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POINT OF COMPLIANCE ANALYSIS AND DIVERSION AREA WATER BALANCE ANALYSIS

For

TALL CHIEF COUNTRY CLUB RESIDENTIAL PLAT PROJECT

Location:
1313 W. SNOQUALMIE RIVER ROAD
FALL CITY, WA 98024

January 18, 2012

By

Hagenson Consultants, LLC
6484-48th Ave SW
Seattle, Washington 98136

HC Job No. 200422

K.C Project # L04P0032

HAROLD E. HAGENSON
STATE OF WASHINGTON
REGISTERED
PROFESSIONAL ENGINEER
1/20/12

L12V0002

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I. INTRODUCTION

A Diversion Area Water Balance is provided to analyze the development impacts of the proposed KCSWM Drainage Adjustment on the adjoining offsite parcels. The Adjustment proposes to divert 15.45 developed acres away from its natural drainage course toward offsite parcels on the valley floor and instead directing it to the onsite wet/detention pond system.

A Point of Compliance analysis is provided to analyze the proposed developed drainage patterns (including the proposed SWM Adjustment for Basin Diversion) from the project and to determine if there is any increase flooding peak flows, flood flow durations or runoff volumes which might impact downstream properties or downstream flooding conditions.

Portions of the proposed onsite Wet/Detention Pond extend into the 100 year floodplain. Given the County's Zero Floodplain Rise Ordinance, concerns have been expressed that increased flood elevations from this intrusion into the floodplain may exceed the allowable floodplain rise. Consequently, the wet/detention pond design used for this analysis was revised (see attached Wet/Detention Pond Point of Compliance Demonstration, 1-20-12) to avoid the floodplain. The revised wet pond and detention pond volume/stage relationship has been maintained to 98% of the original design. The proposed pond outlet location has been moved from wetland D to wetland A in order to address any concerns about possible post development changes to wetland hydrology.

II. SUMMARY AND CONCLUSIONS

The Point of Compliance Analysis results demonstrate that the proposed project meets or exceeds the KCSWDM requirements. Peak flood flows and flow durations for the developed project are fully mitigated by the proposed wet/detention pond. The level of mitigation exceeds the requirements and it is thought that the pond could probably be reduced in size with further refinements which may be provided during final engineering design. The revised Pond design demonstrates that it is feasible to locate the facility outside of the 100 year floodplain, thereby mitigating its impact on the zero rise floodplain. The revised pond design demonstrates that it is feasible to route the pond outflow to the farthest upstream wetland (wetland A) or to split the flows between the major onsite wetlands, thereby allowing flexibility for the future final engineering design.

The Diversion Area Water Balance Analysis results indicate that the proposed project maintains or reduces discharge volumes and reduces peak flood flows and flood flow durations at the downstream offsite property for all events considered, except the 1.1 year event and the 2 year, 15 minutes time step event. The result implies that flood flows are mitigated, while lower event flows show increases which will likely benefit downstream wetland hydrologic maintenance.

III. PROJECT OVERVIEW

The Proposed Development includes platting 18 residential lots on the existing 191.2 acres, consisting of 4 separate tax parcels. Clustering will be used such that the northerly 9 holes of the existing 18-hole country club golf course will be reverted to agrarian or conservancy uses. Site access is provided via a private road and easement adjoining West Snoqualmie River Road, which is classified as a Collector Arterial and currently improved to a rural shoulder and ditch section. Further road improvements are required to widen the existing access. Construction of new Rural Minor access roads (Tall Chief Road) will provide the necessary access. Emergency Access will be provided via Campground Road and Alderra Ridge Emergency Access Road. Existing Zoning is predominantly RA-10 with some RA-5-P. The site is located at 1313 West Snoqualmie River Road in un-incorporated King County, near Fall City, WA. Grading, utility and drainage improvements will be prepared in compliance with the current County Code based on the 1998 surface water manual.

IV. PRELIMINARY CONDITIONS SUMMARY

The property was, until recently, developed with an existing 18 hole Private Golf Course. Currently, the lower 9 hole Golf Course is still in place, but the upper 9 holes have been unused since around 2005. Forest covers the undeveloped hillside and a number of wetlands are located in the lower lying areas. Existing grades vary between very flat in the NE to beyond 40% along the hillside area. Soils are predominantly Nooksak silt loams in the valley floor and Alderwood series gravelly, sandy loams on the hillside. Both soils are till series soils. There is a small area of mixed alluvial soils identified in SCS mapping (included herein). The preliminary geotechnical report identifies thick lenses of gravelly sandy soils located in benches near the southwest portion of the project.

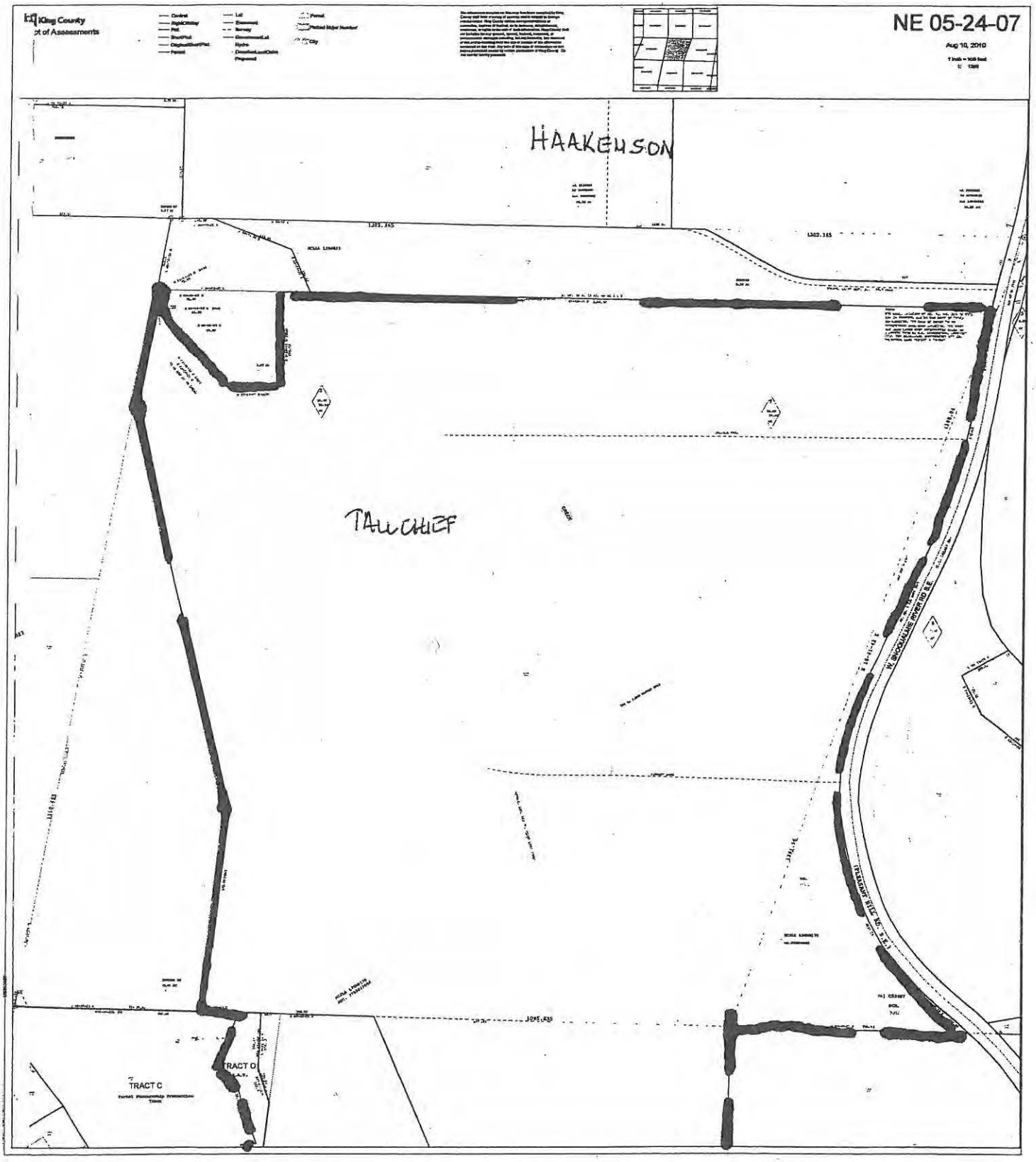
According to King County imap mapping (see attached), the northerly ¾ of the site lies in the Snoqualmie River Basin, while the remainder lies in the Patterson Creek Basin. However, the imap is general in scope and not detailed. More detailed mapping is provided (see attached Existing Conditions Snoq/Patterson Creek Basin Map and full size Basin X mapping included with the Civil Plan set) to demonstrate that the entire project lies within the Snoqualmie River basin and discharge from the project is not directed to Patterson Creek. This mapping utilizes the 2006 FEMA work-study maps and included aerial topography spot elevations. A review of the mapping indicates that the current alignment of Patterson Creek was likely created by early settlers and that the prior natural alignment probably followed the west side of the river valley through wetlands A through F to some downstream confluence point.
The downstream analysis (Hagenson Consultants, Revised March 22, 2007) indicates that portions of the site drain directly to the onsite wetlands (wetlands A, C, D, and F). These areas are identified as Basins A,E,H and I (see attached Existing Conditions Basin Map).

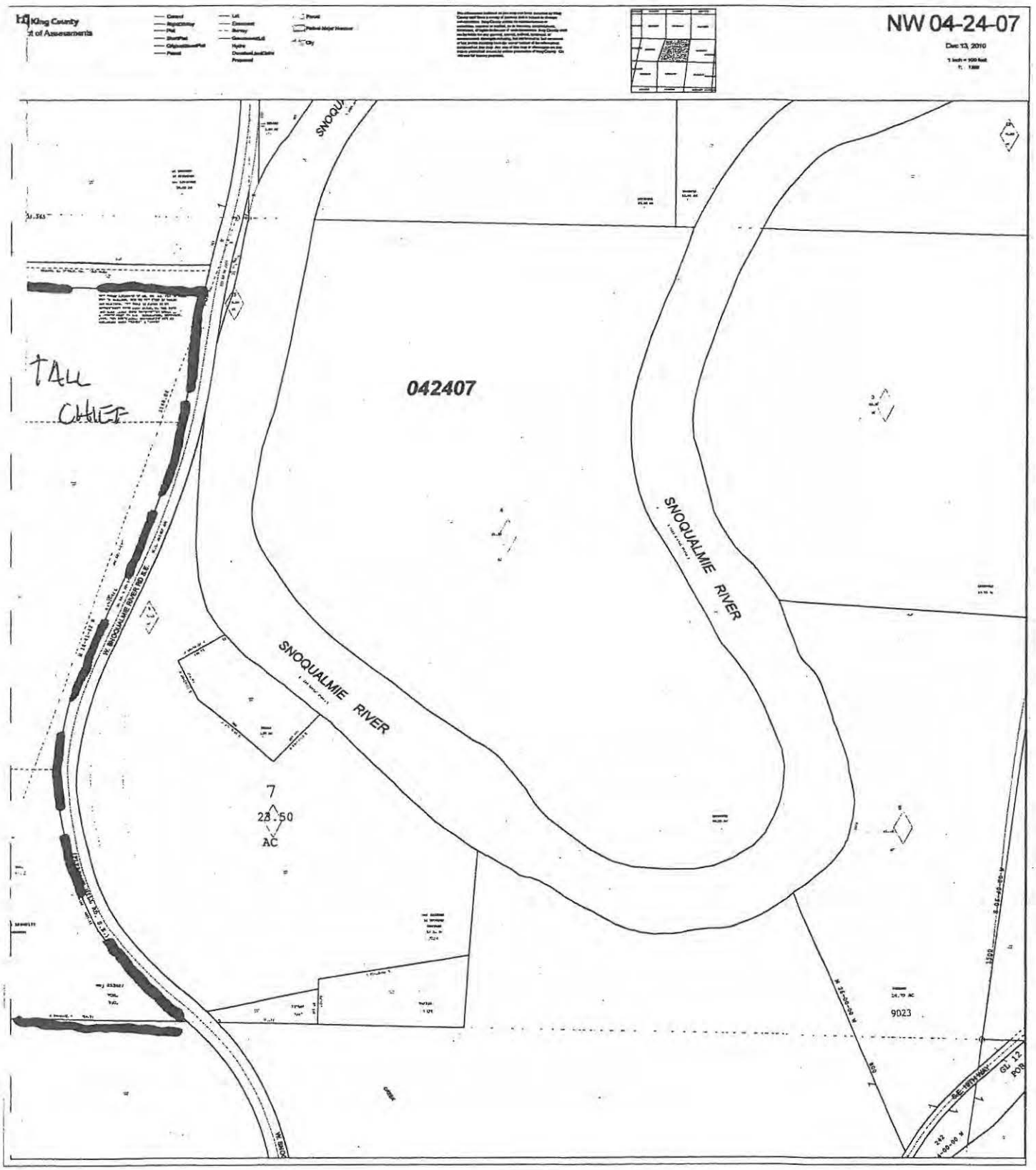
The southerly portions of the site first drain easterly to offsite valley bottom agricultural land before flowing northerly in ditches and re-entering the site at wetlands A. These bypass areas are identified as basins F and B (see attached Existing Conditions Basin Map).

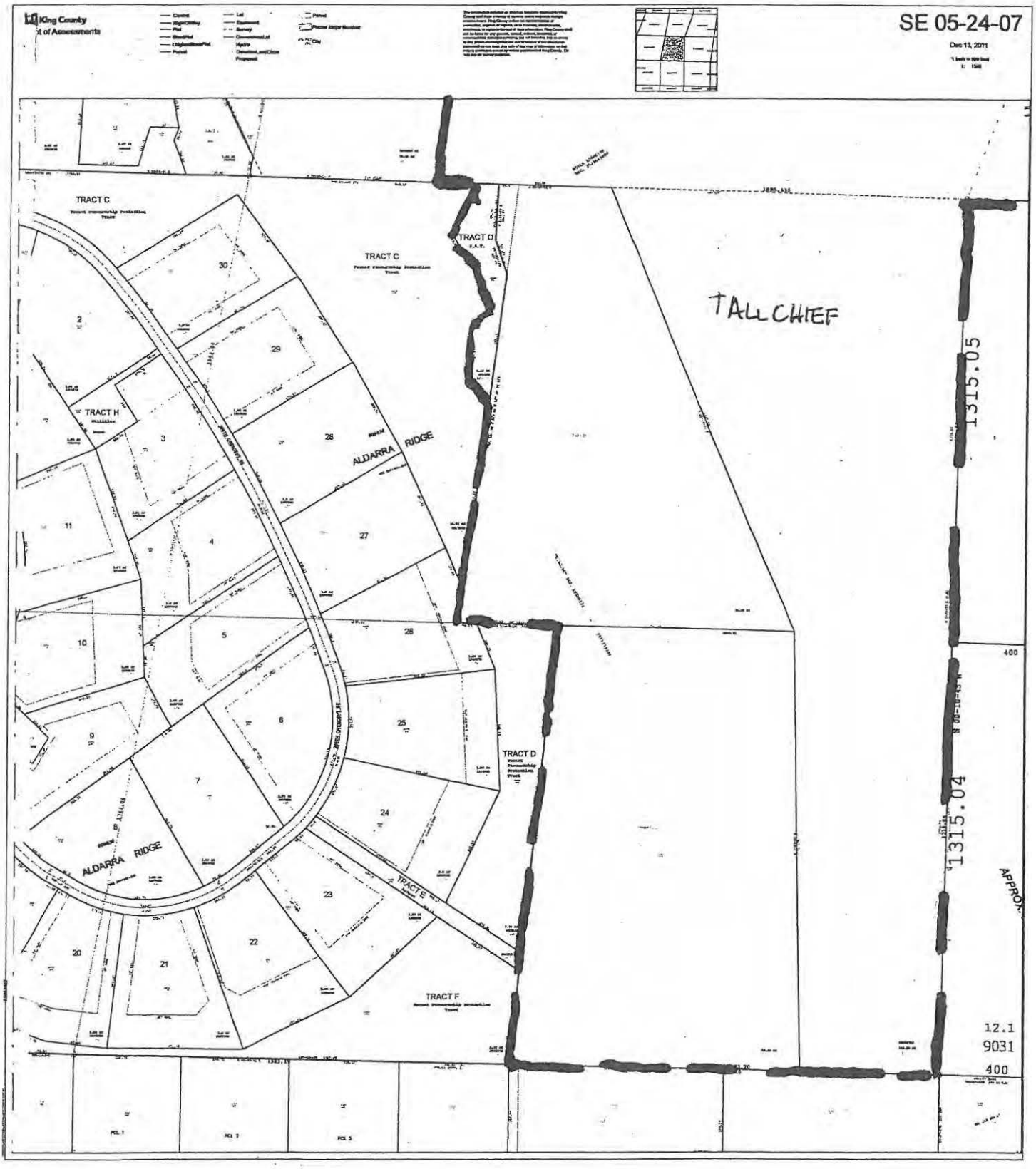
All of the drainage from the site (including bypass areas) passes through Onsite Wetland F before entering a ditch system draining north toward the Green (a.k.a Stickney) slough and eventually re-enters the Snoqualmie River approximately 1 mile north of the site. The 48" culvert located at Tall Chief Road station 16+00 connects wetlands F with wetland D.

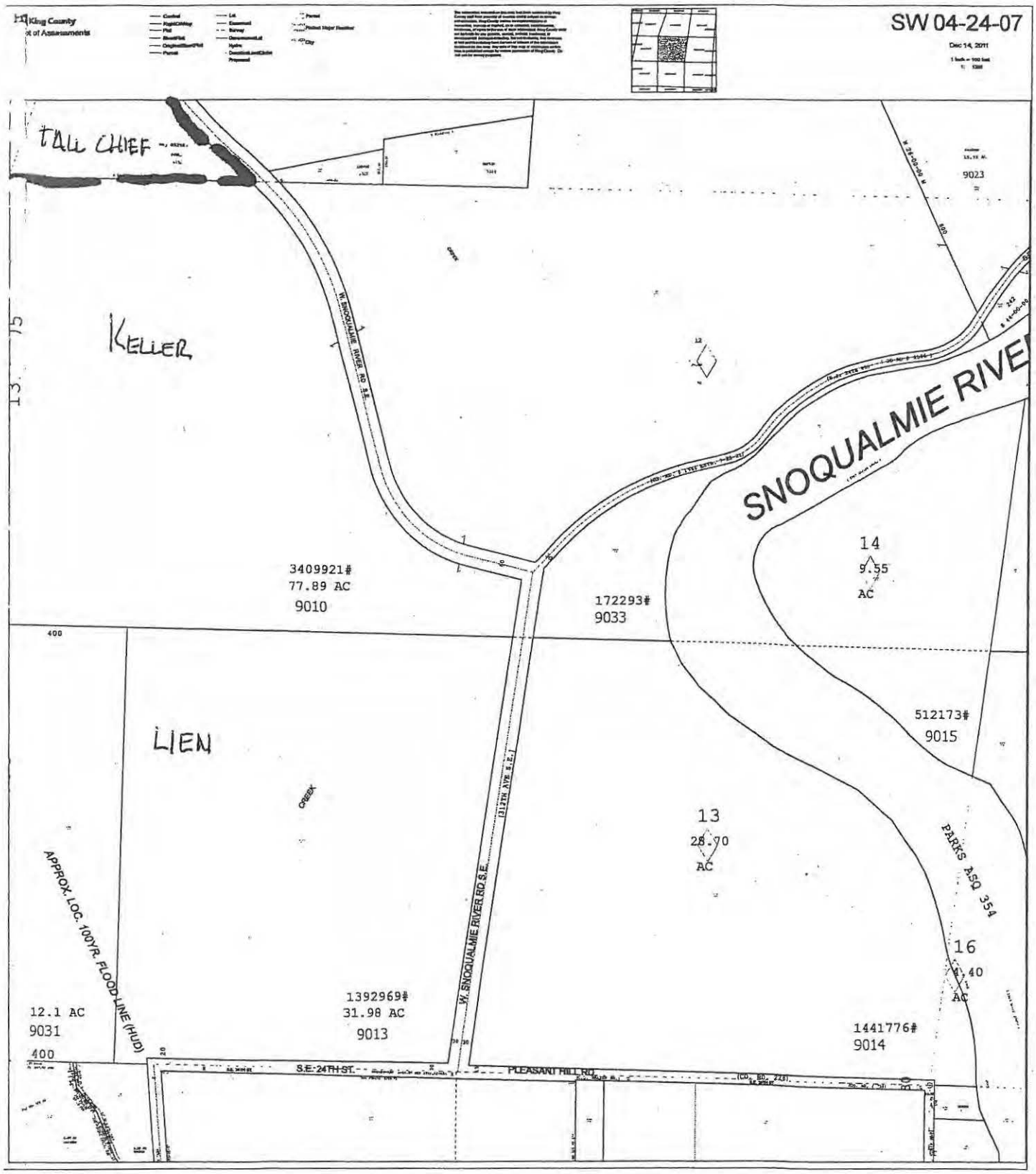
The delineated wetland boundary for wetlands A, C, D, and F is consistent with the elevation 72 contour, such that these wetlands exist at approximately the same elevation. Flow patterns through the wetlands are from south to north. Wetlands A,C, and D are separated from each other by approximately 40 feet of ground (also lying at elevation 72) which was historically mowed and maintained as gravel golf cart paths to provide access from the clubhouse to the lower 9 holes. They are all connected with culverts, (see attached photo record). Wetlands F and D are separated by Tall Chief Road (approx elev 74) but connected by a 48" diameter culvert under the road). The project Wetland Consultant, (Altman Oliver Consultants, Inc). has indicated that wetlands A, C, and D are hydraulically connected and would be connected as one single wetland, if not for the artificial maintenance of the golf cart paths (see Altman Oliver Letter dated Jan 25, 2012).

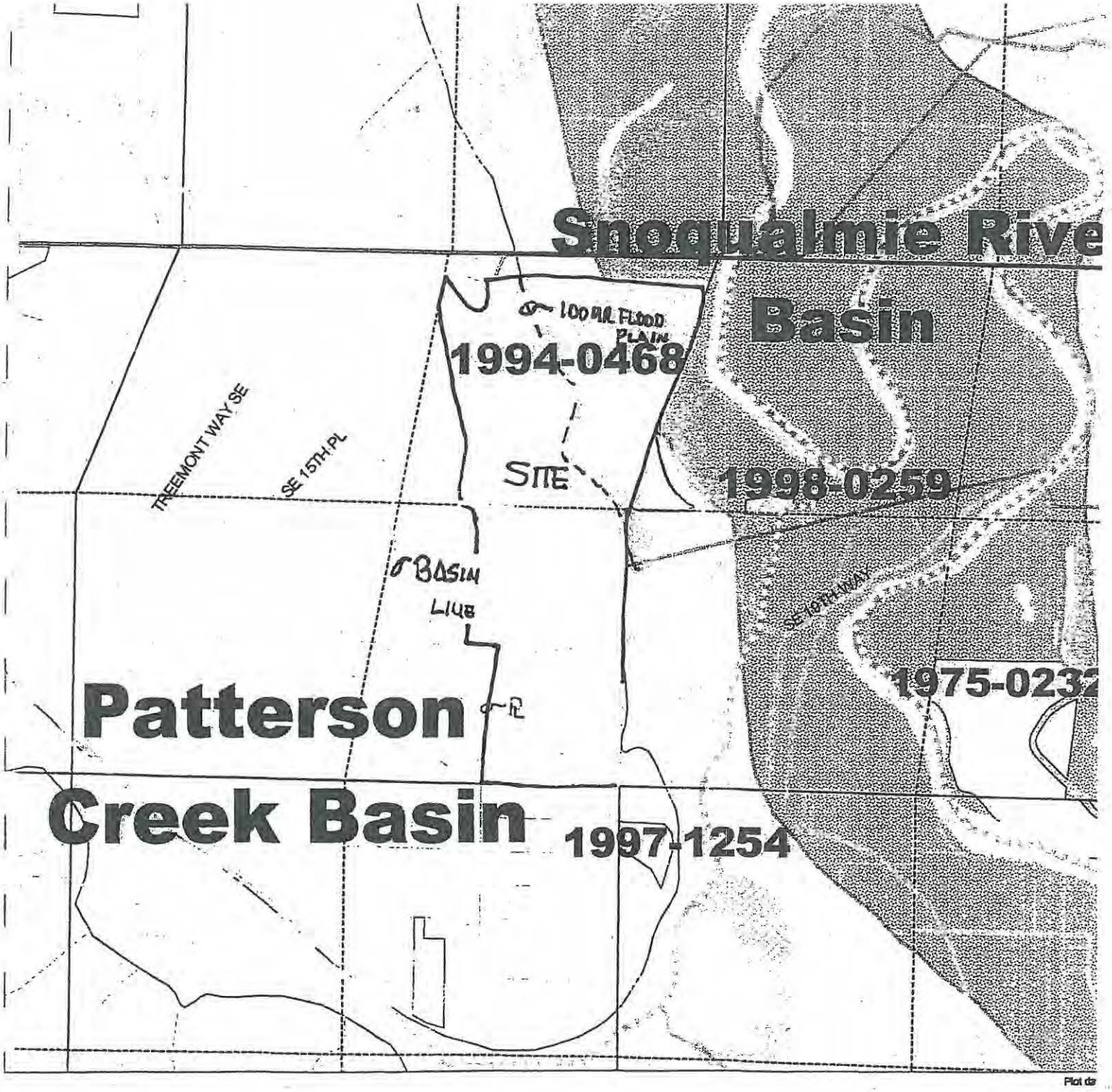
Consequently, the point of compliance for this study purpose is taken wetland A and is regarded as contiguous wetlands A, C, and D. Basin Lag times for modeling purposes are computed from the individual basins to the wetlands (flow through wetlands are taken as zero per SWM requirements). It should be noted that the revised preliminary wet/detention pond layout includes a system to convey the pond outflow to wetland C, although this system could be modified in final engineering design to split flows proportionately to wetlands A, C and D.


King County
of Assessments
NE 05-24-07
Aug 10, 2010
HAAKENSON
TALLCHIEF
TRACT C
TRACT D


King County
Assessments
NW 04-24-07
Dec 13, 2010
042407
SNOQUALMIE RIVER
SNOQUALMIE RIVER
TALL
CHIEF
7
28.50
AC
9023


King County
t of Assessments
SE 05-24-07
Dec 13, 2011
TALL CHIEF
TRACT C
TRACT C
TRACT O
TRACT H
ALDARRA RIDGE
ALDARRA RIDGE
TRACT D
TRACT E
TRACT F
1315.05
1315.04
400
12.1
9031
400


King County
Dept of Assessments
SW 04-24-07
Dec 14, 2011
TALL CHIEF
KELLER
LIEN
W. SNOQUALMIE RIVER RD S.E.
SNOQUALMIE RIVER
3409921#
77.89 AC
9010
172293#
9033
14
9.55
AC
512173#
9015
13
28.70
AC
PARKS ASQ 354
16
5.40
AC
1441776#
9014
1392969#
31.98 AC
9013
12.1 AC
9031
400
APPROX. LOC. 100YR. FLOOD LINE (HUD)
W. SNOQUALMIE RIVER RD. S.E.
(212TH AVE S.E.)
S.E. 24TH ST.
PLEASANT HILL RD.
9023



Plot da

KING COUNTY MAP

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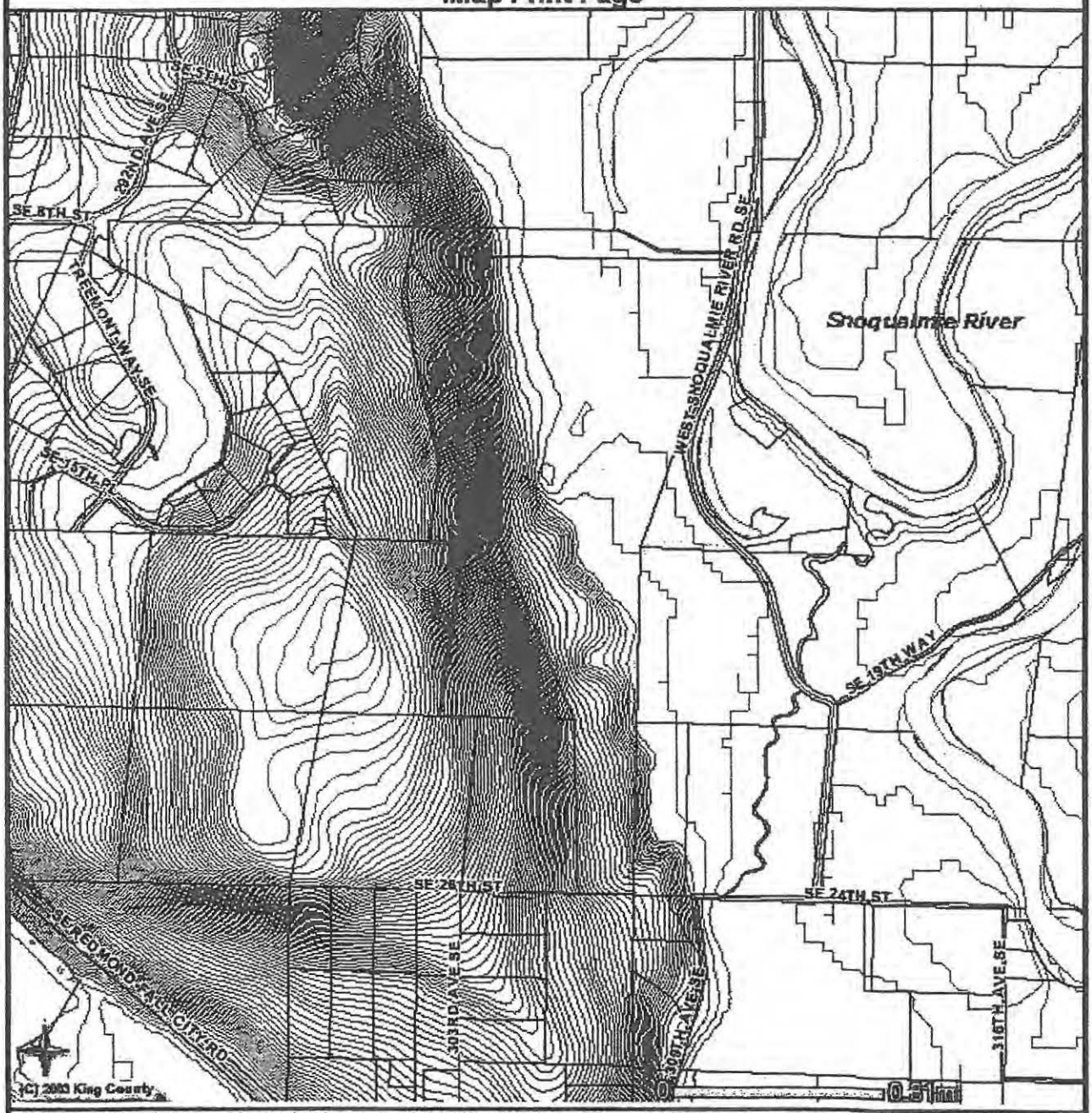

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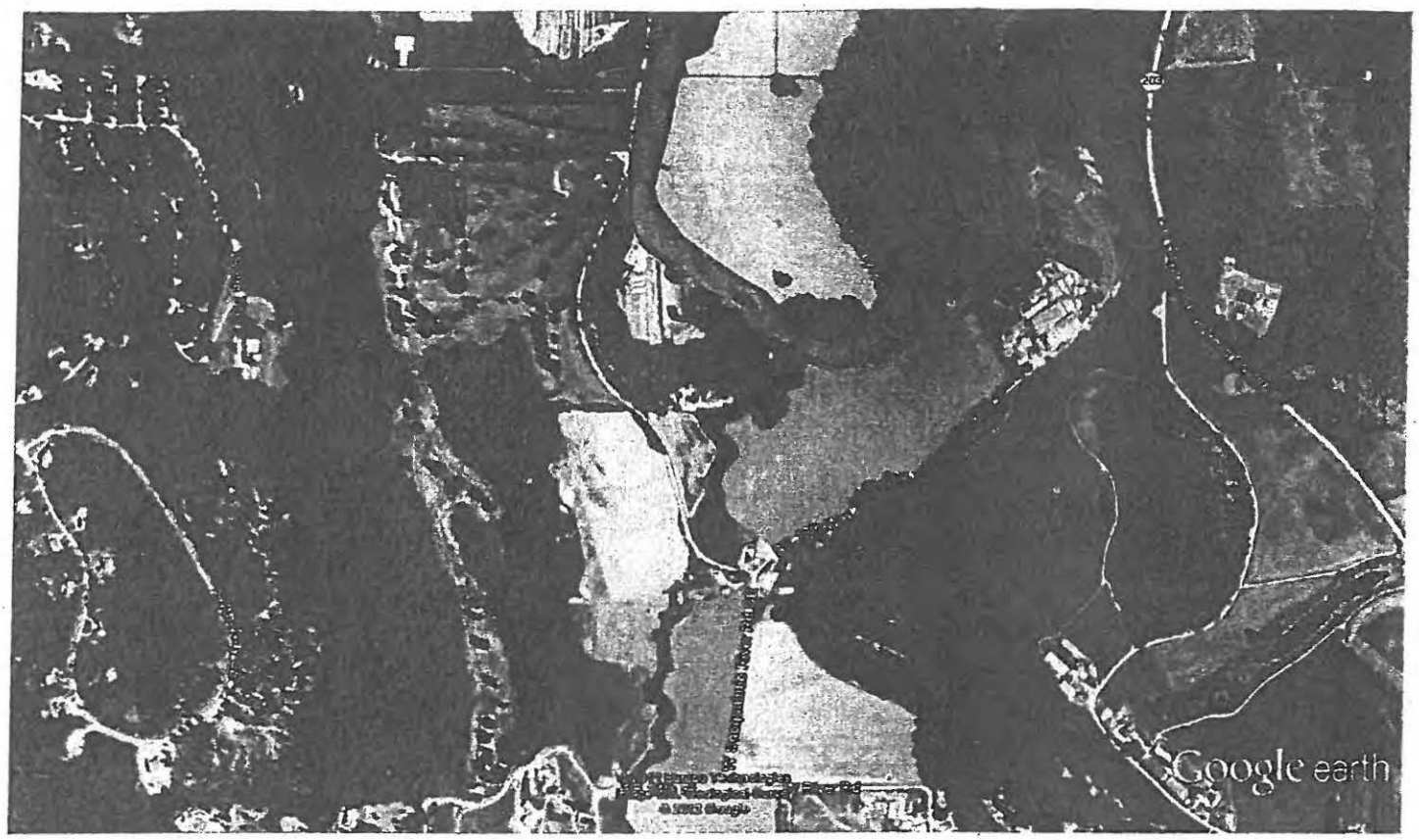
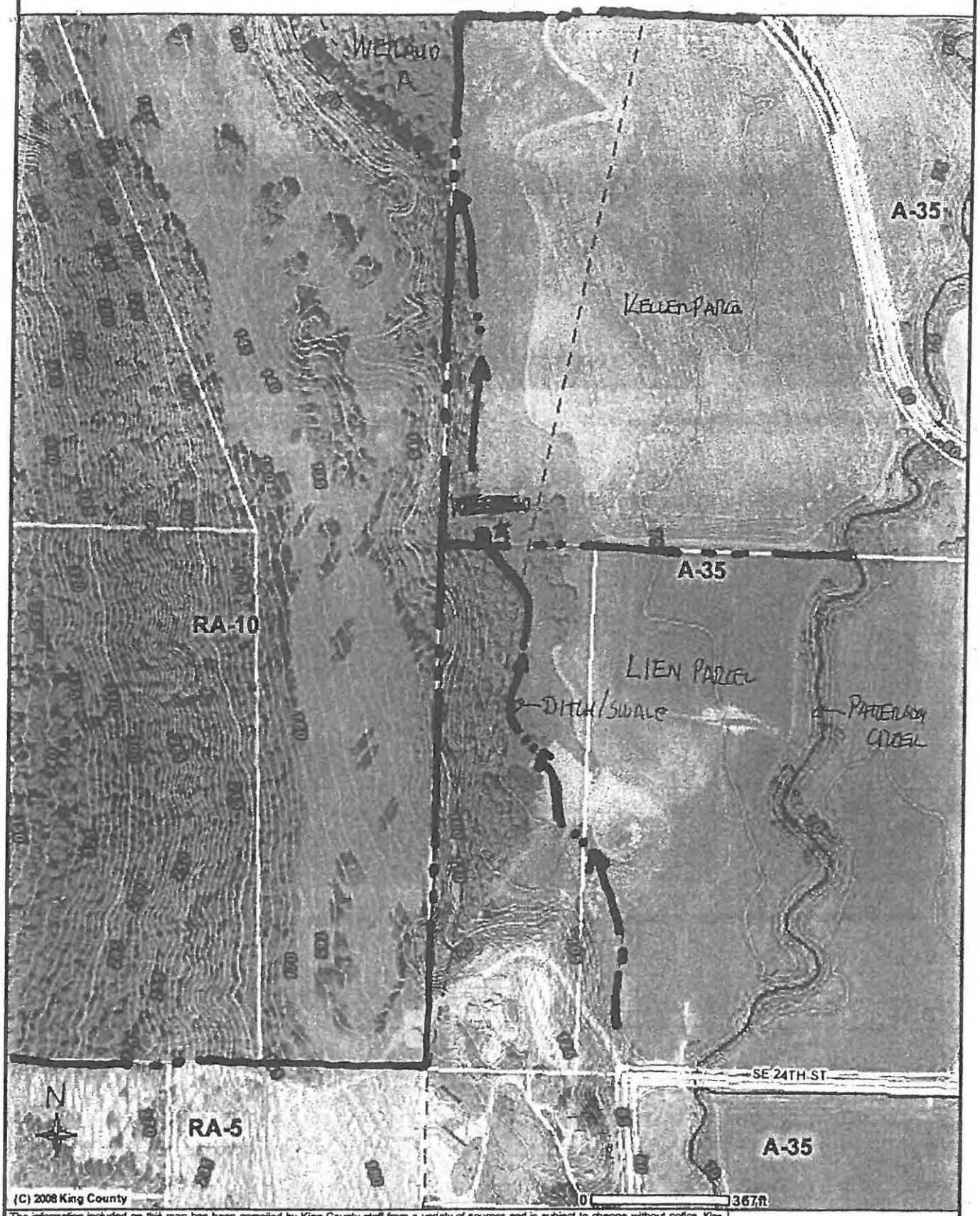


Google earth

feet 5000

km 1

iMAP



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Date: 1/10/2012 Source: King County iMAP - Property Information (http://www.metrokc.gov/GIS/iMAP)

King County

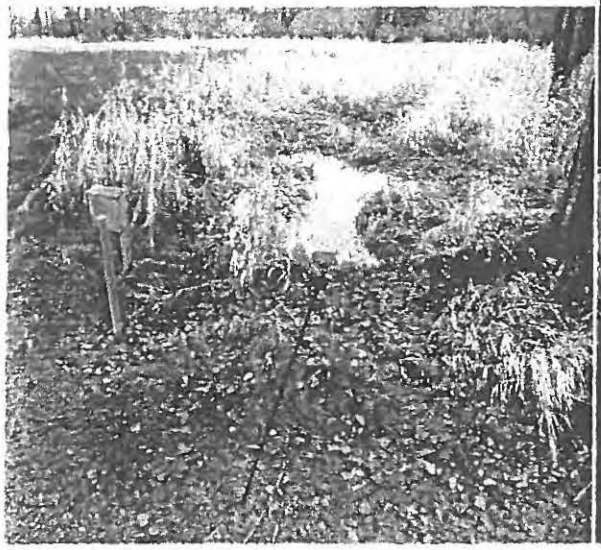
Looking north from SE 24th Near Patterson Creek Bridge

Overland flow path of prior Patterson Creek Overbank flows @ SE 24th

Grassy waterway flows north (right) under canopy near Lien/Tall Chief P.L.

Cart Path between Wetland D and C looking East

18" LCPE culvert under cart path, wetland A on lef, wetland C on Right (looking E)



Wetland C 24" cmp outlet culvert/swale

24" cmp under cartpath between wetland C (on left) and wetland D looking W

cart path between wetland D (on left) & C looking E

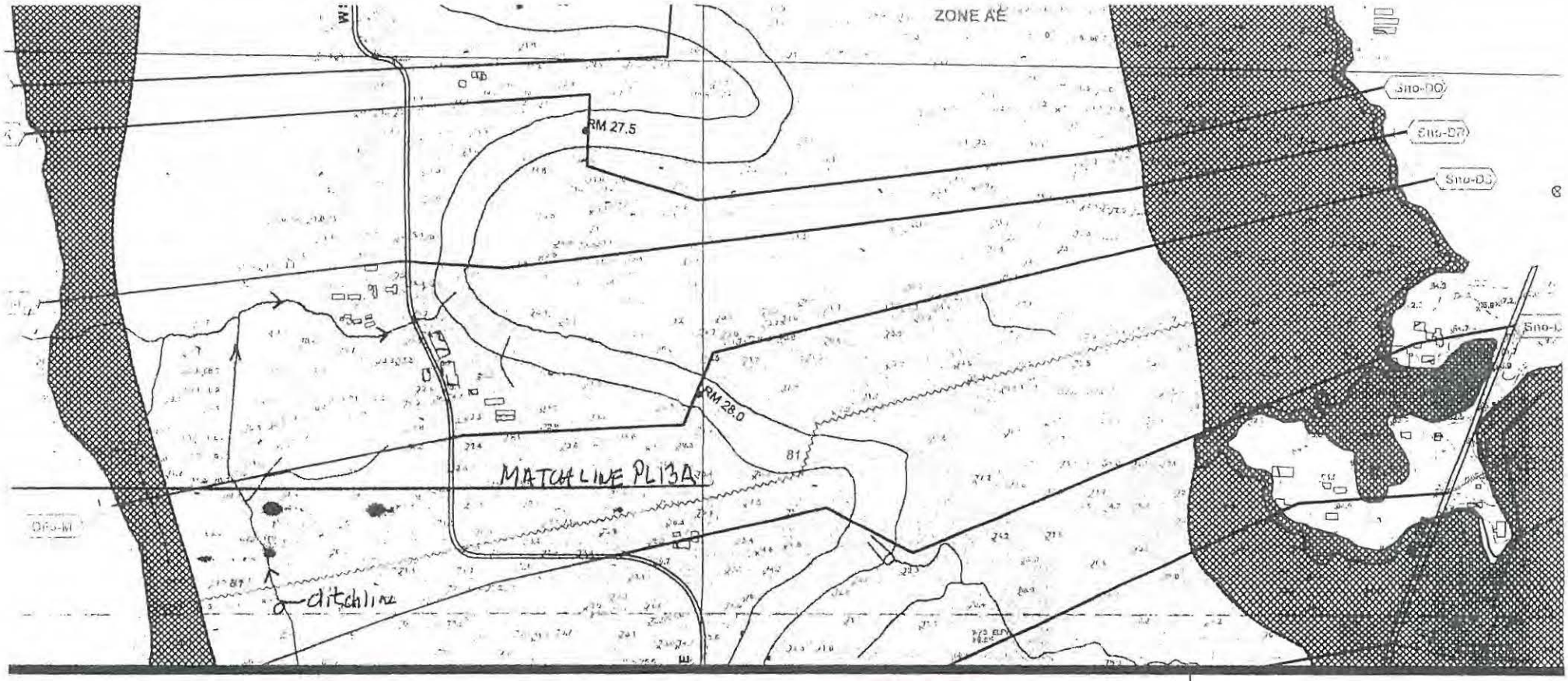
Cart path between wetland C (foreground) and A looking N

Wetland D 48" outlet culvert looking s

48" culvert inlet to Wetland F

N

2006 FEMA WORKMAP PL13B



*Structures

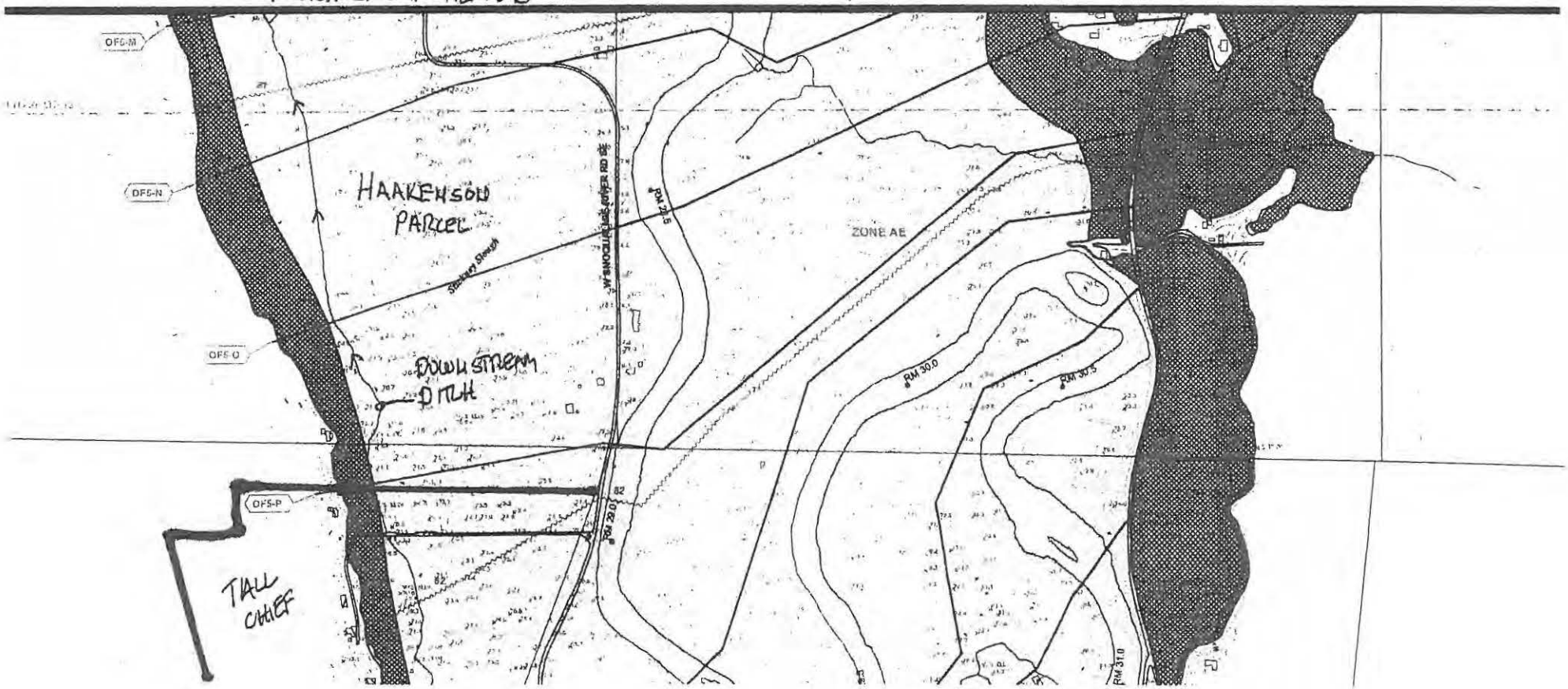
This map has been photogrammetrically compiled from 1"=750' scale, 152.852

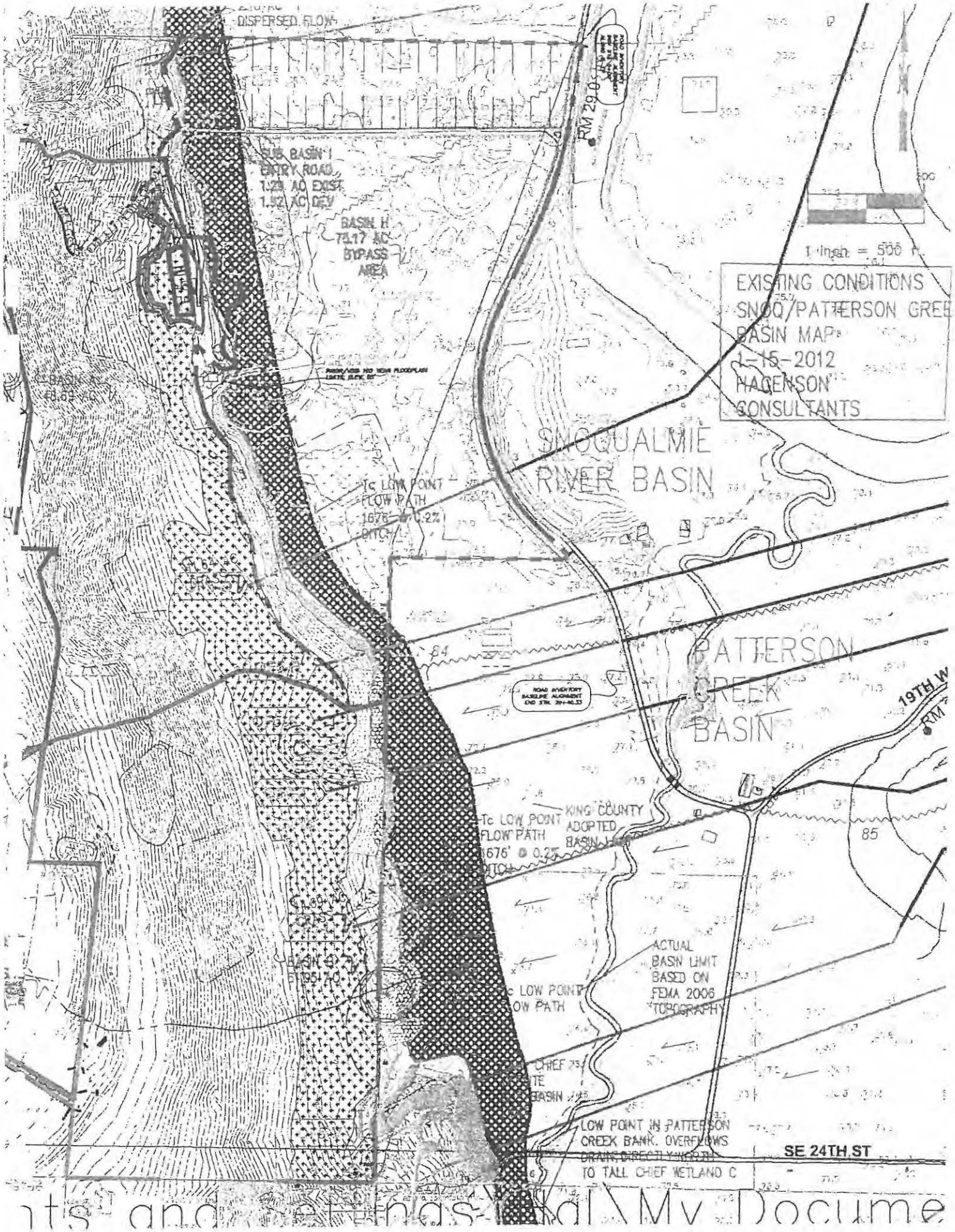
Sheet Index

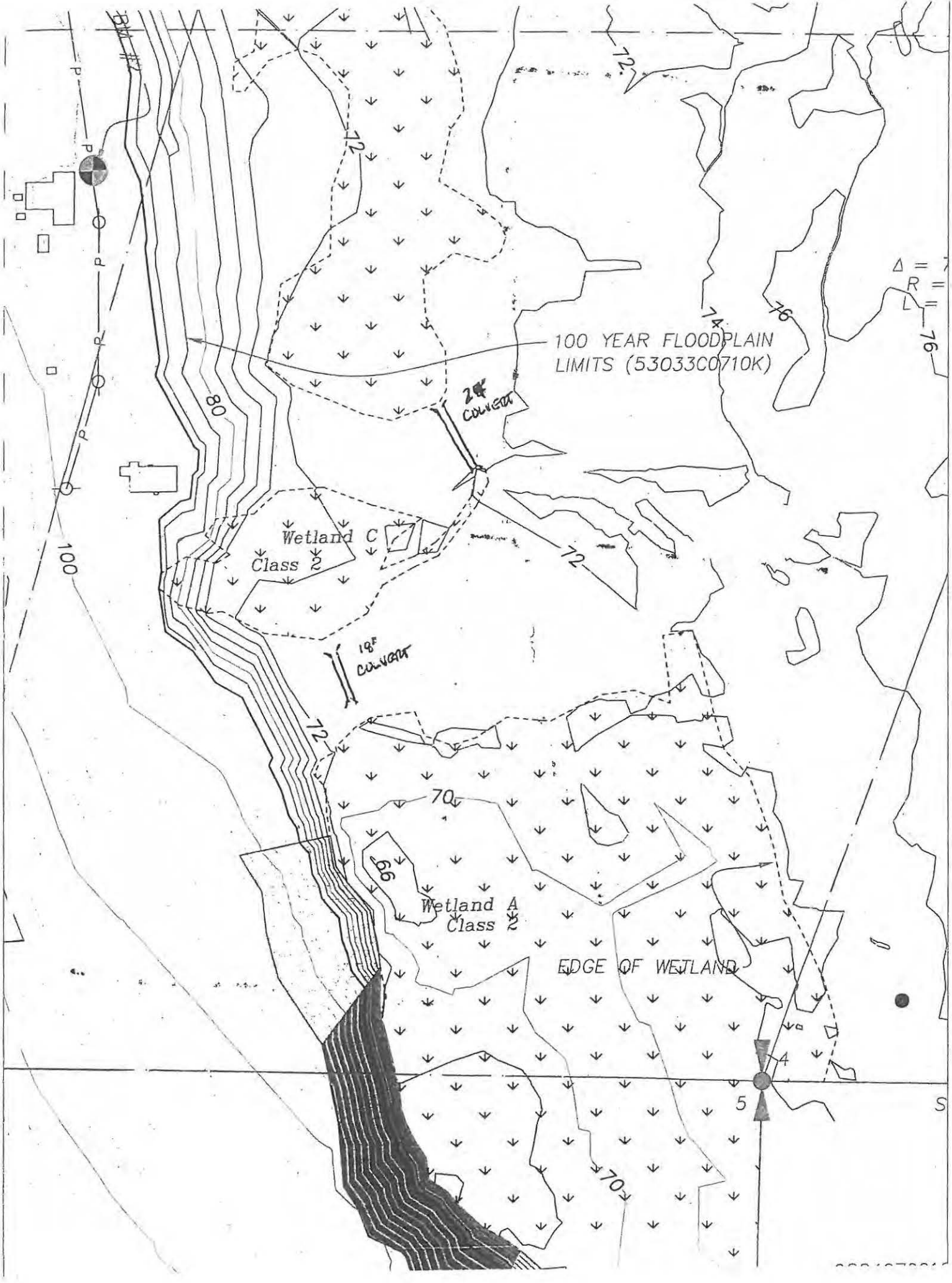
N

FEMA 2006 WORKMAP PL13A

MATCH LINE PLATE 13B




DISPERSED FLOW
SUB BASIN 1
ENTRY ROAD
1.29 AC EXIST
1.52 AC DEV
BASIN H
73.17 AC
BYPASS
AREA
1 inch = 500 ft.
EXISTING CONDITIONS
SNOQ/PATTERSON CREE
BASIN MAP
1-15-2012
HAGENSON
CONSULTANTS
SNOQUALMIE
RIVER BASIN
Tc LOW POINT
FLOW PATH
1676' @ 0.2%
DITCH
PATTERSON
CREEK
BASIN
19TH W
KING COUNTY
ADOPTED
BASIN
Tc LOW POINT
FLOW PATH
1676' @ 0.2%
DITCH
85
ACTUAL
BASIN LIMIT
BASED ON
FEMA 2006
TOPOGRAPHY
BASIN G
51.951 AC
LOW POINT IN PATTERSON
CREEK BANK. OVERFLOWS
TO TALL CHIEF WETLAND C
SE 24TH ST


100 YEAR FLOODPLAIN
LIMITS (53033C0710K)
24" CULVERT
18" CULVERT
Wetland C
Class 2
Wetland A
Class 2
EDGE OF WETLAND
72
74
76
80
100
70
66
4
5
S

V. PROPOSED DRAINAGED IMPROVEMENTS

The site lies in a level two flow control area. Although the entire site qualifies for exemptions as detailed below, specific recommendations in the Geotechnical Engineering Report require that drainage on steeper portions of the hillside be collected in tight lines where possible and conveyed to a discharge point near the valley floor to avoid hillside erosion and instability.

The project qualifies for the Forested Open Space exemption number 5. The project is a rural residential project in the RA-5 and RA-10 Zone. 65% of the residential lot areas will be dedicated in easements or tracts as Forested Open Space. BMP's such as roof and driveway dispersal will be used to accommodate drainage requirements on each of the proposed lots that cannot stub directly into the roadway storm drains.

Roof drain dispersal will largely rely on the splash block method, with 50' min. vegetated flow paths between the roof and any structure or property line. Road dispersal for the driveways will rely partially on sheet flow and where concentrated flows result from roadway cut ends or uphill ditch systems, direct discharges to rock pads with 100 foot flow paths thru vegetation will be allowed where 100 year flows are less than 0.2cfs. Dispersion trenches will be used otherwise, such that any 50' dispersion trench receives no more than 0.5 cfs in the 100-year event. Road dispersion trenches will require location where slopes are less than 15%. In compliance with the geotechnical report recommendations, emphasis is placed on collecting runoff from the hillside bench area and discharging it to the valley floor (through the wet/detention pond) in an effort to avoid hillside erosion and instability. To facilitate collection, a French drain is proposed at approximate elevation 330 along lots 13 thru 17. Extensive sub-basin delineation and modeling will be provided at the construction document phase.

Approximately 15.45 acres (Basin C-Developed Conditions Basin Map) will be diverted northwards along proposed Tall Chief Road and ultimately discharged to the Onsite wet/detention pond along with other portions of the project that naturally drain northward. A SWM Drainage Adjustment application is made for this diversion purpose. Since there is no reasonable and feasible opportunity to drain the basin drainage to the valley floor, the diversion will further allow the removal of drainage from the hillside to avoid erosion and instability.

The proposed wet/detention pond lying in Tract P will serve the project areas where those areas are of sufficient elevation to connect to the Tall Chief Road Storm Drainage Trunk line.

Diversion Basin Water Balance modeling calculations include proposed conditions reflecting 65% open space, and conservatively assume 20% maximum impervious area per lot and 15% developed pervious area per lot as would be allowed by the zoning code. This approach produces higher developed peak flows than would occur if the normal value (8,000 s.f. of impervious per rural lot) were used as allowed under KCSWM for detention pond modeling. Flows were modeled using both 15 minute and 1 hour time steps for comparison. Flow paths were evaluated to determine the amount of effective upstream runoff that would be collected in the proposed roadway curb and gutter storm collection system. KCSWDM pg. 5-15, 16 indicates that runoff is assumed dispersed within 100 feet downstream of a dispersal system in native

growth areas. This value is conservative and was used to delineate the extent of the 15.45 acre developed Bypass Basin C. Surface runoff from uncollected portions of Basin C will infiltrate before reaching conveyance collections systems. Roofs and driveways from lots 13 through 17 were also included in the Basin C diversion area since they will be tight lined into conveyance systems. A reasonable extent of potential grass areas around the homes was also included in the diversion area. Peak flows, flow durations and runoff volumes were computed. Data was tabulated for existing and developed conditions for comparison.

Point of Compliance Storm Water Flow Control targets all offsite tributary areas, all onsite areas and all onsite bypass areas, including developed bypass basin D and developed bypass basin H (existing portions of Tall Chief Road which will be widened by roughly 8 feet between approx station 0+00 to 17+75 and for approximately 700 front feet of Snoqualmie River Road which will be widened with a 4 foot shoulder). These areas lie below the elevation of the proposed wet/detention pond and are therefore bypass areas. Flow Control is achieved by compensating for these bypass areas using the KCRTS Point of Compliance model for the detention facility.

The site lies in a Basic Water Quality area. Although the entire site qualifies for exemptions as detailed below, specific recommendations in the Geotechnical Engineering Report require that drainage on the hillside be collected in tight lines where possible and conveyed to a discharge point near the valley floor to avoid hillside erosion and instability. Consequently, collected storm water containing runoff from pollution generating impervious surfaces such as roadways, must be treated. The proposed wet pond portion of the wet detention pond provides the necessary treatment.

For un-concentrated portions of the project, exemption number 3, Forested Open Space for Rural Residential Projects will apply (KCSWM pg. 1-50 to 1-51). Exemption #3 indicates that any proposed natural discharge area within a project is exempt provided:

1. At least 65% of the unsubmerged portion of the natural discharge area is set aside as forested open space as specified in Section 5.2.1 and
2. The runoff from roads and driveways is dispersed through at least 100 feet of native vegetation (per 5.2.1) and
3. The runoff from continuous lawn areas of 1 acre or more is dispersed through at least 25 feet of native vegetation onsite per 1.2.8.2 (P-1-57).

Per KCSM manual, PG 5-15, appendix C and Section 4.2.2, runoff dispersal can be used as an alternative method to accomplish water quality requirements, such that filtration through grass/pasture removes harmful pollutants. This approach will be applied to those portions of the project that are not otherwise collected and conveyed to the wet/detention pond and to areas which are not otherwise treated with grass filter strips or other means (see following paragraphs).

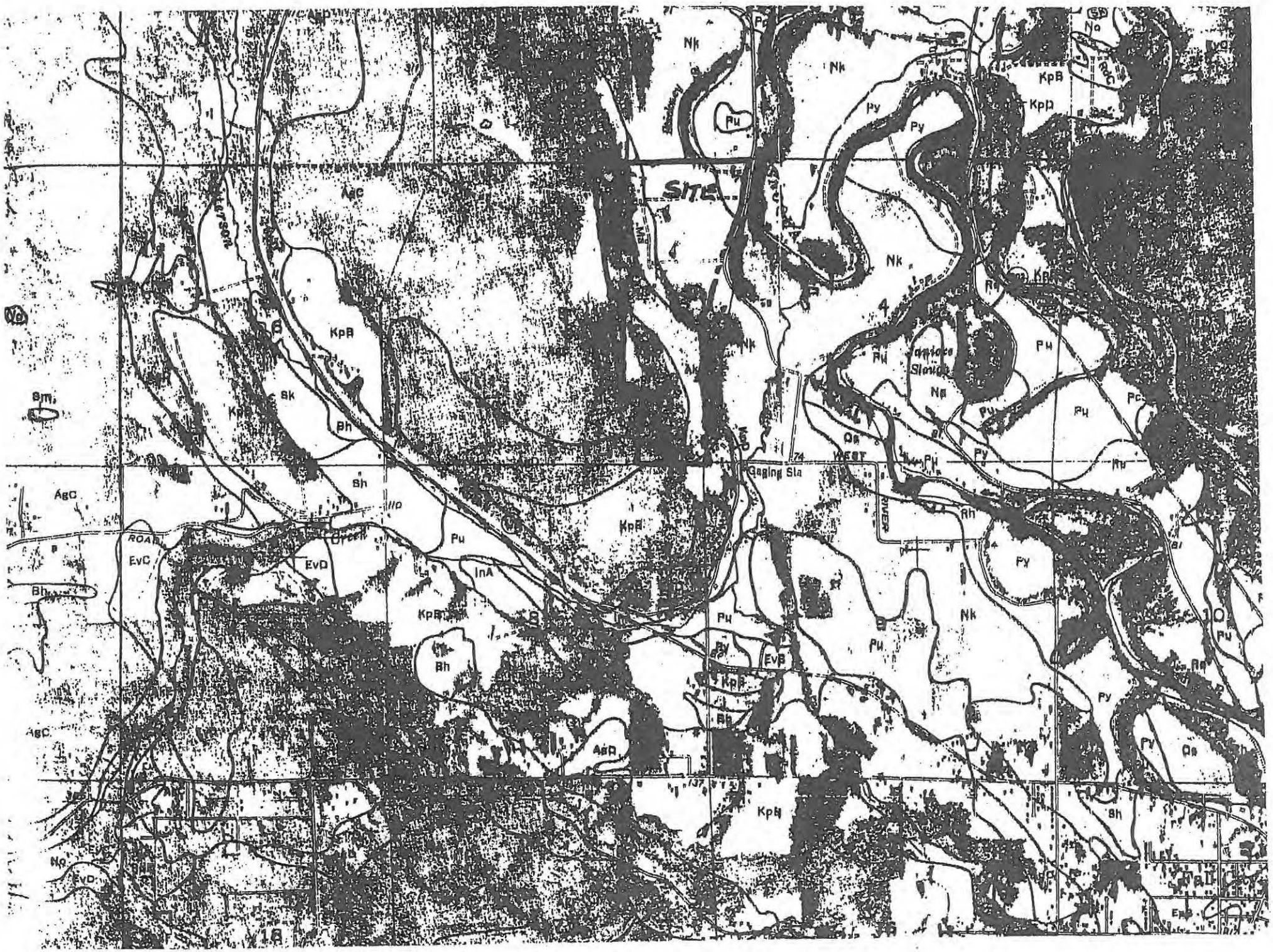
Water Quality facilities will consist of a wet/detention pond in Tract P of the project. If a portion of this facility lies within the 100-year floodplain, a compensating volume will be excavated from the hillside area near Tract A to create mitigation floodplain storage. The current revised design removed the facility from the floodplain, although final engineering design may modify this element.

Water Quality treatment are required for existing portions of Tall Chief Road which will be widened (approx station 0+00 to 17+75) and for frontage portions of Snoqualmie River Road which will be slightly widened. These areas are below the elevation of the proposed wet pond. Treatment will be achieved by providing 20 foot basic grass filter strips along the length of the roadway per KCSWM pg. 6.56, Section 6.3.4. Some of this portion of Tall Chief Road (sta 13+50 to 17+75) cannot accommodate a filter strip due to the adjacent wetland proximity. This area will be treated with a storm filter media/compost filter system.

As noted above, roof downspout dispersal will be utilized for all buildings, as required

The Existing and Developed conditions Basin Maps show the on- & off-site basin areas. The water quality (WQ) volume requirements for the tributary areas are satisfied within the volume of the proposed Pond from the pond bottom elevation (74) to the bottom of the detention elevation (81.5). Between Elevations 81.5 to 85.4, the pond contributes the volume to be used for detention. The detention requirement & orifice sizing were calculated using Version 6.0 of the KCRTS program. The program results are presented in tabular and graphical form.

Upstream tributary offsite basins (Basin E) is included in the analysis and routed through the ponds. The KCRTS program was used to calculate the peak flows of the offsite basins. Note that per KCSWDM Pg 1-36, offsite bypass is required if the offsite existing 100 year flow is greater than 50% of the onsite developed 100 year flow. From the output data, the offsite existing 100-year flow is less than 50%. For detention design modeling, offsite and onsite flows are combined and routed through the pond to establish orifice geometry. A control structure located within a 72"-diameter Manhole at the south end of the Pond and Pond Emergency Spillway will control flow of the pond, (see attached Pond Control Structure & Spillway Details).


SITE
Nk
Py
Pu
KpB
KpD
AgC
Sk
Bh
Sm
EvC
EvD
InA
AgR
Nb
Qs
Rh
Pc
Gaging Sta
WEST
RIVER
ROAD
Green
Jackson
Slough
Fall Creek
4
6
8
10
18

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, indicates the class of slope. Symbols without a slope letter are those of nearly level soils.

SYMBOL	NAME
AgB	Alderwood gravelly sandy loam, 0 to 6 percent slopes
AgC	Alderwood gravelly sandy loam, 6 to 15 percent slopes
AgD	Alderwood gravelly sandy loam, 15 to 30 percent slopes
AkF	Alderwood and Kitsap soils, very steep
AmB	Arents, Alderwood material, 0 to 6 percent slopes *
AmC	Arents, Alderwood material, 6 to 15 percent slopes *
An	Arents, Everett material *
BeC	Beausite gravelly sandy loam, 6 to 15 percent slopes
BeD	Beausite gravelly sandy loam, 15 to 30 percent slopes
BeF	Beausite gravelly sandy loam, 40 to 75 percent slopes
Bh	Bellingham silt loam
Br	Briscot silt loam
Bu	Buckley silt loam
Cb	Coastal Beaches
Ea	Earlmont silt loam
Ed	Edgewick fine sandy loam
EvB	Everett gravelly sandy loam, 0 to 5 percent slopes
EvC	Everett gravelly sandy loam, 5 to 15 percent slopes
EvD	Everett gravelly sandy loam, 15 to 30 percent slopes
EwC	Everett-Alderwood gravelly sandy loams, 6 to 15 percent slopes
InA	Indianola loamy fine sand, 0 to 4 percent slopes
InC	Indianola loamy fine sand, 4 to 15 percent slopes
InD	Indianola loamy fine sand, 15 to 30 percent slopes
KpB	Kitsap silt loam, 2 to 8 percent slopes
KpC	Kitsap silt loam, 8 to 15 percent slopes
KpD	Kitsap silt loam, 15 to 30 percent slopes
KsC	Klaus gravelly loamy sand, 6 to 15 percent slopes
Ma	Mixed alluvial land
NeC	Neilton very gravelly loamy sand, 2 to 15 percent slopes
Ng	Newberg silt loam
Nk	Nooksack silt loam
No	Norma sandy loam
Or	Orcas peat
Os	Orting silt loam
OvC	Ovall gravelly loam, 0 to 15 percent slopes
OvD	Ovall gravelly loam, 15 to 25 percent slopes
OvF	Ovall gravelly loam, 40 to 75 percent slopes
Pc	Pilchuck loamy fine sand
Pk	Pilchuck fine sandy loam
Pu	Puget silty clay loam
Py	Puyallup fine sandy loam
RaC	Ragnar fine sandy loam, 6 to 15 percent slopes
RaD	Ragnar fine sandy loam, 15 to 25 percent slopes
RdC	Ragnar-Indianola association, sloping *
RdE	Ragnar-Indianola association, moderately steep *
Re	Renton silt loam
Rh	Riverwash
Sa	Salal silt loam
Sh	Sammamish silt loam
Sk	Seattle muck
Sm	Shalcar muck
Sn	Si silt loam
So	Snohomish silt loam
Sr	Snohomish silt loam, thick surface variant
Su	Sultan silt loam
Tu	Tulowila muck
Ur	Urban land
[illegible]	[illegible] silt loam

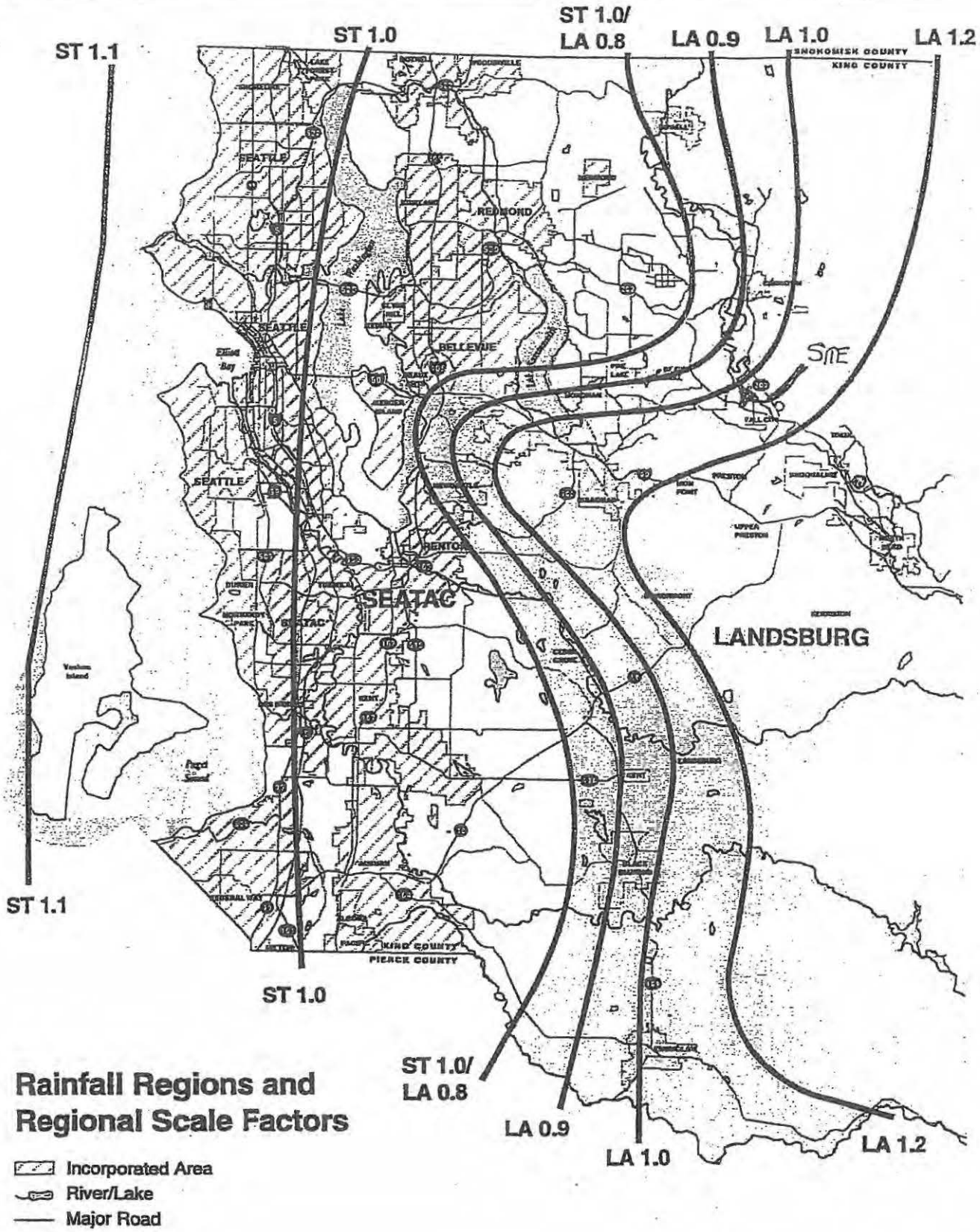
TABLE 3.2.2.B EQUIVALENCE BETWEEN SCS SOIL TYPES AND KCRTS SOIL TYPES

SCS Soil Type	SCS Hydrologic Soil Group	KCRTS Soil Group	Notes
Alderwood (AgB, AgC, AgD)	C	Till	
Arents, Alderwood Material (AmB, AmC)	C	Till	
Arents, Everett Material (An)	B	Outwash	1
Beausite (BeC, BeD, BeF)	C	Till	2
Bellingham (Bh)	D	Till	3
Briscot (Br)	D	Till	3
Buckley (Bu)	D	Till	4
Earlmont (Ea)	D	Till	3
Edgewick (Ed)	C	Till	3
Everett (EvB, EvC, EvD, EwC)	A/B	Outwash	1
Indianola (InC, InA, InD)	A	Outwash	1
Kitsap (KpB, KpC, KpD)	C	Till	
Klaus (KsC)	C	Outwash	1
Neilton (NeC)	A	Outwash	1
Newberg (Ng)	B	Till	3
Nooksack (Nk)	C	Till	3
Norma (No)	D	Till	3
Orcas (Or)	D	Wetland	
Oridia (Os)	D	Till	3
Ovall (OvC, OvD, OvF)	C	Till	2
Pilchuck (Pc)	C	Till	3
Puget (Pu)	D	Till	3
Puyallup (Py)	B	Till	3
Ragnar (RaC, RaD, RaC, RaE)	B	Outwash	1
Renton (Re)	D	Till	3
Salal (Sa)	C	Till	3
Sammamish (Sh)	D	Till	3
Seattle (Sk)	D	Wetland	
Shalcar (Sm)	D	Till	3
Si (Sn)	C	Till	3
Snohomish (So, Sr)	D	Till	3
Sultan (Su)	C	Till	3
Tukwila (Tu)	D	Till	3
Woodinville (Wo)	D	Till	3

Notes:

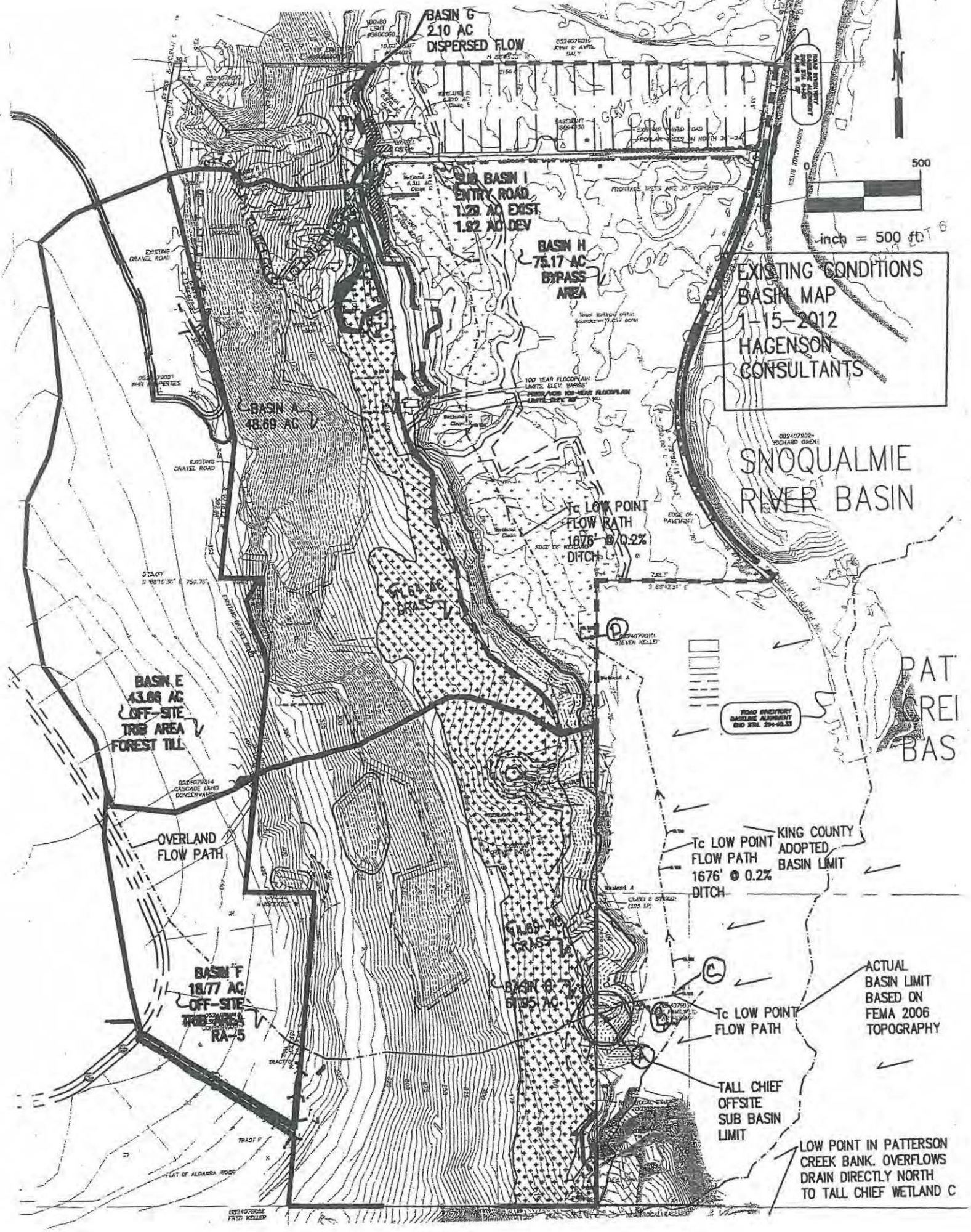
1. Where outwash soils are saturated or underlain at shallow depth (<5 feet) by glacial till, they should be treated as till soils.
2. These are bedrock soils, but calibration of HSPF by King County DNR shows bedrock soils to have similar hydrologic response to till soils.
3. These are alluvial soils, some of which are underlain by glacial till or have a seasonally high water table. In the absence of detailed study, these soils should be treated as till soils.
4. Buckley soils are formed on the low-permeability Osceola mudflow. Hydrologic response is assumed to be similar to that of till soils.

FIGURE 3.2.2.A RAINFALL REGIONS AND REGIONAL SCALE FACTORS



VI. KCRTS MODEL

A. POINT OF COMPLIANCE MODEL


BASIN G
2.10 AC
DISPERSED FLOW
SUB BASIN I
ENTRY ROAD
1.28 AC EXIST
1.92 AC DEV
BASIN H
75.17 AC
BYPASS
AREA
EXISTING CONDITIONS
BASIN MAP
1-15-2012
HAGENSON
CONSULTANTS
BASIN A
48.69 AC
SNOQUALMIE
RIVER BASIN
Tc LOW POINT
FLOW PATH
1676' @ 0.2%
DITCH
BASIN E
43.06 AC
OFF-SITE
TRIB AREA
FOREST TILL
OVERLAND
FLOW PATH
Tc LOW POINT
FLOW PATH
1676' @ 0.2%
DITCH
KING COUNTY
ADOPTED
BASIN LIMIT
BASIN F
18.77 AC
OFF-SITE
TRIB AREA
RA-5
BASIN B
61.95 AC
Tc LOW POINT
FLOW PATH
ACTUAL
BASIN LIMIT
BASED ON
FEMA 2006
TOPOGRAPHY
TALL CHIEF
OFFSITE
SUB BASIN
LIMIT
LOW POINT IN PATTERSON
CREEK BANK. OVERFLOWS
DRAIN DIRECTLY NORTH
TO TALL CHIEF WETLAND C
500
inch = 500 ft

TALL CHIEF	POINT OF COMPLIANCE ANALYSIS	1/26/12

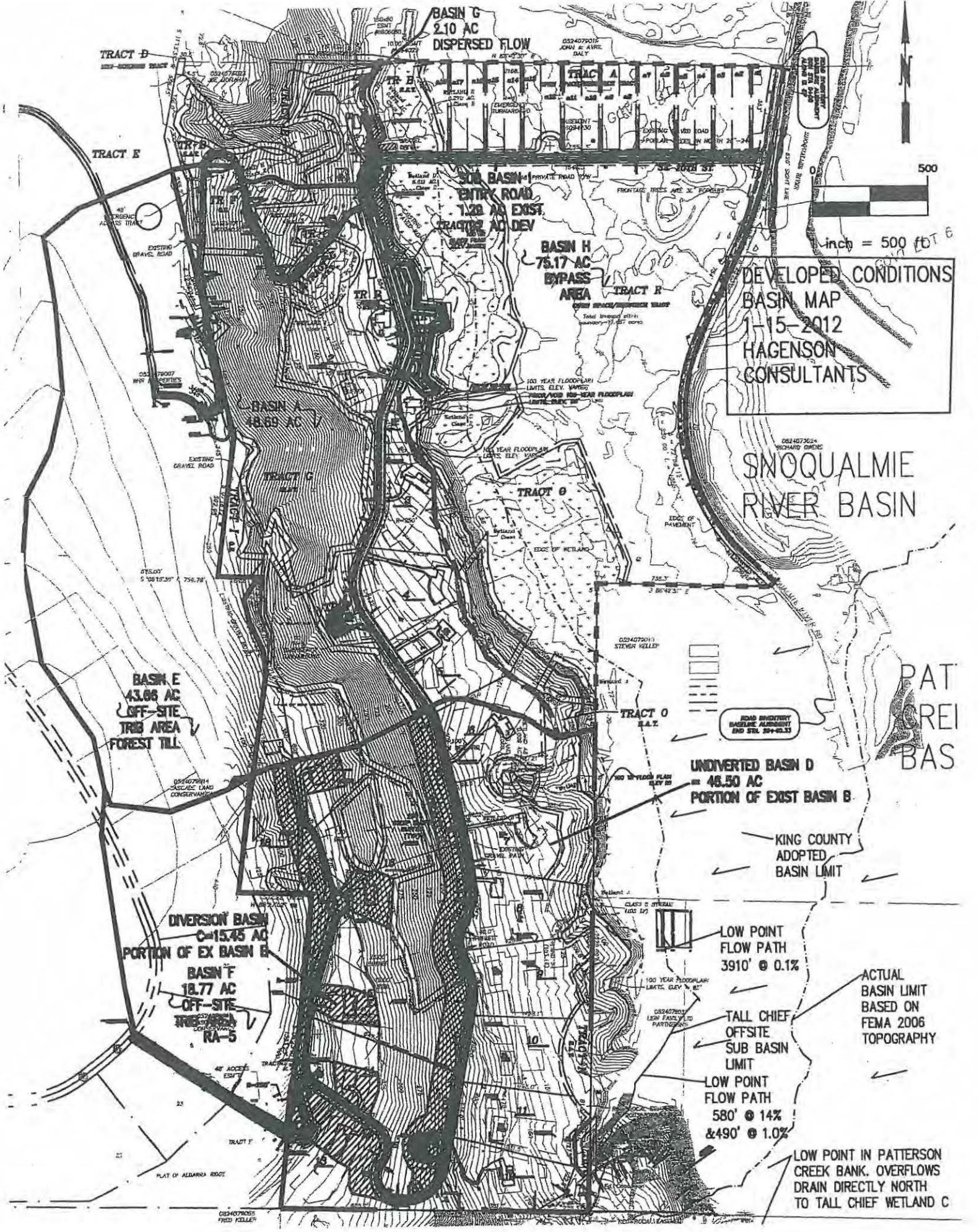
VALUES ESTABLISHED IN TIR (REV 2/17/11)

- POINT OF COMPLIANCE AT OUTLET OF WETLAND D - 48" CULVERT (WETLAND A, C, D connected by culverts at same elev).
- ALL LOTS HAVE 65% OPEN SPACE
- DESIGN PER 1998 KCSWM
- LEVEL 2 FLOW CONTROL
- SCALE FACTOR LA 1.0
- SOILS CLASS C (AG & NK)
- 15 MIN. TIME STEPS PER KCSWM 3-23
- HISTORIC RELOAD PER KCSWM Pg 3-23
- 8000 SF = 0.18 Ac/LOT EFFE. IMPERV SWMP 3-28
- 35% MAX CLEARING (65% NGPE).

EXISTING CONDITIONS (IN ACRES)

BASIN	IMPERV ROADS	IMPERV ROOF & DW	GOLF COURSE PERV LAWNS	PERV PASTURE	PERV FOREST	TOTAL	KCRTS FILE NAME
ONSITE							
A	0.55	0.4	11.64	⊖	36.1	48.69	
E	1.03	3 LOTS ALREADY = 3X0.18 + 0.49 (CAMPGROUND) = 1.04	6.70 CAMPGROUND	⊖	34.89	43.66	
SUBTOT	1.58	1.44	18.34	⊖	70.99	92.35 ✓	PREDEV AE
SOUTHERN BYPASS							
B	⊖	⊖	14.69 GOLF COURSE	⊖	47.26	61.95	
F	0.6	3 LOTS ALREADY = 3X0.18 = 0.54	1.8	⊖	15.83	18.77	
SUBTOTAL	0.6	0.54	16.49	⊖	63.09	80.72 ✓	PREDEV BF — LAG 43.67 min
ONSITE BYPASS							
H	1.29	⊖	⊖	73.88	⊖	75.17	PREDEV H — LAG 8 min.
				TOTAL		248.24	

FLOW PATH	IMPERV	GRASS
BASIN AE & BF	20' @ 10% (HOUSE)	200' @ 10%
Basin predev h	50' @ 1% ROAD	


BASIN G
2.10 AC
DISPERSED FLOW
TRACT D
TRACT A
TRACT E
SUB BASIN
ENTRY ROAD
1.28 AC EXIST.
TRACT 2 AC DEV
BASIN H
75.17 AC
BYPASS
AREA
TRACT R
0
500
inch = 500 ft
DEVELOPED CONDITIONS
BASIN MAP
1-15-2012
HAGENSON
CONSULTANTS
BASIN A
48.69 AC
TRACT G
TRACT O
SNOQUALMIE
RIVER BASIN
BASIN E
43.06 AC
OFF-SITE
TRIB AREA
FOREST TILL
TRACT O
UNDIVERTED BASIN D
= 46.50 AC
PORTION OF EXIST BASIN B
KING COUNTY
ADOPTED
BASIN LIMIT
DIVERSION BASIN
C=15.45 AC
PORTION OF EX BASIN B
BASIN F
18.77 AC
OFF-SITE
TRIB AREA
RA-5
LOW POINT
FLOW PATH
3910' @ 0.1%
ACTUAL
BASIN LIMIT
BASED ON
FEMA 2006
TOPOGRAPHY
TALL CHIEF
OFFSITE
SUB BASIN
LIMIT
LOW POINT
FLOW PATH
580' @ 14%
&490' @ 1.0%
LOW POINT IN PATTERSON
CREEK BANK. OVERFLOWS
DRAIN DIRECTLY NORTH
TO TALL CHIEF WETLAND C

TALL CHIEF	POINT OF COMPLIANCE ANALYSIS	1/16/22

DEVELOPED CONDITIONS. (144 ACRES)

NOTE- ASSUME 8000 SF/LOT MAX IMPERV PER KCSWM Pg 3-27.

BASIN	IMPERV ROADS	IMPERV ROOF & PW	PERV LAWNS	PERV PASTURE	PERV FOREST	TOTAL	KCRTS FILENAME
OUTSITE DRAINS TO WET/DETENTION POND							
A	2.45	LOTS 1-5, 18 x 0.18 + 0.4 (EXIST) = 1.48 (w/o 50% Credit)	15.9 AC OF LOTS X 35% = 5.65 - 1.48 IMP = = 4.09	⊖	remainder 40.67	48.69	
C DIVERSION BASIN PORTION OF EXIST BASIN B	3.71	LOTS 13-17 x 0.18 = 0.9	22.67 AC LOTS X 35% = 7.9 - 0.9 IMP = 7.93	⊖	remainder 2.91	15.45	
E	1.03	1.04	6.70	⊖	34.89	43.66	
SUBTOT	7.19	3.42	18.72	⊖	78.47	107.80 ✓	min dev ace = dev ace
SOUTHERN BYPASS							
D NON DIVERSION PORTION OF EXIST BASIN B	⊖	LOTS 6-12 x 0.18 = 1.26	21.42 AC of LOTS X 35% = 7.50 - 1.26 IMP = 6.24	0	39.0	46.50	
F	0.6	0.54	1.8	⊖	15.83	18.77	DEV DF
SUBTOT	0.6	1.8	8.04	⊖	54.83	65.27 ✓	LAG 45 minutes
OUTSITE BYPASS							
H	1.95	⊖	⊖	73.22		75.17	LAG 0
					TOTAL	248.24 ✓	Dev h

FLOWPATH	IMPERV	IG BASS	
BASIN ace	50' @ 0.77% ROAD	200' @ 10%	dev df (lagged 45 minutes) + dev h = bypass
BASIN de	20' @ 10% HOUSE	200' @ 10%	
BASIN dev h	50' @ 1% road		

TALL CHIEF | POINT OF COMPLIANCE ANALYSIS | 1/16/12

LAG (TIME OF CONCENTRATION) FOR BYPASS BASIN PREDEV & dev df.

PT (A) TO PT (B) $L = 180'$ $S = 25\%$ $K_R = 20.0$ - SHALLOW CHANNEL

$V = K_R\sqrt{S} = 20\sqrt{0.25} = 10$ fps, $T_c = L/60V = 180/60 \times 10 = \underline{0.3}$ MIN

PT (B) TO PT (C) $L = 141'$ $S = 1.2\%$ $K_R = 15.0$ - GRASS DITCH

$V = 15\sqrt{0.012} = 1.6$ FPS $T_c = 141/60 \times 1.6 = \underline{1.47}$ MIN

PT (C) TO PT (D) $L = 1676'$ $S = 0.197\%$ $K_r = 15$ - GRASS DITCH

@ wetland upropline $V = 15\sqrt{0.00197} = 0.66$ fps $T_c = 1676/_{0.66 \times 60} = 41.9$ min.

NOTE: NO LAG REQD THRU wetland

TOTAL 43.67 min.

43.67 ÷ 15 min TIME STEP
= 3.0 TIME STEPS.

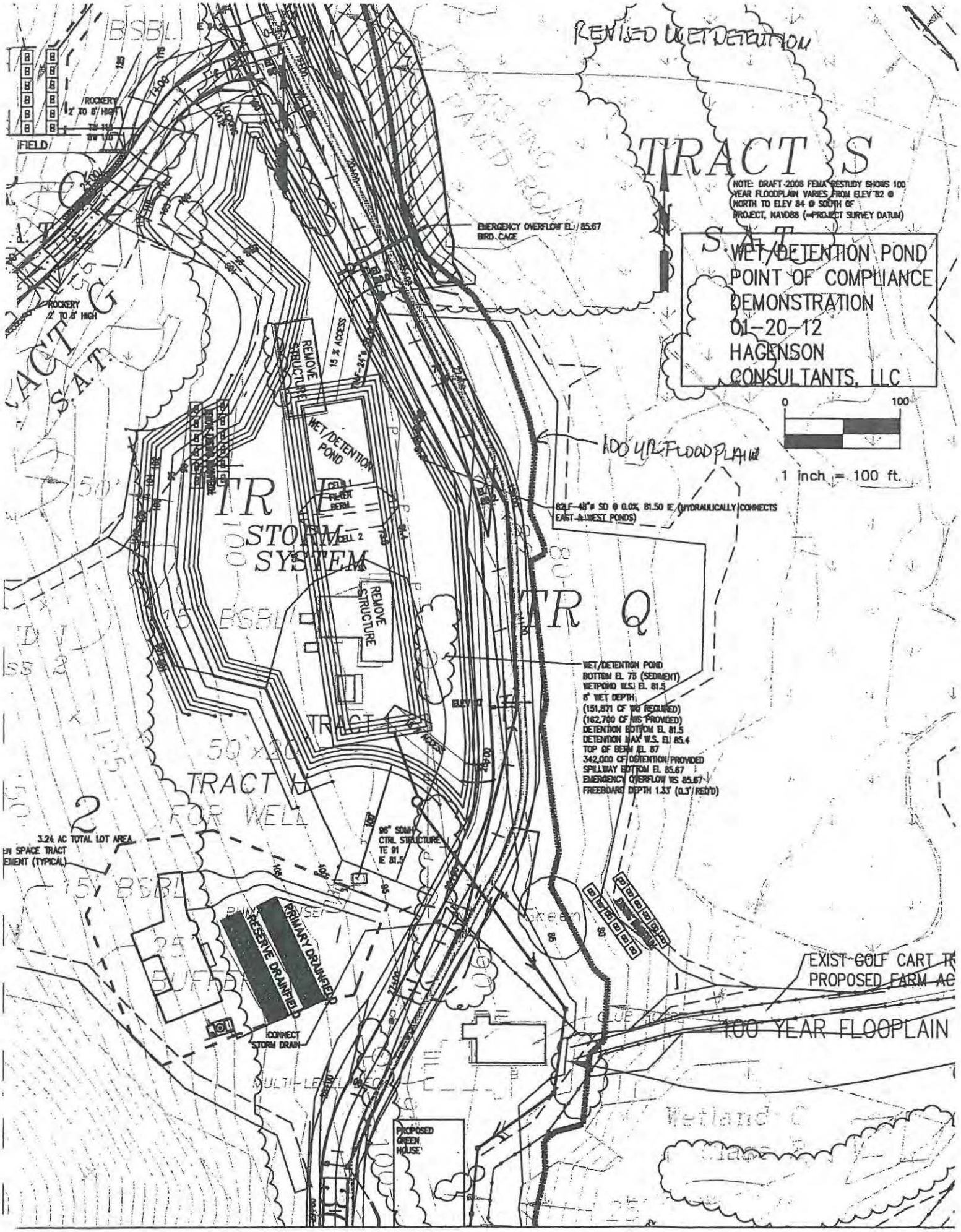
TALL CHIEF | POINT OF COMPLIANCE | 1-18-12

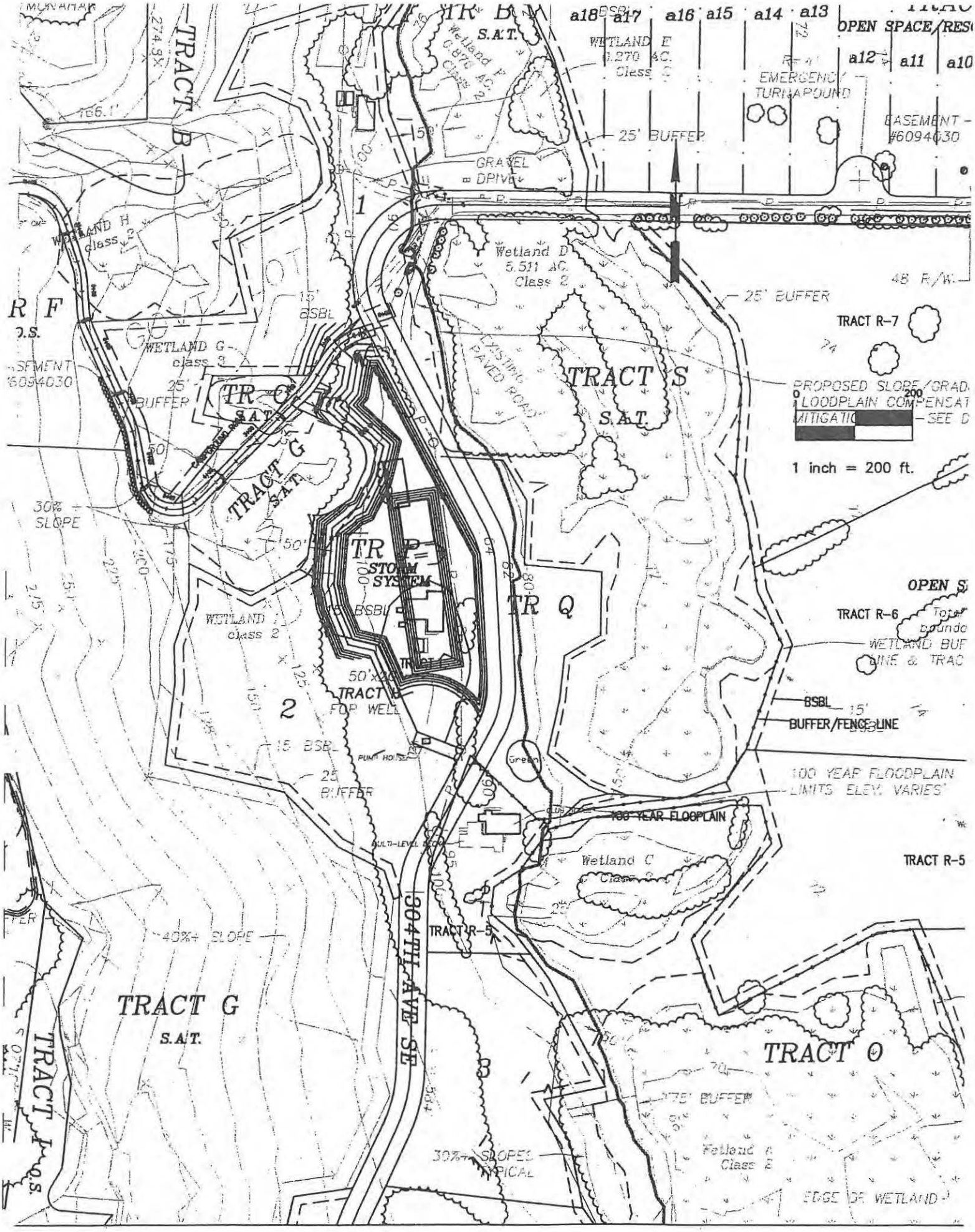
ANALYSIS

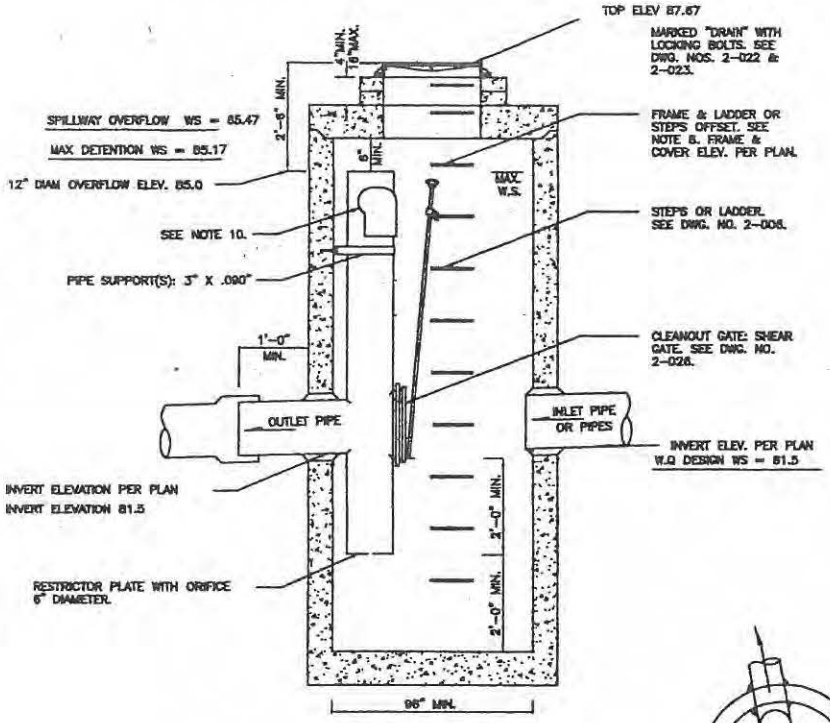
REVISED WET-DETENTION POND - SIMILAR TO PRIOR POND BUT AGGREGATED VOLUMES INTO 1 POND TO ELIMINATE FLOOD PLAIN INTRUSION

	ELEVATION	AREA	INCREMENTAL VOLUME	VOLUME	
	73.0	SEDIMENT STORAGE			
	73.5	14639	0	0	
	75.5	17,296	31935	31935	
	77.5	20,081	37377	69312	
	79.5	22994	43075	112,387	
	81.4	26035	46577	158,964	MAX WET POND EL WET POND VOL REQD = 152000 ✓OK
WET POND DETENTION	81.5	62805	0	0	
	83	67635	97830	97830	
	85	73306	140941	238771	
	85.4	74762	103648	342,419	
	87	79130	123113	465,532	

62,805 SF = = 250' x 250'
2:1 SS
STORAGE D = 3.9'

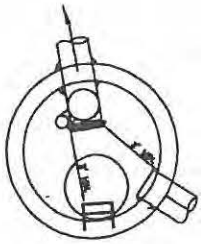

REVISED WET DETENTION
TRACT S
NOTE: DRAFT 2008 FEMA RESTUDY SHOWS 100 YEAR FLOODPLAIN VARIES FROM ELEV 82 @ NORTH TO ELEV 84 @ SOUTH OF PROJECT, NAVD88 (~PROJECT SURVEY DATUM)
WET/DETENTION POND
POINT OF COMPLIANCE
DEMONSTRATION
01-20-12
HAGENSON
CONSULTANTS, LLC
0
100
1 inch = 100 ft.
EMERGENCY OVERFLOW EL. 85.67
BIRD CAGE
ROCKERY
2' TO 8' HIGH
REMOVE STRUCTURE
15' ACCESS
WET/DETENTION POND
CELL 1
FILTER BERM
CELL 2
STORM SYSTEM
100 YR FLOODPLAIN
82LF-48"ø SD @ 0.0%, 81.50 IE (HYDRAULICALLY CONNECTS EAST & WEST PONDS)
TR Q
WET/DETENTION POND
BOTTOM EL. 78 (SEDIMENT)
WETPOND W.S. EL. 81.5
6' WET DEPTH
(151,871 CF WQ REQUIRED)
(162,700 CF WQ PROVIDED)
DETENTION BOTTOM EL. 81.5
DETENTION MAX W.S. EL. 85.4
TOP OF BERM EL. 87
342,000 CF DETENTION PROVIDED
SPILLWAY BOTTOM EL. 85.67
EMERGENCY OVERFLOW WS 85.67
FREEBOARD DEPTH 1.33' (0.3' REQ'D)
TRACT H
FOR WELL
3.24 AC TOTAL LOT AREA
96" SDMH
CTRL. STRUCTURE
TE 91
IE 81.5
RESERVE DRAINFIELD
PRIMARY DRAINFIELD
CONNECT STORM DRAIN
EXIST GOLF CART TR
PROPOSED FARM AC
100 YEAR FLOODPLAIN
PROPOSED GREEN HOUSE
Wetland C


TRACT B
S.A.T.
WETLAND E
0.270 AC.
Class 3
EMERGENCY TURNAROUND
25' BUFFER
EASEMENT - #6094030
GRAVEL DRIVE
WETLAND H
class 3
Wetland D
5.511 AC.
Class 2
48 R/W
TRACT R-7
WETLAND G
class 3
TRACT S
S.A.T.
EXISTING PAVED ROAD
PROPOSED SLOPE/GRAD
FLOODPLAIN COMPENSAT
MITIGATIO
SEE D
1 inch = 200 ft.
TRACT G
S.A.T.
30% SLOPE
TR P
STORM SYSTEM
TR Q
WETLAND I
class 2
TRACT R-6
WETLAND BUF
LINE & TRAC
BSBL
BUFFER/FENCE LINE
50'x20'
TRACT H
FOR WELL
PUMP HOUSE
100 YEAR FLOODPLAIN
LIMITS ELEV. VARIES
100 YEAR FLOODPLAIN
Wetland C
Class 2
TRACT R-5
40%+ SLOPE
TRACT R-5
104TH AVE SE
TRACT G
S.A.T.
TRACT O
TRACT I
Q.S.
30%+ SLOPES TYPICAL
Wetland A
Class 2
EDGE OF WETLAND



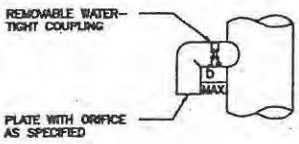
CATCH BASIN TYPE 2
DIAM. AS REQUIRED
SEE DWG. NO. 2-005.

NOTES:
1. PIPE SIZES AND SLOPES: PER PLANS.
2. OUTLET CAPACITY: NOT LESS THAN COMBINED INLETS.
3. EXCEPT AS SHOWN OR NOTED, UNITS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE REQUIREMENTS FOR CATCH BASIN TYPE 2, 54" MIN. DIAM.
4. PIPE SUPPORTS AND RESTRICTOR/SEPARATOR SHALL BE OF SAME MATERIAL, AND BE ANCHORED AT 3' MAX. SPACING BY 5/8" DIAM. STAINLESS STEEL EXPANSION BOLTS OR EMBEDDED 2" IN WALL.
5. THE RESTRICTOR/SEPARATOR SHALL BE FABRICTED FROM .060" ALUMINUM, OR .064" ALUMINIZED STEEL, OR .064" GALVANIZED STEEL PIPE; IN ACCORDANCE WITH AASHTO M 36, M 196, M 197 AND M 274. GALVANIZED STEEL SHALL HAVE TREATMENT 1.
6. OUTLET SHALL BE CONNECTED TO CULVERT OR SEWER PIPE WITH A STANDARD COUPLING BAND FOR CORRUGATED METAL PIPE, OR GROUTED INTO THE BELL OF CONCRETE PIPE.
7. THE VERTICAL RISER STEM OF THE RESTICTOR/SEPARATOR SHALL BE THE SAME DIAM. AS THE HORIZONTAL OUTLET PIPE, WITH AN 8" MIN. DIAM.
8. FRAME AND LADDER OR STEPS OFFSET SO THAT: A. CLEANOUT GATE IS VISIBLE FROM TOP. B. CLIMB DOWN SPACE IS CLEAR OF RISER AND CLEANOUT GATE.
C. FRAME IS CLEAR OF CURB.
9. IF METAL OUTLET PIPE CONNECTS TO CEMENT CONCRETE PIPE: OUTLET PIPE TO HAVE SMOOTH O.D. EQUAL TO CONCRETE PIPE I.D. LESS 1/4".
10. MULTI-ORIFICE ELBOWS MAY BE LOCATED AS SHOWN OR ALL ON ONE SIDE OF RISER TO ASSURE LADDER CLEARANCE.
ORFICE # 1 (BOTTOM) ϕ= 6 IN.
ORFICE # 2 (TOP) ϕ= 16 IN. ELEV = 83.5.5



PLAN

CONTROL MH DATA	SINGLE POND
CATCH BASIN DIAM	96"
TOP ELEV	ELEV 91.0
RISER DIAMETER	48"
RISER ELEV	ELEV 85.4
OUTLET DIAM	24"
OUTLET INV	81.5
ORFICE #1 DIAM	4" @ EL 81.5
ORF #2 DIAM	14" @ EL 82.5

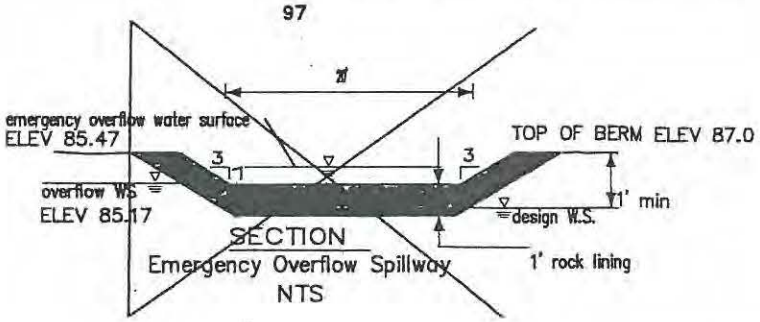


ELBOW DETAIL

FLOW RESTRICTOR / OIL POLLUTION CONTROL DEVICE, TEE TYPE (FROP-T)

2-025

97



USE BIRD CAGE OVERFLOW

POND CONTROL STRUCTURE & SPILLWAY DETAILS
01-20-2012

```
                    Version 6.00
All files will be read/written in the Working Directory
Working Directory:C:\kc_swdm\output
------------------------------------------------------------
                    KCRTS Command

                    CREATE a new Time Series

                Production of Runoff Time Series
   Project Location . Landsburg
    Computing Series  predevae.tsf
Regional Scale Factor    1.00
         Data Type . Historic
Creating 15-minute Time Series File
              Loading Time Series File:C:\KC_SWDM\KC_DATA\LATF15H.rnf  50
Till Forest      70.99 acres              Scaling  Yr:50
              Loading Time Series File:C:\KC_SWDM\KC_DATA\LATG15H.srf  50
                     Flow Path: Length   200.00 ft @ Slope  0.100000
Till Grass       18.34 acres          Adding  Yr:50
              Loading Time Series File:C:\KC_SWDM\KC_DATA\LAEI15H.srf  50
                     Flow Path  Length    20.00 ft @ Slope  0.100000
Impervious        3.02 acres          Adding  Yr:50
                 ---------
       Total Area    92.35 acres
Peak Discharge:  26.17 CFS at  6:00 on May 14 in 1996
                              Storing Time Series File:predevae.tsf  50

                    Time Series Computed
------------------------------------------------------------
                    KCRTS Command

                    CREATE a new Time Series

                Production of Runoff Time Series
   Project Location : Landsburg
    Computing Series : predevbf.tsf
Regional Scale Factor    1.00
         Data Type : Historic
Creating 15-minute Time Series File
              Loading Time Series File:C:\KC_SWDM\KC_DATA\LATF15H.rnf  50
Till Forest      63.09 acres              Scaling  Yr:50
              Loading Time Series File:C:\KC_SWDM\KC_DATA\LATG15H.srf  50
                     Flow Path: Length   200.00 ft @ Slope  0.100000
Till Grass       16.49 acres          Adding  Yr:50
              Loading Time Series File:C:\KC_SWDM\KC_DATA\LAEI15H.srf  50
                     Flow Path: Length    20.00 ft @ Slope  0.100000
Impervious        1.14 acres          Adding  Yr:50
                 ---------
       Total Area    80.72 acres
Peak Discharge  21.63 CFS at  6:00 on May 14 in 1996
                              Storing Time Series File:predevbf.tsf  50

                    Time Series Computed
```

```
Impervious          1.14 acres          Adding  Yr:50

      Total Area .   80.72 acres
Peak Discharge:  21.63 CFS at  6:00 on May 14 in 1996
                              Storing Time Series File:predevbf.tsf  50

                    Time Series Computed
____________________________________________________________________

                         XCRTS Command

                       CREATE a new Time Series

                  Production of Runoff Time Series
   Project Location . Landsburg
    Computing Series . predevh.tsf
Regional Scale Factor     1.00
          Data Type  Historic
Creating 15-minute Time Series File
                Loading Time Series File:C:\KC_SWDM\KC_DATA\LATP15H.rnf  50
Till Pasture        73.88 acres                Scaling  Yr:50
                Loading Time Series File:C:\KC_SWDM\KC_DATA\LAEI15H.srf  50
                        Flow Path: Length   50.00 ft @ Slope  0.010000
Impervious          1.29 acres          Adding  Yr:50

      Total Area .   75.17 acres
Peak Discharge:  26.97 CFS at  4:30 on Sep 18 in 1997
                              Storing Time Series File:predevh.tsf  50

                    Time Series Computed
____________________________________________________________________

                         XCRTS Command

                       CREATE a new Time Series

                  Production of Runoff Time Series
   Project Location  Landsburg
    Computing Series  devace.tsf
Regional Scale Factor     1.00
          Data Type  Historic
Creating 15-minute Time Series File
                Loading Time Series File:C:\KC_SWDM\KC_DATA\LATF15H.rnf  50
Till Forest         78.47 acres                Scaling  Yr:50
                Loading Time Series File:C:\KC_SWDM\KC_DATA\LATG15H.srf  50
                        Flow Path: Length  200.00 ft @ Slope  0.100000
Till Grass          18.72 acres          Adding  Yr:50
                Loading Time Series File:C:\KC_SWDM\KC_DATA\LAEI15H.srf  50
                        Flow Path: Length   50.00 ft @ Slope  0.007700
Impervious          10.61 acres          Adding  Yr:50

      Total Area    107.80 acres
Peak Discharge:  35.67 CFS at  6:00 on May 14 in 1996
                              Storing Time Series File:devace.tsf  50

                    Time Series Computed
```

```
                    Storing Time Series File:devace.tsf  50

                    Time Series Computed
------------------------------------------------------------
                    KCRTS Command
                    -------------
                    CREATE a new Time Series
                    ------------------------

                Production of Runoff Time Series
   Project Location : Landsburg
    Computing Series : devdf.tsf
Regional Scale Factor :   1.00
          Data Type : Historic
Creating 15-minute Time Series File
                Loading Time Series File:C:\KC_SWDM\KC_DATA\LATF15H.rnf  50
Till Forest        54.83 acres              Scaling  Yr:50
                Loading Time Series File:C:\KC_SWDM\KC_DATA\LATG15H.srf  50
                      Flow Path: Length   200.00 ft @ Slope  0.100000
Till Grass          8.04 acres          Adding  Yr:50
                Loading Time Series File:C:\KC_SWDM\KC_DATA\LAET15H.srf  50
                      Flow Path: Length    20.00 ft @ Slope  0.100000
Impervious          2.40 acres          Adding  Yr:50
                  ----------
       Total Area :   65.27 acres
Peak Discharge:  15.62 CFS at  6:00 on May 14 in 1996
                    Storing Time Series File:devdf.tsf  50

                    Time Series Computed
------------------------------------------------------------
                    KCRTS Command
                    -------------
                    CREATE a new Time Series
                    ------------------------

                Production of Runoff Time Series
   Project Location : Landsburg
    Computing Series  devh.tsf
Regional Scale Factor :   1.00
          Data Type  Historic
Creating 15-minute Time Series File
                Loading Time Series File:C:\KC_SWDM\KC_DATA\LATP15H.rnf  50
Till Pasture       73.22 acres              Scaling  Yr:50
                Loading Time Series File:C:\KC_SWDM\KC_DATA\LAET15H.srf  50
                      Flow Path: Length    50.00 ft @ Slope  0.010000
Impervious          1.95 acres          Adding  Yr:50
                  ----------
       Total Area :   75.17 acres
Peak Discharge:  27.36 CFS at  4:30 on Sep 18 in 1997
                    Storing Time Series File:devh.tsf  50

                    Time Series Computed
```

Rdin = dev ace (developed basin a,c,e)

```
                    Storing Time Series File:devdf.tsf  50

                Time Series Computed
-------------------------------------------------------------
                    KCRTS Command

                CREATE a new Time Series

              Production of Runoff Time Series
   Project Location  Landsburg
   Computing Series  devh.tsf
Regional Scale Factor    1.00
         Data Type  Historic
Creating 15-minute Time Series File
            Loading Time Series File:C:\KC_SWDM\KC_DATA\LATP15H.rnf  50
Till Pasture      73.22 acres            Scaling  Yr:50
            Loading Time Series File:C:\KC_SWDM\KC_DATA\LAET15H.srf  50
                  Flow Path: Length   50.00 ft @ Slope  0.010000
Impervious         1.95 acres        Adding  Yr:50

      Total Area    75.17 acres
Peak Discharge:  27.36 CFS at  4:30 on Sep 18 in 1997
                    Storing Time Series File:devh.tsf  50

                Time Series Computed
-------------------------------------------------------------
                    KCRTS Command

                CREATE a new Time Series

              Production of Runoff Time Series
   Project Location  Landsburg
   Computing Series  rdin.tsf
Regional Scale Factor :   1.00
         Data Type  Historic
Creating 15-minute Time Series File
            Loading Time Series File:C:\KC_SWDM\KC_DATA\LATF15H.rnf  50
Till Forest       78.47 acres            Scaling  Yr:50
            Loading Time Series File:C:\KC_SWDM\KC_DATA\LATG15H.srf  50
                  Flow Path  Length  200.00 ft @ Slope  0.100000
Till Grass        18.72 acres        Adding  Yr:50
            Loading Time Series File:C:\KC_SWDM\KC_DATA\LAET15H.srf  50
                  Flow Path  Length   50.00 ft @ Slope  0.007700
Impervious        10.61 acres        Adding  Yr:50

      Total Area :  107.80 acres
Peak Discharge:  35.67 CFS at  6:00 on May 14 in 1996
                    Storing Time Series File:rdin.tsf  50

                Time Series Computed
```

Target.tsf=predev ae + predev bf lagged by 45 minutes to wetland c (=3 ea 15 min time steps)+predev h

```
                    CANCELLED

                    HCRTS Command

                    ADD Time Series

                    Adding Time Series
Computing Series:target.tsf
                    Loading Time Series File:predevae.tsf  50
Peak Flow Rate  26.17 CFS at  6:00 on May 14 in 1996
                Lag=  0.00   Factor:  1.00
                    Loading Time Series File:predevbf.tsf  50
Peak Flow Rate  21.63 CFS at  6:00 on May 14 in 1996
                Lag=  3.00   Factor:  1.00 Completed  Yr:50
                    Loading Time Series File:predevh.tsf  50
Peak Flow Rate  26.97 CFS at  4:30 on Sep 18 in 1997
                Lag=  0.00   Factor:  1.00 Completed  Yr:50
Peak Flow Rate  50.05 CFS at  6:15 on May 14 in 1996
                    Storing Time Series File:target.tsf  50

                Time Series addition complete
```

```
                                    [ 7 0 0]
MAIN MENU [A]
                ADD TIMESERIES
  scales, lags (travel time) and sums multiple timeseries
  files.  Single timeseries may also be scaled or lagged.
=================================================================
What you need
 Source timeseries files to be used (*.TSF)
 Lag (travel) times for the timeseries (default is 0.0)
 Scale Factor for the timeseries (default is 1.0)
  (scale factor = 5.0 will multiply each timestep of
   timeseries specified)
-----------------------------------------------------------------
The routine will
 Sum/Scale the timeseries files as specified
 Save the composite runoff timeseries to a file (*.TSF)

 Note: The saved timeseries will be in the standard runoff
  format.  Stage data from source timeseries will not be car
```

20.89	16	5/10/81 22:00	12.21	33	1.54	0.350
10.38	43	1/23/82 20:45	12.14	34	1.49	0.330
15.09	26	1/05/83 6:45	11.84	35	1.45	0.310
27.85	7	10/30/83 13:00	11.49	36	1.41	0.291
10.42	42	11/01/84 22:15	11.39	37	1.37	0.271
19 82	20	10/22/85 16:15	11.02	38	1.33	0.251
21.01	15	11/21/86 8:00	10.90	39	1.30	0.231
12.14	34	5/01/88 17:00	10.83	40	1.27	0.211
10.90	39	11/22/88 12:45	10 63	41	1.24	0.191
43.95	2	1/09/90 11:15	10.42	42	1.21	0.171
26.21	9	4/04/91 18:00	10.38	43	1.18	0.151
18.47	21	4/18/92 18:00	9.99	44	1.15	0.131
22.20	14	5/21/93 15:00	9.80	45	1.12	0.111
11.49	36	12/10/93 6:30	9.70	46	1.10	0.091
12.70	32	2/19/95 17:15	8.84	47	1.08	0.071
50.05	1	5/14/96 6:15	8.23	48	1.05	0.051
41.21	3	9/18/97 4:30	7.29	49	1.03	0.031
10.63	41	10/30/97 6:00	6.70	50	1.01	0.011
Computed Peaks			56.76		100.00	0.990
Computed Peaks			47.91		50.00	0.980
Computed Peaks			39.93		25.00	0.960
Computed Peaks			30.50		10.00	0.900
Computed Peaks			28.73		8.00	0.875
Computed Peaks			24.01		5.00	0.800
Computed Peaks			15.76		2.00	0.500
Computed Peaks			11.25		1.30	0.231

Compute target flow durations

Analysis Tools Command

Compute Flow DURATION and Exceedence

Loading Stage/Discharge curve:target.tsf

Computing Interval Locations

Computing Flow DurationsCompleted Yr:50

Durations & Exceedence Probabilities to File:target.dur

Computing Durations:

Flow Duration from Time Series File:target.tsf

Cutoff CFS	Count	Frequency %	CDF %	Exceedence %	Probability
1.19	1442869	82.356	82.356	17.644	0.176E+00
3.52	242306	13.830	96.186	3.814	0.381E-01
5.84	47509	2.712	98.897	1.103	0.110E-01
8.17	11763	0.671	99.569	0.431	0.431E-02
10.50	4495	0.257	99.825	0.175	0.175E-02
12.82	1753	0.100	99.926	0.074	0.745E-03
15.15	548	0.031	99.957	0.043	0.432E-03
17.48	256	0.015	99.971	0.029	0.286E-03
19.80	223	0.013	99.984	0.016	0.159E-03
22.13	173	0.010	99.994	0.006	0.599E-04
24.45	70	0.004	99.998	0.002	0.200E-04
26.78	13	0.001	99.999	0.001	0.126E-04
29.11	9	0.001	99.999	0.001	0.742E-05
31.43	5	0.000	100.000	0.000	0.457E-05
33.76	0	0.000	100.000	0.000	0.457E-05
36.09	0	0.000	100.000	0.000	0.457E-05
38.41	2	0.000	100.000	0.000	0.342E-05
40.74	2	0.000	100.000	0.000	0.228E-05
43.06	1	0.000	100.000	0.000	0.171E-05
45.39	2	0.000	100.000	0.000	0.571E-06
47.72	0	0.000	100.000	0.000	0.571E-06
50.04	0	0.000	100.000	0.000	0.571E-06

Compute rd in peaks

Coapute PEAKS and Flow Frequencies

Loading Stage/Discharge curve:rdin.tsf

Flow Frequency Analysis LogPearson III Coefficients

Time Series File:rdin.tsf Mean= 1.137 StdDev= 0.172

Project Location:Landsburg Skew= 0.144

Frequencies & Peaks saved to File:rdin.pks

Flow Frequency Analysis LogPearson III Coefficients

Time Series File:rdin.tsf Mean= 1.137 StdDev= 0.172

Project Location:Landsburg Skew= 0.144

—Annual Peak Flow Rates—			——Flow Frequency Analysis——			
Flow Rate (CFS)	Rank	Time of Peak	- - Peaks - - (CFS)	Rank	Return Period	Prob
17.16	15	2/16/49 17:30	35.66	1	89.50	0.989
27.73	3	3/03/50 14:45	29.31	2	32.13	0.969
14.25	23	2/09/51 3:00	27 73	3	19.58	0.949
9.99	40	11/28/51 18:15	25.95	4	14.08	0.929
10.42	37	2/03/53 16:30	22.49	5	10.99	0.909
13.52	26	9/16/54 16:00	21 81	6	9.01	0.889
8.44	46	5/13/55 0:15	21.40	7	7.64	0.869
7.70	47	12/22/55 6:15	20.64	8	6.63	0.849
10 49	36	2/24/57 13:15	19.42	9	5 86	0.829
10.32	39	12/25/57 16:00	19.17	10	5.24	0.809
19 42	9	9/26/59 13:15	18.23	11	4.75	0 789
11 53	32	10/24/59 10.45	18.21	12	4.34	0.769
8 73	44	2/14/61 20:15	17.98	13	3.99	0 749
5 48	50	1/02/62 20:00	17.39	14	3.70	0.729
17.06	16	2/28/63 19:00	17.16	15	3.44	0.709
22.49	5	6/18/64 17:45	17.06	16	3.22	0.690
11.20	34	11/24/64 2:30	16 92	17	3.03	0.670
9.40	41	5/06/66 7.15	16.57	18	2.85	0.650
11.49	33	2/17/67 14:15	15.89	19	2.70	0.630
13.58	25	6/02/68 3:15	15.30	20	2 56	0.610
17.98	13	6/23/69 20:00	14.97	21	2 44	0 590
7.30	49	1/24/70 4:00	14.30	22	2 32	0.570
16.57	18	9/02/71 2:00	14.25	23	2.22	0.550
21.81	6	9/10/72 13:45	14.05	24	2.13	0.530
7 49	48	10/25/72 10:00	13.58	25	2.04	0.510
14 05	24	11/11/73 0:30	13.52	26	1.96	0.490
19.17	10	12/27/74 1:00	13.43	27	1.89	0.470
11.94	31	12/29/75 13.30	13.11	28	1 82	0 450
14.97	21	8/25/77 23:30	12.68	29	1.75	0 430
14.30	22	12/01/77 20:30	12.51	30	1.70	0.410
8.72	45	10/23/78 18:45	11.94	31	1.64	0 390
13.11	28	12/15/79 6:15	11.53	32	1.59	0.370
18.23	11	5/10/81 22:00	11.49	33	1.54	0.350
9.21	42	10/06/81 1:00	11.20	34	1.49	0.330
10.34	38	7/13/83 4:15	10.96	35	1.45	0.310
20.64	8	1/24/84 15:00	10.49	36	1.41	0.291
8.78	43	11/01/84 20:00	10.42	37	1.37	0.271
15.30	20	10/22/85 16:15	10.34	38	1.33	0.251

9.99	40	11/28/51	18:15	25.95	4	14.08	0.929
10.42	37	2/03/53	16:30	22.49	5	10.99	0.909
13.52	26	9/16/54	16:00	21.81	6	9.01	0.889
8.44	46	5/13/55	0:15	21.40	7	7.64	0.869
7.70	47	12/22/55	6:15	20.64	8	6.63	0.849
10.49	36	2/24/57	13:15	19.42	9	5.86	0.829
10.32	39	12/25/57	16:00	19.17	10	5.24	0.809
19.42	9	9/26/59	13:15	18.23	11	4.75	0.789
11.53	32	10/24/59	10:45	18.21	12	4.34	0.769
8.73	44	2/14/61	20:15	17.98	13	3.99	0.749
5.48	50	1/02/62	20:00	17.39	14	3.70	0.729
17.06	16	2/28/63	19:00	17.16	15	3.44	0.709
22.49	5	6/18/64	17:45	17.06	16	3.22	0.690
11.20	34	11/24/64	2:30	16.92	17	3.03	0.670
9.40	41	5/06/66	7:15	16.57	18	2.85	0.650
11.49	33	2/17/67	14:15	15.89	19	2.70	0.630
13.58	25	6/02/68	3:15	15.30	20	2.56	0.610
17.98	13	6/23/69	20:00	14.97	21	2.44	0.590
7.30	49	1/24/70	4:00	14.30	22	2.32	0.570
16.57	18	9/02/71	2:00	14.25	23	2.22	0.550
21.81	6	9/10/72	13:45	14.05	24	2.13	0.530
7.49	48	10/25/72	10:00	13.58	25	2.04	0.510
14.05	24	11/11/73	0:30	13.52	26	1.96	0.490
19.17	10	12/27/74	1:00	13.43	27	1.89	0.470
11.94	31	12/29/75	13:30	13.11	28	1.82	0.450
14.97	21	8/25/77	23:30	12.68	29	1.75	0.430
14.30	22	12/01/77	20:30	12.51	30	1.70	0.410
8.72	45	10/23/78	18:45	11.94	31	1.64	0.390
13.11	28	12/15/79	6:15	11.53	32	1.59	0.370
18.23	11	5/10/81	22:00	11.49	33	1.54	0.350
9.21	42	10/06/81	1:00	11.20	34	1.49	0.330
10.34	38	7/13/83	4:15	10.96	35	1.45	0.310
20.64	8	1/24/84	15:00	10.49	36	1.41	0.291
8.78	43	11/01/84	20:00	10.42	37	1.37	0.271
15.30	20	10/22/85	16:15	10.34	38	1.33	0.251
18.21	12	11/21/86	8:00	10.32	39	1.30	0.231
12.68	29	5/01/88	16:45	9.99	40	1.27	0.211
10.96	35	11/22/88	12:45	9.40	41	1.24	0.191
25.95	4	1/09/90	11:15	9.21	42	1.21	0.171
16.92	17	4/04/91	17:30	8.78	43	1.18	0.151
15.89	19	1/28/92	13:00	8.73	44	1.15	0.131
17.39	14	5/21/93	15:00	8.72	45	1.12	0.111
13.43	27	5/16/94	15:45	8.44	46	1.10	0.091
12.51	30	9/27/95	15:15	7.70	47	1.08	0.071
35.66	1	5/14/96	6:00	7.49	48	1.05	0.051
29.31	2	9/18/97	4:15	7.30	49	1.03	0.031
21.40	7	8/16/98	15:15	5.48	50	1.01	0.011
Computed Peaks				35.80		100.00	0.990
Computed Peaks				31.78		50.00	0.980
Computed Peaks				27.90		25.00	0.960
Computed Peaks				22.87		10.00	0.900
Computed Peaks				21.85		8.00	0.875
Computed Peaks				19.05		5.00	0.800
Computed Peaks				13.58		2.00	0.500
Computed Peaks				10.14		1.30	0.231

Compute rdin durations

Analysis Tools Command

Compute Flow DURATION and Exceedence

Loading Time Series File:rdin.tsf 50

Computing Interval Locations

Computing Flow DurationsCompleted Yr:50

Durations & Exceedence Probabilities to File:rdin.dur

12.51	30	9/27/95	15:15	7.70	47	1.08	0.071
35.66	1	5/14/96	6:00	7.49	48	1.05	0.051
29.31	2	9/18/97	4:15	7.30	49	1.03	0.031
21.40	7	8/16/98	15:15	5.48	50	1.01	0.011
Computed Peaks				35.80		100.00	0.990
Computed Peaks				31.78		50.00	0.980
Computed Peaks				27.90		25.00	0.960
Computed Peaks				22.87		10.00	0.900
Computed Peaks				21.85		8.00	0.875
Computed Peaks				19.05		5.00	0.800
Computed Peaks				13.58		2.00	0.500
Computed Peaks				10.14		1.30	0.231

Computing Durations.

Flow Duration from Time Series File:rdin.tsf

Cutoff CFS	Count	Frequency %	CDF %	Exceedence %	Probability
0.849	1567000	89.441	89.441	10.559	0.106E+00
2.51	157606	8.996	98.436	1.564	0.156E-01
4.16	20724	1.183	99.619	0.381	0.381E-02
5.82	4520	0.258	99.877	0.123	0.123E-02
7.48	1218	0.070	99.947	0.053	0.532E-03
9.13	489	0.028	99.975	0.025	0.253E-03
10.79	219	0.013	99.987	0.013	0.128E-03
12.45	95	0.005	99.993	0.007	0.736E-04
14.10	55	0.003	99.996	0.004	0.422E-04
15.76	25	0.001	99.997	0.003	0.280E-04
17.42	19	0.001	99.998	0.002	0.171E-04
19.08	13	0.001	99.999	0.001	0.970E-05
20.73	7	0.000	99.999	0.001	0.571E-05
22.39	3	0.000	100.000	0.000	0.400E-05
24.05	1	0.000	100.000	0.000	0.342E-05
25.70	1	0.000	100.000	0.000	0.285E-05
27.36	1	0.000	100.000	0.000	0.228E-05
29.02	1	0.000	100.000	0.000	0.171E-05
30.67	1	0.000	100.000	0.000	0.114E-05
32.33	1	0.000	100.000	0.000	0.571E-06
33.99	0	0.000	100.000	0.000	0.571E-06
35.65	0	0.000	100.000	0.000	0.571E-06

Bypass.tsf = dev df with 45 minutes (3 time step) lag + dev h

```
End Sizing Retention/Detention Facility

KCRTS Command

ADD Time Series

Adding Time Series
Computing Series:bypass.tsf
Loading Time Series File:devdf.tsf  50
Peak Flow Rate:  15.63 CFS at  6:00 on May 14 in 1996
Lag=  3.00   Factor:  1.00 Completed  Yr:50
Loading Time Series File:devh.tsf  50
Peak Flow Rate:  27.36 CFS at  4:30 on Sep 18 in 1997
Lag=  0.00   Factor:  1.00 Completed  Yr:50
Peak Flow Rate:  27.65 CFS at  4:30 on Sep 18 in 1997
Storing Time Series File:bypass.tsf  50

Time Series addition complete
```

Route rd in through pond and compare flow durations and peak flows

```
                    Route Time Series through Facility
                    ----------------------------------

                                Loading Time Series File:rdin.tsf  50
                               Loading Time Series File:bypass.tsf  50

                   Reservoir Routing [R/D Facility]
  Years Complete: 50
                        Inflow/Outflow Analysis
                        -----------------------

   Peak Inflow Discharge:     35.67 CFS at  6:00 on May 14 in 1996
  Peak Outflow Discharge:     10.21 CFS at 13:45 on Jan  9 in 1990
    Peak Reservoir Stage:      3.92  Ft
     Peak Reservoir Elev:     85.42  Ft
  Peak Reservoir Storage: 303537     Cu-Ft
                            6.968 Ac-Ft
                                Storing Time Series File:rdout.tsf  50
Add Time Series:bypass.tsf
   Peak Summed Discharge:     32.64 CFS at 11:15 on Jan  9 in 1990
                                Storing Time Series File:dsout.tsf  50
                            Frequencies & Peaks saved to File:rdout.pks

                 Peaks Calculation..Point of Compliance
                            Loading Stage/Discharge curve:dsout.tsf
        Flow Frequency Analysis      LogPearson III Coefficients
        ------------------------------------------------------------

  Time Series File:dsout.tsf            Mean=  1.135 StdDev=  0.177
  Project Location:Landsburg                   Skew=  0.254
                            Frequencies & Peaks saved to File:dsout.pks

                           Peaks Calculated

                            Peaks Plotting
                                Reading Flow Frequency:rdout.pks
                                Reading Flow Frequency:dsout.pks
                               Reading Flow Frequency:target.pks

                          End Graphics Command

                             Peaks Plotted

                   Duration Calculation..R/D Facility
Computing Interval Locations
Computing Flow Durations
Computing Durations:Completed  Yr:50
                   Durations & Exceedence Probabilities to File:rdout.dur

                 Duration Calculation..Point of Compliance
                                Loading Time Series File:dsout.tsf  50
Computing Interval Locations
Computing Flow Durations
Computing Durations:Completed  Yr:50
                   Durations & Exceedence Probabilities to File:dsout.dur

                           Duration Plotting
                               Loading Flow Duration File:rdout.dur
```

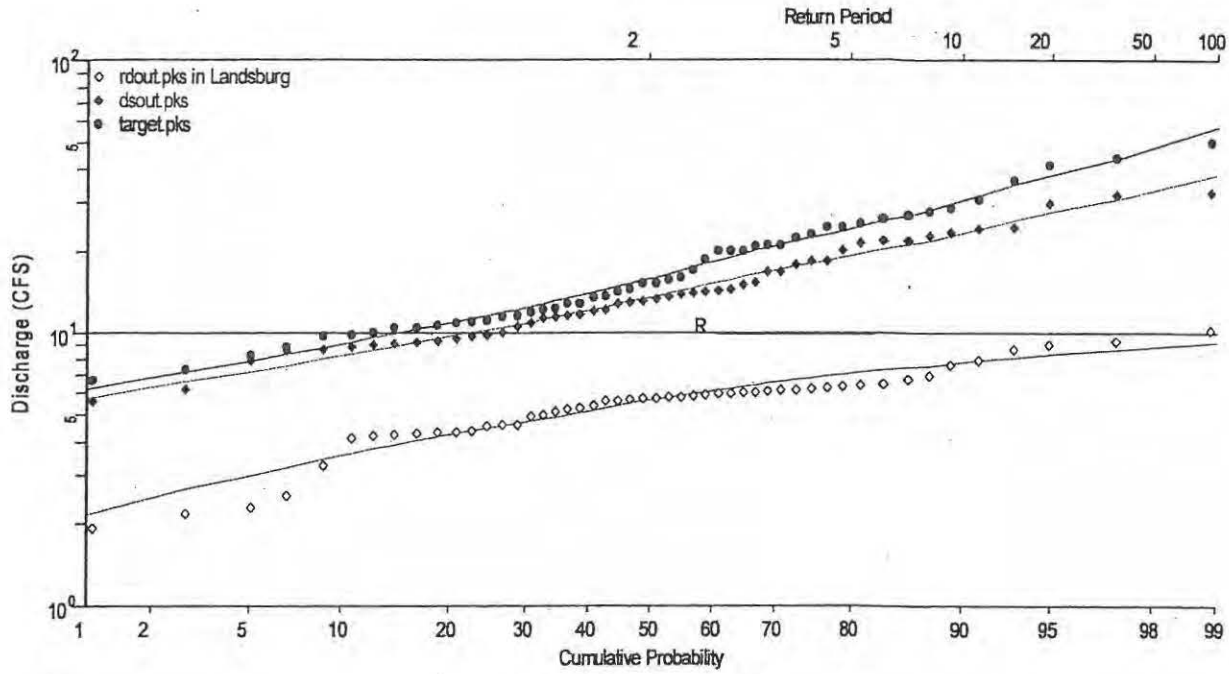
Flow Frequency Analysis LogPearson III Coefficients

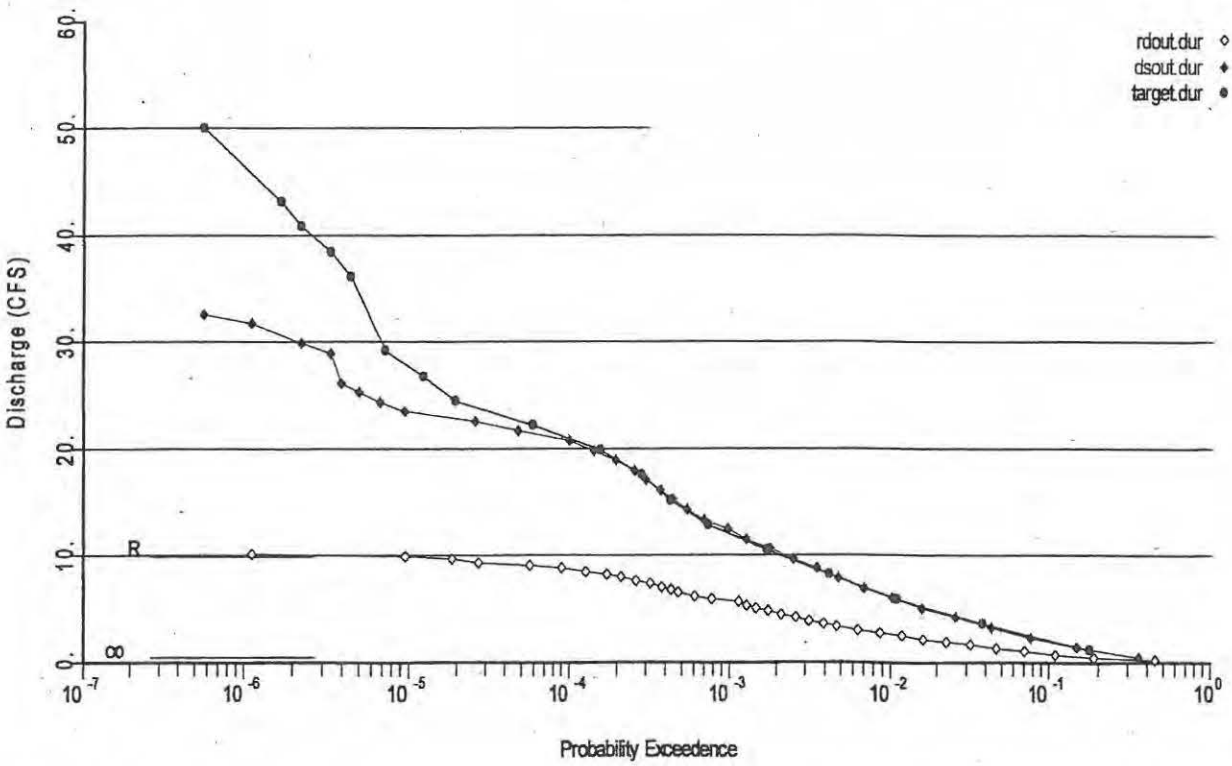
Time Series File:dsout.tsf Mean= 1.135 StdDev= 0.177
Project Location:Landsburg Skew= 0.254

—Annual Peak Flow Rates—			—Flow Frequency Analysis—			
Flow Rate (CFS)	Rank	Time of Peak	- - Peaks - - (CFS)	Rank	Return Period	Prob
17.89	14	2/16/49 20:30	32.61	1	89.50	0.989
24.47	4	3/03/50 15:15	31.92	2	32.13	0.969
23.45	6	2/09/51 16:15	29.98	3	19.58	0.949
9.77	38	1/30/52 8:45	24.47	4	14.08	0.929
9.49	40	1/18/53 18:00	24.19	5	10.99	0.909
13.29	25	1/22/54 16:45	23.45	6	9.01	0.889
12.75	28	2/07/55 21:45	22.76	7	7.64	0.869
12.03	30	12/11/55 15:15	21.86	8	6.63	0.849
11.47	32	12/09/56 15:45	21.71	9	5.86	0.829
8.59	47	1/17/58 6:15	21.38	10	5.24	0.809
12.93	27	9/26/59 13:30	20.15	11	4.75	0.789
14.16	21	11/21/59 0:45	18.36	12	4.34	0.769
11.60	31	11/20/60 13:30	18.28	13	3.99	0.749
6.23	49	12/17/61 9:15	17.89	14	3.70	0.729
11.32	34	2/28/63 19:00	16.82	15	3.44	0.709
21.86	8	6/18/64 18:00	16.77	16	3.22	0.690
14.34	19	1/29/65 4:30	15.33	17	3.03	0.670
5.59	50	1/05/66 18:00	15.03	18	2.85	0.650
9.27	41	12/13/66 8:30	14.34	19	2.70	0.630
12.08	29	6/02/68 23:30	14.28	20	2.56	0.610
16.77	16	6/23/69 20:00	14.16	21	2.44	0.590
8.68	46	12/13/69 20:15	13.95	22	2.32	0.570
24.19	5	9/02/71 2:00	13.77	23	2.22	0.550
18.28	13	2/28/72 15:15	13.57	24	2.13	0.530
8.86	45	1/13/73 3:45	13.29	25	2.04	0.510
9.13	43	11/11/73 3:30	12.95	26	1.96	0.490
21.38	10	12/27/74 1:15	12.93	27	1.89	0.470
13.57	24	12/02/75 23:00	12.75	28	1.82	0.450
9.02	44	8/25/77 23:30	12.08	29	1.75	0.430
13.77	23	12/02/77 18:45	12.03	30	1.70	0.410
9.99	37	2/06/79 16:15	11.60	31	1.64	0.390
18.36	12	12/15/79 6:15	11.47	32	1.59	0.370
16.82	15	11/21/80 13:00	11.37	33	1.54	0.350
11.37	33	1/23/82 20:45	11.32	34	1.49	0.330
15.33	17	1/05/83 9:45	10.80	35	1.45	0.310
21.71	9	1/24/84 23:15	10.50	36	1.41	0.291
10.50	36	11/01/84 23:00	9.99	37	1.37	0.271
15.03	18	10/22/85 16:15	9.77	38	1.33	0.251
20.15	11	11/24/86 4:15	9.67	39	1.30	0.231
10.80	35	3/27/88 9:45	9.49	40	1.27	0.211
9.22	42	4/05/89 15:45	9.27	41	1.24	0.191
32.61	1	1/09/90 11:15	9.22	42	1.21	0.171
22.76	7	11/24/90 14:00	9.13	43	1.18	0.151
13.95	22	4/18/92 18:00	9.02	44	1.15	0.131
14.28	20	5/21/93 15:00	8.86	45	1.12	0.111
7.95	48	12/10/93 6:30	8.68	46	1.10	0.091
12.95	26	2/19/95 19:30	8.59	47	1.08	0.071
31.92	2	5/14/96 6:15	7.95	48	1.05	0.051
29.98	3	9/18/97 4:30	6.23	49	1.03	0.031

23.45	6	2/09/51 16:15	29.98	3	19.58	0.949
9.77	38	1/30/52 8:45	24.47	4	14.08	0.929
9.49	40	1/18/53 18:00	24.19	5	10.99	0.909
13.29	25	1/22/54 16:45	23.45	6	9.01	0.889
12.75	28	2/07/55 21:45	22.76	7	7.64	0.869
12.03	30	12/11/55 15:15	21.86	8	6.63	0.849
11.47	32	12/09/56 15:45	21.71	9	5.86	0.829
8.59	47	1/17/58 6:15	21.38	10	5.24	0.809
12.93	27	9/26/59 13:30	20.15	11	4.75	0.789
14.16	21	11/21/59 0:45	18.36	12	4.34	0.769
11.60	31	11/20/60 13:30	18.28	13	3.99	0.749
6.23	49	12/17/61 9:15	17.89	14	3.70	0.729
11.32	34	2/28/63 19:00	16.82	15	3.44	0.709
21.86	8	6/18/64 18:00	16.77	16	3.22	0.690
14.34	19	1/29/65 4:30	15.33	17	3.03	0.670
5.59	50	1/05/66 18:00	15.03	18	2.85	0.650
9.27	41	12/13/66 8:30	14.34	19	2.70	0.630
12.08	29	6/02/68 23:30	14.28	20	2.56	0.610
16.77	16	6/23/69 20:00	14.16	21	2.44	0.590
8.68	46	12/13/69 20:15	13.95	22	2.32	0.570
24.19	5	9/02/71 2:00	13.77	23	2.22	0.550
18.28	13	2/28/72 15:15	13.57	24	2.13	0.530
8.86	45	1/13/73 3:45	13.29	25	2.04	0.510
9.13	43	11/11/73 3:30	12.95	26	1.96	0.490
21.38	10	12/27/74 1:15	12.93	27	1.89	0.470
13.57	24	12/02/75 23:00	12.75	28	1.82	0.450
9.02	44	8/25/77 23:30	12.08	29	1.75	0.430
13.77	23	12/02/77 18:45	12.03	30	1.70	0.410
9.99	37	2/06/79 16:15	11.60	31	1.64	0.390
18.36	12	12/15/79 6:15	11.47	32	1.59	0.370
16.82	15	11/21/80 13:00	11.37	33	1.54	0.350
11.37	33	1/23/82 20:45	11.32	34	1.49	0.330
15.33	17	1/05/83 9:45	10.80	35	1.45	0.310
21.71	9	1/24/84 23:15	10.50	36	1.41	0.291
10.50	36	11/01/84 23:00	9.99	37	1.37	0.271
15.03	18	10/22/85 16:15	9.77	38	1.33	0.251
20.15	11	11/24/86 4:15	9.67	39	1.30	0.231
10.80	35	3/27/88 9:45	9.49	40	1.27	0.211
9.22	42	4/05/89 15:45	9.27	41	1.24	0.191
32.61	1	1/09/90 11:15	9.22	42	1.21	0.171
22.76	7	11/24/90 14:00	9.13	43	1.18	0.151
13.95	22	4/18/92 18:00	9.02	44	1.15	0.131
14.28	20	5/21/93 15:00	8.86	45	1.12	0.111
7.95	48	12/10/93 6:30	8.68	46	1.10	0.091
12.95	26	2/19/95 19:30	8.59	47	1.08	0.071
31.92	2	5/14/96 6:15	7.95	48	1.05	0.051
29.98	3	9/18/97 4:30	6.23	49	1.03	0.031
9.67	39	10/30/97 6:00	5.59	50	1.01	0.011
Computed Peaks			38.02		100.00	0.990
Computed Peaks			33.31		50.00	0.980
Computed Peaks			28.85		25.00	0.960
Computed Peaks			23.24		10.00	0.900
Computed Peaks			22.13		8.00	0.875
Computed Peaks			19.11		5.00	0.800
Computed Peaks			13.41		2.00	0.500
Computed Peaks			9.97		1.30	0.231

Start Inbox - Microsoft O... Tall Chief Point of C... AutoCAD 2002 - [C... OUTPUT HELP/FILES-XCHG 7:58 PM





Note that dsout flow durations match or are less than target durations which demonstrates no increase in flood durations flows from the proposed project bypass.

Computed peak flows. Note dsout is less than target for all flow frequencies, indicating complete mitigation of developed flows for point of compliance analysis

Finally, compare flow durations for pond

```
                    Analysis Tools Command

                    COMPARE Flow Durations

                        Loading Stage/Discharge curve:dscut tsf
                          Loading Time Series File:target.tsf  50
                      Loading Stage/Discharge curve.target.tsf
                          Loading Time Series File:dscut.tsf  50
Computing Durations:Completed  Yr:50
Computing Durations:Completed  Yr:50
                    Duration Comparison Anaylsis

  Base File: target.tsf
   New File: dscut.tsf

            Duration Comparison Computed and Saved
                                  Output File:compare.prn
```

```
Computed Peaks                    9.97          1.30   0.231
                    Duration Comparison Anaylsis

  Base File: target.tsf
   New File: dscut.tsf
Cutoff Units: Discharge in CFS
          ——Fraction of Time——  ———Check of Tolerance———
 Cutoff   Base     New     %Change Probability  Base    New  %Change
  7.86 | 0.49E-02 0.49E-02  -0.4 | 0.49E-02   7.86   7.85   -0.1
 11.10 | 0.14E-02 0.15E-02   8.8 | 0.14E-02  11.10  11.31    1.9
 14.34 | 0.53E-03 0.54E-03   2.4 | 0.53E-03  14.34  14.43    0.6
 17.59 | 0.28E-03 0.28E-03  -1.0 | 0.28E-03  17.59  17.52   -0.4
 20.83 | 0.11E-03 0.93E-04 -18.9 | 0.11E-03  20.83  20.39   -2.1
 24.08 | 0.26E-04 0.80E-05 -68.9 | 0.26E-04  24.08  22.53   -6.4
 27.32 | 0.97E-05 0.34E-05 -64.7 | 0.97E-05  27.32  23.42  -14.3
 30.57 | 0.63E-05 0.17E-05 -72.7 | 0.63E-05  30.57  24.43  -20.1
 33.81 | 0.46E-05 0.00E+00 -100.0 | 0.46E-05  33.81  26.00  -23.1
 37.05 | 0.34E-05 0.00E+00 -100.0 | 0.34E-05  37.05  28.99  -21.8
 40.30 | 0.23E-05 0.00E+00 -100.0 | 0.23E-05  40.30  29.96  -25.7
 43.54 | 0.17E-05 0.00E+00 -100.0 | 0.17E-05  43.54  30.72  -29.5
 46.79 | 0.57E-06 0.00E+00 -100.0 | 0.57E-06  46.79  32.59  -30.3
 50.03 | 0.57E-06 0.00E+00 -100.0 | 0.57E-06  50.03  32.59  -34.9

Maximum positive excursion = 0.440 cfs (  3.6%)
occurring at 12.17 cfs on the Base Data:target.tsf
and at 12.61 cfs on the  New Data:dscut.tsf

Maximum negative excursion = 17.44 cfs (-34.9%)
occurring at 50.03 cfs on the Base Data:target.tsf
and at 32.59 cfs on the  New Data:dscut.tsf
```

Note that the first value is less than 0 and the remaining values are less (in most cases far less) than the allowed 10% positive excursion,indicating the pond more than amply mitigates development and could probably be reduced in size.

Compute and compare predev H (Basin h bypassed from detention) with developed H to determine if the increase in developed bypass flows exceeds the threshold of 0.4 cfs per KCSWDM pg 3-52. Note results: predev 100 yr = 35.93 cfs and dev 100 yr = 36.06 so difference is 0.13 cfs which is less than 0.4 cfs and so is allowed.

```
                King County Runoff Time Series Program

                        Version 6.00
All files will be read/written in the Working Directory
Working Directory:C:\kc_swdm\output
------------------------------------------------------------
                        KCRTS Command

                   Enter the Analysis TOOLS Module

------------------------------------------------------------
                      Analysis Tools Command

                  Compute PEAKS and Flow Frequencies

                          Loading Time Series File:predevh.tsf  50
        Flow Frequency Analysis     LogPearson III Coefficients

Time Series File:predevh.tsf          Mean=  0.862 StdDev=  0.272
Project Location:Landsburg                  Skew=  0.301
                     Frequencies & Peaks saved to File:predevh.pks  :
------------------------------------------------------------
                      Analysis Tools Command

                  Compute PEAKS and Flow Frequencies

                          Loading Time Series File:devh.tsf  50
        Flow Frequency Analysis     LogPearson III Coefficients

Time Series File:devh.tsf             Mean=  0.889 StdDev=  0.263
Project Location:Landsburg                  Skew=  0.290
                     Frequencies & Peaks saved to File:devh.pks  :
```

Flow Frequency Analysis LogPearson III Coefficients

Time Series File:predevh.tsf Mean= 0.862 StdDev= 0.272
Project Location:Landsburg Skew= 0.301

—Annual Peak Flow Rates—			—Flow Frequency Analysis—			
Flow Rate (CFS)	Rank	Time of Peak	- - Peaks - - (CFS)	Rank	Return Period	Prob
10.24	17	2/16/49 17:30	26.97	1	89.50	0.989
15.79	6	3/03/50 15:15	24.47	2	32.13	0.969
7.58	25	2/08/51 17:30	22.71	3	19.58	0.949
5.11	31	11/28/51 18:15	19.97	4	14.08	0.929
4.22	38	2/03/53 16:45	18.33	5	10.99	0.909
11.92	13	9/16/54 16:00	15.79	6	9.01	0.889
4.11	39	2/07/55 19:45	15.65	7	7.64	0.869
3.65	44	12/11/55 14:15	13.58	8	6.63	0.849
5.28	29	2/24/57 13:15	13.43	9	5.86	0.829
4.10	40	12/25/57 16:00	13.27	10	5.24	0.809
11.65	14	9/26/59 13:30	13.27	11	4.75	0.789
4.64	36	11/21/59 0:30	12.70	12	4.34	0.769
4.08	41	2/14/61 20:15	11.92	13	3.99	0.749
2.49	50	12/17/61 6:15	11.65	14	3.70	0.729
9.80	19	2/28/63 19:00	11.39	15	3.44	0.709
19.97	4	9/18/64 4:15	10.63	16	3.22	0.690
5.17	30	11/24/64 2:45	10.24	17	3.03	0.670
3.54	45	5/06/66 7:15	9.84	18	2.85	0.650
6.49	26	2/17/67 14:15	9.80	19	2.70	0.630
8.49	21	6/02/68 3:15	9.68	20	2.56	0.610
13.43	9	6/23/69 20:00	8.49	21	2.44	0.590
2.91	49	11/04/69 13:15	8.42	22	2.32	0.570
22.71	3	9/02/71 2:00	7.84	23	2.22	0.550
12.70	12	6/25/72 2:15	7.80	24	2.13	0.530
3.05	48	1/13/73 2:45	7.58	25	2.04	0.510
5.29	28	11/11/73 0:45	6.49	26	1.96	0.490
13.27	10	12/27/74 1:15	5.81	27	1.89	0.470
5.06	33	12/29/75 13:30	5.29	28	1.82	0.450
7.80	24	8/25/77 23:30	5.28	29	1.75	0.430
9.84	18	9/22/78 18:00	5.17	30	1.70	0.410
3.18	47	11/04/78 20:45	5.11	31	1.64	0.390
8.42	22	12/15/79 6:15	5.09	32	1.59	0.370
11.39	15	5/18/81 22:00	5.06	33	1.54	0.350
4.06	42	10/06/81 1:00	4.96	34	1.49	0.330
5.09	32	6/18/83 13:45	4.68	35	1.45	0.310
18.33	5	10/30/83 13:00	4.64	36	1.41	0.291
4.68	35	11/01/84 20:00	4.27	37	1.37	0.271
13.58	8	10/22/85 16:15	4.22	38	1.33	0.251
7.84	23	11/21/86 8:15	4.11	39	1.30	0.231
4.96	34	5/01/88 17:00	4.10	40	1.27	0.211
3.27	46	11/22/88 12:45	4.08	41	1.24	0.191
15.65	7	1/09/90 11:15	4.06	42	1.21	0.171
10.63	16	4/04/91 18:00	3.81	43	1.18	0.151
9.68	20	4/18/92 18:00	3.65	44	1.15	0.131
13.27	11	5/21/93 15:00	3.54	45	1.12	0.111
5.81	27	12/10/93 6:30	3.27	46	1.10	0.091
4.27	37	11/30/94 11:45	3.18	47	1.08	0.071
24.47	2	5/14/96 6:15	3.05	48	1.05	0.051
26.97	1	9/18/97 4:30	2.91	49	1.03	0.031

26.97	1	9/18/97 4:30	2.91	49	1.03	0.031
3.81	43	10/30/97 6:00	2.49	50	1.01	0.011
Computed Peaks			35.93		100.00	0.990
Computed Peaks			29.14		50.00	0.980
Computed Peaks			23.23		25.00	0.960
Computed Peaks			16.56		10.00	0.900
Computed Peaks			15.34		8.00	0.875
Computed Peaks			12.20		5.00	0.800
Computed Peaks			7.06		2.00	0.500
Computed Peaks			4.49		1.30	0.231

Flow Frequency Analysis LogPearson III Coefficients

Time Series File:devh.tsf Mean= 0.889 StdDev= 0.263
Project Location:Landsburg Skew= 0.290

—Annual Peak Flow Rates—			—Flow Frequency Analysis—			
Flow Rate (CFS)	Rank	Time of Peak	- - Peaks - - (CFS)	Rank	Return Period	Prob
10.77	17	2/16/49 17:30	27.36	1	89.50	0.989
16.06	6	3/03/50 15:15	24.78	2	32.13	0.969
7.68	25	2/09/51 13:15	23.55	3	19.58	0.949
5.57	31	11/28/51 18:15	20.71	4	14.08	0.929
4.51	39	2/03/53 16:45	19.13	5	10.99	0.909
12.62	13	9/16/54 16:00	16.06	6	9.01	0.889
4.29	43	2/07/55 19:45	16.02	7	7.64	0.869
3.87	45	12/22/55 6:15	14.30	8	6.63	0.849
5.64	28	2/24/57 13:15	13.97	9	5.86	0.829
4.48	40	12/25/57 16:00	13.91	10	5.24	0.809
11.96	15	9/26/59 13:30	13.66	11	4.75	0.789
4.75	37	11/21/59 0:30	13.27	12	4.34	0.769
4.47	41	2/14/61 20:15	12.62	13	3.99	0.749
2.65	50	12/17/61 6:15	12.04	14	3.70	0.729
10.34	19	2/28/63 19:00	11.96	15	3.44	0.709
20.71	4	9/18/64 4:15	10.94	16	3.22	0.690
5.45	33	11/24/64 2:45	10.77	17	3.03	0.670
4.03	44	5/06/66 7:15	10.44	18	2.85	0.650
6.96	26	2/17/67 14:15	10.34	19	2.70	0.630
9.01	21	6/02/68 3:15	10.16	20	2.56	0.610
13.97	9	6/23/69 20:00	9.01	21	2.44	0.590
3.10	49	11/04/69 11:45	8.83	22	2.32	0.570
23.55	3	9/02/71 2:00	8.50	23	2.22	0.550
13.27	12	6/25/72 2:15	8.19	24	2.13	0.530
3.24	48	1/13/73 2:45	7.68	25	2.04	0.510
5.61	29	11/11/73 0:45	6.96	26	1.96	0.490
13.66	11	12/27/74 1:15	6.30	27	1.89	0.470
5.50	32	12/29/75 13:30	5.64	28	1.82	0.450
8.50	23	8/25/77 23:30	5.61	29	1.75	0.430
10.44	18	9/22/78 18:00	5.61	30	1.70	0.410
3.49	47	11/04/78 20:45	5.57	31	1.64	0.390
8.83	22	12/15/79 6:15	5.50	32	1.59	0.370
12.04	14	5/10/81 22:00	5.45	33	1.54	0.350
4.43	42	10/06/81 1:00	5.38	34	1.49	0.330
5.61	30	6/10/83 13:45	5.05	35	1.45	0.310
19.13	5	10/30/83 13:00	4.94	36	1.41	0.291
5.05	35	11/01/84 20:00	4.75	37	1.37	0.271
14.30	8	10/22/85 16:15	4.57	38	1.33	0.251
8.19	24	11/21/86 8:15	4.51	39	1.30	0.231

7.68	25	2/09/51 13:15	23.55	3	19.58	0.949
5.57	31	11/28/51 18:15	20.71	4	14.08	0.929
4.51	39	2/03/53 16:45	19.13	5	10.99	0.909
12.62	13	9/16/54 16:00	16.06	6	9.01	0.889
4.29	43	2/07/55 19:45	16.02	7	7.64	0.869
3.87	45	12/22/55 6:15	14.30	8	6.63	0.849
5.64	28	2/24/57 13:15	13.97	9	5.86	0.829
4.48	40	12/25/57 16:00	13.91	10	5.24	0.809
11.96	15	9/26/59 13:30	13.66	11	4.75	0.789
4.75	37	11/21/59 0:30	13.27	12	4.34	0.769
4.47	41	2/14/61 20:15	12.62	13	3.99	0.749
2.65	50	12/17/61 6:15	12.04	14	3.70	0.729
10.34	19	2/28/63 19:00	11.96	15	3.44	0.709
20.71	4	9/18/64 4:15	10.94	16	3.22	0.690
5.45	33	11/24/64 2:45	10.77	17	3.03	0.670
4.03	44	5/06/66 7:15	10.44	18	2.85	0.650
6.96	26	2/17/67 14:15	10.34	19	2.70	0.630
9.01	21	6/02/68 3:15	10.16	20	2.56	0.610
13.97	9	6/23/69 20:00	9.01	21	2.44	0.590
3.10	49	11/04/69 11:45	8.83	22	2.32	0.570
23.55	3	9/02/71 2:00	8.50	23	2.22	0.550
13.27	12	6/25/72 2:15	8.19	24	2.13	0.530
3.24	48	1/13/73 2:45	7.68	25	2.04	0.510
5.61	29	11/11/73 0:45	6.96	26	1.96	0.490
13.66	11	12/27/74 1:15	6.30	27	1.89	0.470
5.50	32	12/29/75 13:30	5.64	28	1.82	0.450
8.50	23	8/25/77 23:30	5.61	29	1.75	0.430
10.44	18	9/22/78 18:00	5.61	30	1.70	0.410
3.49	47	11/04/78 20:45	5.57	31	1.64	0.390
8.83	22	12/15/79 6:15	5.50	32	1.59	0.370
12.04	14	5/10/81 22:00	5.45	33	1.54	0.350
4.43	42	10/06/81 1:00	5.38	34	1.49	0.330
5.61	30	6/10/83 13:45	5.05	35	1.45	0.310
19.13	5	10/30/83 13:00	4.94	36	1.41	0.291
5.05	35	11/01/84 20:00	4.75	37	1.37	0.271
14.30	8	10/22/85 16:15	4.57	38	1.33	0.251
8.19	24	11/21/86 8:15	4.51	39	1.30	0.231
5.38	34	12/03/87 3:00	4.48	40	1.27	0.211
3.59	46	11/22/88 12:45	4.47	41	1.24	0.191
16.02	7	1/09/90 11:15	4.43	42	1.21	0.171
10.94	16	4/04/91 18:00	4.29	43	1.18	0.151
10.16	20	4/18/92 18:00	4.03	44	1.15	0.131
13.91	10	5/21/93 15:00	3.87	45	1.12	0.111
6.30	27	12/10/93 6:30	3.59	46	1.10	0.091
4.57	38	11/30/94 11:45	3.49	47	1.08	0.071
24.78	2	5/14/96 6:15	3.24	48	1.05	0.051
27.36	1	9/18/97 4:30	3.10	49	1.03	0.031
4.94	36	8/16/98 15:15	2.65	50	1.01	0.011
Computed Peaks			36.06		100.00	0.990
Computed Peaks			29.49		50.00	0.980
Computed Peaks			23.72		25.00	0.960
Computed Peaks			17.12		10.00	0.900
Computed Peaks			15.91		8.00	0.875
Computed Peaks			12.76		5.00	0.800
Computed Peaks			7.52		2.00	0.500
Computed Peaks			4.85		1.30	0.231

KCRTS PROGRAM RUN OUTPUT FILES

Retention/Detention Facility

Type of Facility:	Detention Pond	
Side Slope:	2.00	H:1V
Pond Bottom Length:	250.00	ft
Pond Bottom Width:	250.00	ft
Pond Bottom Area:	62500.	sq. ft
Top Area at 1 ft. FB:	73984.	sq. ft
	1.698	acres
Effective Storage Depth:	4.50	ft
Stage 0 Elevation:	81.50	ft
Storage Volume:	301986.	cu. ft
	6.933	ac-ft
Riser Head:	3.90	ft
Riser Diameter:	48.00	inches
Number of orifices:	2	

Orifice #	Height (ft)	Diameter (in)	Full Head Discharge (CFS)	Pipe Diameter (in)
1	0.00	4.00	0.857	
2	1.00	14.00	9.051	21.0

Top Notch Weir: None
Outflow Rating Curve: None

Stage (ft)	Elevation (ft)	Storage (cu. ft)	(ac-ft)	Discharge (cfs)	Percolation (cfs)	Surf Area (sq. ft)
0.00	81.50	37861.	0.869	0.000	0.00	63706.
0.04	81.54	40411.	0.928	0.089	0.00	63787.
0.08	81.58	42964.	0.986	0.125	0.00	63867.
0.13	81.63	46160.	1.060	0.153	0.00	63969.
0.17	81.67	48720.	1.118	0.177	0.00	64049.
0.21	81.71	51284.	1.177	0.198	0.00	64130.
0.25	81.75	53851.	1.236	0.217	0.00	64212.
0.29	81.79	56421.	1.295	0.234	0.00	64293.
0.33	81.83	58994.	1.354	0.251	0.00	64374.

0.37	81.87	61571.	1.413	0.266	0.00
64455.					
0.47	81.97	68026.	1.562	0.299	0.00
64658.					
0.58	82.08	75151.	1.725	0.329	0.00
64882.					
0.68	82.18	81650.	1.874	0.357	0.00
65086.					
0.78	82.28	88168.	2.024	0.382	0.00
65290.					
0.88	82.38	94708.	2.174	0.406	0.00
65495.					
0.98	82.48	101267.	2.325	0.429	0.00
65700.					
1.00	82.50	102582.	2.355	0.434	0.00
65741.					
1.10	82.60	109166.	2.506	0.500	0.00
65946.					
1.20	82.70	115771.	2.658	0.654	0.00
66152.					
1.30	82.80	122397.	2.810	0.892	0.00
66358.					
1.40	82.90	129043.	2.962	1.210	0.00
66564.					
1.50	83.00	135709.	3.115	1.600	0.00
66771.					
1.60	83.10	142397.	3.269	2.070	0.00
66977.					
1.70	83.20	149105.	3.423	2.600	0.00
67185.					
1.80	83.30	155834.	3.577	3.210	0.00
67392.					
1.90	83.40	162583.	3.732	5.640	0.00
67600.					
2.00	83.50	169354.	3.888	5.930	0.00
67808.					
2.10	83.60	176145.	4.044	6.200	0.00
68017.					
2.20	83.70	182957.	4.200	6.470	0.00
68225.					
2.30	83.80	189790.	4.357	6.720	0.00
68435.					
2.40	83.90	196644.	4.514	6.960	0.00
68644.					
2.50	84.00	203519.	4.672	7.200	0.00
68854.					
2.60	84.10	210415.	4.830	7.420	0.00
69064.					
2.70	84.20	217332.	4.989	7.640	0.00
69274.					
2.80	84.30	224270.	5.149	7.860	0.00
69485.					
2.90	84.40	231229.	5.308	8.070	0.00
69696.					

3.00	84.50	238209.	5.469	8.270	0.00	69907.
3.10	84.60	245210.	5.629	8.470	0.00	70119.
3.20	84.70	252233.	5.790	8.660	0.00	70331.
3.30	84.80	259276.	5.952	8.850	0.00	70543.
3.40	84.90	266341.	6.114	9.040	0.00	70756.
3.50	85.00	273428.	6.277	9.220	0.00	70969.
3.60	85.10	280535.	6.440	9.400	0.00	71182.
3.70	85.20	287664.	6.604	9.570	0.00	71396.
3.80	85.30	294814.	6.768	9.740	0.00	71610.
3.90	85.40	301986.	6.933	9.910	0.00	71824.
4.00	85.50	309179.	7.098	11.310	0.00	72039.
4.10	85.60	316394.	7.263	13.720	0.00	72253.
4.20	85.70	323630.	7.430	16.800	0.00	72469.
4.30	85.80	330887.	7.596	20.410	0.00	72684.
4.40	85.90	338167.	7.763	24.490	0.00	72900.
4.50	86.00	345467.	7.931	28.970	0.00	73116.
4.60	86.10	352790.	8.099	33.830	0.00	73333.
4.70	86.20	360134.	8.268	39.040	0.00	73549.
4.80	86.30	367500.	8.437	44.580	0.00	73767.
4.90	86.40	374887.	8.606	50.420	0.00	73984.
5.00	86.50	382297.	8.776	56.550	0.00	74202.
5.10	86.60	389728.	8.947	62.950	0.00	74420.
5.20	86.70	397181.	9.118	69.630	0.00	74638.
5.30	86.80	404655.	9.290	76.550	0.00	74857.
5.40	86.90	412152.	9.462	83.730	0.00	75076.
5.50	87.00	419671.	9.634	88.840	0.00	75295.
5.60	87.10	427211.	9.807	91.330	0.00	75515.

```
      5.70       87.20      434774.      9.981 93.750       0.00
75735.
      5.80       87.30      442358.     10.155 96.100       0.00
75955.
      5.90       87.40      449965.     10.330 98.400       0.00
76176.
```

Hyd	Inflow	Outflow	Peak Stage	Peak Elev	Storage (Cu-Ft)	Storage (Ac-Ft)
1	25.95	10.21	3.92	85.42	303537.	6.968
2	29.31	3.09	1.78	83.28	154537.	3.548
3	35.66	6.63	2.26	83.76	187365.	4.301
4	16.57	2.30	1.64	83.14	145284.	3.335
5	27.73	6.97	2.41	83.91	197071.	4.524
6	20.64	7.65	2.70	84.20	217494.	4.993
7	11.94	6.03	2.04	83.54	171909.	3.946
8	9.79	4.97	1.87	83.37	160722.	3.690

Hyd	R/D Facility Outflow	Tributary Inflow	Reservoir Inflow	POC Outflow Target	POC Outflow Calc
1	10.21	23.10	********	35.80	32.66
2	3.09	27.65	********	47.91	29.98
3	6.63	25.76	********	*******	31.92
4	2.30	23.80	********	*******	24.19
5	6.97	17.57	********	*******	24.47
6	7.65	14.34	********	*******	21.71
7	6.03	7.78	********	*******	13.58
8	4.97	5.80	********	*******	9.78

```
----------------------------------
Route Time Series through Facility
  Inflow Time Series File:rdin.tsf
 Outflow Time Series File:rdout
     POC Time Series File:dsout

Inflow/Outflow Analysis
   Peak Inflow Discharge:       35.67 CFS at  6:00 on May 14 in 1996
  Peak Outflow Discharge:       10.21 CFS at 13:45 on Jan  9 in 1990
    Peak Reservoir Stage:        3.92  Ft
     Peak Reservoir Elev:       85.42  Ft
  Peak Reservoir Storage:  303537.    Cu-Ft
                        :       6.968 Ac-Ft

Add Time Series:bypass.tsf
   Peak Summed Discharge:       32.64 CFS at 11:15 on Jan  9 in 1990
Point of Compliance File:dsout.tsf
          Flow Frequency Analysis       LogPearson III Coefficients
  Time Series File:rdout.tsf             Mean=   0.733 StdDev=  0.137
  Project Location:Landsburg                     Skew= -0.876

  ---Annual Peak Flow Rates---        -----Flow Frequency Analysis-------
 Flow Rate  Rank  Time of Peak         - - Peaks - -  Rank  Return  Prob
   (CFS)                              (CFS)    (ft)        Period
    6.18     14   2/16/49 21:15       10.19    3.92    1   89.50   0.989
```

6.98	7	3/03/50	15:30
9.36	2	2/09/51	18:00
4.97	34	1/30/52	7:30
4.57	37	1/18/53	18:15
5.73	25	1/22/54	17:00
5.73	26	2/07/55	20:00
5.66	27	12/11/55	14:30
5.15	33	12/09/56	16:15
4.20	44	1/17/58	6:15
4.92	35	1/23/59	22:30
6.02	18	11/21/59	1:15
5.59	29	11/20/60	6:15
2.28	48	12/17/61	7:30
5.29	31	2/03/63	2:30
6.40	10	6/18/64	18:15
5.96	20	1/29/65	1:45
2.18	49	1/05/66	16:30
4.11	45	1/19/67	15:00
5.39	30	6/02/68	23:45
5.84	22	12/03/68	15:45
4.24	43	12/13/69	20:15
6.23	13	1/08/71	23:30
6.17	15	2/28/72	6:30
4.29	42	1/13/73	4:00
3.24	46	2/18/74	23:15
6.37	11	12/27/74	1:30
6.03	17	12/02/75	20:45
1.93	50	3/03/77	1:00
5.89	21	12/02/77	22:15
4.58	36	2/06/79	15:30
6.45	9	12/15/79	14:15
6.75	8	11/21/80	10:30
5.64	28	1/23/82	19:15
6.26	12	1/05/83	9:45
7.64	6	1/24/84	23:45
4.33	40	11/03/84	13:15
5.78	24	1/18/86	20:00
7.93	5	11/24/86	5:45
5.21	32	3/27/88	10:00
4.37	39	4/05/89	15:45
10.19	1	1/09/90	13:45
8.71	4	11/24/90	14:30
5.97	19	1/28/92	13:30
4.52	38	3/22/93	23:30
2.52	47	3/03/94	3:15
5.80	23	2/19/95	18:00
9.06	3	2/08/96	23:00
6.11	16	12/31/96	21:15
4.31	41	10/30/97	6:15
Computed Peaks			
Computed Peaks			
Computed Peaks			
Computed Peaks			
Computed Peaks			

9.36	3.58	2	32.13	0.969
9.06	3.41	3	19.58	0.949
8.71	3.23	4	14.08	0.929
7.93	2.83	5	10.99	0.909
7.64	2.70	6	9.01	0.889
6.98	2.41	7	7.64	0.869
6.75	2.31	8	6.63	0.849
6.45	2.19	9	5.86	0.829
6.40	2.17	10	5.24	0.809
6.37	2.16	11	4.75	0.789
6.26	2.12	12	4.34	0.769
6.23	2.11	13	3.99	0.749
6.18	2.09	14	3.70	0.729
6.17	2.09	15	3.44	0.709
6.11	2.07	16	3.22	0.690
6.03	2.04	17	3.03	0.670
6.02	2.03	18	2.85	0.650
5.97	2.02	19	2.70	0.630
5.96	2.01	20	2.56	0.610
5.89	1.99	21	2.44	0.590
5.84	1.97	22	2.32	0.570
5.80	1.96	23	2.22	0.550
5.78	1.95	24	2.13	0.530
5.73	1.93	25	2.04	0.510
5.73	1.93	26	1.96	0.490
5.66	1.91	27	1.89	0.470
5.64	1.90	28	1.82	0.450
5.59	1.90	29	1.75	0.430
5.39	1.89	30	1.70	0.410
5.29	1.89	31	1.64	0.390
5.21	1.88	32	1.59	0.370
5.15	1.88	33	1.54	0.350
4.97	1.87	34	1.49	0.330
4.92	1.87	35	1.45	0.310
4.58	1.86	36	1.41	0.291
4.57	1.86	37	1.37	0.271
4.52	1.85	38	1.33	0.251
4.37	1.85	39	1.30	0.231
4.33	1.85	40	1.27	0.211
4.31	1.85	41	1.24	0.191
4.29	1.84	42	1.21	0.171
4.24	1.84	43	1.18	0.151
4.20	1.84	44	1.15	0.131
4.11	1.84	45	1.12	0.111
3.24	1.80	46	1.10	0.091
2.52	1.68	47	1.08	0.071
2.28	1.64	48	1.05	0.051
2.18	1.62	49	1.03	0.031
1.93	1.57	50	1.01	0.011
9.17	3.47		100.00	0.990
8.84	3.29		50.00	0.980
8.44	3.09		25.00	0.960
7.77	2.76		10.00	0.900
7.59	2.68		8.00	0.875

Computed Peaks	7.07	2.45	5.00	0.800
Computed Peaks	5.66	1.91	2.00	0.500
Computed Peaks	4.37	1.85	1.30	0.231

Flow Frequency Analysis
Time Series File:dsout.tsf
Project Location:Landsburg

LogPearson III Coefficients
Mean= 1.135 StdDev= 0.177
Skew= 0.254

---Annual Peak Flow Rates---

Flow Rate (CFS)	Rank	Time of Peak
17.89	14	2/16/49 20:30
24.47	4	3/03/50 15:15
23.45	6	2/09/51 16:15
9.77	38	1/30/52 8:45
9.49	40	1/18/53 18:00
13.29	25	1/22/54 16:45
12.75	28	2/07/55 21:45
12.03	30	12/11/55 15:15
11.47	32	12/09/56 15:45
8.59	47	1/17/58 6:15
12.93	27	9/26/59 13:30
14.16	21	11/21/59 0:45
11.60	31	11/20/60 13:30
6.23	49	12/17/61 9:15
11.32	34	2/28/63 19:00
21.86	8	6/18/64 18:00
14.34	19	1/29/65 4:30
5.59	50	1/05/66 18:00
9.27	41	12/13/66 8:30
12.08	29	6/02/68 23:30
16.77	16	6/23/69 20:00
8.68	46	12/13/69 20:15
24.19	5	9/02/71 2:00
18.28	13	2/28/72 15:15
8.86	45	1/13/73 3:45
9.13	43	11/11/73 3:30
21.38	10	12/27/74 1:15
13.57	24	12/02/75 23:00
9.02	44	8/25/77 23:30
13.77	23	12/02/77 18:45
9.99	37	2/06/79 16:15
18.36	12	12/15/79 6:15
16.82	15	11/21/80 13:00
11.37	33	1/23/82 20:45
15.33	17	1/05/83 9:45
21.71	9	1/24/84 23:15
10.50	36	11/01/84 23:00
15.03	18	10/22/85 16:15
20.15	11	11/24/86 4:15
10.80	35	3/27/88 9:45
9.22	42	4/05/89 15:45
32.61	1	1/09/90 11:15
22.76	7	11/24/90 14:00
13.95	22	4/18/92 18:00

-----Flow Frequency Analysis-------

- - Peaks - - (CFS)	Rank	Return Period	Prob
32.61	1	89.50	0.989
31.92	2	32.13	0.969
29.98	3	19.58	0.949
24.47	4	14.08	0.929
24.19	5	10.99	0.909
23.45	6	9.01	0.889
22.76	7	7.64	0.869
21.86	8	6.63	0.849
21.71	9	5.86	0.829
21.38	10	5.24	0.809
20.15	11	4.75	0.789
18.36	12	4.34	0.769
18.28	13	3.99	0.749
17.89	14	3.70	0.729
16.82	15	3.44	0.709
16.77	16	3.22	0.690
15.33	17	3.03	0.670
15.03	18	2.85	0.650
14.34	19	2.70	0.630
14.28	20	2.56	0.610
14.16	21	2.44	0.590
13.95	22	2.32	0.570
13.77	23	2.22	0.550
13.57	24	2.13	0.530
13.29	25	2.04	0.510
12.95	26	1.96	0.490
12.93	27	1.89	0.470
12.75	28	1.82	0.450
12.08	29	1.75	0.430
12.03	30	1.70	0.410
11.60	31	1.64	0.390
11.47	32	1.59	0.370
11.37	33	1.54	0.350
11.32	34	1.49	0.330
10.80	35	1.45	0.310
10.50	36	1.41	0.291
9.99	37	1.37	0.271
9.77	38	1.33	0.251
9.67	39	1.30	0.231
9.49	40	1.27	0.211
9.27	41	1.24	0.191
9.22	42	1.21	0.171
9.13	43	1.18	0.151
9.02	44	1.15	0.131

14.28	20	5/21/93	15:00	8.86	45	1.12	0.111
7.95	48	12/10/93	6:30	8.68	46	1.10	0.091
12.95	26	2/19/95	19:30	8.59	47	1.08	0.071
31.92	2	5/14/96	6:15	7.95	48	1.05	0.051
29.98	3	9/18/97	4:30	6.23	49	1.03	0.031
9.67	39	10/30/97	6:00	5.59	50	1.01	0.011
Computed Peaks				38.02		100.00	0.990
Computed Peaks				33.31		50.00	0.980
Computed Peaks				28.85		25.00	0.960
Computed Peaks				23.24		10.00	0.900
Computed Peaks				22.13		8.00	0.875
Computed Peaks				19.11		5.00	0.800
Computed Peaks				13.41		2.00	0.500
Computed Peaks				9.97		1.30	0.231

Flow Duration from Time Series File:rdout.tsf

Cutoff CFS	Count	Frequency %	CDF %	Exceedence %	Probability
0.145	972612	55.514	55.514	44.486	0.445E+00
0.432	452300	25.816	81.331	18.669	0.187E+00
0.719	135166	7.715	89.046	10.954	0.110E+00
1.01	67882	3.875	92.920	7.080	0.708E-01
1.29	41709	2.381	95.301	4.699	0.470E-01
1.58	26442	1.509	96.810	3.190	0.319E-01
1.87	16229	0.926	97.736	2.264	0.226E-01
2.15	11482	0.655	98.392	1.608	0.161E-01
2.44	7541	0.430	98.822	1.178	0.118E-01
2.73	5362	0.306	99.128	0.872	0.872E-02
3.01	3906	0.223	99.351	0.649	0.649E-02
3.30	3100	0.177	99.528	0.472	0.472E-02
3.59	1400	0.080	99.608	0.392	0.392E-02
3.87	1315	0.075	99.683	0.317	0.317E-02
4.16	943	0.054	99.737	0.263	0.263E-02
4.45	886	0.051	99.787	0.213	0.213E-02
4.73	631	0.036	99.823	0.177	0.177E-02
5.02	511	0.029	99.853	0.147	0.147E-02
5.31	328	0.019	99.871	0.129	0.129E-02
5.59	233	0.013	99.885	0.115	0.115E-02
5.88	653	0.037	99.922	0.078	0.781E-03
6.17	308	0.018	99.939	0.061	0.606E-03
6.45	221	0.013	99.952	0.048	0.479E-03
6.74	83	0.005	99.957	0.043	0.432E-03
7.03	92	0.005	99.962	0.038	0.380E-03
7.31	103	0.006	99.968	0.032	0.321E-03
7.60	102	0.006	99.974	0.026	0.263E-03
7.89	83	0.005	99.978	0.022	0.215E-03
8.17	73	0.004	99.983	0.017	0.174E-03
8.46	80	0.005	99.987	0.013	0.128E-03
8.75	65	0.004	99.991	0.009	0.908E-04
9.03	58	0.003	99.994	0.006	0.576E-04
9.32	53	0.003	99.997	0.003	0.274E-04
9.61	15	0.001	99.998	0.002	0.188E-04
9.89	16	0.001	99.999	0.001	0.970E-05
10.18	15	0.001	100.000	0.000	0.114E-05

Flow Duration from Time Series File:dsout.tsf

Cutoff CFS	Count	Frequency %	CDF %	Exceedence %	Probability
0.466	1133371	64.690	64.690	35.310	0.353E+00
1.38	361210	20.617	85.307	14.693	0.147E+00
2.30	122520	6.993	92.300	7.700	0.770E-01
3.22	58437	3.335	95.636	4.364	0.436E-01
4.14	31284	1.786	97.421	2.579	0.258E-01
5.06	17065	0.974	98.395	1.605	0.160E-01
5.98	9869	0.563	98.959	1.041	0.104E-01
6.89	5901	0.337	99.295	0.705	0.705E-02
7.81	3752	0.214	99.510	0.490	0.490E-02
8.73	2317	0.132	99.642	0.358	0.358E-02
9.65	1778	0.101	99.743	0.257	0.257E-02
10.57	1296	0.074	99.817	0.183	0.183E-02
11.48	937	0.053	99.871	0.129	0.129E-02
12.40	523	0.030	99.901	0.099	0.993E-03
13.32	492	0.028	99.929	0.071	0.712E-03
14.24	284	0.016	99.945	0.055	0.550E-03
15.16	185	0.011	99.956	0.044	0.445E-03
16.08	125	0.007	99.963	0.037	0.373E-03
16.99	116	0.007	99.969	0.031	0.307E-03
17.91	86	0.005	99.974	0.026	0.258E-03
18.83	105	0.006	99.980	0.020	0.198E-03
19.75	97	0.006	99.986	0.014	0.143E-03
20.67	72	0.004	99.990	0.010	0.102E-03
21.59	92	0.005	99.995	0.005	0.491E-04
22.50	40	0.002	99.997	0.003	0.263E-04
23.42	29	0.002	99.999	0.001	0.970E-05
24.34	5	0.000	99.999	0.001	0.685E-05
25.26	3	0.000	99.999	0.001	0.514E-05
26.18	2	0.000	100.000	0.000	0.400E-05
27.09	1	0.000	100.000	0.000	0.342E-05
28.01	0	0.000	100.000	0.000	0.342E-05
28.93	0	0.000	100.000	0.000	0.342E-05
29.85	2	0.000	100.000	0.000	0.228E-05
30.77	2	0.000	100.000	0.000	0.114E-05
31.69	0	0.000	100.000	0.000	0.114E-05
32.60	1	0.000	100.000	0.000	0.571E-06

Route Time Series through Facility
Inflow Time Series File:rdin.tsf
Outflow Time Series File:rdout
POC Time Series File:dsout

Inflow/Outflow Analysis

Peak Inflow Discharge:	35.67	CFS at 6:00 on May 14 in 1996
Peak Outflow Discharge:	10.21	CFS at 13:45 on Jan 9 in 1990
Peak Reservoir Stage:	3.92	Ft
Peak Reservoir Elev:	85.42	Ft
Peak Reservoir Storage:	303537.	Cu-Ft
:	6.968	Ac-Ft

Add Time Series:bypass.tsf
Peak Summed Discharge: 32.64 CFS at 11:15 on Jan 9 in 1990
Point of Compliance File:dsout.tsf
Flow Frequency Analysis
Time Series File:rdout.tsf
Project Location:Landsburg

LogPearson III Coefficients
Mean= 0.733 StdDev= 0.137
Skew= -0.876

---Annual Peak Flow Rates---

Flow Rate (CFS)	Rank	Time of Peak	
6.18	14	2/16/49	21:15
6.98	7	3/03/50	15:30
9.36	2	2/09/51	18:00
4.97	34	1/30/52	7:30
4.57	37	1/18/53	18:15
5.73	25	1/22/54	17:00
5.73	26	2/07/55	20:00
5.66	27	12/11/55	14:30
5.15	33	12/09/56	16:15
4.20	44	1/17/58	6:15
4.92	35	1/23/59	22:30
6.02	18	11/21/59	1:15
5.59	29	11/20/60	6:15
2.28	48	12/17/61	7:30
5.29	31	2/03/63	2:30
6.40	10	6/18/64	18:15
5.96	20	1/29/65	1:45
2.18	49	1/05/66	16:30
4.11	45	1/19/67	15:00
5.39	30	6/02/68	23:45
5.84	22	12/03/68	15:45
4.24	43	12/13/69	20:15
6.23	13	1/08/71	23:30
6.17	15	2/28/72	6:30
4.29	42	1/13/73	4:00
3.24	46	2/18/74	23:15
6.37	11	12/27/74	1:30
6.03	17	12/02/75	20:45
1.93	50	3/03/77	1:00
5.89	21	12/02/77	22:15
4.58	36	2/06/79	15:30
6.45	9	12/15/79	14:15
6.75	8	11/21/80	10:30
5.64	28	1/23/82	19:15
6.26	12	1/05/83	9:45
7.64	6	1/24/84	23:45
4.33	40	11/03/84	13:15
5.78	24	1/18/86	20:00
7.93	5	11/24/86	5:45
5.21	32	3/27/88	10:00
4.37	39	4/05/89	15:45
10.19	1	1/09/90	13:45
8.71	4	11/24/90	14:30

-----Flow Frequency Analysis-------

- - Peaks - - (CFS)	(ft)	Rank	Return Period	Prob
10.19	3.92	1	89.50	0.989
9.36	3.58	2	32.13	0.969
9.06	3.41	3	19.58	0.949
8.71	3.23	4	14.08	0.929
7.93	2.83	5	10.99	0.909
7.64	2.70	6	9.01	0.889
6.98	2.41	7	7.64	0.869
6.75	2.31	8	6.63	0.849
6.45	2.19	9	5.86	0.829
6.40	2.17	10	5.24	0.809
6.37	2.16	11	4.75	0.789
6.26	2.12	12	4.34	0.769
6.23	2.11	13	3.99	0.749
6.18	2.09	14	3.70	0.729
6.17	2.09	15	3.44	0.709
6.11	2.07	16	3.22	0.690
6.03	2.04	17	3.03	0.670
6.02	2.03	18	2.85	0.650
5.97	2.02	19	2.70	0.630
5.96	2.01	20	2.56	0.610
5.89	1.99	21	2.44	0.590
5.84	1.97	22	2.32	0.570
5.80	1.96	23	2.22	0.550
5.78	1.95	24	2.13	0.530
5.73	1.93	25	2.04	0.510
5.73	1.93	26	1.96	0.490
5.66	1.91	27	1.89	0.470
5.64	1.90	28	1.82	0.450
5.59	1.90	29	1.75	0.430
5.39	1.89	30	1.70	0.410
5.29	1.89	31	1.64	0.390
5.21	1.88	32	1.59	0.370
5.15	1.88	33	1.54	0.350
4.97	1.87	34	1.49	0.330
4.92	1.87	35	1.45	0.310
4.58	1.86	36	1.41	0.291
4.57	1.86	37	1.37	0.271
4.52	1.85	38	1.33	0.251
4.37	1.85	39	1.30	0.231
4.33	1.85	40	1.27	0.211
4.31	1.85	41	1.24	0.191
4.29	1.84	42	1.21	0.171
4.24	1.84	43	1.18	0.151

5.97	19	1/28/92	13:30
4.52	38	3/22/93	23:30
2.52	47	3/03/94	3:15
5.80	23	2/19/95	18:00
9.06	3	2/08/96	23:00
6.11	16	12/31/96	21:15
4.31	41	10/30/97	6:15
Computed Peaks			
Computed Peaks			
Computed Peaks			
Computed Peaks			
Computed Peaks			
Computed Peaks			
Computed Peaks			
Computed Peaks			

4.20	1.84	44	1.15	0.131
4.11	1.84	45	1.12	0.111
3.24	1.80	46	1.10	0.091
2.52	1.68	47	1.08	0.071
2.28	1.64	48	1.05	0.051
2.18	1.62	49	1.03	0.031
1.93	1.57	50	1.01	0.011
9.17	3.47		100.00	0.990
8.84	3.29		50.00	0.980
8.44	3.09		25.00	0.960
7.77	2.76		10.00	0.900
7.59	2.68		8.00	0.875
7.07	2.45		5.00	0.800
5.66	1.91		2.00	0.500
4.37	1.85		1.30	0.231

Flow Frequency Analysis
Time Series File:dsout.tsf
Project Location:Landsburg

LogPearson III Coefficients
Mean= 1.135 StdDev= 0.177
Skew= 0.254

---Annual Peak Flow Rates---

Flow Rate (CFS)	Rank	Time of Peak	
17.89	14	2/16/49	20:30
24.47	4	3/03/50	15:15
23.45	6	2/09/51	16:15
9.77	38	1/30/52	8:45
9.49	40	1/18/53	18:00
13.29	25	1/22/54	16:45
12.75	28	2/07/55	21:45
12.03	30	12/11/55	15:15
11.47	32	12/09/56	15:45
8.59	47	1/17/58	6:15
12.93	27	9/26/59	13:30
14.16	21	11/21/59	0:45
11.60	31	11/20/60	13:30
6.23	49	12/17/61	9:15
11.32	34	2/28/63	19:00
21.86	8	6/18/64	18:00
14.34	19	1/29/65	4:30
5.59	50	1/05/66	18:00
9.27	41	12/13/66	8:30
12.08	29	6/02/68	23:30
16.77	16	6/23/69	20:00
8.68	46	12/13/69	20:15
24.19	5	9/02/71	2:00
18.28	13	2/28/72	15:15
8.86	45	1/13/73	3:45
9.13	43	11/11/73	3:30
21.38	10	12/27/74	1:15
13.57	24	12/02/75	23:00
9.02	44	8/25/77	23:30
13.77	23	12/02/77	18:45
9.99	37	2/06/79	16:15
18.36	12	12/15/79	6:15

-----Flow Frequency Analysis-------

- - Peaks - - (CFS)	Rank	Return Period	Prob
32.61	1	89.50	0.989
31.92	2	32.13	0.969
29.98	3	19.58	0.949
24.47	4	14.08	0.929
24.19	5	10.99	0.909
23.45	6	9.01	0.889
22.76	7	7.64	0.869
21.86	8	6.63	0.849
21.71	9	5.86	0.829
21.38	10	5.24	0.809
20.15	11	4.75	0.789
18.36	12	4.34	0.769
18.28	13	3.99	0.749
17.89	14	3.70	0.729
16.82	15	3.44	0.709
16.77	16	3.22	0.690
15.33	17	3.03	0.670
15.03	18	2.85	0.650
14.34	19	2.70	0.630
14.28	20	2.56	0.610
14.16	21	2.44	0.590
13.95	22	2.32	0.570
13.77	23	2.22	0.550
13.57	24	2.13	0.530
13.29	25	2.04	0.510
12.95	26	1.96	0.490
12.93	27	1.89	0.470
12.75	28	1.82	0.450
12.08	29	1.75	0.430
12.03	30	1.70	0.410
11.60	31	1.64	0.390
11.47	32	1.59	0.370

16.82	15	11/21/80	13:00	11.37	33	1.54	0.350
11.37	33	1/23/82	20:45	11.32	34	1.49	0.330
15.33	17	1/05/83	9:45	10.80	35	1.45	0.310
21.71	9	1/24/84	23:15	10.50	36	1.41	0.291
10.50	36	11/01/84	23:00	9.99	37	1.37	0.271
15.03	18	10/22/85	16:15	9.77	38	1.33	0.251
20.15	11	11/24/86	4:15	9.67	39	1.30	0.231
10.80	35	3/27/88	9:45	9.49	40	1.27	0.211
9.22	42	4/05/89	15:45	9.27	41	1.24	0.191
32.61	1	1/09/90	11:15	9.22	42	1.21	0.171
22.76	7	11/24/90	14:00	9.13	43	1.18	0.151
13.95	22	4/18/92	18:00	9.02	44	1.15	0.131
14.28	20	5/21/93	15:00	8.86	45	1.12	0.111
7.95	48	12/10/93	6:30	8.68	46	1.10	0.091
12.95	26	2/19/95	19:30	8.59	47	1.08	0.071
31.92	2	5/14/96	6:15	7.95	48	1.05	0.051
29.98	3	9/18/97	4:30	6.23	49	1.03	0.031
9.67	39	10/30/97	6:00	5.59	50	1.01	0.011
Computed Peaks				38.02		100.00	0.990
Computed Peaks				33.31		50.00	0.980
Computed Peaks				28.85		25.00	0.960
Computed Peaks				23.24		10.00	0.900
Computed Peaks				22.13		8.00	0.875
Computed Peaks				19.11		5.00	0.800
Computed Peaks				13.41		2.00	0.500
Computed Peaks				9.97		1.30	0.231

Flow Duration from Time Series File:rdout.tsf

Cutoff CFS	Count	Frequency %	CDF %	Exceedence_Probability %	
0.145	972612	55.514	55.514	44.486	0.445E+00
0.432	452300	25.816	81.331	18.669	0.187E+00
0.719	135166	7.715	89.046	10.954	0.110E+00
1.01	67882	3.875	92.920	7.080	0.708E-01
1.29	41709	2.381	95.301	4.699	0.470E-01
1.58	26442	1.509	96.810	3.190	0.319E-01
1.87	16229	0.926	97.736	2.264	0.226E-01
2.15	11482	0.655	98.392	1.608	0.161E-01
2.44	7541	0.430	98.822	1.178	0.118E-01
2.73	5362	0.306	99.128	0.872	0.872E-02
3.01	3906	0.223	99.351	0.649	0.649E-02
3.30	3100	0.177	99.528	0.472	0.472E-02
3.59	1400	0.080	99.608	0.392	0.392E-02
3.87	1315	0.075	99.683	0.317	0.317E-02
4.16	943	0.054	99.737	0.263	0.263E-02
4.45	886	0.051	99.787	0.213	0.213E-02
4.73	631	0.036	99.823	0.177	0.177E-02
5.02	511	0.029	99.853	0.147	0.147E-02
5.31	328	0.019	99.871	0.129	0.129E-02
5.59	233	0.013	99.885	0.115	0.115E-02
5.88	653	0.037	99.922	0.078	0.781E-03
6.17	308	0.018	99.939	0.061	0.606E-03
6.45	221	0.013	99.952	0.048	0.479E-03
6.74	83	0.005	99.957	0.043	0.432E-03

7.03	92	0.005	99.962	0.038	0.380E-03
7.31	103	0.006	99.968	0.032	0.321E-03
7.60	102	0.006	99.974	0.026	0.263E-03
7.89	83	0.005	99.978	0.022	0.215E-03
8.17	73	0.004	99.983	0.017	0.174E-03
8.46	80	0.005	99.987	0.013	0.128E-03
8.75	65	0.004	99.991	0.009	0.908E-04
9.03	58	0.003	99.994	0.006	0.576E-04
9.32	53	0.003	99.997	0.003	0.274E-04
9.61	15	0.001	99.998	0.002	0.188E-04
9.89	16	0.001	99.999	0.001	0.970E-05
10.18	15	0.001	100.000	0.000	0.114E-05

Flow Duration from Time Series File:dsout.tsf

Cutoff CFS	Count	Frequency %	CDF %	Exceedence %	Probability
0.466	1133371	64.690	64.690	35.310	0.353E+00
1.38	361210	20.617	85.307	14.693	0.147E+00
2.30	122520	6.993	92.300	7.700	0.770E-01
3.22	58437	3.335	95.636	4.364	0.436E-01
4.14	31284	1.786	97.421	2.579	0.258E-01
5.06	17065	0.974	98.395	1.605	0.160E-01
5.98	9869	0.563	98.959	1.041	0.104E-01
6.89	5901	0.337	99.295	0.705	0.705E-02
7.81	3752	0.214	99.510	0.490	0.490E-02
8.73	2317	0.132	99.642	0.358	0.358E-02
9.65	1778	0.101	99.743	0.257	0.257E-02
10.57	1296	0.074	99.817	0.183	0.183E-02
11.48	937	0.053	99.871	0.129	0.129E-02
12.40	523	0.030	99.901	0.099	0.993E-03
13.32	492	0.028	99.929	0.071	0.712E-03
14.24	284	0.016	99.945	0.055	0.550E-03
15.16	185	0.011	99.956	0.044	0.445E-03
16.08	125	0.007	99.963	0.037	0.373E-03
16.99	116	0.007	99.969	0.031	0.307E-03
17.91	86	0.005	99.974	0.026	0.258E-03
18.83	105	0.006	99.980	0.020	0.198E-03
19.75	97	0.006	99.986	0.014	0.143E-03
20.67	72	0.004	99.990	0.010	0.102E-03
21.59	92	0.005	99.995	0.005	0.491E-04
22.50	40	0.002	99.997	0.003	0.263E-04
23.42	29	0.002	99.999	0.001	0.970E-05
24.34	5	0.000	99.999	0.001	0.685E-05
25.26	3	0.000	99.999	0.001	0.514E-05
26.18	2	0.000	100.000	0.000	0.400E-05
27.09	1	0.000	100.000	0.000	0.342E-05
28.01	0	0.000	100.000	0.000	0.342E-05
28.93	0	0.000	100.000	0.000	0.342E-05
29.85	2	0.000	100.000	0.000	0.228E-05
30.77	2	0.000	100.000	0.000	0.114E-05
31.69	0	0.000	100.000	0.000	0.114E-05
32.60	1	0.000	100.000	0.000	0.571E-06

B. DIVERSION AREA WATER BALANCE MODEL

Tall Chief Diversion Area Water Balance Summary

1/15/2012 based on 1 hr time steps

Storm Return Period	predev	dev	Change in flow compared to post dev condition change in flow	% change
100 yr	10.16	8.61	-1.55	-15%
25 YR	6.15	5.12	-1.03	-17%
10 yr	5.39	4.95	-0.44	-8%
2 yr	2.97	2.69	-0.28	-9%
1.1 yr	1.4	1.61	0.21	15%
Discharge volume from time series	371,598 cf	336,707cf	34981	-9%
	based on 15 min time steps			
100 yr	15.11	15.18	0.07	0.40%
25 YR	8.17	8.15	-0.02	-0.20%
10 yr	7.7	7.67	-0.03	-0.40%
2 yr	4.96	5.63	0.67	13%
1.1 yr	1.61	2.85	1.24	77%
Discharge Volume from time series	458,906cf	397,903 cf	61003	-13%

TALL CHIEF | DIVERSION WATERBALANCE | HEH 1-13-12

ALL IN ACRES

EXISTING CONDITIONS - FLOWS EAST TO EAST BASIN X & Y ARE PART OF EXIST BASIN B

BASIN	PERVIOUS LAWN	PERVIOUS FOREST	TOTAL
D	14.69	31.81	46.50
C	Ø	15.45	15.45
TOTALS	14.69	47.26	61.95

POST DEVELOPED CONDITIONS - FLOWS TO EAST

BASIN	IMPERV ROADS	IMPERV ROOF & DW	PERVIOUS LAWNS	PERV FOREST	TOTAL	
D	Ø	21.42 Ac of LOTS X 20% = 4.28	21.42 X 15% + 27.33 X 15% = 7.31	34.91	46.50	LOT 6 THRU 12 (21.42 Ac)
C	3.71	27.33 Ac of LOTS X 20% = 5.47	Ø	6.27	15.45	LOT 13 THRU 18 (27.33 Ac)
TOTALS	Ø	4.28	7.31	34.91	46.50	

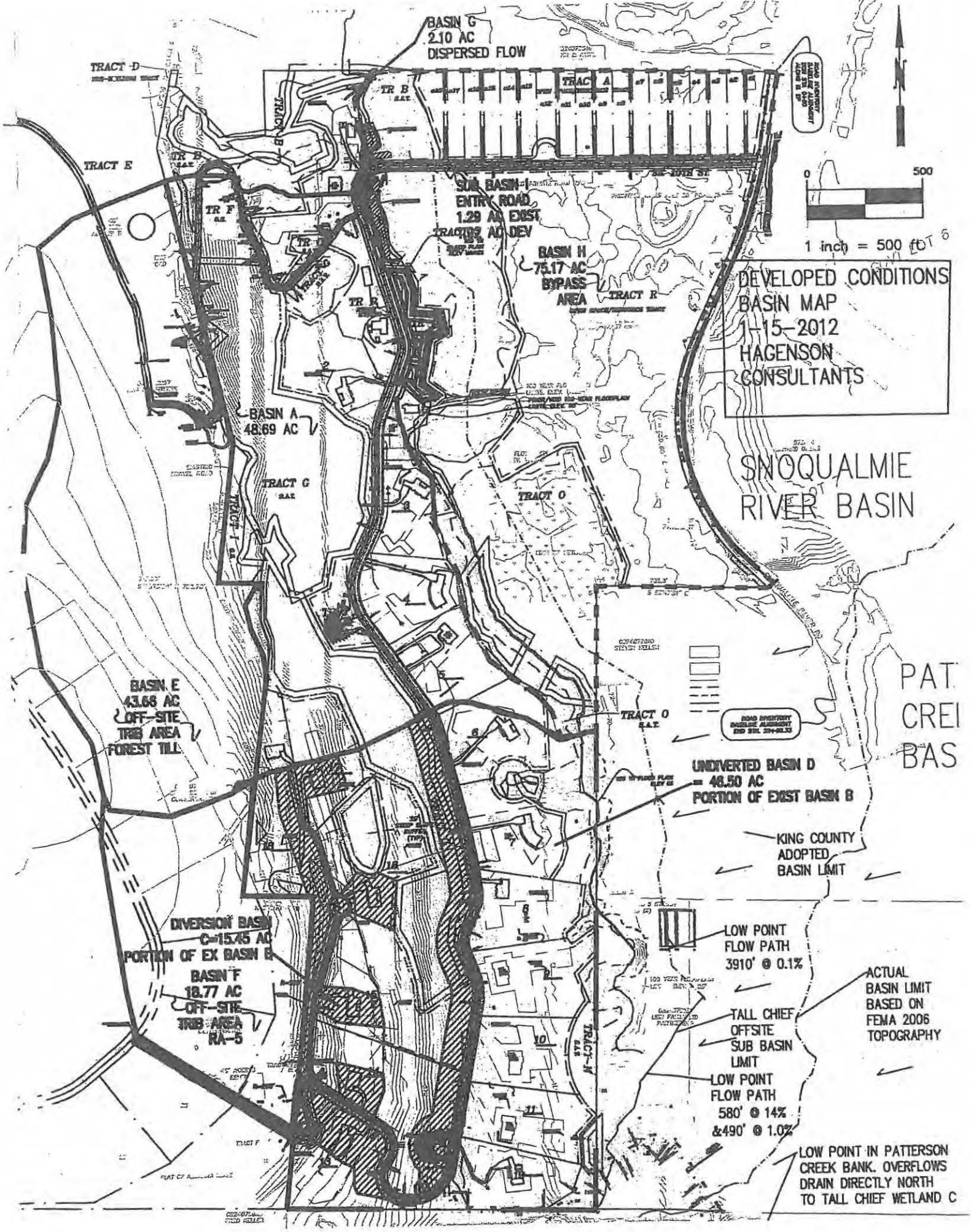
DIVERTED TO WET/DETENTION

SCALE FACTOR - LA 1.0

SOILS PER TIR - GROUP C TILL (Ag & NK)

1 HR TIME STEPS

NOTE - POST DEVELOPED CONDITIONS CONSERVATIVELY REFLECT MAX IMPERV (20%) ALLOWED BY CODE (VERSUS 8000 SF/LOT ALLOWED FOR FLOW CONTROL MODELING KCSWM Pg 3-27)


BASIN G
2.10 AC
DISPERSED FLOW
TRACT D
TRACT A
TR B
TRACT E
TR F
SUB BASIN
ENTRY ROAD
1.29 AC EXIST
TRACT B
BASIN H
75.17 AC
BYPASS
AREA
TRACT R
TR R
BASIN A
48.69 AC
TRACT G
TRACT O
TRACT I
BASIN E
43.66 AC
OFF-SITE
TRIB AREA
FOREST TILL
TRACT O
UNDIVERTED BASIN D
= 46.50 AC
PORTION OF EXIST BASIN B
KING COUNTY
ADOPTED
BASIN LIMIT
DIVERSION BASIN
C=15.45 AC
PORTION OF EX BASIN B
BASIN F
18.77 AC
OFF-SITE
TRIB AREA
RA-5
LOW POINT
FLOW PATH
3910' @ 0.1%
ACTUAL
BASIN LIMIT
BASED ON
FEMA 2006
TOPOGRAPHY
TALL CHIEF
OFFSITE
SUB BASIN
LIMIT
LOW POINT
FLOW PATH
580' @ 14%
&490' @ 1.0%
LOW POINT IN PATTERSON
CREEK BANK. OVERFLOWS
DRAIN DIRECTLY NORTH
TO TALL CHIEF WETLAND C
TRACT N
TRACT F
0
500
1 inch = 500 ft
DEVELOPED CONDITIONS
BASIN MAP
1-15-2012
HAGENSON
CONSULTANTS
SNOQUALMIE
RIVER BASIN
PAT
CREI
BAS

Tall Chief

Basin Diversion Water Balance 1-15-2012 1 hour time steps

```
                King County Runoff Time Series Program

                        Version 6.00
All files will be read/written in the Working Directory
Working Directory:C:\kc_swdm\output
-------------------------------------------------------------------------
                        KCRTS Command

                        CREATE a new Time Series

                    Production of Runoff Time Series
   Project Location : Landsburg
    Computing Series : predev.tsf
Regional Scale Factor :   1.00
          Data Type : Reduced
Creating Hourly Time Series File
                Loading Time Series File:C:\KC_SWDM\KC_DATA\LATF60R.rnf   8
Till Forest        47.26 acres              Scaling  Yr: 8
                Loading Time Series File:C:\KC_SWDM\KC_DATA\LATG60R.rnf   8
Till Grass         14.69 acres          Adding  Yr: 8

      Total Area :   61.95 acres
Peak Discharge:  10.16 CFS at  7:00 on Jan  9 in Year 8
                                Storing Time Series File:predev.tsf   8

                    Time Series Computed
-------------------------------------------------------------------------
                        KCRTS Command

                        CREATE a new Time Series

                    Production of Runoff Time Series
   Project Location : Landsburg
    Computing Series : dev.tsf
Regional Scale Factor :   1.00
          Data Type : Reduced
Creating Hourly Time Series File
                Loading Time Series File:C:\KC_SWDM\KC_DATA\LATF60R.rnf   8
Till Forest        34.91 acres              Scaling  Yr: 8
                Loading Time Series File:C:\KC_SWDM\KC_DATA\LATG60R.rnf   8
Till Grass          7.31 acres          Adding  Yr: 8
                Loading Time Series File:C:\KC_SWDM\KC_DATA\LAEI60R.rnf   8
Impervious          4.28 acres          Adding  Yr: 8

      Total Area :   46.50 acres
Peak Discharge:  8.61 CFS at  7:00 on Jan  9 in Year 8
                                Storing Time Series File:dev.tsf   8

                    Time Series Computed
```

Flow Frequency Analysis

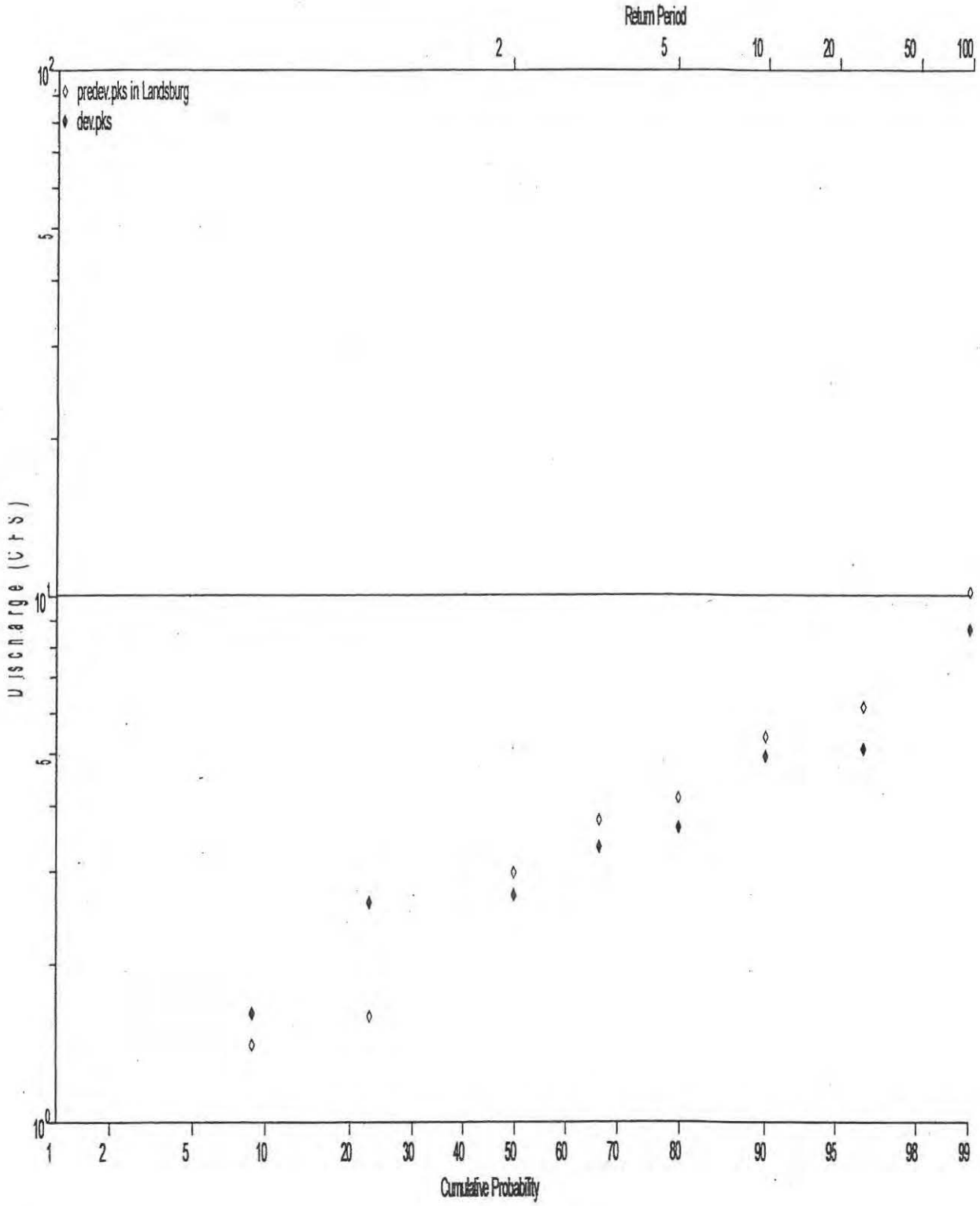
Time Series File:predev.tsf
Project Location:Landsburg

—Annual Peak Flow Rates—			—Flow Frequency Analysis—			
Flow Rate (CFS)	Rank	Time of Peak	- - Peaks - - (CFS)	Rank	Return Period	Prob
6.15	2	2/09/01 14:00	10.16	1	100.00	0.990
1.40	8	1/05/02 16:00	6.15	2	25.00	0.960
4.13	4	2/28/03 16:00	5.39	3	10.00	0.900
1.59	7	8/26/04 1:00	4.13	4	5.00	0.800
3.74	5	1/05/05 10:00	3.74	5	3.00	0.667
2.97	6	1/18/06 21:00	2.97	6	2.00	0.500
5.39	3	11/21/06 9:00	1.59	7	1.30	0.231
10.16	1	1/09/08 7:00	1.40	8	1.10	0.091
Computed Peaks			8.82		50.00	0.980

Flow Frequency Analysis

Time Series File:dev.tsf
Project Location:Landsburg

—Annual Peak Flow Rates—			—Flow Frequency Analysis—			
Flow Rate (CFS)	Rank	Time of Peak	- - Peaks - - (CFS)	Rank	Return Period	Prob
5.12	2	2/09/01 14:00	8.61	1	100.00	0.990
1.61	8	1/05/02 16:00	5.12	2	25.00	0.960
3.62	4	2/28/03 16:00	4.95	3	10.00	0.900
2.60	7	8/26/04 1:00	3.62	4	5.00	0.800
3.33	5	1/05/05 10:00	3.33	5	3.00	0.667
2.69	6	1/18/06 16:00	2.69	6	2.00	0.500
4.95	3	11/21/06 9:00	2.60	7	1.30	0.231
8.61	1	1/09/08 7:00	1.61	8	1.10	0.091
Computed Peaks			7.44		50.00	0.980


Return Period
2
5
10
20
50
100
predev.pks in Landsburg
dev.pks
Discharge (cfs)
Cumulative Probability
1
2
5
10
20
30
40
50
60
70
80
90
95
98
99

```
                                   Loading Time Series File:dev.tsf  8
      Flow Frequency Analysis
 ------------------------------------------
 Time Series File:dev.tsf
 Project Location:Landsburg
                                Frequencies & Peaks saved to File:dev.pks  :
 ------------------------------------------------------------------------
                        Analysis Tools Command
                        ----------------------
                   Compute Flow DURATION and Exceedence
                   ------------------------------------
                                 Loading Time Series File:predev.tsf  8
Computing Flow DurationsCompleted  Yr: 7
                   Durations & Exceedence Probabilities to File:predev.dur  :
 ------------------------------------------------------------------------
                        Analysis Tools Command
                        ----------------------
                   Compute Flow DURATION and Exceedence
                   ------------------------------------
                                 Loading Stage/Discharge curve:dev.tsf  :
Computing Flow DurationsCompleted  Yr: 7
                   Durations & Exceedence Probabilities to File:dev.dur  :
```

Computing Durations:

Flow Duration from Time Series File:predev.tsf

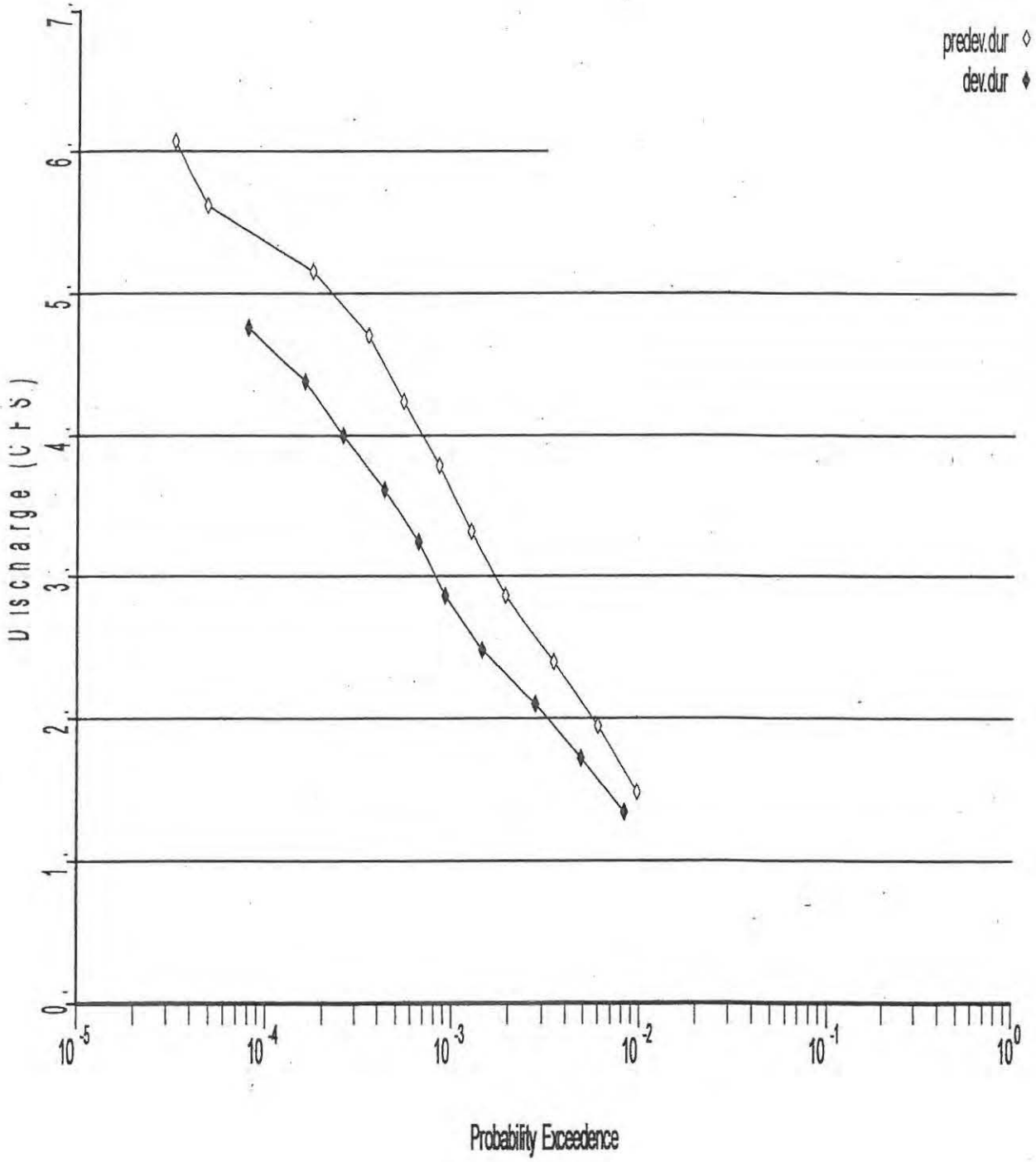
Cutoff CFS	Count	Frequency %	CDF %	Exceedence %	Probability
1.48	60715	99.013	99.013	0.987	0.987E-02
1.94	236	0.385	99.398	0.602	0.602E-02
2.40	155	0.253	99.651	0.349	0.349E-02
2.86	94	0.153	99.804	0.196	0.196E-02
3.32	41	0.067	99.871	0.129	0.129E-02
3.78	26	0.042	99.914	0.086	0.864E-03
4.24	19	0.031	99.945	0.055	0.554E-03
4.70	12	0.020	99.964	0.036	0.359E-03
5.16	11	0.018	99.982	0.018	0.179E-03
5.62	8	0.013	99.995	0.005	0.489E-04
6.08	1	0.002	99.997	0.003	0.326E-04
6.54	2	0.003	100.000	0.000	0.000E+00
7.00	0	0.000	100.000	0.000	0.000E+00

Computing Durations:

Flow Duration from Time Series File:dev.tsf

Cutoff CFS	Count	Frequency %	CDF %	Exceedence %	Probability
1.34	60804	99.159	99.159	0.841	0.841E-02
1.72	217	0.354	99.512	0.488	0.488E-02
2.10	127	0.207	99.720	0.280	0.280E-02
2.48	81	0.132	99.852	0.148	0.148E-02
2.86	34	0.055	99.907	0.093	0.930E-03
3.24	16	0.026	99.933	0.067	0.669E-03
3.62	14	0.023	99.956	0.044	0.440E-03
4.00	11	0.018	99.974	0.026	0.261E-03
4.38	6	0.010	99.984	0.016	0.163E-03
4.76	5	0.008	99.992	0.008	0.815E-04
5.14	5	0.008	100.000	0.000	0.000E+00

Start 2012-1-13 DIVERSI... KCRTS Basin Divers... KCRTS Help / Files - KCRTS KCRTS Analysis Tools 1:23 PM


predev.dur
dev.dur
Discharge (CFS)
0.
1.
2.
3.
4.
5.
6.
7.
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
Probability Exceedence

Analysis Tools Command

Compute VOLUME Discharge

Time Series Found in Memory:predev.tsf :

Discharge Volume

Discharge Volume from Time Series

predev.tsf

between 10/01/00 00:00 and 10/30/00 23:59

371598. Cu-Ft or 8.531 Ac-Ft in 30.0 days

Discharge Volume File:predev.prn :

Volume Computed

Analysis Tools Command

Compute VOLUME Discharge

Loading Time Series File:dev.tsf 8

Discharge Volume

Discharge Volume from Time Series

dev.tsf

between 10/01/00 00:00 and 10/30/00 23:59

336707. Cu-Ft or 7.730 Ac-Ft in 30.0 days

Discharge Volume File:dev.prn :

Volume Computed

Analysis Tools Command

RETURN to Previous Menu

KCSWM OUTPUT FILES DOCUMENTATION

KCRTS Program...File Directory:

C:\KC_SWDM\KC_DATA\

[C] CREATE a new Time Series

LA

47.26	0.00	0.000000	Till Forest
0.00	0.00	0.000000	Till Pasture
14.69	0.00	0.000000	Till Grass
0.00	0.00	0.000000	Outwash Forest
0.00	0.00	0.000000	Outwash Pasture
0.00	0.00	0.000000	Outwash Grass
0.00	0.00	0.000000	Wetland
0.00	0.00	0.000000	Impervious

predev.tsf

T

1.00000

T

[C] CREATE a new Time Series

LA

34.91	0.00	0.000000	Till Forest
0.00	0.00	0.000000	Till Pasture
7.31	0.00	0.000000	Till Grass
0.00	0.00	0.000000	Outwash Forest
0.00	0.00	0.000000	Outwash Pasture
0.00	0.00	0.000000	Outwash Grass

```
    0.00     0.00     0.000000  Wetland
    4.28     0.00     0.000000  Impervious
dev.tsf
T
  1.00000
T
[T] Enter the Analysis TOOLS Module
[P] Compute PEAKS and Flow Frequencies
predev.tsf
predev.pks
[P] Compute PEAKS and Flow Frequencies
dev.tsf
dev.pks
[D] Compute Flow DURATION and Exceedence
predev.tsf
predev.dur
F
F
```

Flow Frequency Analysis

Time Series File:predev.tsf

Project Location:Landsburg

—Annual Peak Flow Rates—			——Flow Frequency Analysis——			
Flow Rate (CFS)	Rank	Time of Peak	- - Peaks - - (CFS)	Rank	Return Period	Prob
6.15	2	2/09/01 14:00	10.16	1	100.00	0.990
1.40	8	1/05/02 16:00	6.15	2	25.00	0.960
4.13	4	2/28/03 16:00	5.39	3	10.00	0.900
1.59	7	8/26/04 1:00	4.13	4	5.00	0.800
3.74	5	1/05/05 10:00	3.74	5	3.00	0.667
2.97	6	1/18/06 21:00	2.97	6	2.00	0.500
5.39	3	11/21/06 9:00	1.59	7	1.30	0.231
10.16	1	1/09/08 7:00	1.40	8	1.10	0.091
Computed Peaks			8.82		50.00	0.980

Flow Frequency Analysis

Time Series File:dev.tsf

Project Location:Landsburg

---Annual Peak Flow Rates---			----Flow Frequency Analysis------			
Flow Rate (CFS)	Rank	Time of Peak	- - Peaks - - (CFS)	Rank	Return Period	Prob
5.12	2	2/09/01 14:00	8.61	1	100.00	0.990
1.61	8	1/05/02 16:00	5.12	2	25.00	0.960
3.62	4	2/28/03 16:00	4.95	3	10.00	0.900
2.60	7	8/26/04 1:00	3.62	4	5.00	0.800
3.33	5	1/05/05 10:00	3.33	5	3.00	0.667
2.69	6	1/18/06 16:00	2.69	6	2.00	0.500
4.95	3	11/21/06 9:00	2.60	7	1.30	0.231
8.61	1	1/09/08 7:00	1.61	8	1.10	0.091
Computed Peaks			7.44		50.00	0.980

Discharge Volume from Time Series

predev.tsf

between 10/01/00 00:00 and 10/30/00 23:59

371598. Cu-Ft or 8.531 Ac-Ft in 30.0 days

Discharge Volume from Time Series

dev.tsf

between 10/01/00 00:00 and 10/30/00 23:59

336707. Cu-Ft or 7.730 Ac-Ft in 30.0 days

The Following Analysis is identical but uses 15 minutes time steps to asses conveyance flows

```
                King County Runoff Time Series Program

                        Version 6.00
All files will be read/written in the Working Directory
Working Directory:C:\kc_swdm\output
------------------------------------------------------------
                        KCRTS Command

                      CREATE a new Time Series

                 Production of Runoff Time Series
   Project Location : Landsburg
    Computing Series : 15predev.tsf
Regional Scale Factor :    1.00
          Data Type : Reduced
Creating 15-minute Time Series File
                Loading Time Series File:C:\KC_SWDM\KC_DATA\LATF15R.rnf   8
Till Forest        47.26 acres                Scaling  Yr: 8
                Loading Time Series File:C:\KC_SWDM\KC_DATA\LATG15R.rnf   8
Till Grass         14.69 acres          Adding  Yr: 8

       Total Area :   61.95 acres
Peak Discharge:  15.10 CFS at  7:30 on Jan  9 in Year 8
                              Storing Time Series File:15predev.tsf   8

                    Time Series Computed
------------------------------------------------------------
                        KCRTS Command

                      CREATE a new Time Series

                 Production of Runoff Time Series
   Project Location : Landsburg
    Computing Series : 15dev.tsf
Regional Scale Factor :    1.00
          Data Type : Reduced
Creating 15-minute Time Series File
                Loading Time Series File:C:\KC_SWDM\KC_DATA\LATF15R.rnf   8
Till Forest        34.91 acres                Scaling  Yr: 8
                Loading Time Series File:C:\KC_SWDM\KC_DATA\LATG15R.rnf   8
Till Grass          7.31 acres          Adding  Yr: 8
                Loading Time Series File:C:\KC_SWDM\KC_DATA\LAET15R.rnf   8
Impervious          4.28 acres          Adding  Yr: 8

       Total Area :   46.50 acres
Peak Discharge:  15.16 CFS at  7:30 on Jan  9 in Year 8
                              Storing Time Series File:15dev.tsf   8

                    Time Series Computed
```

Compute PEAKS and Flow Frequencies

Loading Time Series File:15predev.tsf 8

Flow Frequency Analysis

Time Series File:15predev.tsf
Project Location:Landsburg

Frequencies & Peaks saved to File:15predev.pks :

Analysis Tools Command

Compute PEAKS and Flow Frequencies

Loading Time Series File:15dev.tsf 8

Flow Frequency Analysis

Time Series File:15dev.tsf
Project Location:Landsburg

Frequencies & Peaks saved to File:15dev.pks :

Flow Frequency Analysis

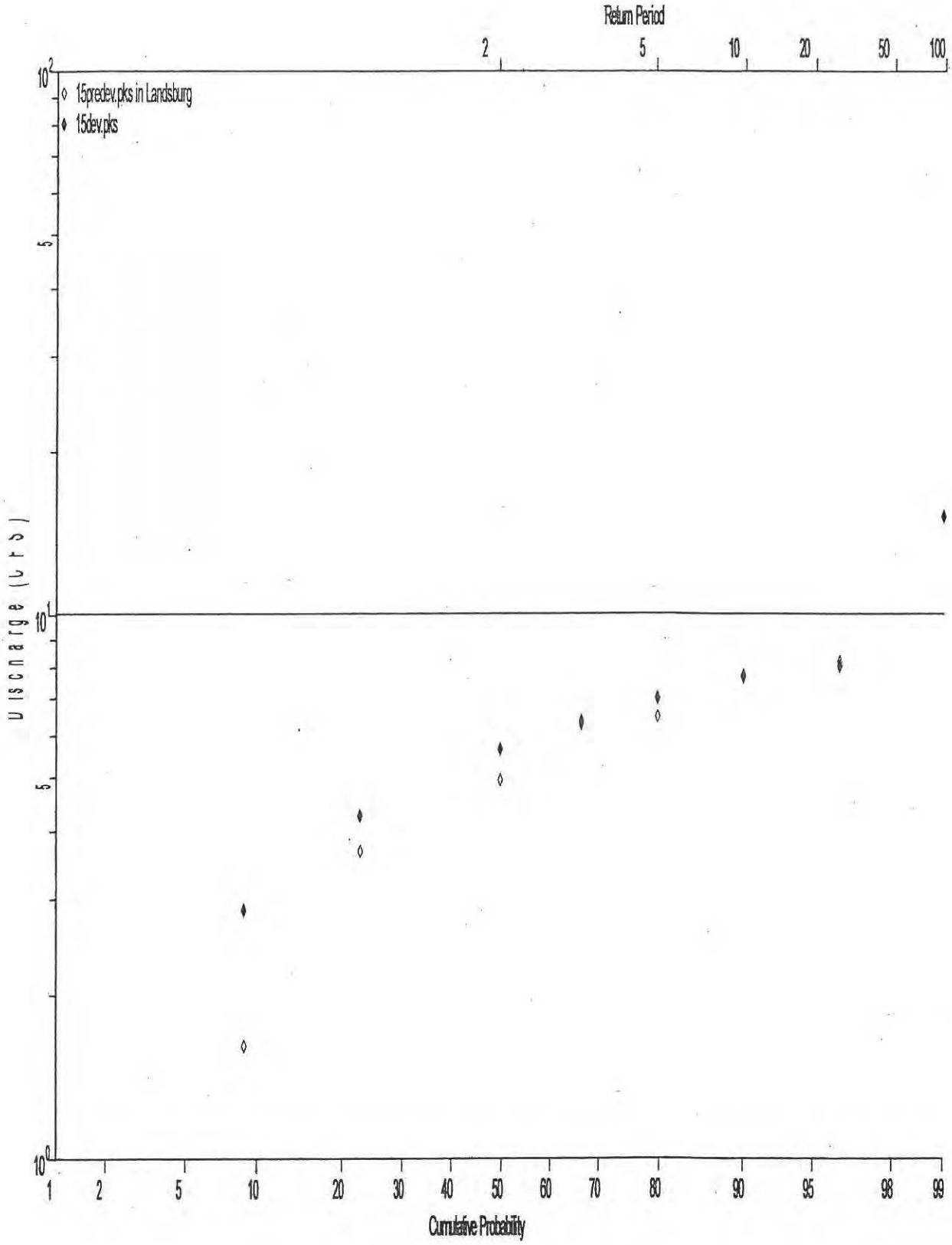
Time Series File:15predev.tsf
Project Location:Landsburg

—Annual Peak Flow Rates—			—Flow Frequency Analysis—			
Flow Rate (CFS)	Rank	Time of Peak	- - Peaks - - (CFS)	Rank	Return Period	Prob
6.27	5	2/09/01 13:30	15.11	1	100.00	0.990
1.61	8	1/05/02 15:15	8.17	2	25.00	0.960
8.17	2	6/25/03 2:15	7.70	3	10.00	0.900
7.70	3	8/25/04 23:30	6.49	4	5.00	0.800
3.67	7	1/05/05 8:00	6.27	5	3.00	0.667
4.96	6	10/22/05 16:15	4.96	6	2.00	0.500
6.49	4	11/21/06 8:15	3.67	7	1.30	0.231
15.11	1	1/09/08 7:30	1.61	8	1.10	0.091
Computed Peaks			12.80		50.00	0.980

Flow Frequency Analysis

Time Series File:15dev.tsf
Project Location:Landsburg

—Annual Peak Flow Rates—			—Flow Frequency Analysis—			
Flow Rate (CFS)	Rank	Time of Peak	- - Peaks - - (CFS)	Rank	Return Period	Prob
5.63	6	2/09/01 3:00	15.18	1	100.00	0.990
2.85	8	5/06/02 7:15	8.05	2	25.00	0.960
8.05	2	6/25/03 2:15	7.67	3	10.00	0.900
7.67	3	8/25/04 23:30	7.00	4	5.00	0.800
4.25	7	9/10/05 16:45	6.35	5	3.00	0.667
7.00	4	10/22/05 16:15	5.63	6	2.00	0.500
6.35	5	11/21/06 8:00	4.25	7	1.30	0.231
15.18	1	1/09/08 7:30	2.85	8	1.10	0.091
Computed Peaks			12.80		50.00	0.980


Return Period
2
5
10
20
50
100
15predev.pks in Landsburg
15dev.pks
Discharge (cfs)
Cumulative Probability
1
2
5
10
20
30
40
50
60
70
80
90
95
98
99

Compute Flow DURATION and Exceedence

Loading Time Series File:15predev.tsf 8
Computing Flow DurationsCompleted Yr: 7
Durations & Exceedence Probabilities to File:15predev.dur :

Analysis Tools Command

Compute Flow DURATION and Exceedence

Loading Stage/Discharge curve:15predev.tsf :
Computing Flow DurationsCompleted Yr: 7
Durations & Exceedence Probabilities to File:15predev.dur :

Analysis Tools Command

Compute Flow DURATION and Exceedence

Loading Stage/Discharge curve:15dev.tsf :
Computing Flow DurationsCompleted Yr: 7
Durations & Exceedence Probabilities to File:15dev.dur :

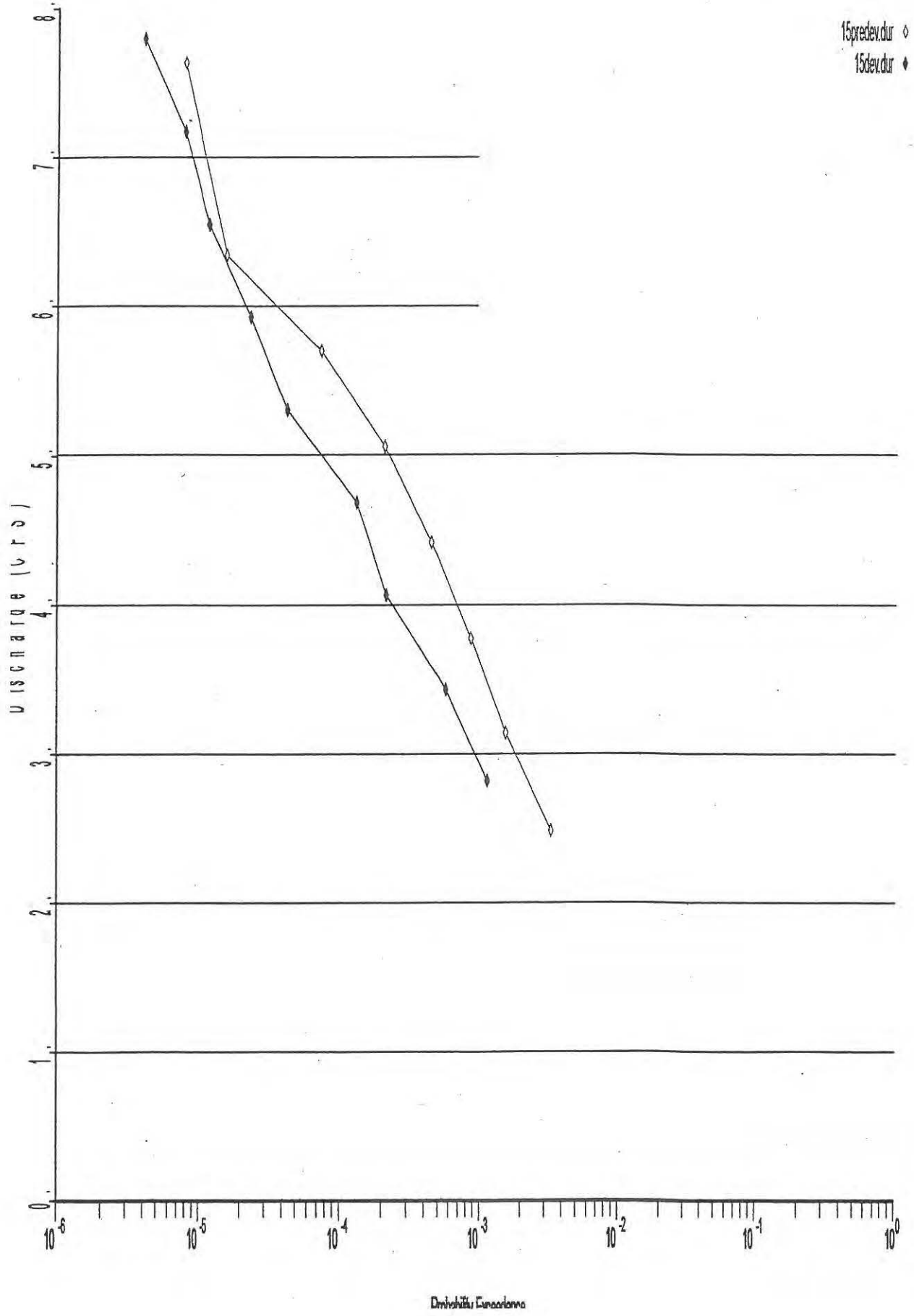
7.64	0	0.000	99.999	0.001	0.815E-05
8.28	2	0.001	100.000	0.000	0.000E+00
8.93	0	0.000	100.000	0.000	0.000E+00

Computing Durations:
Flow Duration from Time Series File:15predev.tsf

Cutoff CFS	Count	Frequency %	CDF %	Exceedence %	Probability
2.48	244444	99.659	99.659	0.341	0.341E-02
3.13	440	0.179	99.839	0.161	0.161E-02
3.77	176	0.072	99.910	0.090	0.897E-03
4.41	105	0.043	99.953	0.047	0.469E-03
5.06	61	0.025	99.978	0.022	0.220E-03
5.70	35	0.014	99.992	0.008	0.775E-04
6.35	15	0.006	99.998	0.002	0.163E-04
6.99	2	0.001	99.999	0.001	0.815E-05
7.64	0	0.000	99.999	0.001	0.815E-05
8.28	2	0.001	100.000	0.000	0.000E+00
8.93	0	0.000	100.000	0.000	0.000E+00

Computing Durations:
Flow Duration from Time Series File:15dev.tsf

Cutoff CFS	Count	Frequency %	CDF %	Exceedence %	Probability
2.81	244993	99.883	99.883	0.117	0.117E-02
3.43	143	0.058	99.941	0.059	0.587E-03
4.06	89	0.036	99.978	0.022	0.224E-03
4.68	21	0.009	99.986	0.014	0.139E-03
5.31	23	0.009	99.996	0.004	0.448E-04
5.93	5	0.002	99.998	0.002	0.245E-04
6.55	3	0.001	99.999	0.001	0.122E-04
7.18	1	0.000	99.999	0.001	0.815E-05
7.80	1	0.000	100.000	0.000	0.408E-05
8.43	1	0.000	100.000	0.000	0.000E+00
9.05	0	0.000	100.000	0.000	0.000E+00


15predev.dur
15dev.dur
Discharge (cfs)
0.
1.
2.
3.
4.
5.
6.
7.
8.
10^{-6}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
Probability Exceedance

Analysis Tools Command

Compute VOLUME Discharge

Loading Time Series File:15predev.tsf 8

Discharge Volume

Discharge Volume from Time Series

15predev.tsf

between 10/01/00 00:00 and 10/30/00 23:59

458906. Cu-Ft or 10.535 Ac-Ft in 30.0 days

Discharge Volume File:15predev.prn :

Volume Computed

Analysis Tools Command

Compute VOLUME Discharge

Loading Time Series File:15dev.tsf 8

Discharge Volume

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Discharge Volume File:15dev.prn :

Volume Computed

Analysis Tools Command

RETURN to Previous Menu

HelpFiles-KCRTS

Start Diversion Analysis... KCRTS Basin Divers... KCRTS Help Files - KCRTS KCRTS Main Menu 2:46 PM

KCSWM OUTPUT FILES DOCUMENTATION

KCRTS Program...File Directory:

C:\KC_SWDM\KC_DATA\

[C] CREATE a new Time Series

LA

47.26	0.00	0.000000	Till Forest
0.00	0.00	0.000000	Till Pasture
14.69	0.00	0.000000	Till Grass
0.00	0.00	0.000000	Outwash Forest
0.00	0.00	0.000000	Outwash Pasture
0.00	0.00	0.000000	Outwash Grass
0.00	0.00	0.000000	Wetland
0.00	0.00	0.000000	Impervious

15predev.tsf

T

1.00000

F

[C] CREATE a new Time Series

LA

34.91	0.00	0.000000	Till Forest
0.00	0.00	0.000000	Till Pasture
7.31	0.00	0.000000	Till Grass
0.00	0.00	0.000000	Outwash Forest
0.00	0.00	0.000000	Outwash Pasture
0.00	0.00	0.000000	Outwash Grass

0.00 0.00 0.000000 Wetland

4.28 0.00 0.000000 Impervious

15dev.tsf

T

1.00000

F

[T] Enter the Analysis TOOLS Module

[P] Compute PEAKS and Flow Frequencies

15predev.tsf

15predev.pks

[P] Compute PEAKS and Flow Frequencies

15dev.tsf

15dev.pks

[D] Compute Flow DURATION and Exceedence

15predev.tsf

15predev.dur

F

F

Flow Frequency Analysis

Time Series File:15predev.tsf

Project Location:Landsburg

---Annual Peak Flow Rates---			----Flow Frequency Analysis-----			
Flow Rate (CFS)	Rank	Time of Peak	- - Peaks - - (CFS)	Rank	Return Period	Prob
6.27	5	2/09/01 13:30	15.11	1	100.00	0.990
1.61	8	1/05/02 15:15	8.17	2	25.00	0.960
8.17	2	6/25/03 2:15	7.70	3	10.00	0.900
7.70	3	8/25/04 23:30	6.49	4	5.00	0.800
3.67	7	1/05/05 8:00	6.27	5	3.00	0.667
4.96	6	10/22/05 16:15	4.96	6	2.00	0.500
6.49	4	11/21/06 8:15	3.67	7	1.30	0.231
15.11	1	1/09/08 7:30	1.61	8	1.10	0.091
Computed Peaks			12.80		50.00	0.980

Flow Frequency Analysis

Time Series File:15dev.tsf

Project Location:Landsburg

—Annual Peak Flow Rates—			——Flow Frequency Analysis——			
Flow Rate (CFS)	Rank	Time of Peak	- - Peaks - - (CFS)	Rank	Return Period	Prob
5.63	6	2/09/01 3:00	15.18	1	100.00	0.990
2.85	8	5/06/02 7:15	8.05	2	25.00	0.960
8.05	2	6/25/03 2:15	7.67	3	10.00	0.900
7.67	3	8/25/04 23:30	7.00	4	5.00	0.800
4.25	7	9/10/05 16:45	6.35	5	3.00	0.667
7.00	4	10/22/05 16:15	5.63	6	2.00	0.500
6.35	5	11/21/06 8:00	4.25	7	1.30	0.231
15.18	1	1/09/08 7:30	2.85	8	1.10	0.091
Computed Peaks			12.80		50.00	0.980

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