PRELIMINARY STORM DRAINAGE REPORT

for

AIRPORT HEIGHTS P.U.D. PLAT

June 15, 2009

Encompass Engineering & Surveying, Job No. 08003

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SITE HYDRAULIC ANALYSIS

I. OVERVIEW

Detention Basin - consists of the entire Airport Heights P.U.D. project site, including the tributary area to the north located outside of the site boundary, as shown on Exhibit 1 in Appendix A. It is used in preliminary storm drainage analysis of the proposed Airport Heights P.U.D. Preliminary Plat.

A detention facility is proposed in the northerly portion of Open Space Tract to detain the post-development run-off associated with the proposed site improvements. The proposed facility is designed to detain the post-development 2-year, 25-year and 100-year storm events. The run-off will be released at 50% of the pre-developed 2-year, pre-developed 25-year and pre-developed 100-year storm events, as required by the Department of Ecology's 2005 Stormwater Management Manual for Eastern Washington (SWMMEW), into an existing unnamed seasonal drainage channel located west of the northerly portion of Open Space Tract. As part of the site hydraulic analysis, the proposed detention facility is enlarged to mitigate the 25-year and 100-year storm events from existing Lanigan Meadows Plat (information is shown as part of this report in the following sections). The treatment for the post-development run-off is provided by a 200-foot long bio-filtration swale.

The precipitation information used for the pre-development and post-development run-off calculations is based on the Isopluvials provided in the SWMMEW:

$P_{2yr} = 2.0$"
$P_{25yr} = 3.5$"
$P_{100yr} = 5.0$"

Based on the knowledge of the local soils and soils percolation information provided by the Kittitas County Public Health Department, it is determined that the Hydrologic Soil Group is "D".

Lanigan Meadows Plat Basin - consists of the entire Lanigan Meadows Plat site located southeast from the project site, as shown on Exhibits 4A and 4B in Appendix A. The assumed 25-year and 100-year pre-development and post-development flows from this basin are mitigated in the storm drainage analysis for Airport Heights P.U.D. in order to facilitate flooding issues downstream of this basin. Taking into consideration the proximity of Lanigan Meadows Plat to Airport Heights P.U.D. project, it is assumed that the precipitation information and Hydrologic Soils Group classification are the same.

Culvert Basin - consists of the tributary area located north and northwest of the project site, as shown on Exhibit 5 in Appendix A. It is used in preliminary analysis of the unnamed seasonal drainage channel and culvert design.

A new culvert is proposed at the Danko Road extension crossing of the unnamed seasonal channel. The culvert is designed to handle 100-year storm event with a minimum of 1 ft. of freeboard. The precipitation information used for the pre-development and post-development run-off calculations is based on the Isopluvials provided in the SWMMEW:

$P_{100yr} = 5.0$"

Based on the knowledge of the local soils and soils percolation information provided by the Kittitas County Public Health Department, it is determined that the Hydrologic Soil Group is "D".

II. PRE-DEVELOPMENT SITE CONDITIONS

Detention Basin:

The pre-development condition of the entire project site is determined to be pervious, assuming most of the area is considered wooded open space and pasture.

A = 37.4 ac
CN = 79 (Woods – Fair Condition)
T_c = 80 min. (see Appendix B)

Utilizing King County Hydrograph Program (SBUH method), the following run-off quantities are calculated (See Appendix B):

Q_{2yr} = 1.32 cfs
Q_{25yr} = 5.57 cfs
Q_{100yr} = 11.31 cfs

Lanigan Meadows Plat Basin:

The pre-development condition of the entire project site is determined to be pervious, assuming most of the area is considered wooded open space and pasture.

A = 6.2 ac
CN = 84 (Open space and Pasture – Fair Condition)
T_c = 27 min.

Utilizing King County Hydrograph Program (SBUH method), the following run-off quantities are calculated (See Appendix B):

Q_{25yr} = 2.16 cfs
Q_{100yr} = 3.87 cfs

III. POST-DEVELOPMENT SITE CONDITIONS

Detention Basin:

IMPERVIOUS AREA – In addition to the proposed paved and gravel roads and approximate proposed surface area of the detention pond, it is assumed that 10,000 sq. ft. is used as impervious area for each lot. Applying the basic dispersion method to the impervious area, it is assumed that 50% of the area is treated as impervious and 50% as grass.

A = 2.92 ac
CN = 98 (Paved road & driveways, roofs, pond)

PERVIOUS AREA – In addition to the undeveloped tributary area to the north of the project site, it is assumed that 50% of the assumed impervious area per lot after applying the basic dispersion method is treated as grass. It is assumed that the remaining area per each lot is treated as 50% grass and 50% pasture.

A = 34.5 ac
CN=79 (Woods – Fair Condition)
CN=84 (Open space and Pasture – Fair Condition)
Tc=84 min (See Appendix B)

Utilizing King County Hydrograph Program (SBUH method), the following run-off quantities are calculated (See Appendix B):

Q_2=2.02 cfs
Q_{25}=6.86 cfs
Q_{100}=12.83 cfs

BIOSWALE ANALYSIS – In order to provide the treatment for the roadway and lots post-development run-off, a 200-foot long bio-filtration swale is proposed from Danko Road extension to the proposed detention pond. The bio-filtration swale is designed based on SWMMEW requirements. The following swale configuration is calculated (See Appendix B):

$Q_{6\text{-month}}$ = 0.73 cfs
$Q_{25\text{-year}}$ = 6.86 cfs
Side Slopes = 3:1
Swale Longitudinal Slope = 0.010 ft/ft
Utilize trapezoidal shape
Swale Bottom Width = 8.5 ft.
Swale Velocity @ Treatment = 0.96 ft/sec.

ROADSIDE DITCH – Normal depth analysis is performed on the roadway ditch located along the north edge of the proposed private gravel road (See Appendix B). Taking into consideration the worst case scenario, the analysis of the triangular ditch shows that the ditch has adequate capacity to handle the 100-year storm event (See Appendix B). The worst case scenario is considered to be a point in the roadside ditch that has the shallowest depth with the flattest slope at the narrowest width, and it is estimated to be at station 10+77.98.

Lanigan Meadows Plat Basin:

IMPERVIOUS AREA – Based on the site visit of the developed plat and the final plans, the following area is assumed for the impervious condition:

A = 1.3 ac
CN = 98 (Paved road & driveways, roofs, pond)

PERVIOUS AREA – Based on the site visit of the developed plat and the final plans, the following area is assumed for the pervious condition:

A = 4.9 ac
CN=84 (Open space and Pasture – Fair Condition)
Tc=10 min (Assumed)

Utilizing King County Hydrograph Program (SBUH method), the following run-off quantities are calculated (See Appendix B):

Q_{25}=3.37 cfs
Q_{100}=5.60 cfs

The difference between Lanigan Measows Plat basin pre-development and post-development run-off quantities for mitigation purposes is as follows:

ΔQ_{25}= 3.37 – 2.16 = 1.21 cfs
ΔQ_{100}= 5.60 – 3.87 = 1.73 cfs

IV. CULVERT DESIGN

Culvert Basin:

The pre-development condition of the entire project site is determined to be pervious, assuming most of the area is considered wooded open space and pasture (See Appendix C):

A = 319 ac
CN = 73 (Woods – Fair Condition)
T_c = 102 min. (See Appendix C)

Utilizing King County Hydrograph Program (SBUH method), the following run-off quantities are calculated (See Appendix C):

Q_{100yr} = 61.90 cfs

Based on the preliminary analysis of the configuration of the existing unnamed drainage channel and the 100-year run-off quantities, it is determined that the proposed culvert would be regulated by the inlet control. For preliminary calculations purposes, the nomograph of the headwater depth for the corrugated metal pipe with inlet control is used to size the proposed culvert. Based on the nomograph data, the following results are calculated (See Appendix C):

Q_{100}=61.90 cfs
Assume Inlet Control
Headwater depth (HW) = 1.5 times culvert diameter max. for culverts larger than 18-inch
Inlet to be mitered and conform to slope section
Minimum Required Culvert Diameter = 42 in.
Culvert has to be buried 1 foot
Culvert has a 1-foot freeboard
Provided Culvert Diameter = 72 in.

V. DETENTION POND DESIGN

Detention Basin:

Allowable discharge rates from the proposed detention pond are based on the SWMMEW (See Appendix B):

Post-Development Q_2 = ½ Pre-Development Q_2 = 0.66 cfs
Post-Development Q_{25} = Pre-Development Q_{25} = 5.57 cfs
Post-Development Q_{100} = Pre-Development Q_{100} = 11.31 cfs

Utilizing King County Hydrograph Program (SBUH method), the following REQUIRED volumes are modeled (See Appendix B):

$V_{½\ 2\text{-}yr}$ = 57,030 cf
$V_{25\text{-}yr}$ = 66,310 cf
$V_{100\text{-}yr}$ = 79,450 cf

The volumes above do not include mitigated storm run-off from Lanigan Meadows Plat. In order to mitigate the difference between post-development and pre-development flows for 25-year and 100-year storm events for Lanigan Meadows Plat, detention basin flows are over-detained by the proposed detention pond. This requires the detention pond to be enlarged such that the increase from the Lanigan

Meadows Plat flows and actual outflow for the enlarged proposed detention pond are not larger than the target outflow as shown in Appendix B. Based on the analysis, only the 25-year and 100-year storm events for Lanigan Meadows Plat are mitigated. The enlarged REQUIRED volume of the proposed detention pond is (Appendix B):

V_{Design} = 66,216 cf (for a 3 ft stage depth)
$V_{½\ 2\text{-}yr}$ = 59,015 cf
$V_{25\text{-}yr}$ = 76,260 cf
$V_{100\text{-}yr}$ = 89,450 cf

Based on the design information shown on the plans, the following PROVIDED volumes are calculated (See Appendix B):

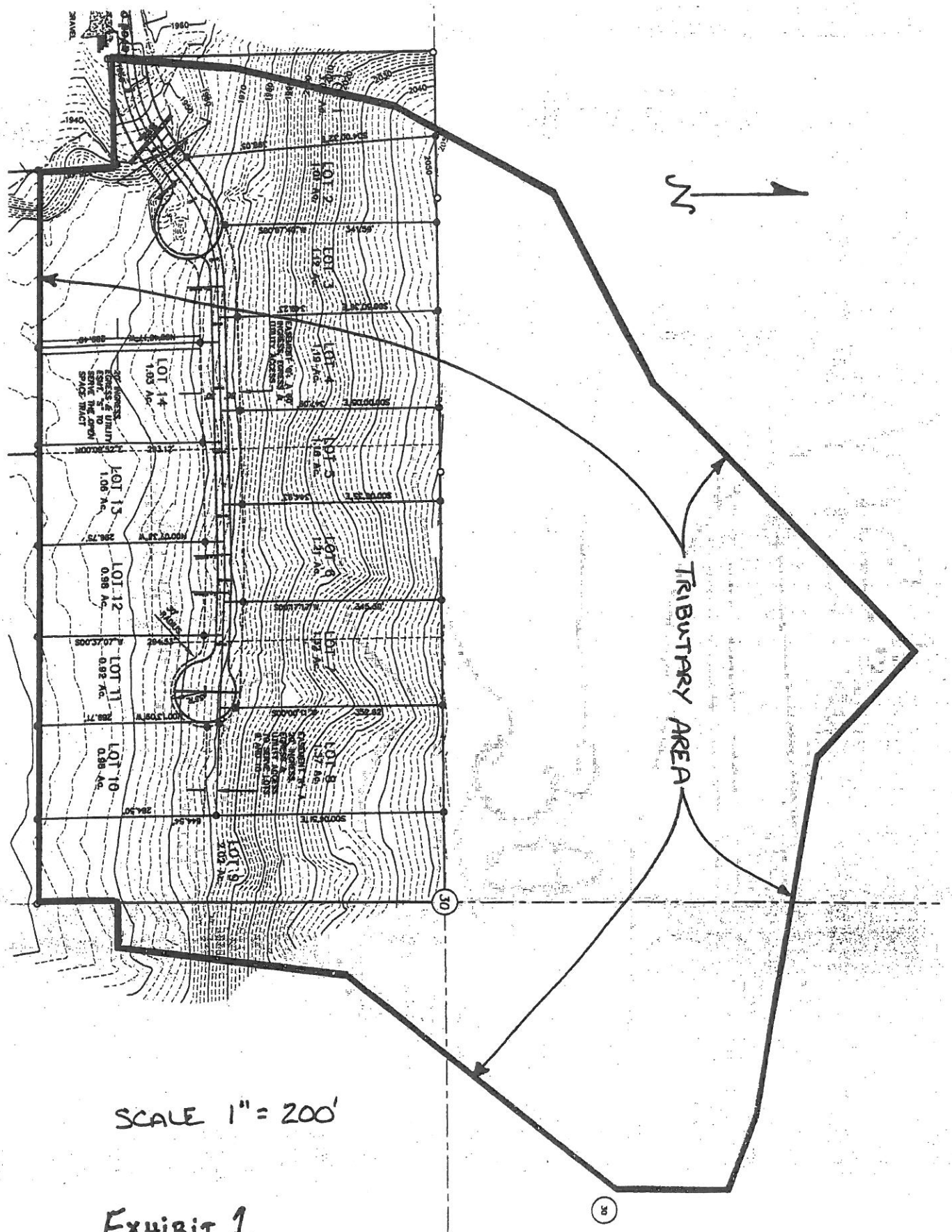
V_{Design} = 68,280 cf (for a 3 ft stage depth)
$V_{½\ 2\text{-}yr}$ = 59,015 cf
$V_{25\text{-}yr}$ = 76,260 cf
$V_{100\text{-}yr}$ = 92,390 cf

The following criteria are set for the detention pond calculation and design:

Side Slopes = 3:1
Riser Stage Depth = 3.0 ft
Bottom Orifice Diameter = 3.75 in.
Top Orifice Diameter = 0.50 in.; Top Orifice Height = 2.50 ft
Emergency Overflow was designed for 100-year storm event

	#1.	#2.	3.	4.	5.
Storm Event	Actual Release (cfs)	Lanigan ΔQ (cfs)	Actual Release + Lanigan ΔQ (cfs)	Target Release (cfs)	Meets Requirement?
2-year	0.63	N/A	N/A	0.66	Yes (#4 ≥ #1)
25-year	4.36	1.21	5.57	5.57	Yes (#4 ≥ #3)
100-year	8.83	1.73	10.56	11.31	Yes (#4 ≥ #3)

APPENDIX 'A'



SCALE 1" = 200'

EXHIBIT 1

DETENTION BASIN 37.41 ACRES

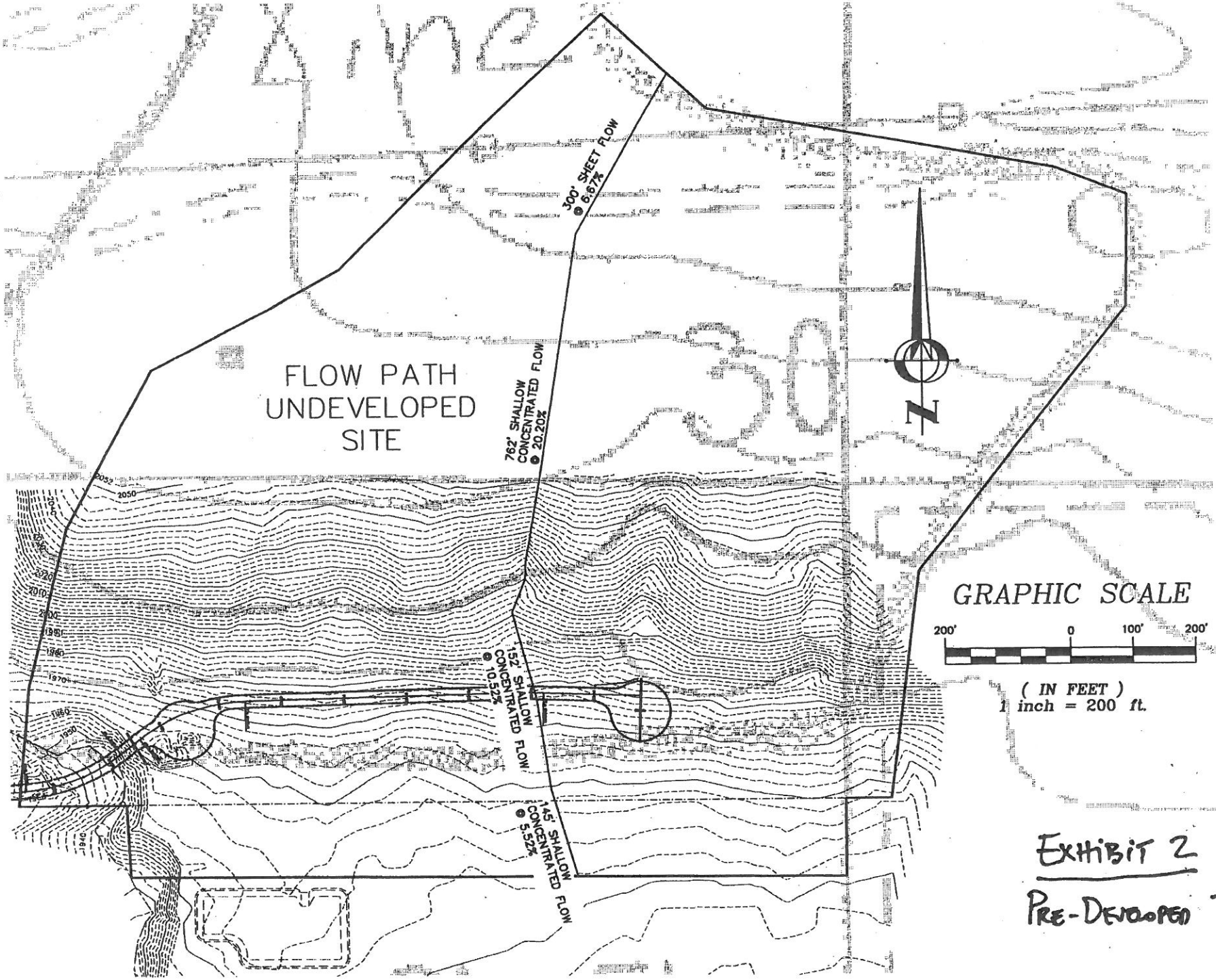


EXHIBIT 2

PRE-DEVELOPED Tc

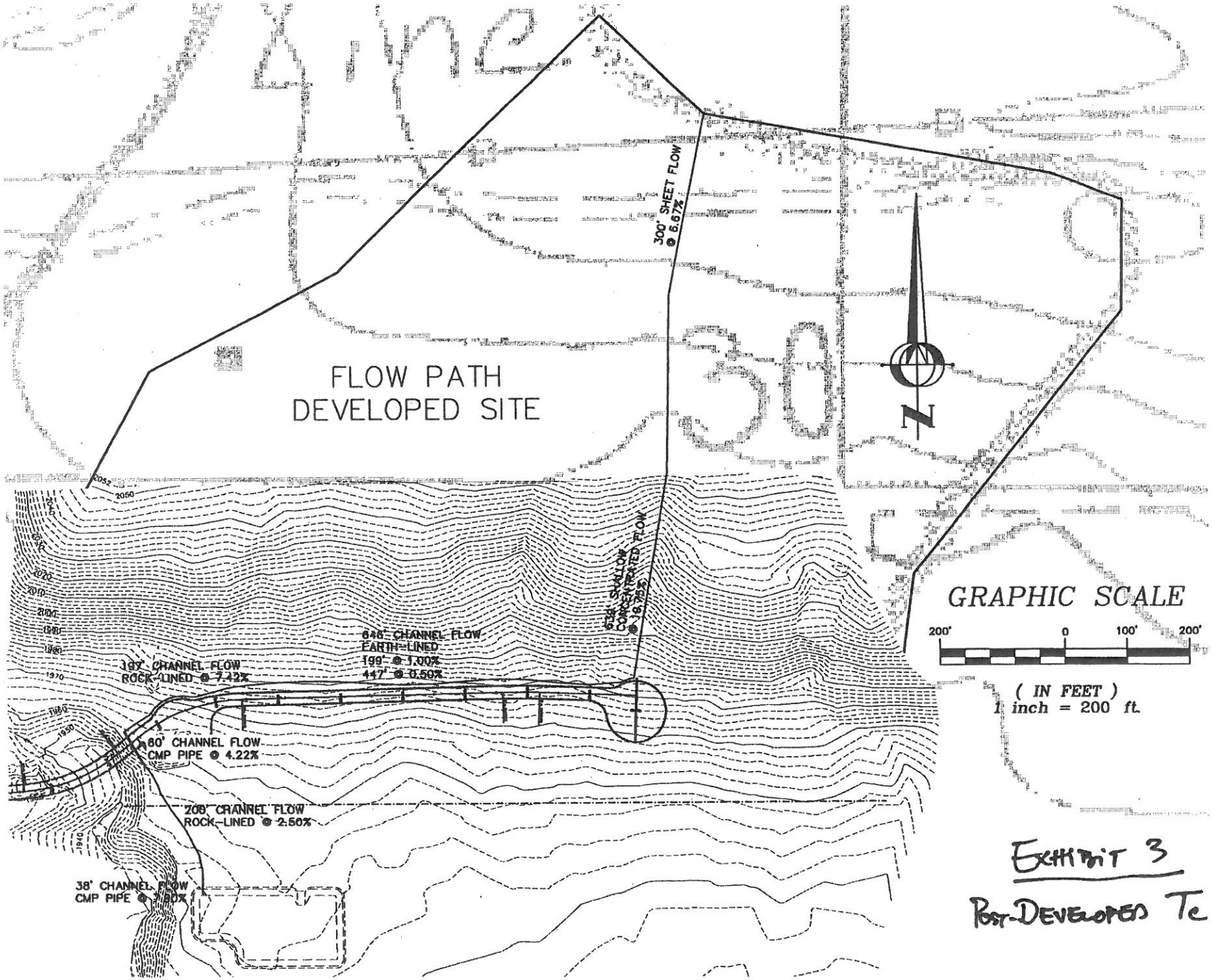


EXHIBIT 3

POST-DEVELOPED Tc

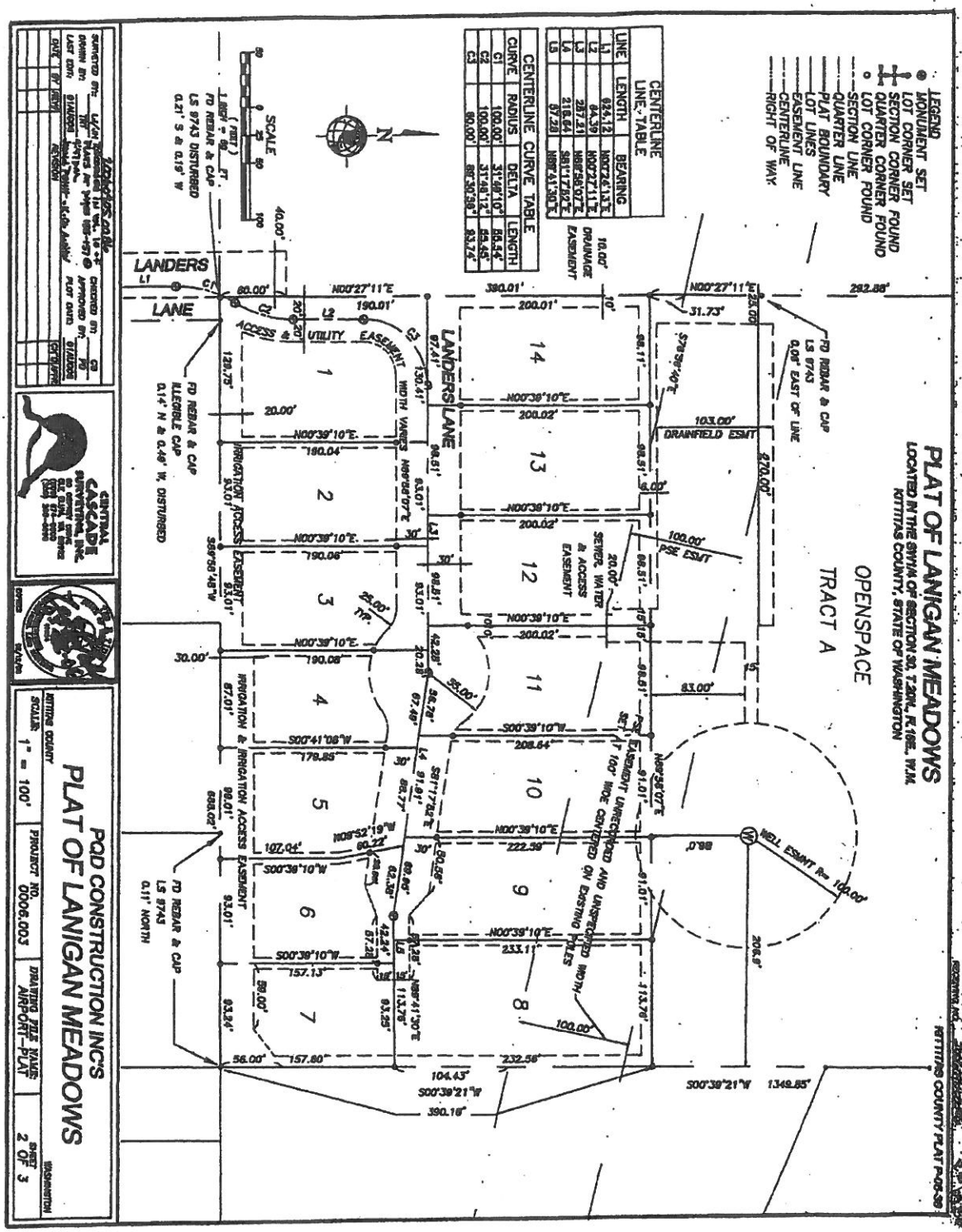


EXHIBIT 4A

LANIGAN MEADOWS PLAT BASIN

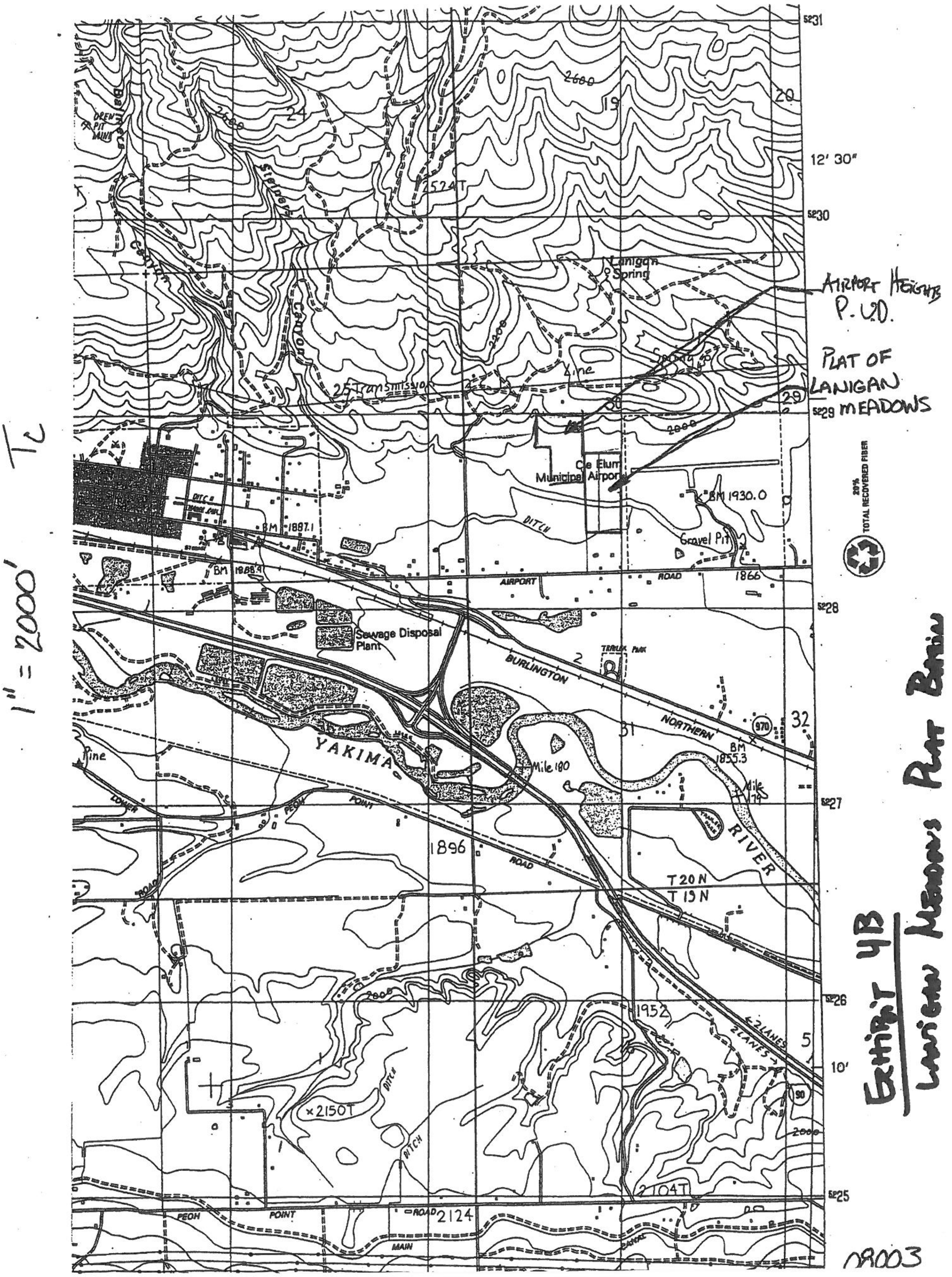
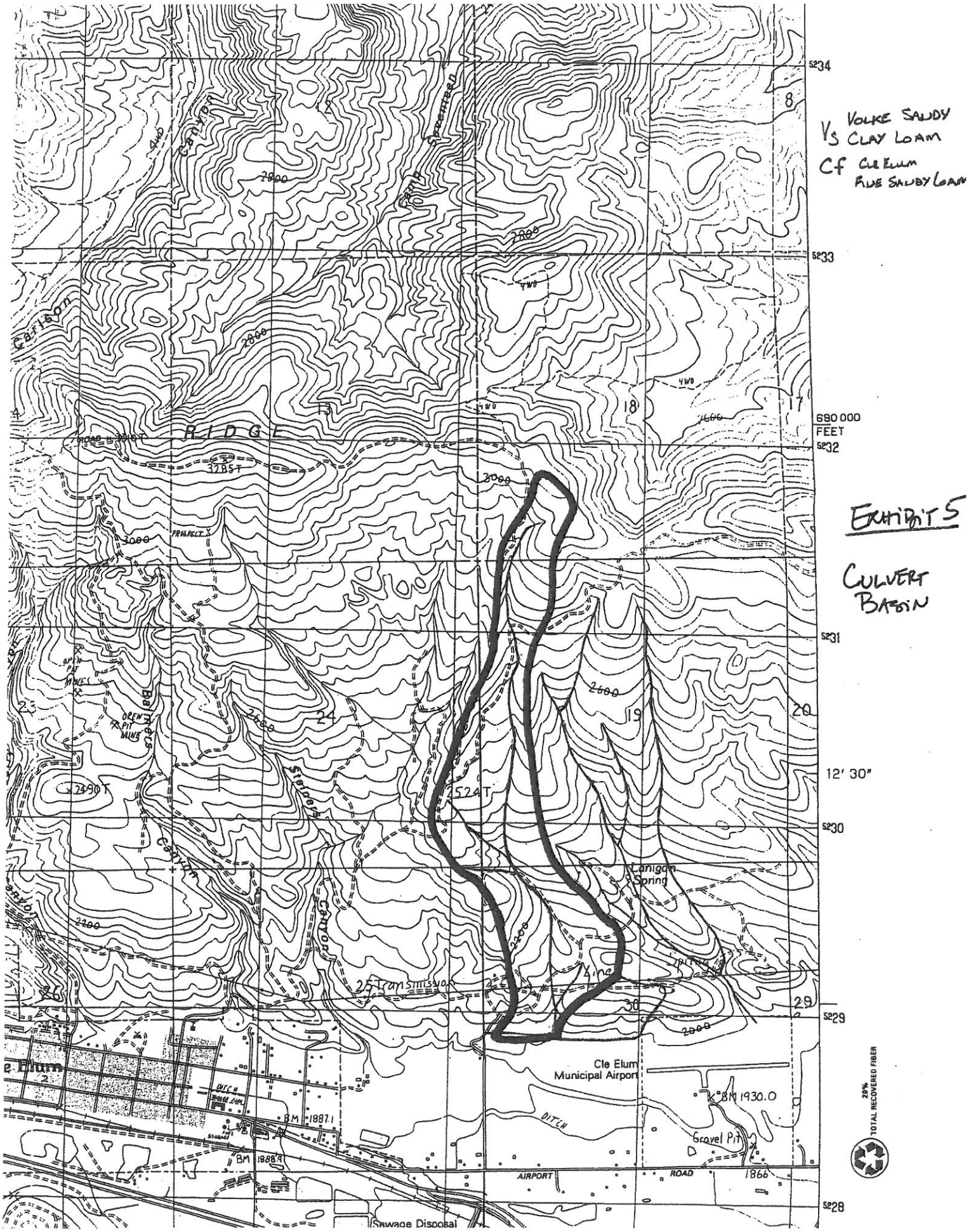


Exhibit 4B
Lanigan Meadows Plat Boundary
1" = 2000'
Tc
Airport Heights P.U.D.
Plat of Lanigan Meadows
nR003
Lanigan Spring
Canyon
Steiners
25 Transmission Line
Cle Elum Municipal Airport
BM 1930.0
Gravel Pit
Ditch
Airport Road
1866
BM 1887.1
BM 1888.4
Sewage Disposal Plant
Burlington Northern
Trailer Park
970
BM 1855.3
Mile 180
Mile 179
Yakima River
Lower Peoh Point Road
1896
T20N
T19N
1952
2 lanes
90
×2150T
2104T
Peoh Point Road 2124
Main Canal
2524T
2600
2000
12' 30"
10'
19
20
24
25
26
29
31
32
5
2


Vs VOLKE SANDY CLAY LOAM
Cf CLE ELUM RIDGE SANDY LOAM
EXHIBIT 5
CULVERT BASIN
RIDGE
Carlson Canyon
Stedman Canyon
Cle Elum Municipal Airport
Gravel Pit
AIRPORT ROAD
Sewage Disposal
Lanigan Spring
690 000 FEET
12' 30"
28% TOTAL RECOVERED FIBER

APPENDIX 'B'

EXISTING CONDITIONS

Under the existing conditions the runoff will begin flowing as sheet flow from the northeastern end of On-Site Basis and then to concentrated shallow flow through the rest of the On-Site Basin towards the southerly portion of the Airport Heights P.U.D. Plat.

The Soil Survey of Kittitas County Area, Washington identifies the soil in this area as a Type "D" soil.

CALCULATE TIME OF CONCENTRATION

Total area =	1,629,580 S.F.	37.41 acres	
Pervious area =	1,629,580 S.F.	37.41 acres	79 CN
Impervious area =	0 S.F.	0.00 acres	0 CN

Calculate time of Concentration Undeveloped Tc=Tsh+

n_s =	0.8	L_1 =	300
$P_2 24_{hr}$ =	2	L_2 =	762
S_{o1} =	0.0667	L_3 =	152
S_{o2} =	0.202	L_4 =	145
S_{o3} =	0.1052	V_2 =	2.25
S_{o4} =	0.0552	V_3 =	1.62
k =	5	V_4 =	1.17

$$T_t = \frac{0.42\,(n_s L)^{0.8}}{(P_2\,24_{hr})^{0.5}\,(S_o)^{0.4}}$$

$$T_t = \frac{L}{60V} \qquad V = k\sqrt{S_o}$$

T_1 = 70 T_2 = 5.65 T_3 = 1.56 T_4 = 2.06

Tc= 79.62 min ⇒ **assume 80 min**

Calculate time of Concentration Developed Tc=Tsh+

n_s =	0.8						
$P_2 24_{hr}$ =	2						
S_{o1} =	0.0667	L_1 =	300			T_1 =	70
S_{o2} =	0.1975	L_2 =	629	V_2 =	2.22	T_2 =	4.72
S_{o3} =	0.01	L_3 =	199	V_3 =	2.00	T_3 =	1.66
S_{o4} =	0.005	L_4 =	447	V_4 =	1.41	T_4 =	5.27
S_{o5} =	0.0742	L_5 =	197	V_5 =	5.72	T_5 =	0.57
S_{o6} =	0.0422	L_6 =	60	V_6 =	4.31	T_6 =	0.23
S_{o7} =	0.025	L_7 =	200	V_7 =	2.37	T_7 =	1.41
S_{o8} =	0.079	L_8 =	38	V_8 =	5.90	T_8 =	0.11
k =	5	k =	20				
k =	15	k =	21				

Tc= 84.31 min ⇒ **assume 84 min**

DETENTION BASIN - PRE-DEVELOPMENT CONDITION:

```
------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********   2-YEAR  24-HOUR STORM  ****  2.00" TOTAL PRECIP. *********
------------------------------------------------------------------------
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
      37.4       37.4  79.0     .0  98.0        80.0

  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      1.32          12.50           70359


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  25-YEAR  24-HOUR STORM  ****  3.50" TOTAL PRECIP. *********
------------------------------------------------------------------------
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
      37.4       37.4  79.0     .0  98.0        80.0

  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      5.57          8.17            210361


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  100-YEAR  24-HOUR STORM  ****  5.00" TOTAL PRECIP. *********
------------------------------------------------------------------------
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
      37.4       37.4  79.0     .0  98.0        80.0

  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
     11.31          8.17            375769
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LANIGAN MEADOWS PLAT BASIN - PRE-DEVELOPMENT CONDITION:

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------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********   2-YEAR  24-HOUR STORM  ****  2.00" TOTAL PRECIP. *********
------------------------------------------------------------------------
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       6.2        6.2   84.0    .0   98.0        27.0

  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
     .66            7.83            16611


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  25-YEAR  24-HOUR STORM  ****  3.50" TOTAL PRECIP. *********
------------------------------------------------------------------------
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       6.2        6.2   84.0    .0   98.0        27.0

  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
     2.16           7.83            43206


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 100-YEAR  24-HOUR STORM  ****  5.00" TOTAL PRECIP. *********
------------------------------------------------------------------------
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       6.2        6.2   84.0    .0   98.0        27.0

  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
     3.87           7.83            73007
```

DETENTION BASIN - POST-DEVELOPMENT CONDITION:

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------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********   2-YEAR  24-HOUR STORM  ****  2.00" TOTAL PRECIP. *********
------------------------------------------------------------------------
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
      37.4       34.5  81.0     2.9  97.0        84.0

  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
      2.02          8.50          92505


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  25-YEAR  24-HOUR STORM  ****  3.50" TOTAL PRECIP. *********
------------------------------------------------------------------------
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
      37.4       34.5  81.0     2.9  97.0        84.0

  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
      6.86          8.17          244197


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  100-YEAR  24-HOUR STORM  ****  5.00" TOTAL PRECIP. *********
------------------------------------------------------------------------
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
      37.4       34.5  81.0     2.9  97.0        84.0

  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
     12.83          8.00          417524
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Encompass Engineering & Surveying
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Phone: (509) 674-7433 Fax: (509) 674-7419

JOB _____
SHEET NO. _____ OF _____
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____
SCALE _____

BIOFILTRATION SWALE DESIGN:

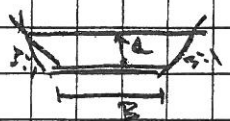
(1.) PEAK FLOW RATE FOR 6-MONTH, 24-HOUR:

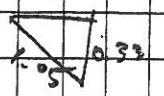
$P_{6mo,24hr} = C_{w/s}(P_{2yr\,24hr})$ $\quad C_{w/s} = \frac{0.2+0.66}{2} = 0.68$

$P_{6mo,24hr} = 0.68(2) = 1.36''$ $\rightarrow Q_{6mo,24hr} = 0.73$

(2.) SWALE $S = 1.0\%$ min.

(3.) USE TRAPEZOIDAL SHAPE





ASSUME $d = 0.33$ FT

$A = 2\times(\frac{1}{2}\times 0.33\times 1) + 0.33B = 0.33 + 0.33B = 0.33(1+B)$

$P = 2.1 + B$

$R = \frac{0.33(1+B)}{2.1+B}$

(4.) CALCULATE FOR B:

$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$ $\rightarrow$ $Q = 0.73$ CFS (6mo/24hr)

$n = 0.03$

$d = 0.33$ FT

$S = 0.010$ FT/FT

$Q = 6.66$ CFS (25-yr/24hr)

$0.73 = \frac{1.486}{0.03}(0.33+0.33B)\left(\frac{0.33(1+B)}{2.1+B}\right)^{2/3}(0.01)^{0.5}$

$B = 8.5'$

SWALE Depth $= d + 1 = 1.33$ FT

BIOFILTRATION SWALE

6 month, 24-hr

S=	0.0100	ft/ft	channel slope
n=	0.0300		manning's roughness coefficient
H=	0.0875	ft	depth of flow
B=	8.5	ft	bottom of channel width
Z_R=	3		slope of right ditch side wall as in Z:1
Z_L=	3		slope of left ditch side wall as in Z:1
A=	0.77	ft^2	area of the trapezoidal section
P=	9.05	ft	wetted perimeter
R=	0.08	ft	Hydraulic Radius
Q=	0.73	cfs	
V=	0.96	ft/sec	Velocity → < 1 fps OK

Bio Filtration Swale

25-yr, 24-hr

S=	0.0100	ft/ft	channel slope
n=	0.0300		manning's roughness coefficient
H=	0.33	ft	depth of flow
B=	8.5	ft	bottom of channel width
Z_R=	3		slope of right ditch side wall as in Z:1
Z_L=	3		slope of left ditch side wall as in Z:1
A=	3.13	ft^2	area of the trapezoidal section
P=	10.59	ft	wetted perimeter
R=	0.30	ft	Hydraulic Radius
Q=	6.89	cfs	
V=	2.20	ft/sec	Velocity

OK!

Encompass Engineering & Surveying
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Phone: (509) 674-7433 Fax: (509) 674-7419

JOB _____

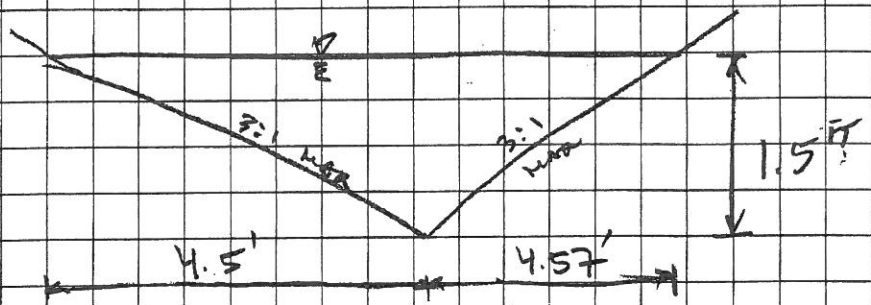
SHEET NO. _____ OF _____

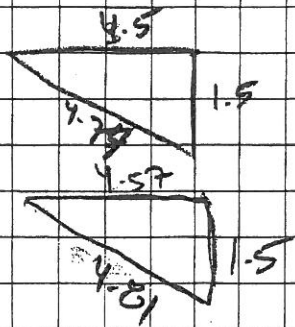
CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE _____

Roadside Ditch Capacity Analysis:





$$A = \tfrac{1}{2}(4.5)(1.5) + \tfrac{1}{2}(4.57)(1.5) = 6.8 \text{ FT}$$

$$P = 4.74 + 4.81 = 9.55 \text{ FT}$$

$$R = \frac{A}{P} = \frac{6.8}{9.55} = 0.71 \text{ FT}$$

$$Q = \frac{1.486}{n} A R^{2/3} S^{1/2} \quad \rightarrow \quad n = 0.033, \; S = 0.5\%$$

$$Q = \frac{1.486}{0.033}(6.8)(0.71)^{2/3}(0.005)^{1/2}$$

$$\boxed{Q = 7.23 \text{ CFS}}$$

OK

LANIGAN MEADOWS PLAT BASIN - POST-DEVELOPMENT CONDITION:

```
------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********   2-YEAR  24-HOUR STORM  ****  2.00" TOTAL PRECIP. *********

------------------------------------------------------------------------
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
      6.2        4.9   84.0   1.3   98.0       10.0

  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
     1.33          7.83           21610

------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  25-YEAR  24-HOUR STORM  ****  3.50" TOTAL PRECIP. *********
------------------------------------------------------------------------
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
      6.2        4.9   84.0   1.3   98.0       10.0

  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
     3.37          7.83           49783


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 100-YEAR  24-HOUR STORM  ****  5.00" TOTAL PRECIP. *********
------------------------------------------------------------------------
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
      6.2        4.9   84.0   1.3   98.0       10.0

  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
     5.60          7.83           80472
```

DETENTION BASIN - DETENTION DESIGN:

PERFORMANCE:	INFLOW	TARGET-OUTFLOW	ACTUAL-OUTFLOW	PK-STAGE	STORAGE
DESIGN HYD:	2.02	.66	.66	3.00	57030
TEST HYD 1:	6.86	5.57	4.67	3.42	66310
TEST HYD 2:	12.83	11.31	9.23	3.99	79450

ENLARGEMENT OPTION: ALLOWS FOR INCREASING STORAGE AT A SPECIFIED STAGE HEIGHT, TO PROVIDE A FACTOR OF SAFETY.

PERFORMANCE:	INFLOW	TARGET-OUTFLOW	ACTUAL-OUTFLOW	PK-STAGE	STORAGE
DESIGN HYD:	2.02	.66	.63	2.71	59015
TEST HYD 1:	6.86	5.57	4.36	3.40	76260
TEST HYD 2:	12.83	11.31	8.83	3.90	89450

STRUCTURE DATA: R/D-POND (3.0:1 SIDE SLOPES)

RISER-HEAD	POND-BOTTOM-AREA	TOP-AREA(@1'F.B.)	STOR-DEPTH	STORAGE-VOLUME
3.00 FT	19311.1 SQ-FT	26962.0 SQ-FT	3.00 FT	66216 CU-FT

DOUBLE ORIFICE RESTRICTOR:	DIA(INCHES)	HT(FEET)	Q-MAX(CFS)
BOTTOM ORIFICE:	3.75	.00	.660
TOP ORIFICE:	.50	2.50	.005

STAGE(FT)	DISCHARGE(CFS)	STORAGE(CU-FT)	PERM-AREA(SQ-FT)
.00	.00	.0	.0
.30	.21	5873.2	.0
.60	.30	11907.6	.0
.90	.36	18105.1	.0
1.20	.42	24467.5	.0
1.50	.47	30996.9	.0
1.80	.51	37695.3	.0
2.10	.55	44564.5	.0
2.40	.59	51606.4	.0
2.50	.60	53992.5	.0
2.70	.63	58823.1	.0
3.00	.66	66216.5	.0
3.10	1.14	68720.6	.0
3.20	1.99	71244.6	.0
3.30	3.10	73788.5	.0
3.40	4.40	76352.6	.0
3.50	5.88	78936.8	.0
3.60	7.32	81541.1	.0
3.70	7.86	84165.8	.0
3.80	8.36	86810.8	.0
3.90	8.83	89476.2	.0

AVERAGE VERTICAL PERMEABILITY: .0 MINUTES/INCH

APPENDIX 'C'

Encompass Engineering & Surveying
214 Pennsylvania Ave.
Cle Elum, Washington 98922
Phone: (509) 674-7433 Fax: (509) 674-7419

JOB 08003 DENEEN
SHEET NO. _____ OF _____
CALCULATED BY TREVIN ROLETTO DATE 02/03/2009
CHECKED BY _____ DATE _____
SCALE _____

OFF-SITE BASIN 319 ACRES

SOIL GROUP = C
CN = 73 (WOODS - FAIR)
n_s = 0.4 WOODS OR FOREST, POOR COVER
k_c = 5 FORESTED SWALE W/ HEAVY GROUND LITTER (n = 0.10)

FLOW LENGTH = 9,990 FT
SLOPE = 0.1061

$V = k_c \sqrt{S_o} = (5)(\sqrt{0.1061})$

$V = 1.63$ ft/s

T_c = 102 min.

$T = \frac{L}{V} = \frac{9990}{(60)(1.63)} = 102$ min

CULVERT BASIN - PRE-DEVELOPMENT CONDITION:

```
------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 100-YEAR  24-HOUR STORM  ****  5.00" TOTAL PRECIP. *********
------------------------------------------------------------------------
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                   A     CN     A     CN
     319.0       319.0  73.0    .0   98.0       102.0

  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
     61.90         8.50          2606160
```

FIGURE 4.3.1.C HEADWATER DEPTH FOR CORRUGATED PIPE CULVERTS WITH INLET CONTROL