.9058	40.95498026	37.23180024
	Low Effectiveness	13614.21739	14975.63913	41.13346981	37.39406346

Estimate of Daily Load Reduction Sand Creek in Jordan

			HIGH FLOW REDUCTIONS: Daily Load Esstimated Reduction lbs/day			MID FLOW REDUCTIONS: Daily Load Estimated Reduction lbs/day		
					High Flow Reduction Goal 1540000 lbs TSS/day			Mid Flow Reduction Goal 44000 lbs TSS/day
BMPS	EPA Only		47695	3%	91% during 36.5 day high flow period Sedimentation along flow path to nearest water body already considered in historical cost calcs.	4739	11%	Assume 27% load during 109 day mid flow period Sedimentation along flow path to nearest water body already considered in historical cost calcs. Does not include other BMPS enabled by project
Cover Crops	EPA Only							
	High		1531	0%	91% during 36.5 day high flow period Sedimentation along flow path already	152	0%	Assume 27% load during 109 day mid flow period
	Low		544	0%	considdered in net areal load rate	54	0%	Sedimentation along flow path already considdered in net areal load rate Does not include other acreage enabled by the project
Capital Projects								
	Low	3 sties	20047	1%	Assumptions	1992	5%	Assumptions
	Low	EPA Only	8010	1%	91% during 36.5 day high flow period	796	2%	Assume 27% load during 109 day mid flow period
	Low	2nd site	8646	1%	Direct reduction to creek since near channel	859	2%	Direct reduction to creek since near channel
	Low	4 sites	28058	2%		2788	6%	
	Low	5 sites	36704	2%		3647	8%	
	High	3 sties	21227	1%	Assumptions	2109	5%	Assumptions
	High	EPA Only	8482	1%	91% during 36.5 day high flow period	843	2%	Assume 27% during 109 day mid flow period
	High	2nd site	9155	1%	Direct reduction to creek since near channel	910	2%	Direct reduction to creek since near channel
	High	4 sites	29708	2%		2952	7%	
	High	5 sites	38863	3%		3861	9%	
Combined	TACs, Cover and Capital							
	Low	3 sites	68287	4%		6785	15%	
	Low	EPA only	56250	4%		5589	13%	
	Low	2nd site	56886	4%		5652	13%	
	Low	4 sites	76297	5%		7581	17%	
	Low	5 sites	84944	6%		8440	19%	
	High	3 sites	70452	5%		7000	16%	
	High	EPA only	57707	4%		5733	13%	
	High	2nd site	58380	4%		5800	13%	
	High	4 sites	78934	5%		7842	18%	
	High	5 sites	88089	6%		8752	20%	

Combined Total Reduction (High and Mid Flows)

EPA Only	1366 Tons/year
4sites	1382 Tons/year
5 sites	1868 Tons/year

Conclusions

1. Should be able to meet 20% of mid flow reduction goal
2. should be able to meet 5% of high flow reduction goal
   - Does not include flow reduction considerations from practices (cover crops)
   - Does not include other BMPs not enabled by EPA grant
3. Results compare well with MCES SWAT model results (Scenario 6 MCES 2010) where channel stability improvements in the middle Sand Creek Watershed showed greatest incremental annual load reduction