

TECHNICAL MEMORANDUM

CPH
CONSULTANTS

DATE: January 28, 2016

TO: Wayne Nelson
Pacific Ridge – DHR, LLC

FROM: Jamie Schroeder, PE

CC: John Mirante, Pacific Ridge

PROJECT: Lake Forest Park 5
Single-Family Residential Homes
CPH Project No. 0132-15-004

SUBJECT: Storm Drainage Evaluation



11431 Willows Road NE, #120
Redmond, WA 98052

Phone (425)285-2390
Fax (425)285-2389

www.cphconsultants.com

This technical memorandum has been prepared to provide an evaluation of the function and conveyance capacity of the existing storm drainage improvements serving King County parcels 4022904990, 4022904996, 4022905032, 4022905034, and 4022905036. The lots are located off of NE 189th Place just west of the intersection of 45th Place NE in Lake Forest Park, Washington. These existing lots were created as part of two short plats (King County Short Plats 587021 and 587022) totaling 8 lots recorded in 1989. Three of the existing lots have been developed with single-family homes and the remaining 5 lots will be built out with homes as part of this project.

These original short plats constructed the existing infrastructure to serve the 8 lots. The NE 189th Place roadway and cul-de-sac were constructed, along with storm drainage collection systems for the road and connections for each individual lot, a detention tank facility, and other utility services for each of the lots. The storm drainage for the roadway is conveyed by rolled curb and gutter to existing catch basin inlets located at the low point at the cul-de-sac turnaround. There are 6" diameter below grade pipes stubbed to each of the 8 lots for connection of individual lot storm drainage. Collected runoff is conveyed southerly from the type 2 catch basin on the south side of NE 189th Place approximately 150 feet within a 12" CMP pipe to a detention tank system located in a tract at the southeast corner of the site. The detention tank system consists of 66 lineal feet of 60" CMP culvert along with a control restrictor structure for release of the flows. The control restrictor is located within a 54" type 2 catch basin and this discharges south via a 12" pipe to a storm drainage system within an easement on the parcel to the south. These existing storm drainage improvements are shown on the final corrected construction plans attached to this memorandum as Figures 1 and 2.

The storm discharge from the on-site storm drainage facility is conveyed south 10 feet via a 12" concrete pipe to a type 1 catch basin within a 10' storm drainage easement on the neighboring property. The 12" pipe then continues south adjacent to the eastern property line of parcel 0732010040 for approximately 175 feet to a type 1 catch basin at the end of NE 187th Place. The system continues southerly in a 12" pipe across the cul-de-sac to a 10' storm drainage easement on parcel 0732010070 (see copy of Bender's Evergreen Estates Division #2 plat for reference). The pipe system flows adjacent to the northwesterly property boundary for approximately 150 feet before turning south through the property for 135 feet. The storm drainage system then extends south for approximately 200 feet and connects to the roadway storm drainage system within NE 186th Street. It appears that the existing underground storm drainage conveyance system traverses parcels 4022905162 and 0732000120 to NE 186th Street. The storm drainage system within NE 186th Street flows westerly approximately 520 feet to the intersection of 40th Place NE, then turns south at the intersection of 40th Place NE which is beyond ¼ mile downstream of the subject properties. The storm drainage continues southerly and eventually discharges to Lyon Creek about ½ mile downstream. Figure 3 shows an overall map of the downstream conveyance system for reference.

A site reconnaissance was performed on January 27, 2016 to inspect the existing storm drainage facilities on-site along with observations of the downstream storm drainage system. The temperature was approximately 50 degrees and cloudy with traces of precipitation at the time of the visit. An inspection of the downstream conveyance system was also completed where accessible. Portions of the downstream system traverse private property, such as parcels 4022905162 and 0732000120, so I was not able to walk through these private properties. Visual inspections of the downstream conveyance path show no signs of flooding, erosion, or overtopping at the time of visit.

On-site catch basin grates and lids were removed and visually inspected for signs of deterioration, sediment, and general function. All of the on-site structures and pipe connections were found to be in good condition and no signs of failures, deterioration of materials, missing parts, or excessive sediment was observed. The open channel ditches, culvert inlets, and general sheet flow drainage on the existing lots was also observed and no signs of flooding, overtopping, or erosion was observed. The existing system appears to be in good condition, functioning properly, and no major maintenance appears to be required.

An analysis of the conveyance capacity of the existing storm drainage system was completed to confirm that the existing system has adequate capacity to serve the full build out of the existing eight lots in accordance with the adopted 2009 King County Surface Water Design Manual. Per the manual, pipe systems shall be designed to convey and contain the 25-yr peak flow, assuming developed conditions for onsite tributary areas and ensure the 100-yr runoff event does not create or aggregate a flooding problem. Table 1 below summarized the developed land use cover for total areas of the two associated short plats.

Table 1 - Developed Land Use Cover (Full build out)

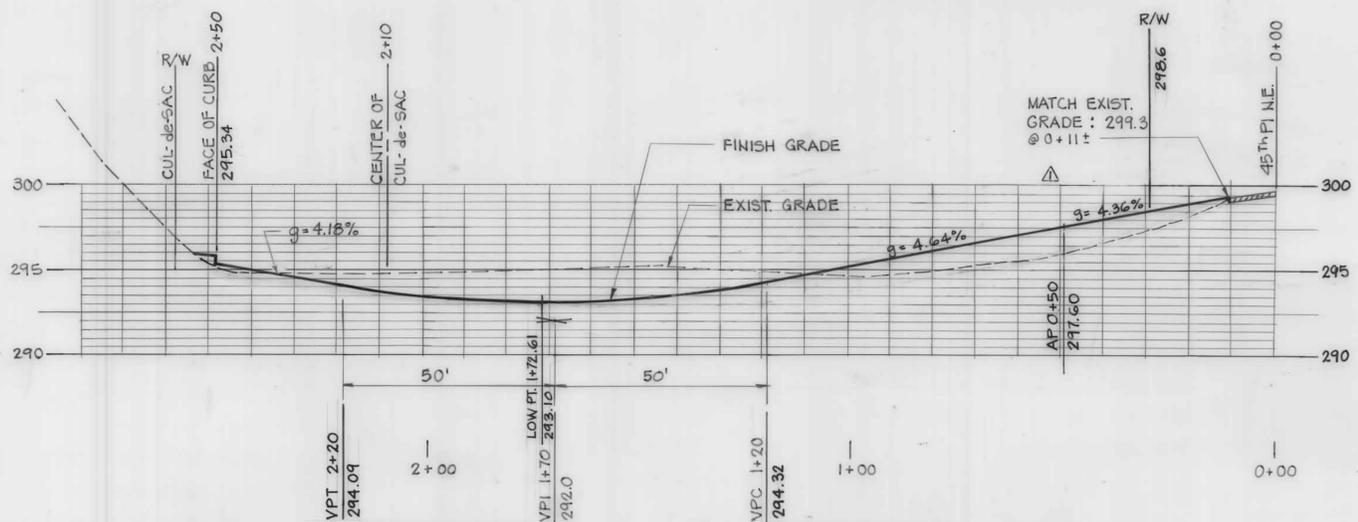
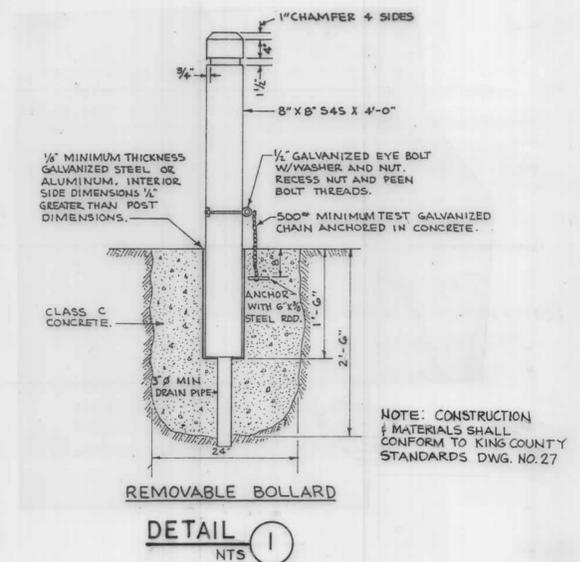
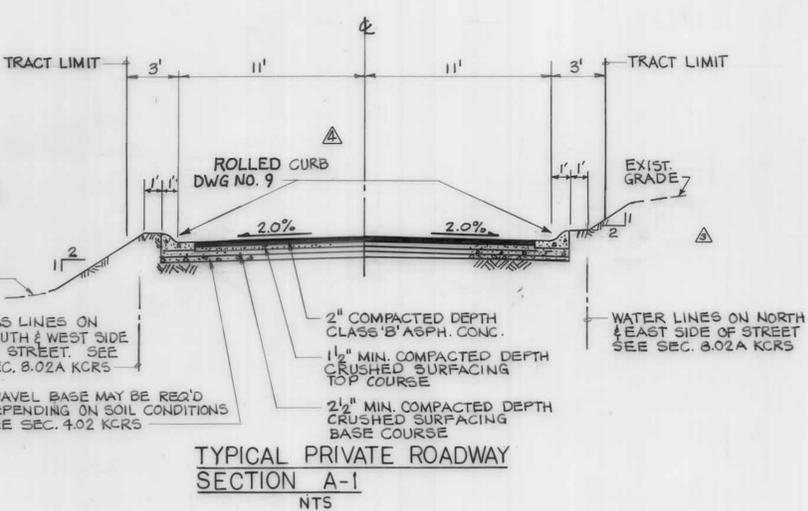
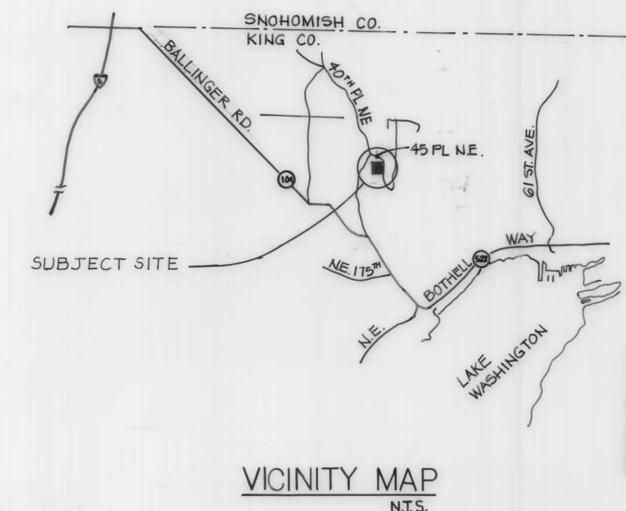
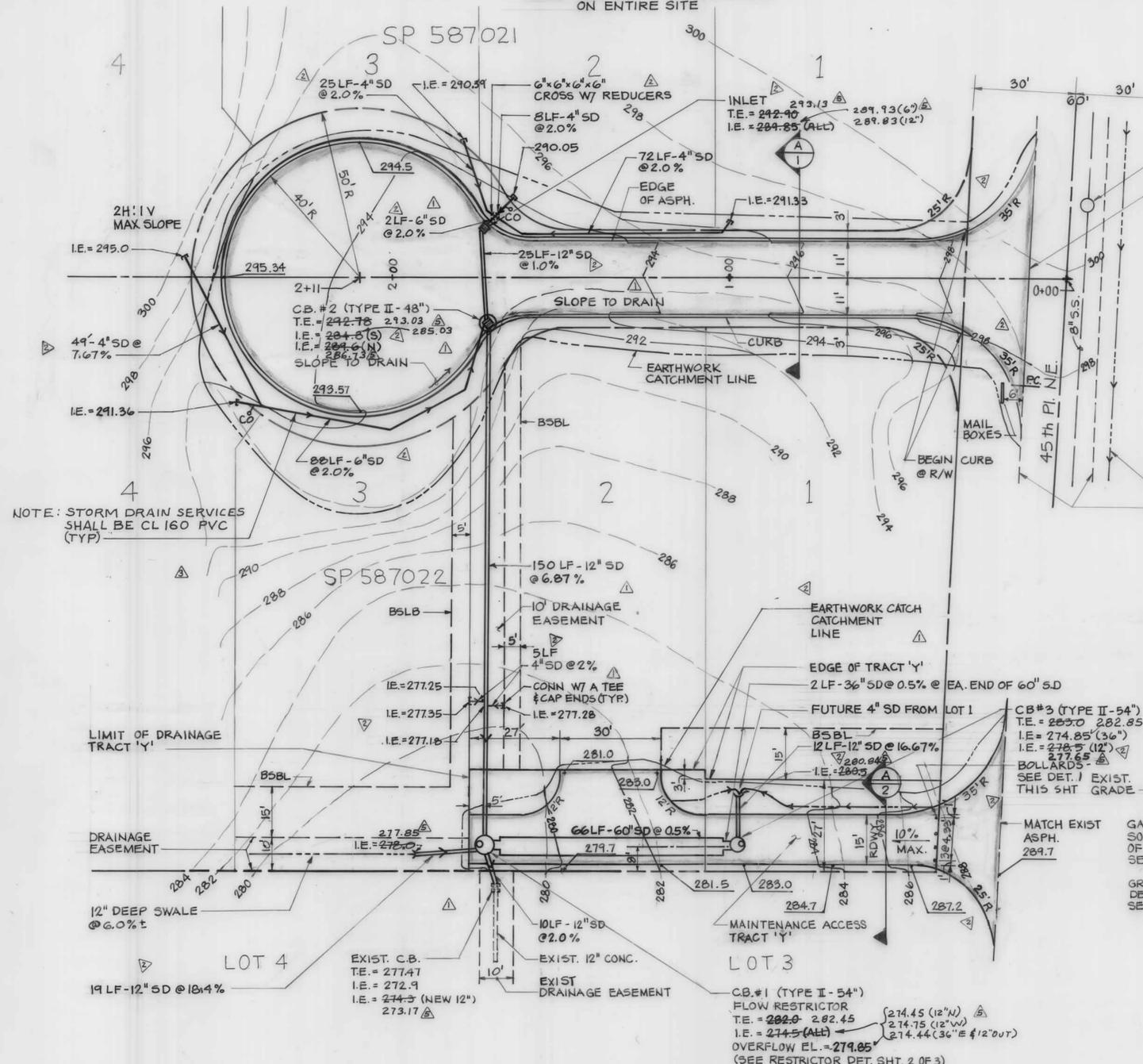
Sub-Basin Name	Total Area (acres)	Land Cover (acres)		
		Impervious	Till Grass	Till Forest
Total Site	2.47	0.88	1.59	0.0

The on-site stormwater collection, conveyance, and flow control systems for each of the new home lots have been designed in accordance with the Small Project Drainage review requirements per the King County Stormwater Design Manual. In general the roof drain collection system for each home will be discharged to a proposed rain garden or infiltration facility that will connect to the existing roof drain stubs that were installed during the King County Short Plat #2587021 and #2587022 improvements. These mitigated impervious areas will then flow to the existing detention tank system to provide additional reduction of flows prior to discharge.

The Rational method has been used to determine the peak flows for the project using the conservative approach outlined below and the existing conveyance system has been analyzed using hydraulic backwater calculations. The calculations confirm that the existing system has adequate capacity and will not overtop using the 100-year peak flow. This exceeds the KCSWDM requirement that the conveyance system contains the 25-year peak flow. It is also a very conservative calculation since the peak flows calculated to not account for the individual flow control BMPs to be installed with each of the new homes and peak flows will be further reduced with the existing detention tank facility. The Rational and backwater conveyance calculations are attached for reference.

In conclusion the existing storm drainage system is functioning properly, in good condition, and will provide adequate conveyance capacity for the five new homes without modification. Please, contact me directly at (425) 285-2392 or by e-mail at jamie@cphconsultants.com if you have questions or need any additional information related to this issue. Thank you.

NOTE: SEE SHT. 3 FOR CONTOURS ON ENTIRE SITE



KING COUNTY
APPROVAL DATE: 9/15/88
SIGNATURE: [Signature]

SK. V.O. Okereke, per correction on SHT 3/3, 9/9/88
9/12/88 Butch

DATUM: NORTHEAST LAKE WASHINGTON SEWER DISTRICT
BENCHMARK: INVERT OF SANITARY SEWER MANHOLE NORTH OF PRIVATE ROAD EL. = 289.00

DAVID C. DOUGHERTY
STATE OF WASHINGTON
REGISTERED PROFESSIONAL ENGINEER
7/7/88

FINAL CORRECTED PLAN
Project Name: Sinclair
Date: 11/17/89
Approved: [Signature]

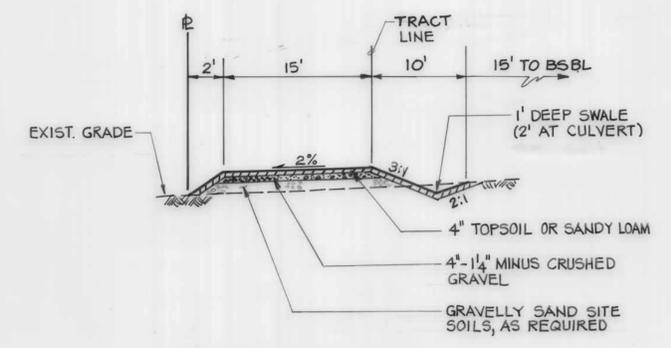
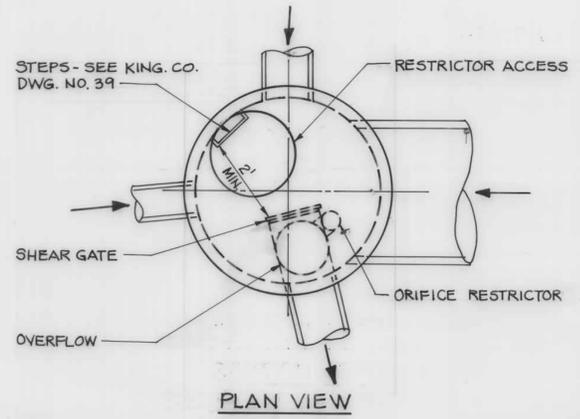
Owner: Jim Sinclair, 390-7 Sisters Rd., Port Ludlow, Wa. 98365, 437-2393
Engineer: Site Development Services, 310 - 208th Street SE, Bothell 98012, 481-9687

Legal Description:
SP 587021: Lot 1-B, Except the Northerly 12 feet thereof; in Block 10, First Addition to Lake Forest Park, according to the Plat recorded in Volume 20 of Plats, page 82 in King County, Washington.
SP 587022: Lots 2 & 3, Except the Southerly 71.07 ft. of said Lot 3 thereof, as measured along the Westerly line, all in Block 10, First Addition to Lake Forest Park, according to the Plat recorded in Volume 10 of Plats, page 82 in King County, Washington.
AS CONSTRUCTED 9/21/89 [Signature]
CHANGED CURB TYPE 3/8/89 [Signature]
REVISED 1/6/88 PER COUNTY REVIEW [Signature]
REVISED 8/16/88 PER COUNTY REVIEW [Signature]
REVISED 7/7/88 PER COUNTY REVIEW [Signature]

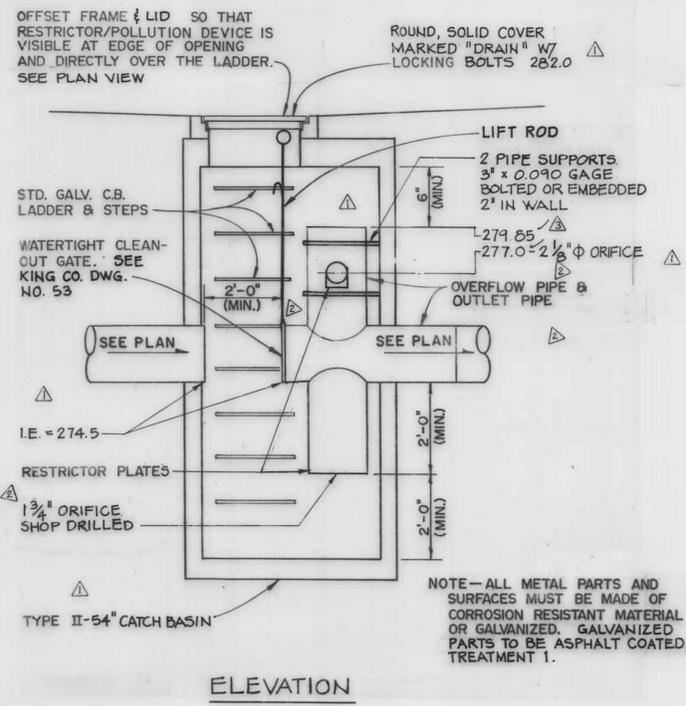
NOTE: SHEET 3 of 3, T.E.S.C.P. AVAILABLE ON MICROFILM ONLY. (P-1218B)

SP 587021 & 587022	
SCALE AS SHOWN	APPROVED BY: [Signature]
DATE: 1 29 88	DRAWN BY: RLM
DRAINAGE & ROADWAY PLAN	
JIM SINCLAIR	DRAWING NUMBER: 1 OF 3

FIGURE 2



MAINTENANCE RDWY
SECTION A-2
N.T.S



FLOW RESTRICTOR & OIL POLLUTION CONTROL DEVICE
SEE KING COUNTY DWGS. 52 & 53

KING COUNTY
APPROVAL DATE: 9/15/88
SIGNATURE: [Signature]
OK, V. O. Okereke, See SHT 3/3, 9/9/88
9/12/88 Butak

GENERAL PLAN NOTES

- All construction shall be in accordance with the King County Code (KCC), Road Standards (KCRS), and Council's conditions of preliminary subdivision approval. It shall be the sole responsibility of the developer and the developer's engineer to correct any error, omission, or variation from the above requirements found in these plans. All corrections shall be at no additional cost or liability to King County.
- The design elements within these plans have been reviewed according to the King County BALD Engineering Review checklist. Some elements may have been overlooked or missed by the County reviewer. Any variance from adopted standards is not allowed unless specifically approved by King County, prior to construction.
- Approval of this road, grading, and drainage plan does not constitute an approval of any other construction (e.g. domestic water conveyance, sewer conveyance, gas, electrical, etc.).
- Before any construction or development activity a preconstruction meeting must be held between the Division's Development Inspection Unit, the Developer, and the Developer's Construction Representative.
- A copy of these approved plans must be on the job site whenever construction is in progress.
- Construction noise shall be limited by King County Code (Section 12.88); normally this is 7 a.m. to 10 p.m. weekdays and 9 a.m. to 10 p.m. on weekends.
- It shall be the permittee's/contractor's responsibility to obtain all construction easements necessary before initiating off-site work within the road rights-of-way.
- Franchised utilities or other installations that are not shown on these approved plans shall not be constructed unless an approved set of plans that meet all requirements of KCRS Chapter 8 are submitted to the Division's Development Inspection Unit three days prior to construction.
- Datum shall be KCAS unless otherwise approved by the Division.
- Groundwater system construction shall be within a right-of-way or appropriate drainage easement, but not underneath the roadway section. All groundwater systems must be constructed in accordance with Section B1 3.02 of the APWA Standard Specifications.
- All utility trenches shall be backfilled and compacted to 95% density.
- All roadway subgrade shall be backfilled and compacted to 95% density. WSDOT 2-06.3.
- Open cutting of existing roadways is not allowed unless specifically approved by the Division and noted on these approved plans. Any open cut shall be restored in accordance with KCRS 8.03 (B)3.
- The Contractor shall be responsible for providing adequate safeguards, safety devices, protective equipment, flaggers, and any other needed actions to protect the life, health, and safety of the public, and to protect property in connection with the performance of work covered by the contract. Any work within the traveled right-of-way that may interrupt normal traffic flow shall require at least one flagger for each lane of traffic affected. All sections of the WSDOT Standard Specifications 1-07.23 - Traffic Control, shall apply.
- Structures, grading, fill and obstructions (including but not limited to decks, patios, outbuildings, or overhangs beyond 18") are prohibited within the BSBL and drainage easements, as shown.
- All downspouts, roof and footing drains shall be tightlined to the approved outlets shown on the approved plans on file.

DRAINAGE PLAN NOTES

- Proof of liability insurance shall be submitted to the Division prior to the preconstruction meeting (KCC 9.04.100.D).
- All pipe and appurtenances shall be laid on a properly prepared foundation in accordance with WSDOT 7-02.3(1). This shall include leveling and compacting the trench bottom, the top of the foundation material, and any required pipe bedding, to a uniform grade so that the entire pipe is supported by a uniformly dense unyielding base.
- Steel pipe shall be galvanized and have asphalt treatment #1 or better inside and outside (KCRS 7.03).
- All drainage structures, such as catch basins and manholes, not located within a traveled roadway or sidewalk, shall have solid locking lids. All drainage structures associated with a permanent retention/detention facility shall have solid locking lids (KCRS 7.03).
- All catch basin grates shall conform to KCRS drawing numbers 41,46,47, or 48, which includes the stamping "OUTFALL TO STREAM, DUMP NO POLLUTANTS" and "Property of King County" (KCRS 7.07).
- All driveway culverts located within King County right-of-way shall be of sufficient length to provide a minimum 3:1 slope from the edge of the driveway to the bottom of the ditch. Culverts shall have beveled end sections to match the side slope (KCRS 7.03(J)).
- Rock for erosion protection of roadway ditches, where required, must be of sound quarry rock, placed to a depth of 1 foot and must meet the following specifications: 4"-8"/40%-70% passing; 2"-4" rock/30%-40% passing; and 2" rock/10%-20% passing. Installation shall be in accordance with KCRS drawing number 51.
- Drainage outlets (stub-outs) shall be provided for each individual lot, except for those lots approved for infiltration by King County. Stub-outs shall conform to the following:
 - Each outlet shall be suitably located at the lowest elevation on the lot, so as to service all future roof downspouts and footing drains, driveways, yard drains, and any other surface or subsurface drains necessary to render the lots suitable for their intended use. Each outlet shall have free-flowing, positive drainage to an approved stormwater conveyance system or to an approved outfall location.
 - Outlets on each lot shall be located with a five-foot-high, 2" x 4" stake marked "storm" or "drain". The stub-out shall extend above surface level, be visible and be secured to the stake.
 - Pipe material shall conform to underdrain specifications described in KCRS 7.04 and, if non-metallic, the pipe shall contain wire or other acceptable detection feature.
 - Drainage easements are required for drainage systems designed to convey flows through individual lots.
 - The developer and/or contractor is responsible for coordinating the locations of all stub-out conveyance lines with respect to the utilities (e.g. power, gas, telephone, television).
 - All individual stub-outs shall be privately owned and maintained by the lot home owner.

STRUCTURE NOTES

- These plans are approved for standard road and drainage improvements only. Plans for structures such as bridges, vaults, and retaining walls require a separate review and approval by the Division prior to construction (KCC 16.04, 16.70, 14.20, KCRS 6.04).
- Pond berms greater than 6-ft. in height are considered to be earth dams. Plans for dams require a separate review and approval by the WS Dept. of Ecology prior to construction.
- Rockeries are considered to be a method of bank stabilization and erosion control. Rockeries shall not be constructed to serve as retaining walls. All rockeries shall be constructed in accordance to KCRS drawing numbers 19,20, and 21.

REVISD 8/16/88 DeJ
REVISD 1/7/88 PER COUNTY REVIEW DeJ
AS CONSTRUCTED 7/21/89 DeJ

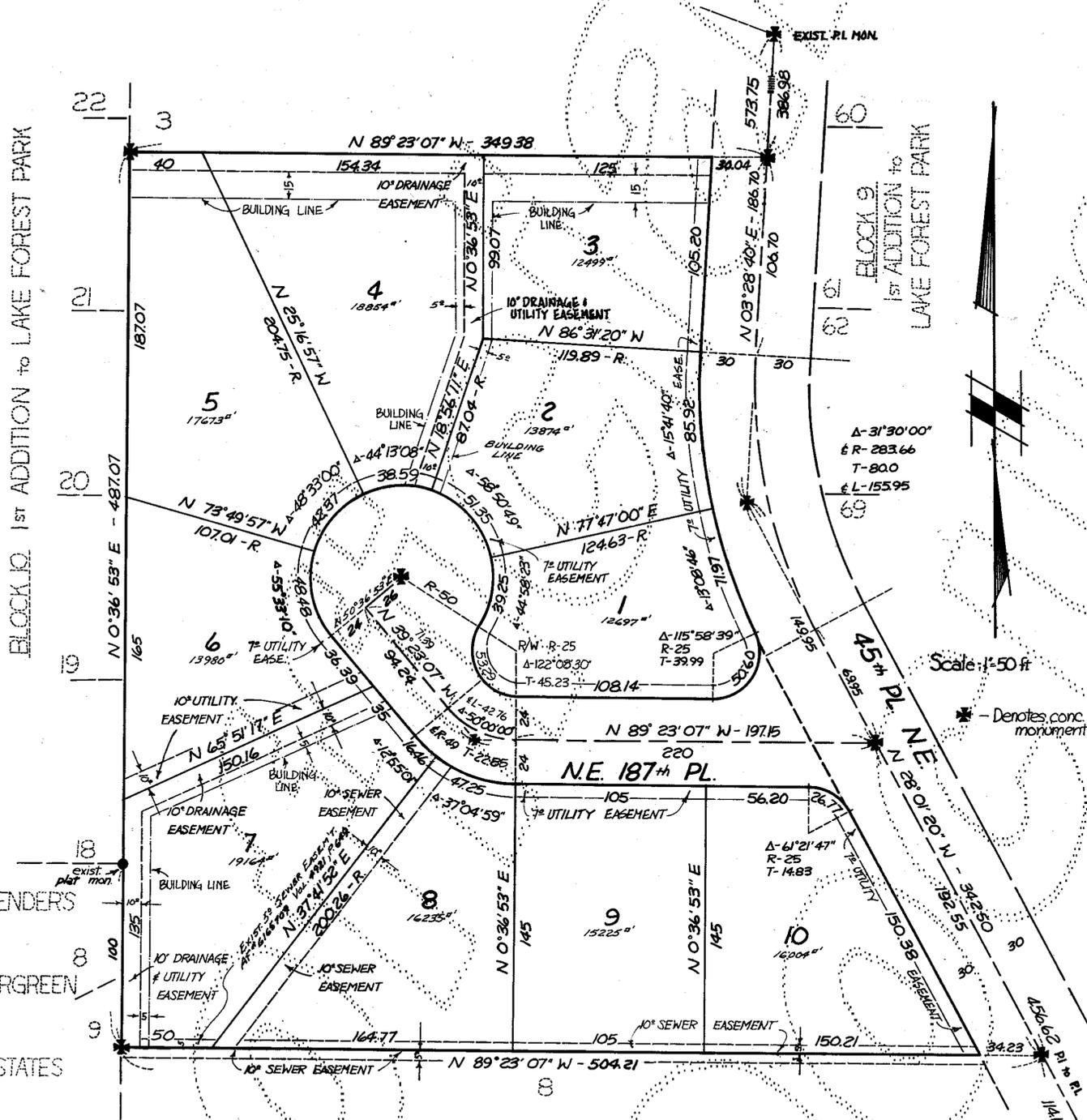
FINAL CORRECTED PLAN
SINCLAIR
11/17/89
[Signature]



SP 587021 & 587022	
SCALE: AS SHOWN	APPROVED BY: [Signature]
DATE: 1-29-88	DRAWN BY: RLM
DRAINAGE DETAILS	
JIM SINCLAIR	DRAWING NUMBER: 2 of 3

BENDERS EVERGREEN ESTATES DIVISION #2

SE 1/4 SW 1/4 SEC 3, T26N, R4E, WM
KING COUNTY WASHINGTON



DESCRIPTION

This plat of BENDERS EVERGREEN ESTATES DIVISION #2 embraces all and is a replat of the South 71.07 feet of Lot 3, as measured along the West line thereof, and all of Lots 4, 5, 6, and 7 in Block 10 of the plat of FIRST ADDITION TO LAKE FOREST PARK, as recorded in Volume 20 of Plats, on page 82, records of King County, Washington. SUBJECT TO an easement as recorded under A.F. #615709, in Volume 4921 of Deeds, on page 619, records of King County, Washington. SUBJECT TO restrictions as recorded under: A.F. #1340037, in Volume 1071 of Deeds, on page 425; A.F. #1332770 in Volume 1094 of Deeds, on page 493; A.F. #134384 in Volume 1063 of Deeds on page 238; A.F. #2096089 in Volume 1292 of Deeds, on page 315, records of King County, Washington.

DEDICATION

KNOW ALL MEN BY THESE PRESENTS that we the undersigned owners in fee simple of the land being hereby platted, do declare this plat and dedicate to the use of the public forever all streets and avenues shown hereon and the use thereof for all public purposes not inconsistent with the use thereof for public highway purposes; also the right to make all necessary slopes for cuts or fills upon the lots and blocks shown on this plat in the original reasonable grading of the streets and avenues as shown hereon. IN WITNESS WHEREOF we set our hands and seals this 22nd day of January 1970

John F. Bender, Jr. *James C. Bender*
JOHN F. BENDER, JR. JAMES C. BENDER
Patricia V. Bender, Darlene R. Bender
PATRICIA V. BENDER DARLENE R. BENDER

ACKNOWLEDGEMENT

STATE OF WASHINGTON
COUNTY OF KING
This is to certify that on this 22nd day of January 1970, before me the undersigned a Notary Public, personally appeared John F. Bender, Jr. and Patricia V. Bender, his wife, and James C. Bender and Darlene R. Bender, his wife, to me known to be the individuals that executed the within and foregoing instrument and acknowledged the said instrument to be the free and voluntary act and deed of said individuals for the uses and purposes herein mentioned. In witness whereof, I set my hand and official seal the day and year first written above.

RESTRICTIONS

No lot or portion of a lot in this plat, shall be divided and sold or resold or ownership changed or transferred whereby the ownership or any portion of this plat shall be less than the area required for the use district in which located.

APPROVALS

DEPARTMENT OF PUBLIC WORKS
Examined and approved this 30th day of October 1972
[Signature]
DIRECTOR

DEPARTMENT OF PLANNING
Examined and approved this 1st day of November 1972
[Signature]
PLANNING DIRECTOR

DEPARTMENT OF ASSESSMENTS
Examined and approved this 19th day of 1972
[Signature]
HARLEY H. HOPPE
KING COUNTY ASSESSOR
DEPUTY KING CO. ASSESSOR

KING COUNTY COUNCIL
Examined and approved this 30th day of 1972
[Signature]
CHM. KING CO. COUNCIL

ATTEST:
[Signature]
CLERK, KING CO. COUNCIL

SURVEYORS CERTIFICATE

I, M.B. Meyring, Professional Land Surveyor hereby certify that this plat of Benders Evergreen Estates Division #2 is based upon an actual survey and subdivision of Section 3, T26N, R4E, W1M, that the courses and distances are shown correctly thereon and that the monuments will be set and lot and block corners staked correctly on the ground, and that I have fully complied with provisions of the platting regulations.

[Signature]
MAXWELL B. MEYRING
REGISTERED LAND SURVEYOR

TREASURER'S CERTIFICATE

DEPARTMENT OF FINANCE
I hereby certify that all property taxes are paid, that there are no delinquent special assessments certified to this office for collection and that all special assessments certified to this office for collection on any of the property herein contained dedicated as streets, alleys or for other public use, are paid in full. This day of 1972

[Signature]
KING COUNTY TREASURER
DEPUTY KING CO. TREASURER

EASEMENT PROVISION

An easement is hereby reserved for and granted to: Pacific Northwest Bell Co, King County Water District #83, and Seattle City Light, and their respective successors and assigns, under and upon the exterior 7 feet parallel with and adjoining the street frontage of all lots in which to install, lay, construct, renew, operate, and maintain underground conduits, cables, and wires with necessary facilities and other equipment for the purpose of serving this subdivision and other property with electric, telephone, and water service, together with the right to enter upon the lots at all times for the purposes herein stated. Also to Seattle City Light a 5 foot easement along the East side of Lot 4 for underground power provision.

RECORDING CERTIFICATE

7305300802
DEPARTMENT OF RECORDS AND ELECTIONS
Filed for Record at the request of the King County Council this 30th day of MAY 1973 at 33 minutes past 2:00 P.M. and recorded in Vol. 95 of Plats, page 59 records of King County, Washington.

[Signature]
NORWARD J. BROOKS
MANAGER
S.U.P.T. OF RECORDS

APPENDIX A - CPH Rational Calculations

Project Name: Lake Forest Park Property
 CPH Project No.: 0132-15-004

	10 yr	25 yr	100yr
a _r	2.44	2.66	2.61
b _r	0.64	0.65	0.63
P _r	2.37	2.84	3.43

(NOAA Atlas - Isopluvial Maps)

Description: Rational calculation spreadsheet for backwater analysis

Basin / Subbasin	Total Area		C1	A1 (acres)	C2	A2 (acres)	Cc	Flowpath Slope (ft/ft)	k _R (KCSWDM Table 3.2.1.C)	Velocity (fps)	Length of Flowpath (feet)	Travel Time (minutes)	Travel Time Used (minutes)	i _r	I _r	A _t (acres)	Q _{Basin} (cfs)	Q _t Total (cfs)	Length of Pipe (feet)	Diameter of Pipe (inches)	Slope of Pipe (ft/ft)	Manning's Value "n"	Velocity Full (fps)	Q _f Full (cfs)	Q _f /Q _t	Q Ratio	To CB
	SF	AC																									
Total Site	107481	2.47	0.90	0.88	0.25	1.59	0.48	0.02	20.00	2.83	50.00	0.29	6.30	0.82	2.81	2.47	3.34	3.34	SEE BACKWATER SPREADSHEET								

