CITY OF ROSS

STORMWATER DRAINAGE POLICY

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CONTENTS

TABLES

3.3.1 EXECUTIVE SUMMARY

Kadrmas, Lee and Jackson (KLJ) has prepared this Stormwater Drainage Policy for the express purpose of establishing guidelines for the design and analysis of future stormwater facilities within the City of Ross and its extraterritorial jurisdiction. The City has experienced flood-related problems in the past as a result of growth and a lack of cohesive development standards. It is the ultimate, overarching goal of this Policy to, in conjunction with proposed improvements and recommendations, to mitigate and control the loss of real and personal property from the effects of stormwater flood events and; thus, improve the quality of life among the citizens that inhabit the City.

3.3.2 STORMWATER DESIGN CRITERIA

INTRODUCTION

This section outlines the general criteria for stormwater analysis and design in the City of Ross. The Stormwater Design Criteria below will discuss the appropriate methodologies for hydrology, open channel hydraulics, closed conduit hydraulics, streets, curbs and gutters, culverts, detention/retention ponds, water quality and erosion control. In addition, the approval process for stormwater facilities is described in detail.

GENERAL HYDROLOGY

The determination of peak flow, runoff volume, time of concentration, peak and lag time is crucial to the design of effective stormwater management facilities. The most accurate assessment of rainfall runoff would be to measure the peak flowrate from a rainfall event that has a known recurrence interval. This method is not feasible; thus, an estimation that is made based on empirical and theoretical data is most widely used to estimate hydrologic parameters. The main purpose of performing hydrologic calculations, with respect to this Manual, is to analyze the peak flow of stormwater that contributes to a catchment or conveyance structure based on a specific recurrence interval.

Precipitation in the City of Ross can widely vary, though it averages 14-15 inches per year and generally has a semi-arid climate. The depth of stormwater resulting from a frequency storm is based on the storm duration. The most common rainfall durations are the 1-hour, 6-hour and 24-hour events, which were developed by the National Resources Conservation Service (NRCS) in conjunction with the United States Army Corps of Engineers (COE). It shall be required that for a drainage area of 1 square mile or less, the 6-hour storm duration shall be used for the design of stormwater facilities. If the drainage area is greater than 1 square mile, a 24-hour storm duration shall be used for design.

The recurrence interval is the storm that is known to occur, based on historical rainfall data, every X number of years. For example, a 100-year storm is one that statistically occurs roughly every 100 years, though a small possibility exists that it may happen in back-to-back years, for example. The rainfall depths associated with particular recurrence intervals and storm durations were derived from the National Weather Service (NWS) Technical Paper No. 40 release in 1960. The rainfall depths have been transferred to a tabular format (Table 1) for ease in applying the rainfall depths to be used for a given recurrence interval. These values should be used for any hydrologic computer models submitted to the City for review. In addition, the Soil Conservation Service (SCS) Type II storm distribution should be used. The distribution breakdown for the Type II storm is available on most hydrology software packages. Acceptable packages include (but are not limited to) HEC-1, HEC-HMS, TR-55, TR-20 and HydroCAD. The master drainage study that was performed as a basis for stormwater design was completed in HydroCAD.

Table 1: Precipitation Events and Recurrence Interval

Frequency	1-Hour Rainfall (in.)	6-Hour Rainfall (in.)	24-Hour Rainfall (in.)
2-Year	1.0	1.4	1.8
5-Year	1.4	1.9	2.5
10-Year	1.7	2.3	3.0
25-Year	2.0	2.6	3.5
50-Year	2.2	3.2	4.1
100-Year	2.6	3.5	4.6
500-Year	-	4.5	5.3

HYDROLOGIC ANALYSIS

Many methodologies are generally available to use for the establishment of the peak runoff values, including the Rational Method, SCS Unit Hydrograph Method, TR55 (Urban Stormwater) and USGS Regression Equations, which apply to large watersheds that have little observed or gaged data. For the City of Ross, the SCS Unit Hydrograph method is the preferred method to be utilized given the relatively small contributing watershed area and the tendency of the Rational Method to under-design storm drain systems and detention facilities. The unit hydrograph is the incidental hydrograph for a depth of 1-inch based on the surface properties of a particular watershed and can be augmented based on a uniform flow depth to determine the peak flow rate, $Q_{p.}$

Time of Concentration

The time of concentration (T_c) is defined as the time it takes for rainfall to travel from the most hydraulically remote point in the watershed down to the point of interest, generally the outfall of the basin. The time of concentration can vary for similar sized watersheds based on factors such as shape, flow patterns and degree of urbanization or impervious area. The total time of concentration is broken up based on four flow regimes: overland (or sheet) flow, shallow concentrated flow, open channel flow and closed conduit flow.

Sheet Flow:

Sheet Flow is the flow generally from the top of the watershed no more than 300 feet downstream along planar surfaces. Tillage patterns in crops can cause sheet flow to collect and should not be taken into account when determining the length of sheet flow. The equation for sheet flow is:

EQ. 1

$$T_s = \frac{0.00398*(n)*(L)^{0.8}}{S^4}$$

where:

T_s	=	travel time of sheet flow (in hours)
n	=	Manning's roughness coefficient
L	=	hydraulic flow length (in feet)
S	=	hydraulic grade line (HGL) slope (dimensionless)

Shallow Concentrated Flow:

Shallow Concentrated Flow is the flow regime immediately after sheet flow where flow becomes concentrated and collected. An average velocity can be determined from the equations below based on slope. If the slope is less than 0.005 ft./ft., the following equation (Eq. 2) can be used:

EQ. 2

V_{sh} = $16.13*(S)^{1/2}$ - Unpaved

V_{sh} = $20.32*(S)^{1/2}$ - Paved

V_{sh} = $7.00*(S)^{1/2}$ - Grass

V_{sh} = $10.00*(S)^{1/2}$ - Tilled

The travel time of shallow concentrated flow (T_{sh}) can be determined by using the following equation (Eq. 3):

EQ. 3

$$T_{sh} = \frac{L}{(60*V_{sh})}$$

Occasionally, shallow concentrated flows will occur over both multiple terrain surfaces (paved, unpaved,etc.). If that is the case, use the appropriate velocity equation separately.

Open Channel Flow:

Farther down the watershed, collected water will begin to flow in defined ditches, ephemeral streams or open channels and this flow is classified as channel flow. The majority of the channels in the City of Ross are usually ditches adjacent to streets, along Highway 2 or along the BNSF railroad. The Manning's equation is the most widely used and accepted formula to calculate open channel conveyance. The velocity in the channel can be calculated with Eq. 4 below:

EQ. 4

$$V_{cc} = \frac{1.49*(0.25*D)^{2/3}* S^{1/2}}{n}$$

$$V_{ch} = \frac{1.49*(R_h)^{2/3}* S^{1/2}}{n}$$

where:

R_h = hydraulic radius (in feet)

The travel time for open channel flow (T_{ch}) can be calculated by using Eq. 69 above.

Closed Conduit Flow:

Storm drain conduits in the receiving system may be collecting runoff and usually travel very rapidly to a discharge location such as an outfall, basin, lake, reservoir or depression. The velocity (V_{cc}) is calculated as:

EQ. 5

The travel time for open channel flow (T_{cc}) can be calculated by using **Eq. 2**.

The total time of concentration (T_c); therefore, is obtained by adding the travel times together ($T_s + T_{sh} + T_{ch} + T_{cc}$).

Storm drain design should be calculated using a software package such as StormCAD or SWMM; hand calculations are also acceptable and must be detailed to show the distribution of inflow to each catch basin or inlet and, if needed, bypassed flow for on-grade inlets.

Curve Number

The runoff curve number (CN) was developed by the SCS (now the NRCS) based upon an empirical analysis of runoff from small catchments and is widely used for determining the approximate amount of potential runoff from a storm event. The curve number is based on the hydrologic soil group (HSG), land cover, land use, treatment and hydrologic condition. The HSG is divided into four groups dependent on the types of surface soils in the area. Reference the *Soil Survey for Mountrail County* for detailed soil maps and explanation of the HSG in the area. The runoff CN should be taken from the TR-55 Manual developed by the Natural Resources Conservation Service (NRCS), a copy of which is provided. Refer to the tables below.

Table 2-2a Runoff curve numbers for urban areas [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

1 Average runoff condition, and $I_a = 0.2S$.
2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.
3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.
4 Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.
5 Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2b Runoff curve numbers for cultivated agricultural lands [1]

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment [2]	Hydrologic condition [3]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

1 Average runoff condition, and I_a=0.2S
2 Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.
3 Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

Table 2-2c Runoff curve numbers for other agricultural lands [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4]	48	65	73
Woods—grass combination (orchard or tree farm). [5]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

1 Average runoff condition, and $I_a = 0.2S$.
2 *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.
3 *Poor:* <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.
4 Actual curve number is less than 30; use CN = 30 for runoff computations.
5 CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.
6 *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Table 2-2d Runoff curve numbers for arid and semiarid rangelands 1/

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition 2/	A 3/	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

1 Average runoff condition, and $I_a = 0.2S$. For range in humid regions, use table 2-2c.
2 Poor: <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.
3 Curve numbers for group A have been developed only for desert shrub.

OPEN CHANNEL ANALYSIS

The majority of open channel analysis that would be performed in the City of Ross is design of ditches and swales as no ephemeral or natural streams exist within the City limits. Most of these ditches will be along the BNSF railroad or along developed Highway 2, though as the City develops into the future other designs may occur.

For the analysis and/or design of existing or proposed open channel conveyances in the City, a standard-step backwater computational analysis will be required using acceptable hydraulic software packages including HEC-2 or HEC-RAS. Any other hydraulic models that the user wishes to utilize will be allowed as long as it is computed using the Manning's Equation and is approved by the City Engineer.

For the purposes of channel design, the flow velocity for grass-lined channels shall not exceed 8.0 feet per second (fps) for the 100-year storm. The maximum limiting velocity shall be less than 5.0 fps for earthen channels and swales. The minimum velocity for any open channel in the City shall be 2.0 fps.

The Manning's "n" values should be classified based on the surface terrain in the channel and accounts for frictional loss of energy as water flows downstream. Concrete or rip-rap lined channels will have a lower capacity for friction loss compared to earthen and grass-lined channels and these values should be determined from site conditions as well as qualified engineering judgment.

Newly designed or enhanced open channels in the City should have a minimum freeboard of 1.0 foot above the computed year water surface.

CULVERTS

The analysis and design of culverts in the City should be made to convey the entire flow from an open channel. Culverts are to be composed of reinforced concrete or corrugated steel or metal pipes. Any other pipe material will not be allowed to be constructed without the approval of the City Engineer. Inverts shall be flush with the natural grade of the channel to allow for a smooth grade. Skewed culverts that are not placed normal, or perpendicular, to the road surface nor have an orientation that is not parallel to the channel banks is not allowed without the approval of the City Engineer.

The minimum velocity exiting the culvert must be greater than 3 fps to prevent silt deposits in culverts, which can diminish the effectiveness of the culvert facility. Also, if the maximum velocity is greater than 8 fps, some type of end protection shall be installed to prevent erosion and scouring. This can be accomplished with the installation of concrete or stone rip-rap or other apron placed both at the upstream and downstream faces of the culvert to armor the culvert from potential erosive capabilities. The maximum allowable outlet velocity for new culverts is 15 fps. Any design velocities higher than 15 fps may require acceptable outlet protection or energy dissipation design, which will be at the discretion of the City Engineer.

The design of culverts should also take into account the potential headwater elevation, which shall be no higher than the crown of the pipe for the 25-year storm and no higher than the edge of the cross street for the 100-year storm. All culverts in the City shall also be under inlet control and greater than 15” in diameter unless otherwise allowed by the City Engineer. Culvert calculations should be computed with an acceptable computer program such as HEC-RAS, CulvertMaster, FlowMaster or HY-8.

STREET, CURBS AND GUTTERS

The majority of the streets within the City have not been paved with concrete or asphalt and one of the major reasons that flooding has occurred in the past is that runoff transmits soil particles from developed neighborhoods and deposits them alongside the road in ditches and, in the absence of proper drainage, this accumulation gradually increases the road surface elevation with time. This has caused the foundations of houses in some locations to be lower than the edge of the road, which causes stormwater runoff to pond along the road and then back up and inundate the entire neighborhood. One of the recommendations offered by this Drainage Policy to mitigate this flood threat within the City is to develop an initiative to pave streets and install curbs and gutters, which will help out tremendously in allowing stormwater to drain runoff very quickly out to a collection or storage system. This can be noted in the Flood Control Facilities Plan in Section II of the Flood Control Master Plan.

Any storm drain system built for local and collector streets in the City should have enough capacity to allow the hydraulic grade line (HGL) for the 10-year storm to be no higher than the top of curb under any circumstances. The HGL from the 100-year storm event is to be contained within the street right-of-way or no more than 6” above the crown of the road for the 100-year storm, whichever is less. Additionally, the 100-year water surface will not be allowed to overtop the right-of-way under any circumstances.

DETENTION/RETENTION PONDS

The construction of detention or retention ponds in the City can provide benefits to stormwater quality as well as attenuate peak flow rates and reduce the burden on facilities downstream, especially in regards to pipes, culverts and channels. The key to an effective detention pond design is to place them at a location where the effects can be maximized. Regional or local detention ponds, for instance, could be situated upstream of the BNSF railroad north of the City and upstream of the borrow ditches next to Highway 2. With the future development south of Highway 2, the placement of detention facilities should be a key factor in the approval process.

Generally, detention is best served to attenuate or limit the flow rate departing from developed areas to pre-developed or existing conditions. The amount of storage needed is the volumetric difference from the pre-developed and developed rainfall hydrographs while taking into account release from any orifices, inlets or weirs. Any pre-developed flow that is bypassed from detention must be notated in the detention calculations and taken into account in determining the required detention storage. The release rate for low-flow events through a primary outlet, such as a culvert or general orifice, should be no more than the pre-developed 10-year flow. An overflow weir should be constructed to discharge no more than the pre-developed 100-year flow rate. In this case, the 100-year flow must be the combined flow from the primary outlet and overflow weir taken in tandem. Side slopes for open detention ponds should be no steeper than 4H:1V unless approved by the City Engineer. Detention pond calculations can be compiled with dynamic computer software programs such as HydroCAD, PondPack, HEC-HMS, HEC-1 or by an Excel spreadsheet.

EROSION CONTROL

The impacts of surface erosion resulting from development and construction can affect water quality in sloughs and ditches in the City and can have the potential to degrade storm drain pipes and clog inlets. It is imperative that erosion control protection and best management practices (BMP) be selected to prevent pollution associated with stormwater from adversely impacting the City. BMPs are defined as the most effective means of controlling erosion by optimizing its capacity to prevent stormwater pollution. Design criteria should be made in accordance with the National Pollutant Discharge Elimination System (NPDES), the Natural Resources Conservation Service (NRCS) or as authorized by the City Engineer.

Different forms of erosion control protection can be utilized and the selection of BMPs should be considering carefully in the design process. Temporary controls are those that are placed for a short amount of time while construction takes place. Examples of these controls include:

- Sediment Traps
- Silt Dikes and Fences
- Rock Check Dams

The placement of these structures should be designed to intercept stormwater flow to the maximum extent possible before, during and after construction. Sediment traps should not be used above a watershed area of more than 2.5 acres and should be placed ahead of drainage structures. Silt fences are appropriate to trap silt and prevent polluted particles from discharging into swales and ditches, especially those along Highway 2 and the BNSF railroad on the north side of the City. The fences should be made of a durable fabric and placed between 10 and 25 feet above the top of slope of a ditch, swale or embankment; sediment should be removed when it reaches 1/3 the height of the fence. Rock check dams can be used within a ditch or swale to collect erosive material, though they are recommended to be used where the stream length upstream of the point discharge is considerable. It is the responsibility of the project contractor (or owner if agreed upon) or a delegated representative to inspect the BMPs at least every 21 days and within 24 hours of a rainfall event of more than 0.5-inches. Inspectors should note tears or defects in the BMPs and notify the operator immediately. Temporary controls should be maintained and functional for at least 30 days after the site has been finally stabilized. Final site stabilization occurs after 70% of the site has established permanent ground cover.

After the project areas have been stabilized, permanent erosion control can apply to projects. It is recommended that permanent vegetative cover be established before the end of the construction season or maintained continuously during the winter season until spring planting can commence. Examples of permanent erosion control include:

- Erosion Control Fabric Blankets
- Seeding
- Sodding

Fabric Blankets are used where vegetative cover is sparse or cannot grow due to stripping of the surface soil from previous instances of erosion or other factors. The blankets must be anchored into place in the soil and inspected periodically to check for tears in the fabric or places where the anchor does not clasp and hold the blanket. The fabric blanket also must not be used on slopes of greater than 2:1. Seeding of the ground must be done during a time of the year where temperature and moisture conditions are optimal for seed germination and growth. Sodding is useful as an alternative to seeding as blowing winds can disperse seed and some animals are known to devour them before they settle into the soil. Sod tiles must be staked in the ground for slopes greater than 10% but must not be used for a slope greater than 17%.

SUBMITTAL AND APPROVAL PROCESS

The City of Ross requires with this Drainage Policy that a Stormwater Management Plan (SWMP) be prepared with the preliminary platting or development of real property that fall within its boundaries or enforced jurisdiction. The SWMP should be a stand-alone document that identifies the methodology, assumptions, recommendations and conclusions to resolve any anticipated issues pertaining to stormwater on the proposed site. All downstream stormwater facilities shall be analyzed for potential impacts from the proposed development and, furthermore, it should be proved that those facilities will be able to convey the proposed discharges.

A licensed Professional Engineer in North Dakota is required to seal and certify that the document has been developed using appropriate engineering principles and judgment with acceptable and generally established design criteria as directed by the City Engineer. The SWMP should specify and include, at the very minimum:

- Description and general location of the subject property
- Soils, land use and current and future zoning
- Summary of existing off-site and on-site drainage patterns
- Summary of existing and proposed stormwater drainage facilities
- Design criteria and techniques used for hydrologic and hydraulic analysis
- Impact of property on FEMA-established floodplain and/or floodway
- Compliance with any previous drainage studies
- Erosion control plan
- Hydrological and hydraulic raw output backup files in paper format
- One copy of the input and output models burned to a CD disc for preservation by the City
- Figures, exhibits and charts graphically showing the pre-developed and post-developed watershed areas and pertinent drainage facilities

It should be noted that all stormwater management plans should comply with all local, state and federal regulations, codes and statutes. This Drainage Policy shall not supersede or otherwise conflict with any laws or ordinances, unless directed by the City Engineer. The SWMP may be required to be sent to other agencies for review. The approval of the document by the City or any other agency shall not necessarily signify approval of specific design standards.

A preliminary SWMP shall be submitted in conjunction with the preliminary plat submittal to the City Engineer. Three (3) copies of the SWMP should be delivered to the City for review and approval by the City Engineer. It shall be the discretion of the City Engineer to reject or disapprove the SWMP and request that it be modified before acceptance of the preliminary plat.

It is understood that the stormwater facilities be built as closely to the design in the approved SWMP as possible. It is the responsibility of the Engineer to continually coordinate with City officials regarding changes that may need to be made relative to the SWMP. A final SWMP sealed by a licensed Professional Engineer will be required to be submitted if final construction as-builts show any deviation from the preliminary SWMP that will affect the design and calculations. A final stormwater letter shall be submitted to the City in lieu of a final SWMP if insignificant changes were made to the preliminary SWMP during construction.