Table 9.1 Capacities of Gravity Line and Pressure Mains

Gravity Collection Lines at Minimum Grade			
Pipe Size (in)	Minimum Slope	Capacity (gpm)	Capacity (gpd)
4	0.008	80	115,000
6	0.006	200	288,000
8	0.004	340	490,000
10	0.0028	500	720,000
12	0.0022	710	1,022,000
15	0.0015	1040	1,498,000
18	0.0012	1500	2,160,000
21	0.001	2,080	3,000,000
Based on minimum velocity of 2 fps, and C=100			

Pressure Pipeline Hydraulic Capacity		
Pipe Size (in)	Capacity (gpm)	Capacity (gpd)
4	195	282,000
6	440	635,000
8	785	1,128,000
10	1,225	1,763,000
Based on minimum velocity of 3.5 fps		

Table 9.2 Predicted Flows for Conventional Collection System

Year	Population	EDUs	ADF (mgd)	MMF (mgd)	PDF (mgd)	PHF (mgd)
1998	533	288	0.070	0.127	0.197	0.253
2023	1116	603	0.147	0.266	0.413	0.531
UBO	4132	2454	0.545	0.982	1.53	1.96

Estimates of Capital Costs

An estimate with unit quantities and prices was made for a gravity collection system in Table 9.3. Cost of abandoning existing septic tanks and installation of private service laterals is not included in the project costs, and will be borne directly by the customer. This cost will vary considerably, depending on the length of building sewer required and size and configuration of the septic tank(s). For the average homeowner, an opinion of probable costs is $1,500 based on the following:

Table 9-3 Preliminary Opinion of Probable Cost for Proposed Gravity Collection System

			Entire CSD		*Core Service Area*		*West Crescent*		*All Areas*	
Description	**Unit**	**Unit Cost ($)**	**Quantity**	**Extension ($)**	**Quantity**	**Extension ($)**	**Quantity**	**Extension ($)**	**Quantity**	**Extension ($)**
18" Sewer main	LF	$45	1,014	$45,630	1,014	$45,630	-	$0	1,014	$45,63
15" Sewer main	LF	$42	-	$0	-	$0	-	$0	-	$
12" Sewer main	LF	$40	2,991	$119,640	2,220	$88,800	-	$0	2,991	$119,64
10" Sewer main	LF	$35	4,913	$171,955	-	$0	-	$0	4,913	$171,95
8" Sewer main	LF	$30	26,105	$783,150	10,500	$315,000	16,750	$502,500	42,855	$1,285,65
Manholes	EA	$2,000	90	$180,000	40	$80,000	34	$68,000	124	$248,00
Cleanouts	EA	$250	9	$2,250	3	$750	6	$1,500	15	$3,75
Boring (18" Main) and Casing	LF	$500	60	$30,000	-	$0	-	$0	60	$30,00
Boring (8" Main) and Casing	LF	$350	240	$84,000	120	$42,000	-	$0	240	$84,00
Creek Crossing (Conc. encasement)	LF	$250	-	$0	-	$0	-	$0	-	$
Bridge Crossing (8" Gravity)	LF	$100	-	$0	-	$0	100	$10,000	100	$10,00
Service Wyes (18"x6")	EA	$150	5	$750	-	$0	-	$0	5	$75
Service Wyes (12"x6")	EA	$100	10	$1,000	-	$0	-	$0	10	$1,00
Service Wyes (10"x6")	EA	$75	18	$1,350	-	$0	-	$0	18	$1,35
Service Wyes (8"x6")	EA	$50	177	$8,850	123	$6,150	100	$5,000	277	$13,85
6" Service Laterals	LF	$25	10,500	$262,500	10,500	$262,500	5,000	$125,000	15,500	$387,50
Air Release Valve and Manhole	EA	$4,000	1	$4,000	1	$4,000	-	$0	1	$4,00
Rock Excavation	CY	$100	200	$20,000	40	$4,000	95	$9,500	295	$29,50
Gravel Surface Replacement	CY	$15	400	$6,000	160	$2,400	200	$3,000	600	00
Asphalt Surface Replacement	TON	$75	275	$20,625	55	$4,125	130	$9,750	405	$30,37
Concrete Surface Replacement	SY	$25	100	$2,500	40	$1,000	20	$500	120	$3,00
Seeding	SQ	$10	1,400	$14,000	560	$5,600	675	$6,750	2,075	$20,75
Compaction Testing	EA	$250	14	$3,500	4	$1,000	6	$1,500	20	$5,00
Construction Subtotal				$1,761,700		$862,955		$743,000		$2,504,70
Construction Contingencies				$176,170		$86,296		$74,300		$250,47
Engineering and Construction Observation				$352,340		$172,591		$148,600		$500,94
Legal and Administrative				$88,085		$43,148		$37,150		$125,23
Easement Acquisition and Right of Way				$15,000		$5,000		$5,000		$20,00
TOTAL				$2,393,295		$1,169,989		$1,008,050		$3,401,34

50 lineal ft. of 4" building sewer	$1,000
Abandon 1,000 gallon septic tank (pump and fill with sand)	$ 500
	$1,500

Opinions of probable cost for the sanitary sewer lateral in the public right-of-way (between the sewer man and property line) have been included in Table 9.7.

Annual O&M Costs

Cost associated with the operation and maintenance of a wastewater collection system include:

a) Energy cost associated with pumping
b) Pump station maintenance
c) Pipeline maintenance
d) Transportation
e) Education
f) Administration
g) New service connections
h) Maintenance equipment
i) Replacement and depreciation fund

Annual operation and maintenance cost are difficult to accurately estimate for a new system. One method is to compare with similar systems. However, this is also difficult since treatment costs and collection system costs are generally not separated in city budgets. Staff responsibilities often include both the collection and treatment systems. In a recent study for the city of Sisters, a comparison of municipalities that only operate a collection system (treatment is provided through a regional system) was made. From this comparison, it can be assumed that O&M cost for the new collection system in Crescent will be about $50 per connection per year. With an estimated current number of EDUs at 288, initial yearly O&M costs will be about $14,400.

9.3 SEPTIC TANK EFFLUENT COLLECTION (STEP/STEG)

As discussed in Section 8.3, the topography in Crescent allows the majority of the district to be served with gravity flow. Sewer-line connections along Highway 97 and the lower elevations may require septic tank pumping (STEP) since the collector line could be surcharged with gravity flow from higher elevations.

Design flows of 70 gpcd have been used widely and have often been found to be conservative. A value of 100 gpcd should have an adequate compensation for I/I and will be used for design in this case. Septic tanks can also provide some storage, reducing the peaking factors for the gravity systems. Table 9.4 gives design flows for the STEP/STEG collection system.

A general equation has been developed from the results of several studies (EPA manual on alternative collection systems) and is shown below:

$$Q = 0.5N + 20$$

Q = design flow (gpm)
N = number of households

The result of this equation with the projected number of EDUs at 603 is 322 gpm. This is within 5 percent of the PHF given below and is therefore considered to be a reasonable estimate.

Table 9.4 Predicted Flows for STEP/STEG System

Year	Population	EDUs	ADF (mgd)	MMF (mgd)	PDF (mgd)	PHF (mgd)
1998	533	288	0.059	0.106	0.164	0.211
2023	1,116	603	0.123	0.221	0.344	0.442

Estimate of Capital Costs

A STEG/STEP has many similarities to a conventional collection system. A 4-inch line is the minimum allowable size since it is no longer necessary to keep solids in suspension. Manholes can be substituted with cleanouts and inspection ports. Depending on the density of development, these features can provide significant capital cost savings over conventional gravity systems. However, new septic tanks for all connections are required, and some tanks will require effluent pumping. For the purpose of preliminary cost estimates, it is assumed that 10 percent of the new connections will need effluent pumping systems.

A tentative layout is shown on Figure 9-2, and opinions of probable costs are summarized in Table 9.5.

Annual O&M Costs

In addition to the cost of running a conventional collection system, STEP collection includes the following extra costs:

a) Cost for pumping septic tanks
b) Maintenance septic tank pumps

To estimate annual O&M costs, the following assumptions have been made:

a) Septic tanks require pumping every five years
b) Effluent pumps will need overhauling in five years
c) Only 10% of connection will need effluent pumping systems