Encompass
ENGINEERING & SURVEYING

TECHNICAL INFORMATION REPORT

for

Lake Forest Condo
14727 35th Ave NE
Lake Forest Park, WA 98155

Original submittal: July 17, 2015
Revised Submittal: September 18, 2015

Encompass Engineering Job No. 15539

Prepared

For
14727 Investment LLC
22902 74th Avenue West
Edmonds, WA 98026

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King County Department of Development and Environmental Services

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 1 PROJECT OWNER AND PROJECT ENGINEER

Project Owner **14727 Investment LLC.**

Address **22902 74TH Ave West**

Edmonds, WA 98026

Phone **425-985-7817**

Project Engineer **Chad Allen**

Company **Encompass Engineering**

Address/Phone **425-392-0250**

Part 2 PROJECT LOCATION AND DESCRIPTION

Project **Lake Forest Condo**

Location

Township **26**

Range **04**

Section **16**

SITE ADDRESS: **14727 35th Ave NE**

Lake forest park, WA 98155

Part 3 TYPE OF PERMIT APPLICATION

- ☐ Subdivision
- ☐ Short Subdivision
- ☐ Grading
- ☐ Commercial
- ☐ Other **Condo Building**

Part 4 OTHER REVIEWS AND PERMITS

- ☐ DFW HPA
- ☐ Shoreline Management
- ☐ COE 404
- ☐ Rockery
- ☐ DOE Dam Safety
- ☐ Structural Vaults
- ☐ FEMA Floodplain
- ☐ Other
- ☐ COE Wetlands

Part 5 SITE COMMUNITY AND DRAINAGE BASIN

Community
Lake Forest Park

Drainage Basin
Lake WA

Part 6 SITE CHARACTERISTICS

- ☐ River ______
- ☐ Stream ______
- ☐ Critical Stream Reach
- ☐ Depressions/Swales
- ☐ Lake ______
- ☐ Steep Slopes ______
- ☐ Floodplain ______
- ☐ Wetlands ______
- ☐ Seeps/Springs
- ☐ High Groundwater Table
- ☐ Groundwater Recharge
- **X** Other **N/A**

Part 7 SOILS

Soil Type	Slopes	Erosion Potential	Erosive Velcoties
Silty Fine Sand	**9%±**	**LOW**	
(Refer to Geotech Report)			

☐ Additional Sheets Attached

Part 8 DEVELOPMENT LIMITATIONS

REFERENCE	LIMITATION/SITE CONSTRAINT
☐ Ch. 4 – Downstream Analysis	**LEVEL 1/NO CONSTRAINT**
☐	
☐	
☐	
☐	
☐	

☐ Additional Sheets Attached

Part 9 ESC REQUIREMENTS

MINIMUM ESC REQUIREMENTS DURING CONSTRUCTION

- ☐ Sedimentation Facilities
- X Stabilized Construction Entrance
- X Perimeter Runoff Control
- ☐ Clearing and Grading Restrictions
- X Cover Practices
- X Construction Sequence
- ☐ Other

MINIMUM ESC REQUIREMENTS AFTER CONSTRUCTION

- X Stabilize Exposed Surface
- ☐ Remove and Restore Temporary ESC Facilities
- X Clean and Remove All Silt and Debris
- ☐ Ensure Operation of Permanent Facilities
- ☐ Flag Limits of SAO and open space preservation areas
- ☐ Other

Part 10 SURFACE WATER SYSTEM

☐ Grass Lined Channel	☐ Tank	☐ Infiltration	Method of Analysis
☐ Pipe System	X Vault	☐ Depression	**KCRTS and WWHM**
☐ Open Channel	☐ Energy Dissapator	☐ Flow Dispersal	Compensation/Mitigation of Eliminated Site Storage
☐ Dry Pond	☐ Wetland	☐ Waiver	____________
☐ Wet Pond	☐ Stream	☐ Regional Detention	

Brief Description of System Operation __

A level 2 detention-only vault is provided for the required flow control which will discharge to existing public storm system____________

Facility Related Site Limitations

Reference	Facility	Limitation

Part 11 STRUCTURAL ANALYSIS

- ☐ Cast in Place Vault
- ☐ Retaining Wall
- ☐ Rockery > 4' High
- ☐ Structural on Steep Slope
- ☐ Other

Part 12 EASEMENTS/TRACTS

- ☐ Drainage Easement
- ☐ Access Easement
- ☐ Native Growth Protection Easement
- ☐ Tract
- ☐ Other

Part 13 SIGNATURE OF PROFESSIONAL ENGINEER

I or a civil engineer under my supervision my supervision have visited the site. Actual site conditions as observed were incorporated into this worksheet and the attachments. To the best of my knowledge the information provided here is accurate.

____

Signed/Date

I. PROJECT OVERVIEW

General. The project proposes to develop a 0.20 acre parcel into a 5-story condominium units including a parking garage level with on-grade concrete slab.

Project Location. The project site address is 14727 35th Ave NE, Lake Forest Park, WA 98155 and is located west of SR 522. More generally, the site is located within Section 16, Township 26 North, Range 4 East, W.M., King County, Washington.

Existing and Proposed Project Site Characteristics. The parcel is currently developed with a single family residential, and some significant trees with lawn. The site slopes down from west to east at an average of approximately 9%±.

It is proposed to develop the parcel into a 5-story condominium units including a parking garage level with on-grade concrete slab. Also, the project proposed to have frontage improvement including adding sidewalks, walkway and driveway entrances.

Critical Areas. The project site does not have any critical areas.

Soils. Refer to attached geotech report prepared by LIU Associated, Inc.

Proposed Stormwater Controls. The site storm drainage system has been designed according to the standards set forth by the 2009 King County Surface Water Design Manual (KCSWDM). This project involves development of a 0.20 acre parcel into a 5 story-condominium units.

Refer to Section IV of this TIR for additional information regarding the Flow Control and Water Quality BMPs.

Vicinity Map

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Date: 5/4/2015 King County

1 in : 188 feet

0 0.02 0.04 Miles

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II. CONDITIONS AND REQUIREMENTS SUMMARY

CORE REQUIREMENTS

Core Requirement #1: Discharge at the natural Location

Runoff generally sheetflows across the site from west to east. Refer to the Level 1 Downstream Analysis in Section III for a complete description of the existing drainage path.

Core Requirement #2: Offsite Analysis

An offsite drainage analysis is provided in Section III of this TIR. Level 1 Drainage Analysis has been prepared and no problems identified.

Core Requirement #3: Flow Control

The KCRTS analysis was performed and is been determined this project is exempt from providing any detention; however, the city requires this project to provide a detention facility; therefore, A Level 2, detention-only vault is provided for the flow control. The vault will discharge into an existing catch basin located on the south side of the 148th St. Refer to section IV of this TIR for additional information.

Core Requirement #4: Conveyance System

Conveyance system analysis and design is provided in Section V of this TIR.

Core Requirement #5: Erosion and Sediment Control

A temporary erosion and sediment control (TESC) plan provides BMPs to be implemented during construction.

Core Requirement #6: Maintenance and Operations

Refer to section X of this TIR for Maintenance and Operations.

Core Requirement #7: Financial Guarantees and Liability

The owner will arrange for any financial guarantees and liabilities required by the permit.

Core Requirement #8: Water Quality

Refer to section IV of this TIR for Water Quality Analysis.

SPECIAL REQUIREMENTS

Special Requirement #1: Other Adopted Area-Specific Requirements

Critical Drainage Area – N/A

Master Drainage Plan – N/A

Basin Plan – This site is located within the Lake Washington drainage basin

Lake management Plan – N/A

Shared Facility Drainage Plan – N/A

Special Requirement #2: Floodplain/Floodway Delineation

N/A

Special Requirement #3: Flood Protection Facilities

N/A

Special Requirement #4: Source controls

N/A

Special Requirement #5: Oil Control

N/A

III. OFF-SITE ANALYSIS

Downstream Analysis. Level 1 downstream analysis for this project was conducted on May 5, 2015. The weather on the day of the site visit was cloudy with the temperature of approximately 57°F.

-Refer to the attached Downstream Drainage Map and Photos.

Runoff from the existing project site sheetflows from west to east and enters into a CB's at point (A and B) for a total of approximately 60-feet downstream from the project site to point B. From there flow continues east through the public storm system located on the south side of the NE 148th St and enters into a CB at point C for a total of 90-feet downstream from the project site. From there flow continues east through an 18-inch pipe and enters into the CB's at point D,E, and F for a total of approximately 280-feet downstream form the project site. At point F flow crosses the NE 148th St to north through 18-inch pipe to the CB's at point D, H, I, and J, for a total of approximately 840-feet downstream from the project site. Form there flow continues north along the west side of the 37th Ave NE and enters into a CB at point K that crosses the 37th Ave NE to east and enters into another CB at point L through a 12-inch conc. pipes according to the information provided by the city. From there flow continues north and enters into the storm drainage system along the Ne 151st ST for more than 1,300-feet down stream form the project site.

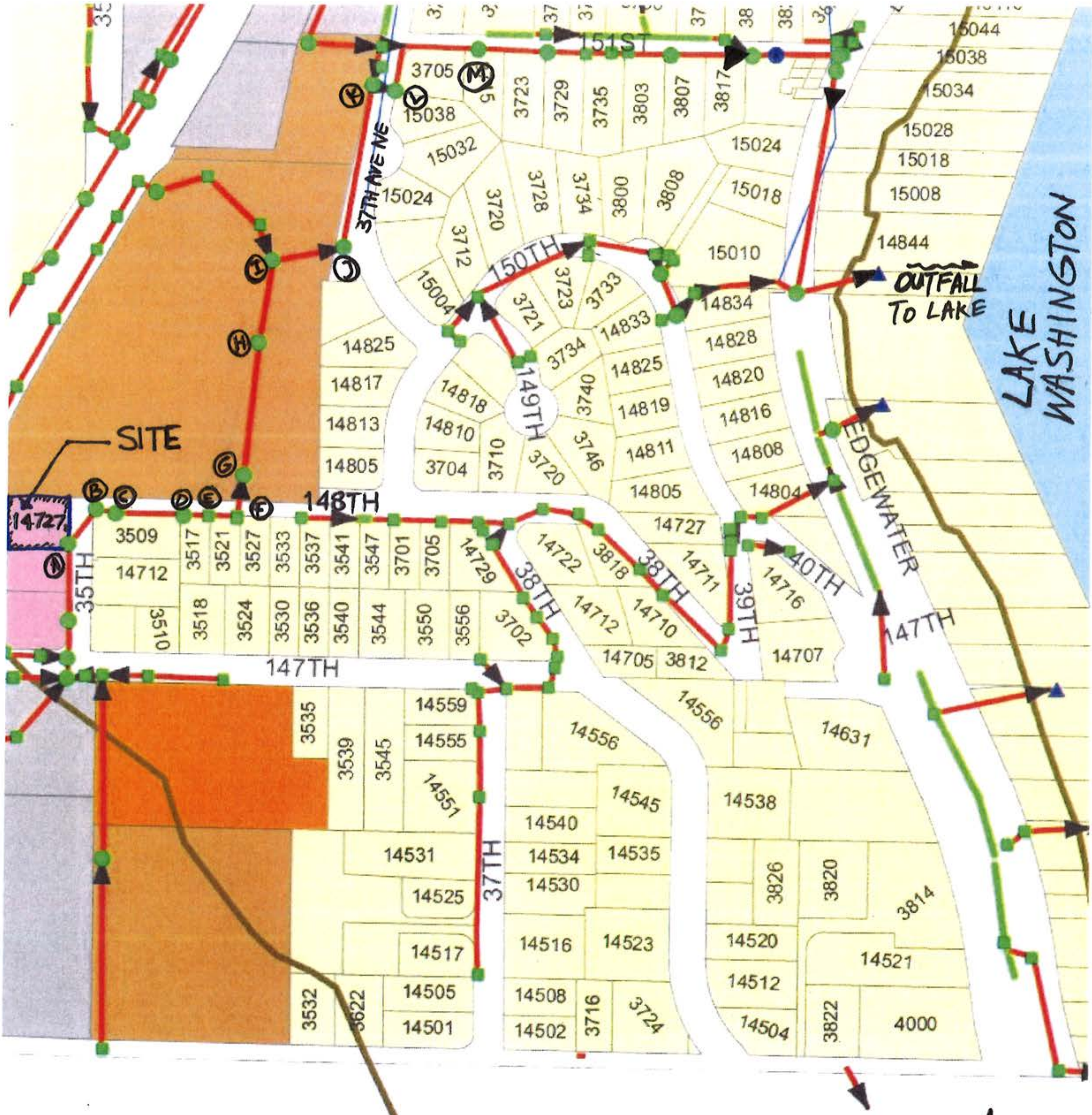
There were no apparent existing potential drainage, flooding, erosion, or environmental problems identified during the field visit and analysis of the downstream drainage path. The proposed project will not adversely impact the existing storm drainage systems.

Photo 1: Looking West - View of the Project Site

Photo 2: CB at point a

Photo 3: Looking East-View of the SE 148th st. – CB at point B

Photo 4: CB at point F



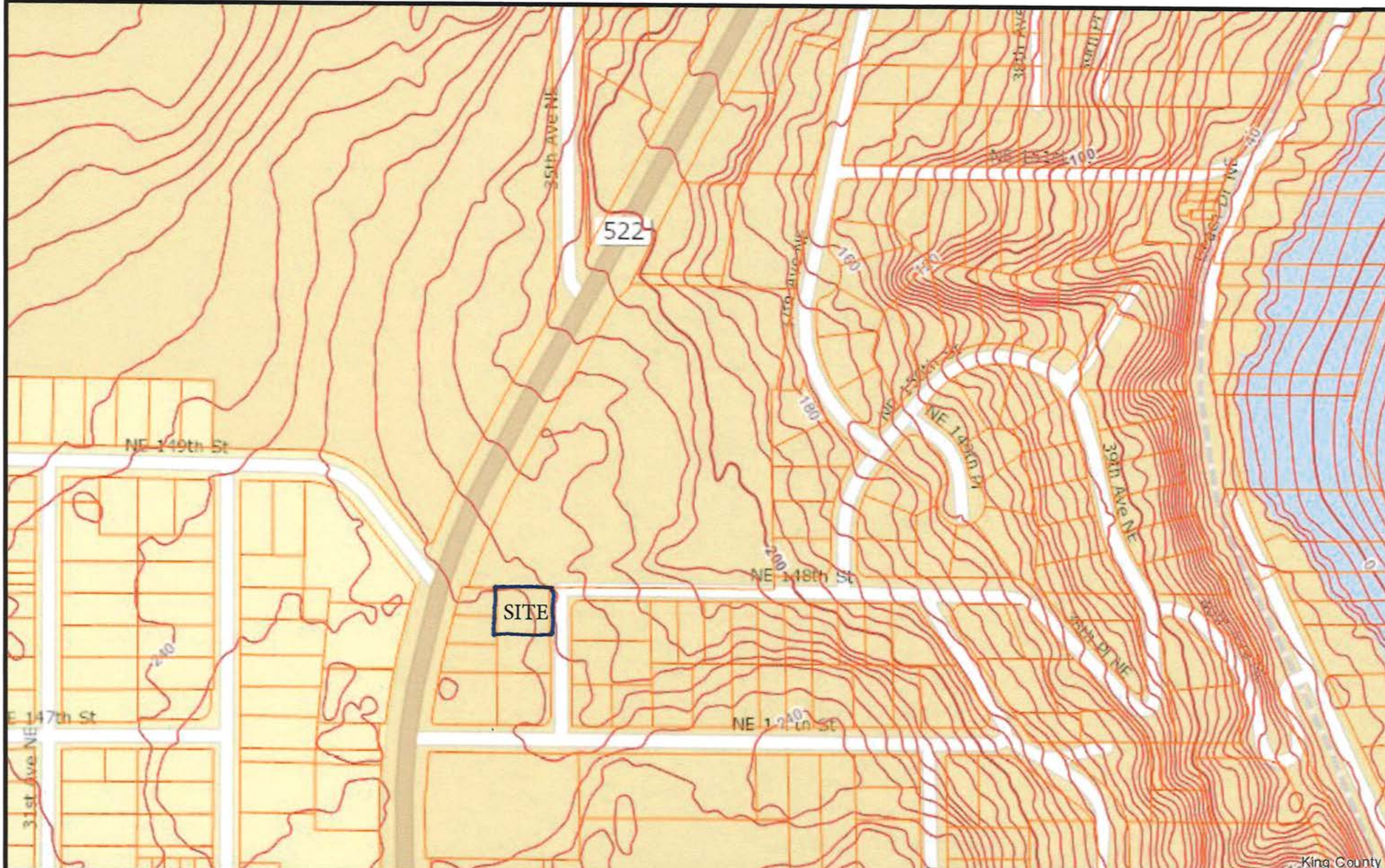
Downstream Drainage Map

1"=200'

LEGEND

- Quality Facilities
- Outfalls
- Manholes
- Control Structures
- Catch Basins
- RD Pipes
- Pipes
- Ditches
- Streams

Overland Relief



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Date: 5/13/2015

King County

1 in : 376 feet

0 0.04 0.08 Miles

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OFF-SITE ANALYSIS DRAINAGE SYSTEM TABLE

SURFACE WATER DESIGN MANUAL, CORE REQUIREMENT #2

Basin: **Subbasin Name:** **Subbasin Number:**

Symbol	Drainage Component Type, Name, and Size	Drainage Component Description	Slope	Distance from site discharge	Existing Problems	Potential Problems	Observations of field inspector, resource reviewer, or resident
see map	Type: sheet flow, swale, stream, channel, pipe, pond; Size: diameter, surface area	drainage basin, vegetation, cover, depth, type of sensitive area, volume	%	¼ ml = 1,320 ft.	constrictions, under capacity, ponding, overtopping, flooding, habitat or organism destruction, scouring, bank sloughing, sedimentation, incision, other erosion		tributary area, likelihood of problem, overflow pathways, potential impacts
A	Sheet flow to CB-18" pipe	Storm Pipe	2±%	0	None	None	
B	CB-18" pipe	Storm Pipe	2±%	60'	None	None	
C	CB-18" pipe	Storm Pipe	2±%	90'	None	None	
D	CB-18" pipe	Storm Pipe	2±%	210'	None	None	
E	CB-18" pipe	Storm Pipe	2±%	250'	None	None	
F	CB-18" pipe	Storm Pipe	2±%	270'	None	None	
G	CB/MH pipe	Storm Pipe	2±%	280'	None	None	
H	CB/MH pipe	Storm Pipe	2±%	370'	None	None	
I	CB/MH pipe	Storm Pipe	2±%	540'	None	None	
J	CB-12" pipe	Storm Pipe	2±%	740'	None	None	
K	CB-12" pipe	Storm Pipe	2±%	840'	None	None	
L	CB-12" pipe	Storm Pipe	2±%	1,200'	None	None	
M	CB-12" pipe	Storm Pipe	2±%	1,300'±	None	None	

IV. FLOW CONTROL AND WATER QUALITY FACILITY ANALYSIS AND DESIGN

Proposed Drainage Overview. The site storm drainage system has been designed according to the standards set forth by the 2009 King County Surface Water Design Manual 2009 (KCSWDM). The project proposes to develop a 0.20 acre parcel into a 5-story condominium units including a parking garage level with on-grade concrete slab.
The site will have frontage improvement including adding sidewalks, walkway and driveway entrances.

For this conceptual Drainage plan, for the KCRTS analysis was performed to make sure the proposed impervious surfaces will not result in an increase in 100—year flows of greater than 0.1 CFS, and it is been determined that this project is exempt from providing any detention. But since the city requires a detention facility for this project, a Level 2 detention-only vault is provided for flow control.

KCRTS Analysis to determine the proposed impervious surfaces will not result in an increase in 100—year flows of greater than 0.1 CFS:

Ex. Condition
Total Project Site Area: 0.20 acres.

- $A\ imp_{EX} = 0$
- $A\ per_{EX} = 0.22$ acres (till forest) - Including off-site frontage improvement

- Rainfall Regional Scale Factor = Seatac 1.1

Using KCRTS (see printout)

- $Q_{100\text{-}EX} = 0.020$ CFS

Developed Conditions

- $A\ imp_{DEV} = 0.22$ acres (Impervious)

Therefore:

KCRTS inputs:

- $A\ per_{EX} = 0.22$ acres (till forest)
- $A\ imp_{DEV} = 0.22$ acres impervious

Using KCRTS (see printout)

- $Q_{100\text{-}DEV} = 0.115$ CFS

$\Delta Q_{100} = Q_{100\text{-}DEV} - Q_{100\text{-}EX} = 0.115 - 0.020 =$ **.095 CFS**

✓ **$\Delta Q_{100} < 0.1$ CFS => Detention is not required**

KCRTS Existing Conditions Peaks

Flow Frequency Analysis
Time Series File:15539u.tsf
Project Location:Sea-Tac

---Annual Peak Flow Rates---			-----Flow Frequency Analysis-------				
Flow Rate (CFS)	Rank	Time of Peak	- - Peaks - - (CFS)	Rank	Return Period	Prob	
0.015	2	2/09/01 18:00	0.020	1	100.00	0.990	**$Q_{100D-EX}$**
0.004	7	1/05/02 16:00	0.015	2	25.00	0.960	
0.012	3	2/28/03 3:00	0.012	3	10.00	0.900	
0.001	8	3/24/04 20:00	0.012	4	5.00	0.800	
0.007	6	1/05/05 8:00	0.010	5	3.00	0.667	
0.012	4	1/18/06 20:00	0.007	6	2.00	0.500	
0.010	5	11/24/06 4:00	0.004	7	1.30	0.231	
0.020	1	1/09/08 9:00	0.001	8	1.10	0.091	
Computed Peaks			0.018		50.00	0.980	

KCRTS Developed Conditions Peaks

Flow Frequency Analysis
Time Series File:15539d.tsf
Project Location:Sea-Tac

---Annual Peak Flow Rates---			-----Flow Frequency Analysis-------				
Flow Rate (CFS)	Rank	Time of Peak	- - Peaks - - (CFS)	Rank	Return Period	Prob	
0.059	7	2/09/01 2:00	0.115	1	100.00	0.990	**$Q_{100D-DEV}$**
0.052	8	1/05/02 16:00	0.088	2	25.00	0.960	
0.072	3	12/08/02 18:00	0.072	3	10.00	0.900	
0.060	6	8/26/04 2:00	0.071	4	5.00	0.800	
0.071	4	10/28/04 16:00	0.063	5	3.00	0.667	
0.063	5	1/18/06 16:00	0.060	6	2.00	0.500	
0.088	2	10/26/06 0:00	0.059	7	1.30	0.231	
0.115	1	1/09/08 6:00	0.052	8	1.10	0.091	
Computed Peaks			0.106		50.00	0.980	

$\Delta Q_{100} = Q_{100\ DEV} - Q_{100\ EX} = 0.115 - 0.020 = 0.095 < .1$ CFS

Flow Control BMPs

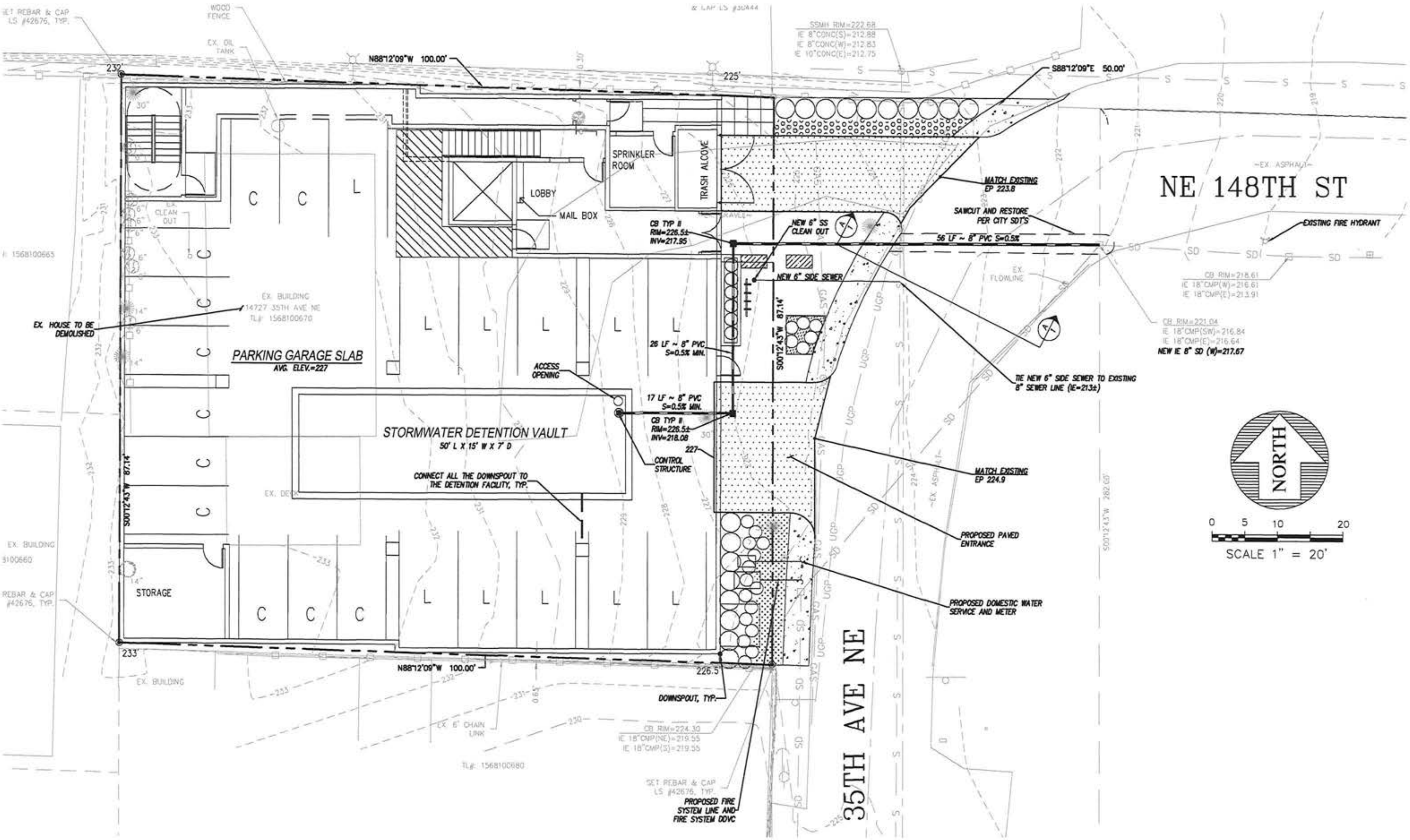
Because the project site is too small WWHM 2012 software will provide a better result to determine the required volume for the flow control.

A detention-only vault will be constructed to provide the flow control for this project. Runoff from the rooftop (0.20 ac.) will convey to the detention vault which will discharge into the public storm drainage system—a CB located on the south side of the NE 148th St.

-See attached Conceptual Drainage Site plan and WWHM 2012 print out.

Water Quality

This project will create less than 5,000 sf pollution generating surfaces; therefore, water quality design is not required.


NE 148TH ST
35TH AVE NE
NORTH
SCALE 1" = 20'
PARKING GARAGE SLAB
AVG. ELEV.=227
STORMWATER DETENTION VAULT
50' L X 15' W X 7' D
CONNECT ALL THE DOWNSPOUT TO THE DETENTION FACILITY, TYP.
ACCESS OPENING
CONTROL STRUCTURE
SPRINKLER ROOM
TRASH ALCOVE
LOBBY
MAIL BOX
STORAGE
EX. HOUSE TO BE DEMOLISHED
EX. BUILDING 14727 35TH AVE NE TL# 1568100670
N88°12'09"W 100.00'
S88°12'09"E 50.00'
S00°12'43"W 87.14'
MATCH EXISTING EP 223.8
SAWCUT AND RESTORE PER CITY SDT'S
56 LF ~ 8" PVC S=0.5%
EXISTING FIRE HYDRANT
NEW 6" SS CLEAN OUT
NEW 6" SIDE SEWER
CB TYP II RIM=226.5± INV=217.95
26 LF ~ 8" PVC S=0.5% MIN.
17 LF ~ 8" PVC S=0.5% MIN.
CB TYP II RIM=226.5± INV=218.08
TIE NEW 6" SIDE SEWER TO EXISTING 8" SEWER LINE (IE=213±)
CB RIM=221.04 IE 18"CMP(SW)=216.84 IE 18"CMP(E)=216.64
NEW IE 8" SD (W)=217.67
CB RIM=218.61 IE 18"CMP(W)=216.61 IE 18"CMP(E)=213.91
SSMH RIM=222.68 IE 8"CONC(S)=212.88 IE 8"CONC(W)=212.83 IE 10"CONC(E)=212.75
MATCH EXISTING EP 224.9
PROPOSED PAVED ENTRANCE
PROPOSED DOMESTIC WATER SERVICE AND METER
PROPOSED FIRE SYSTEM LINE AND FIRE SYSTEM DDVC
DOWNSPOUT, TYP.
CB RIM=224.30 IE 18"CMP(NE)=219.55 IE 18"CMP(S)=219.55
SET REBAR & CAP LS #42676, TYP.
EX. 6" CHAIN LINK
TL# 1568100680
WOOD FENCE
EX. OIL TANK
EX. CLEAN OUT
EX. BUILDING

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	15539
Site Name:	Lake Forest Condo
Site Address:	14727 35th Ave NE
City:	Lake Forest Park
Report Date:	9/17/2015
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	0.00 (adjusted)
Version:	2013/11/20

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data
Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	Acres
C, Forest, Mod	0.2
Pervious Total	0
Impervious Land Use	Acres
Impervious Total	0
Basin Total	0

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	Acres
Pervious Total	0
Impervious Land Use	Acres
ROOF TOPS FLAT	0.2
Impervious Total	0
Basin Total	0

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

Routing Elements
Predeveloped Routing

Mitigated Routing

Vault 1

Width:	15 ft.	
Length:	48.9343731191278 ft.	
Depth:	7 ft.	
Discharge Structure		
Riser Height:	6 ft.	
Riser Diameter:	18 in.	
Orifice 1 Diameter:	0.5 in. min.	Elevation:0 ft.
Orifice 2 Diameter:	0.5 in. min.	Elevation:4.002 ft.
Orifice 3 Diameter:	0.5 in. min.	Elevation:4.5 ft.
Element Flows To:		

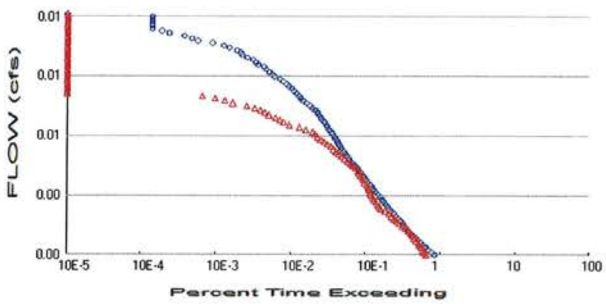
Outlet 1 Outlet 2

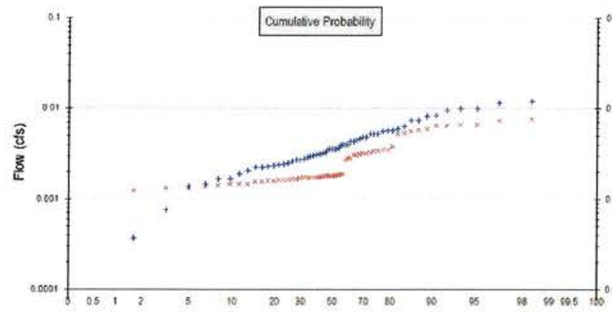
Vault Hydraulic Table

Stage(ft)	Area(ac)	Volume(ac-ft)	Discharge(cfs)	Infilt(cfs)
0.0000	0.016	0.000	0.000	0.000
0.0778	0.016	0.001	0.000	0.000
0.1556	0.016	0.002	0.000	0.000
0.2333	0.016	0.003	0.000	0.000
0.3111	0.016	0.005	0.000	0.000
0.3889	0.016	0.006	0.000	0.000
0.4667	0.016	0.007	0.000	0.000
0.5444	0.016	0.009	0.000	0.000
0.6222	0.016	0.010	0.000	0.000
0.7000	0.016	0.011	0.000	0.000
0.7778	0.016	0.013	0.000	0.000
0.8556	0.016	0.014	0.000	0.000
0.9333	0.016	0.015	0.000	0.000
1.0111	0.016	0.017	0.001	0.000
1.0889	0.016	0.018	0.001	0.000
1.1667	0.016	0.019	0.001	0.000
1.2444	0.016	0.021	0.001	0.000
1.3222	0.016	0.022	0.001	0.000
1.4000	0.016	0.023	0.001	0.000
1.4778	0.016	0.024	0.001	0.000
1.5556	0.016	0.026	0.001	0.000
1.6333	0.016	0.027	0.001	0.000
1.7111	0.016	0.028	0.001	0.000
1.7889	0.016	0.030	0.001	0.000
1.8667	0.016	0.031	0.001	0.000
1.9444	0.016	0.032	0.001	0.000
2.0222	0.016	0.034	0.001	0.000
2.1000	0.016	0.035	0.001	0.000
2.1778	0.016	0.036	0.001	0.000
2.2556	0.016	0.038	0.001	0.000
2.3333	0.016	0.039	0.001	0.000
2.4111	0.016	0.040	0.001	0.000
2.4889	0.016	0.041	0.001	0.000
2.5667	0.016	0.043	0.001	0.000
2.6444	0.016	0.044	0.001	0.000
2.7222	0.016	0.045	0.001	0.000
2.8000	0.016	0.047	0.001	0.000
2.8778	0.016	0.048	0.001	0.000

2.9556	0.016	0.049	0.001	0.000
3.0333	0.016	0.051	0.001	0.000
3.1111	0.016	0.052	0.001	0.000
3.1889	0.016	0.053	0.001	0.000
3.2667	0.016	0.055	0.001	0.000
3.3444	0.016	0.056	0.001	0.000
3.4222	0.016	0.057	0.001	0.000
3.5000	0.016	0.059	0.001	0.000
3.5778	0.016	0.060	0.001	0.000
3.6556	0.016	0.061	0.001	0.000
3.7333	0.016	0.062	0.001	0.000
3.8111	0.016	0.064	0.001	0.000
3.8889	0.016	0.065	0.001	0.000
3.9667	0.016	0.066	0.001	0.000
4.0444	0.016	0.068	0.002	0.000
4.1222	0.016	0.069	0.002	0.000
4.2000	0.016	0.070	0.003	0.000
4.2778	0.016	0.072	0.003	0.000
4.3556	0.016	0.073	0.003	0.000
4.4333	0.016	0.074	0.003	0.000
4.5111	0.016	0.076	0.003	0.000
4.5889	0.016	0.077	0.004	0.000
4.6667	0.016	0.078	0.004	0.000
4.7444	0.016	0.079	0.005	0.000
4.8222	0.016	0.081	0.005	0.000
4.9000	0.016	0.082	0.005	0.000
4.9778	0.016	0.083	0.005	0.000
5.0556	0.016	0.085	0.006	0.000
5.1333	0.016	0.086	0.006	0.000
5.2111	0.016	0.087	0.006	0.000
5.2889	0.016	0.089	0.006	0.000
5.3667	0.016	0.090	0.006	0.000
5.4444	0.016	0.091	0.007	0.000
5.5222	0.016	0.093	0.007	0.000
5.6000	0.016	0.094	0.007	0.000
5.6778	0.016	0.095	0.007	0.000
5.7556	0.016	0.097	0.007	0.000
5.8333	0.016	0.098	0.007	0.000
5.9111	0.016	0.099	0.008	0.000
5.9889	0.016	0.100	0.008	0.000
6.0667	0.016	0.102	0.259	0.000
6.1444	0.016	0.103	0.810	0.000
6.2222	0.016	0.104	1.538	0.000
6.3000	0.016	0.106	2.409	0.000
6.3778	0.016	0.107	3.400	0.000
6.4556	0.016	0.108	4.500	0.000
6.5333	0.016	0.110	5.699	0.000
6.6111	0.016	0.111	6.988	0.000
6.6889	0.016	0.112	8.362	0.000
6.7667	0.016	0.114	9.816	0.000
6.8444	0.016	0.115	11.34	0.000
6.9222	0.016	0.116	12.94	0.000
7.0000	0.016	0.118	14.61	0.000
7.0778	0.016	0.119	16.35	0.000
7.1556	0.000	0.000	18.15	0.000

Analysis Results
POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.2
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0
Total Impervious Area: 0.2

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.003837
5 year	0.006434
10 year	0.007918
25 year	0.00947
50 year	0.010411
100 year	0.011194

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.002299
5 year	0.003735
10 year	0.004944
25 year	0.006806
50 year	0.008466
100 year	0.010384

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.004	0.002
1950	0.005	0.003
1951	0.010	0.008
1952	0.003	0.001
1953	0.002	0.003
1954	0.004	0.002
1955	0.006	0.002
1956	0.005	0.006
1957	0.003	0.002
1958	0.004	0.002

1959	0.004	0.002
1960	0.005	0.003
1961	0.004	0.003
1962	0.002	0.001
1963	0.002	0.002
1964	0.004	0.003
1965	0.002	0.003
1966	0.003	0.002
1967	0.006	0.003
1968	0.004	0.002
1969	0.003	0.002
1970	0.002	0.002
1971	0.002	0.002
1972	0.007	0.007
1973	0.003	0.003
1974	0.003	0.002
1975	0.004	0.002
1976	0.003	0.002
1977	0.000	0.001
1978	0.003	0.002
1979	0.001	0.001
1980	0.005	0.006
1981	0.002	0.002
1982	0.003	0.003
1983	0.004	0.002
1984	0.002	0.002
1985	0.001	0.001
1986	0.007	0.002
1987	0.006	0.004
1988	0.002	0.002
1989	0.002	0.002
1990	0.011	0.003
1991	0.008	0.007
1992	0.003	0.002
1993	0.003	0.001
1994	0.001	0.001
1995	0.005	0.003
1996	0.010	0.007
1997	0.008	0.007
1998	0.002	0.002
1999	0.006	0.006
2000	0.003	0.002
2001	0.000	0.001
2002	0.004	0.003
2003	0.004	0.002
2004	0.004	0.005
2005	0.004	0.001
2006	0.005	0.005
2007	0.009	0.007
2008	0.012	0.004
2009	0.006	0.002

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0119	0.0077
2	0.0114	0.0073
3	0.0099	0.0066

4	0.0098	0.0066
5	0.0095	0.0065
6	0.0084	0.0065
7	0.0082	0.0060
8	0.0074	0.0059
9	0.0073	0.0056
10	0.0064	0.0053
11	0.0059	0.0053
12	0.0057	0.0038
13	0.0057	0.0035
14	0.0056	0.0035
15	0.0053	0.0034
16	0.0052	0.0034
17	0.0052	0.0033
18	0.0048	0.0032
19	0.0048	0.0032
20	0.0046	0.0031
21	0.0044	0.0031
22	0.0043	0.0030
23	0.0043	0.0028
24	0.0040	0.0028
25	0.0040	0.0027
26	0.0040	0.0019
27	0.0039	0.0019
28	0.0036	0.0018
29	0.0036	0.0018
30	0.0036	0.0018
31	0.0035	0.0018
32	0.0035	0.0018
33	0.0035	0.0018
34	0.0033	0.0018
35	0.0032	0.0018
36	0.0031	0.0017
37	0.0031	0.0017
38	0.0031	0.0017
39	0.0030	0.0017
40	0.0029	0.0017
41	0.0029	0.0017
42	0.0027	0.0017
43	0.0027	0.0017
44	0.0027	0.0017
45	0.0026	0.0016
46	0.0025	0.0016
47	0.0024	0.0016
48	0.0024	0.0016
49	0.0023	0.0016
50	0.0023	0.0016
51	0.0022	0.0016
52	0.0022	0.0015
53	0.0021	0.0015
54	0.0019	0.0014
55	0.0017	0.0014
56	0.0016	0.0014
57	0.0015	0.0014
58	0.0014	0.0013
59	0.0007	0.0013
60	0.0004	0.0012
61	0.0001	0.0011

Duration Flows
The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0019	17926	13909	77	Pass
0.0020	16332	13257	81	Pass
0.0021	14970	12647	84	Pass
0.0022	13725	12059	87	Pass
0.0023	12639	11484	90	Pass
0.0023	11668	10962	93	Pass
0.0024	10816	10337	95	Pass
0.0025	10023	9700	96	Pass
0.0026	9278	9112	98	Pass
0.0027	8641	8575	99	Pass
0.0028	8064	8002	99	Pass
0.0029	7569	7377	97	Pass
0.0029	7107	6819	95	Pass
0.0030	6667	6175	92	Pass
0.0031	6256	5636	90	Pass
0.0032	5863	5210	88	Pass
0.0033	5491	4825	87	Pass
0.0034	5118	4408	86	Pass
0.0035	4772	3923	82	Pass
0.0035	4487	3484	77	Pass
0.0036	4216	3300	78	Pass
0.0037	3995	3123	78	Pass
0.0038	3749	2943	78	Pass
0.0039	3531	2789	78	Pass
0.0040	3324	2680	80	Pass
0.0041	3140	2550	81	Pass
0.0041	2943	2468	83	Pass
0.0042	2766	2381	86	Pass
0.0043	2607	2312	88	Pass
0.0044	2464	2233	90	Pass
0.0045	2323	2123	91	Pass
0.0046	2171	2022	93	Pass
0.0047	2051	1946	94	Pass
0.0047	1943	1852	95	Pass
0.0048	1836	1774	96	Pass
0.0049	1751	1678	95	Pass
0.0050	1642	1566	95	Pass
0.0051	1525	1446	94	Pass
0.0052	1422	1332	93	Pass
0.0053	1333	1224	91	Pass
0.0053	1267	1127	88	Pass
0.0054	1198	1015	84	Pass
0.0055	1131	937	82	Pass
0.0056	1068	864	80	Pass
0.0057	1015	799	78	Pass
0.0058	964	730	75	Pass
0.0059	927	664	71	Pass
0.0060	889	598	67	Pass
0.0060	853	531	62	Pass
0.0061	809	487	60	Pass
0.0062	770	449	58	Pass
0.0063	730	412	56	Pass
0.0064	693	336	48	Pass

0.0065	655	280	42	Pass
0.0066	633	204	32	Pass
0.0066	606	170	28	Pass
0.0067	558	151	27	Pass
0.0068	529	132	24	Pass
0.0069	506	109	21	Pass
0.0070	480	95	19	Pass
0.0071	446	83	18	Pass
0.0072	409	70	17	Pass
0.0072	379	55	14	Pass
0.0073	341	36	10	Pass
0.0074	305	28	9	Pass
0.0075	285	21	7	Pass
0.0076	268	14	5	Pass
0.0077	250	0	0	Pass
0.0078	231	0	0	Pass
0.0078	216	0	0	Pass
0.0079	199	0	0	Pass
0.0080	185	0	0	Pass
0.0081	167	0	0	Pass
0.0082	150	0	0	Pass
0.0083	128	0	0	Pass
0.0084	117	0	0	Pass
0.0084	109	0	0	Pass
0.0085	100	0	0	Pass
0.0086	91	0	0	Pass
0.0087	77	0	0	Pass
0.0088	72	0	0	Pass
0.0089	65	0	0	Pass
0.0090	55	0	0	Pass
0.0090	47	0	0	Pass
0.0091	45	0	0	Pass
0.0092	40	0	0	Pass
0.0093	32	0	0	Pass
0.0094	27	0	0	Pass
0.0095	19	0	0	Pass
0.0096	12	0	0	Pass
0.0096	10	0	0	Pass
0.0097	8	0	0	Pass
0.0098	5	0	0	Pass
0.0099	4	0	0	Pass
0.0100	3	0	0	Pass
0.0101	3	0	0	Pass
0.0102	3	0	0	Pass
0.0102	3	0	0	Pass
0.0103	3	0	0	Pass
0.0104	3	0	0	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Vault 1 POC	☐	22.94			☐	0.00			
Total Volume Infiltrated		22.94	0.00	0.00		0.00	0.00	0%	No Treat Credit
Compliance with LID Standard 8% of 2-yr to 50-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

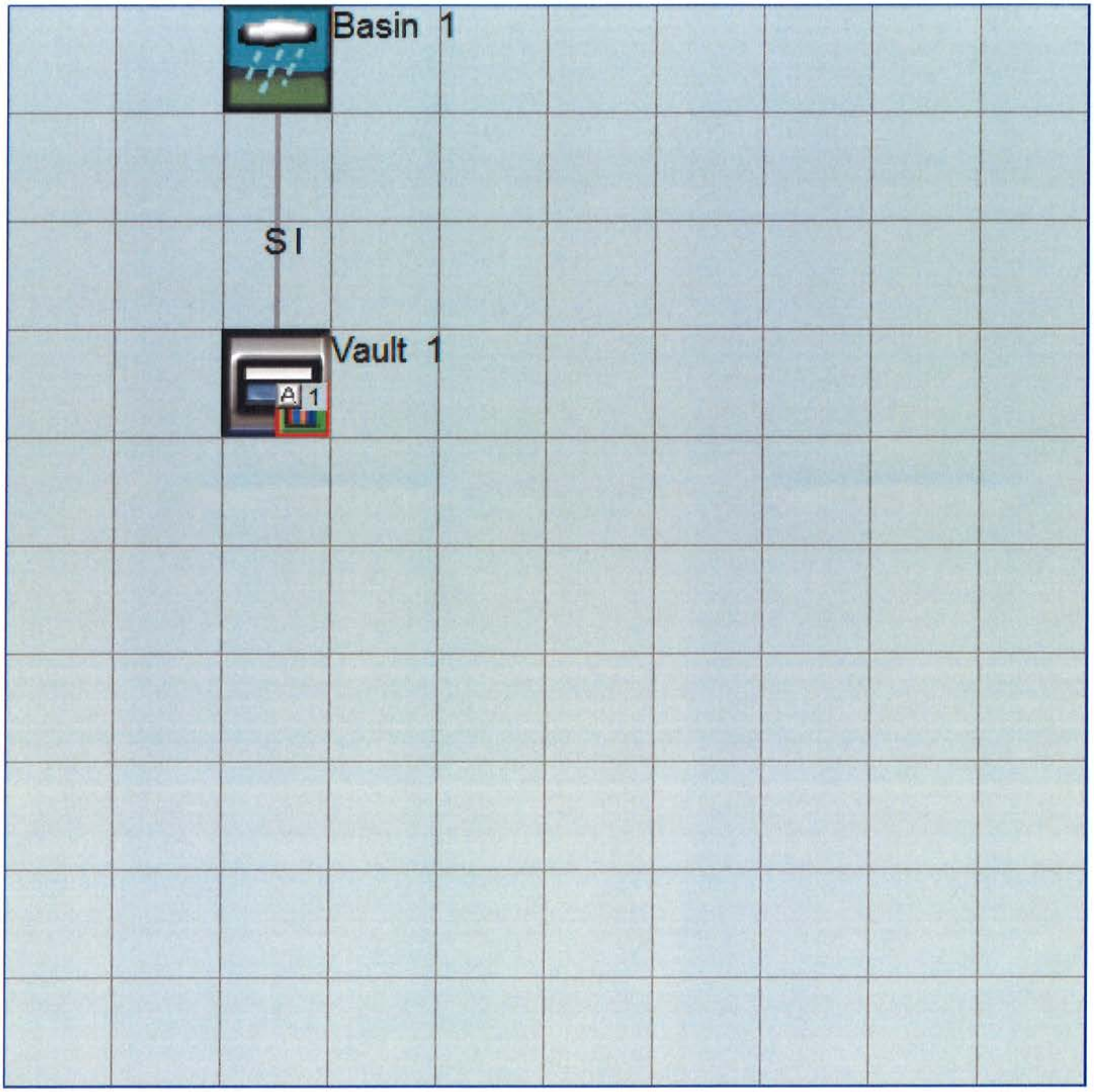
No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic

Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   15539.wdm
MESSU      25   Pre15539.MES
           27   Pre15539.L61
           28   Pre15539.L62
           30   POC155391.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      11
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                   MAX                     1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
   11      C, Forest, Mod         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   11         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   11         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
```

```
  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   11        0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2          ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   11              0       4.5      0.08       400       0.1       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3          ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   11              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                   ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   11            0.2       0.5      0.35         6       0.5       0.7
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   11              0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name-------> Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out            ***
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI      ***
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2          ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3          ***
    # -  # ***PETMAX    PETMIN
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
  END IWAT-STATE1
```

```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->  MBLK   ***
<Name>   #                  <-factor->     <Name>   #  Tbl#   ***
Basin  1***
PERLND  11                         0.2     COPY   501    12
PERLND  11                         0.2     COPY   501    13

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1      INPUT  TIMSER 1


<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                           in  out                           ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *   *  *  *  *  *        *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    0.833          PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    0.833          IMPLND   1 999 EXTNL  PREC
```

```
WDM        1 EVAP     ENGL      0.76               PERLND   1 999 EXTNL  PETINP
WDM        1 EVAP     ENGL      0.76               IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    501 FLOW     ENGL       REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   15539.wdm
MESSU      25   Mit15539.MES
           27   Mit15539.L61
           28   Mit15539.L62
           30   POC155391.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      IMPLND       4
      RCHRES       1
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1   PYR DIG2 FIL2 YRND
    1         Vault  1                   MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
  END PRINT-INFO

  PWAT-PARM1
```

```
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >       PWATER input info: Part 2          ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >       PWATER input info: Part 3          ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name-------> Unit-systems  Printer ***
    # -  #                      User  t-series Engl Metr ***
                                       in  out          ***
    4       ROOF TOPS/FLAT        1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    4         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    4         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI      ***
    4         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >       IWATER input info: Part 2          ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    4             400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >       IWATER input info: Part 3          ***
    # -  # ***PETMAX    PETMIN
    4               0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    4               0         0
  END IWAT-STATE1
```

```
END IMPLND

SCHEMATIC
<-Source->                    <--Area-->     <-Target->   MBLK   ***
<Name>   #                    <-factor->     <Name>   #   Tbl#   ***
Basin  1***
IMPLND   4                          0.2      RCHRES   1      5

******Routing******
IMPLND   4                          0.2      COPY     1     15
RCHRES   1                            1      COPY   501     16
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1


<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                         in  out                             ***
    1     Vault  1               1    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR   *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *   *  *  *  *  *       *  *  *  *  *          ***
    1        0  1  0  0   4  0  0  0  0       0  0  0  0  0       2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH      STCOR        KS       DB50         ***
  <------><--------><--------><--------><--------><--------><-------->         ***
    1             1      0.01       0.0        0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit       for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1            0        4.0  0.0  0.0  0.0  0.0        0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
```

FTABLES
FTABLE 1
92 4

Depth (ft)	Area (acres)	Volume (acre-ft)	Outflow1 (cfs)	Velocity (ft/sec)	Travel Time*** (Minutes)***
0.000000	0.016851	0.000000	0.000000		
0.077778	0.016851	0.001311	0.000264		
0.077778	0.016851	0.002621	0.000374		
0.155556	0.016851	0.003932	0.000458		
0.233333	0.016851	0.005242	0.000529		
0.311111	0.016851	0.006553	0.000591		
0.388889	0.016851	0.007864	0.000648		
0.466667	0.016851	0.009174	0.000700		
0.544444	0.016851	0.010485	0.000748		
0.622222	0.016851	0.011795	0.000793		
0.700000	0.016851	0.013106	0.000836		
0.777778	0.016851	0.014417	0.000877		
0.855556	0.016851	0.015727	0.000916		
0.933333	0.016851	0.017038	0.000953		
1.011111	0.016851	0.018349	0.000989		
1.088889	0.016851	0.019659	0.001024		
1.166667	0.016851	0.020970	0.001058		
1.244444	0.016851	0.022280	0.001090		
1.322222	0.016851	0.023591	0.001122		
1.400000	0.016851	0.024902	0.001153		
1.477778	0.016851	0.026212	0.001183		
1.555556	0.016851	0.027523	0.001212		
1.633333	0.016851	0.028833	0.001240		
1.711111	0.016851	0.030144	0.001268		
1.788889	0.016851	0.031455	0.001295		
1.866667	0.016851	0.032765	0.001322		
1.944444	0.016851	0.034076	0.001348		
2.022222	0.016851	0.035386	0.001374		
2.100000	0.016851	0.036697	0.001399		
2.177778	0.016851	0.038008	0.001424		
2.255556	0.016851	0.039318	0.001448		
2.333333	0.016851	0.040629	0.001472		
2.411111	0.016851	0.041939	0.001496		
2.488889	0.016851	0.043250	0.001519		
2.566667	0.016851	0.044561	0.001542		
2.644444	0.016851	0.045871	0.001564		
2.722222	0.016851	0.047182	0.001587		
2.800000	0.016851	0.048493	0.001608		
2.877778	0.016851	0.049803	0.001630		
2.955556	0.016851	0.051114	0.001651		
3.033333	0.016851	0.052424	0.001672		
3.111111	0.016851	0.053735	0.001693		
3.188889	0.016851	0.055046	0.001714		
3.266667	0.016851	0.056356	0.001734		
3.344444	0.016851	0.057667	0.001754		
3.422222	0.016851	0.058977	0.001774		
3.500000	0.016851	0.060288	0.001793		
3.577778	0.016851	0.061599	0.001813		
3.655556	0.016851	0.062909	0.001832		
3.733333	0.016851	0.064220	0.001851		
3.811111	0.016851	0.065530	0.001870		
3.888889	0.016851	0.066841	0.001888		
3.966667	0.016851	0.068152	0.002394		
4.044444	0.016851	0.069462	0.002745		
4.122222	0.016851	0.070773	0.002995		
4.200000	0.016851	0.072083	0.003202		
4.277778	0.016851	0.073394	0.003384		
4.355556	0.016851	0.074705	0.003549		
4.433333	0.016851	0.076015	0.003917		
4.511111	0.016851	0.077326	0.004456		
4.588889	0.016851	0.078637	0.004816		
4.666667	0.016851	0.079947	0.005120		
4.744444	0.016851	0.081258	0.005392		
4.822222	0.016851	0.082568	0.005641		
4.900000	0.016851	0.083879	0.005874		

```
  4.977778  0.016851  0.085190  0.006093
  5.055556  0.016851  0.086500  0.006301
  5.133333  0.016851  0.087811  0.006500
  5.211111  0.016851  0.089121  0.006691
  5.288889  0.016851  0.090432  0.006875
  5.366667  0.016851  0.091743  0.007052
  5.444444  0.016851  0.093053  0.007224
  5.522222  0.016851  0.094364  0.007391
  5.600000  0.016851  0.095674  0.007554
  5.677778  0.016851  0.096985  0.007712
  5.755556  0.016851  0.098296  0.007866
  5.833333  0.016851  0.099606  0.008017
  5.911111  0.016851  0.100917  0.008165
  5.988889  0.016851  0.102227  0.259769
  6.066667  0.016851  0.103538  0.810418
  6.144444  0.016851  0.104849  1.538926
  6.222222  0.016851  0.106159  2.409147
  6.300000  0.016851  0.107470  3.400894
  6.377778  0.016851  0.108780  4.500762
  6.455556  0.016851  0.110091  5.699008
  6.533333  0.016851  0.111402  6.988130
  6.611111  0.016851  0.112712  8.362121
  6.688889  0.016851  0.114023  9.816030
  6.766667  0.016851  0.115334  11.34568
  6.844444  0.016851  0.116644  12.94750
  6.922222  0.016851  0.117955  14.61836
  7.000000  0.016851  0.119265  16.35552
  END FTABLE  1
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL     0.833         PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL     0.833         IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL     0.76          PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL     0.76          IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   1 HYDR   RO     1 1        1      WDM   1000 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1001 STAG     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK        15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK    15

  MASS-LINK        16
RCHRES     ROFLOW                          COPY           INPUT  MEAN
  END MASS-LINK    16


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

ERROR/WARNING ID: 238 1

The continuity error reported below is greater than 1 part in 1000 and is therefore considered high.

Did you specify any "special actions"? If so, they could account for it.

Relevant data are:
DATE/TIME: 1958/ 8/31 24: 0

RCHRES : 1

RELERR	STORS	STOR	MATIN	MATDIF
-6.113E-02	0.00000	0.0000E+00	0.00000	-4.098E-09

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

ERROR/WARNING ID: 238 1

The continuity error reported below is greater than 1 part in 1000 and is therefore considered high.

Did you specify any "special actions"? If so, they could account for it.

Relevant data are:
DATE/TIME: 1967/ 8/31 24: 0

RCHRES : 1

RELERR	STORS	STOR	MATIN	MATDIF
-7.608E-03	0.00000	0.0000E+00	0.00000	-3.488E-08

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

ERROR/WARNING ID: 238 1

The continuity error reported below is greater than 1 part in 1000 and is therefore considered high.

Did you specify any "special actions"? If so, they could account for it.

Relevant data are:

DATE/TIME: 1973/ 8/31 24: 0

RCHRES : 1

RELERR	STORS	STOR	MATIN	MATDIF
-8.386E-03	0.00000	0.0000E+00	0.00000	-3.169E-08

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

ERROR/WARNING ID: 238 1

The continuity error reported below is greater than 1 part in 1000 and is therefore considered high.

Did you specify any "special actions"? If so, they could account for it.

Relevant data are:
DATE/TIME: 1979/ 6/30 24: 0

RCHRES : 1

RELERR	STORS	STOR	MATIN	MATDIF
-1.742E-03	0.00000	0.0000E+00	0.00000	-1.536E-07

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

ERROR/WARNING ID: 238 1

The continuity error reported below is greater than 1 part in 1000 and is therefore considered high.

Did you specify any "special actions"? If so, they could account for it.

Relevant data are:
DATE/TIME: 1993/ 9/30 24: 0

RCHRES : 1

RELERR	STORS	STOR	MATIN	MATDIF
-3.110E-01	0.00000	0.0000E+00	0.00000	-5.911E-10

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.

```
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or
reach/reservior) at the end of the present interval.
STORS  is the storage of material in the pu at the start of the present
printout reporting period.
MATIN  is the total inflow of material to the pu during the present printout
reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the
present printout reporting period.
```

```
The count for the WARNING printed above has reached its maximum.

If the condition is encountered again the message will not be repeated.
```

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www.clearcreeksolutions.com

V. CONVEYANCE SYSTEM ANALYSIS AND DESIGN

Conveyance system analysis will be provide with the final design.

VI. SPECIAL REPORTS AND STUDIES

LUI Associates, Inc.

- Soil Logs

LIU & ASSOCIATES, INC.

Geotechnical Engineering Engineering Geology Earth Science

May 7, 2015

Mr. Andy Wang
22902 – 74th Avenue West
Edmonds, WA 98026

Dear Mr. Wang:

Subject: Geotechnical Investigation
Mix-Use Building
14727 – 35th Avenue NE
Lake Forest Park, Washington
L&A Job No. 15-036

INTRODUCTION

We understand that a mix-use building development project is proposed for the subject property located at the above addresses in Lake Forest Park, Washington. At your request, we have completed a geotechnical investigation for this project. The purpose of this investigation is to explore and characterize subsurface conditions of the project site and provide geotechnical recommendations on grading, erosion mitigation, surface and ground water drainage control, site stabilization, detention vault design, and building foundation support for the subject project. Presented in this report are our findings, conclusion, and recommendations.

PROJECT DESCRIPTION

We understand that the proposed building will be a five-story, above-grade structure. The first (ground) floor will be used as a parking garage with on-grade concrete slab. The

19213 Kenlake Place NE · Kenmore, Washington 98028
Phone (425) 483-9134 · Fax (425) 486-2746

second floor will have a PT slab with concrete walls between the first and second floors. An underground detention vault will be constructed under the ground floor to store roof runoff.

SCOPE OF SERVICES

Our scope of services for this study comprises specifically the following:

1 Review geologic and soil conditions at the site based on a published geologic map.

2. Explore the site for subsurface (soil and groundwater) conditions with backhoe test pits excavated down to a firm soil stratum or to the maximum depth (about 10 feet) capable by the backhoe used in excavating the test pits, whichever occurs first.

3. Perform necessary geotechnical analyses based subsurface data in test pits and provide geotechnical recommendations of grading, site stabilization, erosion mitigation, surface and ground water drainage control, foundation support to the building, etc., for the proposed development.

4. Prepare a written report to present our findings, conclusions, and recommendations.

SITE CONDITIONS

Surface Condition

The general location of the project site is shown on Plate 1 – Vicinity Map. The site is situated in the upper portion of a gentle to steep, easterly-declining hillside above the west shore of the nearby Lake Washington. The site is a rectangle-shaped land approximately 86 feet north-south by 100 feet east-west in size. The site is bounded by 35th Avenue NE to the east, and is adjoined by a commercial property to the west and residential development to the north and south. Approximately the west half of the site is nearly flat, with the rest of the site sloping down gently eastward.

The project site is currently occupied by an existing residence in its west half. The residence is accessed off 35th Avenue NE via a paved driveway entering the northeast corner of the site. Tall mature evergreen and deciduous trees dotting the perimeter of the site. The open unpaved ground within the site is mostly covered by lawn grass.

Geologic Setting

The Geologic Map of Seattle – A Progress Report, by K. Goetz Troost, D. B. Booth, A. P. Wisher and S. A. Shimel (2006) was referenced for the geologic and soil conditions of the project site. According to this publication, the surficial soil units at and in the vicinity of the site are mapped as Deposits of Pre-Frazer Glaciation Age (Q_{pf}), overlain by Vashon Till (Q_{vt}) and Recessional Outwash (Q_{vr}).

The geology of the Puget Sound Lowland has been modified by the advance and retreat of several glaciers in the past one million years or so and the subsequent deposits and erosions. The latest glacier advanced to the Puget Sound Lowland is referred to as the Vashon Stade of the Fraser Glaciation which had occurred during the later stages of the Pleistocene Epoch, and retreated from the region some 12,500 years ago. Test pits excavated on the project site encountered the Vashon till (Q_{vt}) and pre-Frazer deposit (Q_{pf}), but not the recessional outwash soil unit.

The deposits of the Vashon till soil unit were plowed directly under glacial ice during the most recent glacial period as the glacier advanced over an eroded, irregular surface of older formations and sediments. This soil unit is composed of a mixture of unsorted clay, silt, sand, gravel, and scattered cobbles and boulders. The Vashon till soil over the top two to three feet is normally weathered to a medium-dense state, and is moderately permeable and compressible. The underlying fresh till soil, commonly referred to as "hard pan", is very-dense and cemented. The fresh till deposits possess a compressive strength comparable to that of low-grade concrete, and can remain stable on steep natural slopes or man-make cuts for a long period. The fresh till deposits are of extremely low permeability and can hardly allow stormwater to seep through, but are of high bearing capacity and can provide excellent foundation support to structures with little or no settlement.

The advance outwash soil unit (Q_{va}) is composed of stratified sand with various amounts of gravel and minor amount of silt and clay, deposited by the meltwater of advancing glacial ice of the last glacier. Due to their generally granular composition, the advance outwash deposits are of moderately high permeability and drains fairly well. The advance outwash deposits had been glacially overridden and are generally dense to very dense in their natural, undisturbed state, except the top several feet of soils exposed on slopes which are normally weathered to a loose to medium-dense state. The fresh advance outwash deposits can stand in steep cuts or natural slopes for extended period when undisturbed and properly drained. Where exposed on slopes devoid of vegetation cover and subject to storm runoff or groundwater seepage, the surficial advance outwash soils can be gradually eroded. The fresh advance outwash deposits are also quite stable in confined condition and capable of providing very good foundation support to structures with little settlement.

The pre-Frazer deposits (Q_{pf}) are composed of glacial and non-glacial deposits of interbedded silt, fine sand, occasional gravel, and diamicts of indeterminate age and origin. These deposits are generally very-stiff to hard and are of extremely low permeability in their native undisturbed state. The deposits can remain stable and provide good bearing capacity in confined and well-drained condition, and may peel off in chunks from exposed cut banks if saturated.

Soil Condition

Subsurface conditions at the site were explored on April 13, 2014, with three test pits excavated to depths from 9.0 to 10.0 feet with a rubber-track backhoe. The approximate locations of the test pits are shown on Plate 2 - Site and Exploration Location Plan. The test pits were located with either a tape measure or by visual reference to existing topographic features in the field and on the topographic survey map, and their locations should be considered as only accurate to the measuring method used.

A geotechnical engineer from our office was present during subsurface exploration, examined the soil and geologic conditions encountered, and completed logs of test pits. Soil samples obtained from each soil unit in the test pits were visually classified in general accordance with United Soil Classification System, a copy of which is presented on Plate 3. Detailed descriptions of soils encountered during site exploration are presented in test pit logs on Plates 4 and 5.

Test Pits 1 and 2, located near the southwest and southeast corners of the site respectively, encountered a Vashon till deposit at 2.7 feet and 4.4 feet deep. The Vashon till deposit is consisted of light-gray, very-dense, cemented, gravelly, silty, fine sand with occasional cobble. This Vashon till layer in Test Pit 1 is about 4.8 feet thick, and is underlain to the depth explored by an advance outwash deposit of brown, dense to very-dense, non-cemented, gravelly, silty, fine sand. Test Pit 3, located near the northeast corner of the site, encountered the same advance outwash deposit at 4.2 feet below ground surface. The advance outwash layer in this test pit is about 2.3 feet thick, and is underlain to the depth explored by a light-brown to light-gray deposit of hard silt which appears to be of the pre-Frazer soil unit mapped in the above-referenced geologic map. The Vashon till in Test Pits 1 and 2 and the advance outwash in Test Pit 3 are overlain by a thin layer of loose organic topsoil and a layer of weathered soil of brown, medium-dense, silty fine sand with trace gravel.

Groundwater Condition

Groundwater was not encountered by any of the three test pits excavated on the site. Advance outwash deposits are normally of moderately high permeability, but the high silt content in the advance outwash soil layer under the project site encountered by Test Pit 3 would significantly reduce permeability of this soil layer. Furthermore, the advance outwash layer under the site is sandwiched between the Vashon till and the pre-Frazer deposits of extremely low permeability and its water dispersal capability would be further reduced. Storm runoff infiltrating into the more permeable surficial soils would perch on top of the underlying glacial till soil layer. The depth to and the amount of this near-surface perched groundwater would fluctuate seasonally, depending on precipitation, surface runoff, ground vegetation cover, site utilization, and other factors. The perched groundwater may accumulate and rise in the wet winter and early spring months and completely dry up in the dryer summer and early fall months.

GEOLOGIC HAZARDS AND REMEDIATION

Landslide Hazard

The project site is nearly flat to gently sloped and is underlain at shallow depth by very-dense glacial till, dense advance outwash, and hard pre-Frazer deposits. These deposits are of very-high to high shear strength and have high resistance against slope failure. Therefore, the landslide hazard of the site should be minimal.

Erosion Hazard

The surficial topsoil and the weathered soil are of low resistance to erosion and the underlying glacial till and advance outwash deposits are of high resistance against erosion. The erosion potential of the site will be minimized due to its flat to gentle slope. Therefore, the erosion hazard of the site should also be minimal. To further mitigate erosion hazard, disturbed unpaved areas should be vegetated and landscaped for erosion protection. Concentrated stormwater should not be discharged onto the ground within or adjacent to the site. Storm runoff over impervious surfaces, such as roofs and paved open area, should be captured with underground drain lines connected to roof downspouts and by catch basins installed in paved areas. Stormwater collected by such drain line systems should be tightlined to discharge into a storm sewer or a detention facility.

Seismic Hazard

The Puget Sound region is in an active seismic zone. The site is underlain at shallow depth by very-dense glacial till and advance outwash deposit of very-high to high shear strength. Therefore, the potential for seismic hazards, such as liquefaction, landslides and lateral soil spreading, should be minimal. The proposed building, however, should be designed for seismic forces induced by strong earthquakes. Based on the soil conditions encountered by the test pits, it is our opinion that Seismic Use Group I and Site Class C should be used in the seismic design of the proposed residences in accordance with the 2012 International Building Code (IBC).

DISCUSSIONS AND RECOMMENDATIONS

General

Based on the subsurface conditions encountered by the test pits excavated on the site, it is our opinion that the site is suitable for the proposed development, provided that the recommendations in this report are fully implemented and observed during and following completion of construction. The building may be supported on conventional footing foundations bearing on or into very-dense glacial till and/or dense advance outwash and/or hard pre-Frazer silt deposits.

Site Preparation and General Grading

Vegetation within construction limits should be cleared and grubbed. Existing structures to be demolished should also have their foundations removed. Topsoil and unsuitable weathered soil should be completely stripped within the building pad and in areas subject to traffic and structural load. The exposed soils should be compacted to a non-yielding state with a mechanical compactor and proof-rolled with a piece of heavy earthwork equipment.

Temporary Drainage and Erosion Control

The site is mantled by layers of topsoil, weathered soil, and locally with pre-Frazer silt soil, all with a high percentage of fines and these soils are moisture sensitive. These fine-grained soils can be disturbed easily and cause construction complications when saturated. A layer of clean, 2-to-4-inch quarry spalls should be placed over areas of frequent traffic, such as the entrance to the site, as required, to protect the subgrade soils from disturbance by construction traffic.

Silt fences should be installed along the downhill sides of construction areas to minimize transport of sediments onto neighboring properties or the streets. The bottom of the filter cloth of silt fences should be anchored in a trench filled with onsite soil.

Intercepting ditches or trench drains should be installed around construction areas, as required, to intercept and drain away storm runoff and near-surface groundwater seepage. Water captured by such ditches or trench drains should be discharged into a nearby storm inlet. The storm inlet should be covered with a non-woven filter fabric sock to prevent sediments from entering the storm sewer system. The filter sock should be cleaned frequently during construction to prevent clogging, and should be removed after completion of construction.

Spoil soils should be hauled off of the site as soon as possible. Spoil soils and imported structural fill material to be stored separately on site, and should be covered with plastic tarps securely weighted down with sandbags.

Excavation and Fill Slopes

Under no circumstance should excavation slopes be steeper than the limits specified by local, state and federal safety regulations if workers have to perform construction work in excavated areas. Unsupported temporary cuts greater than 4 feet in height should be no steeper than 1H:1V in topsoil and weathered soil, and may be vertical in the underlying, very-dense glacial till, the dense advance outwash, and the hard pre-Frazer silt soils provided that the overall depth of excavation does not exceed 15 feet deep. Based on soil data obtained from the two test pits excavated on the site, building footprint excavation for the proposed building and detention vault pit excavation may consist of 1H:1V sloped cut for the top 3.5 feet, then vertical cut to bottom of excavation. Permanent cut banks should be no steeper than 2-1/4H:1V in topsoil and weathered soil, and no steeper than 1-1/2H:1V in the underlying very-dense till soil. The soil units and the stability of cut banks should be verified by a geotechnical engineer during excavation.

Permanent fill embankments required to support structural or traffic load, if any, should be constructed with compacted structural fill placed over the underlying, undisturbed, very-dense till soil after the surficial unsuitable soils are completely stripped. Permanent fill embankments should be no steeper than 2-1/4H:1V. After completion, the sloping faces of fill embankments should be compacted to a non-yielding state with a hoe-pack.

The above recommended temporary and permanent cuts and fill slopes are under the assumption that groundwater seepage would not be encountered during construction. If groundwater seepage is encountered, the slope grading work should be immediately halted and the slope stability re-evaluated. The slopes may have to be flattened and other measures taken to stabilize the slopes.

Storm runoff should not be allowed to flow uncontrolled over the top of cut and fill slopes. Unpaved permanent cut slopes or fill embankments should be vegetated as soon as possible for erosion protection and long-term stability, and should be covered with plastic tarps, as required, to provide erosion protection against storm runoff until the vegetation is fully established.

Structural Fill

Structural fill is the fill that supports structural or traffic load. Structural fill should consist of clean granular soils free of organic and other deleterious substances and with particles not larger than three inches. Structural fill should have a moisture content within one percent of its optimum moisture content at the time of placement. The optimum moisture content is the soil water content that enables the soil to be compacted to the highest dry density for a given compaction effort. Onsite soils meeting the above requirements may be used as structural fill. Imported material to be used as structural fill, should be clean, free-draining, granular soils containing no more than 7.5% by weight finer than the No. 200 sieve based on the fraction of the material passing No. 4 sieve, with individual particles not larger than three inches.

The ground over which structural fill is to be placed should be prepared in accordance with recommendations in the SITE PREPARATION AND GENERAL GRADING and EXCAVATION AND FILL SLOPES sections of this report. Structural fill should be placed in lifts no more than 10 inches thick in its loose state, with each lift compacted to a minimum percentage of the maximum dry density determined by ASTM D1557 (Modified Proctor Method) as follows:

Application	% of Maximum Dry Density
Within building pads and under foundations	95%
Roadway/driveway subgrade	95% for top 3 feet and 90% below
Retaining wall backfill	92%
Utility trench backfill	95% for top 4 feet and 90% below

In-situ density of structural fill should be tested with a nuclear densometer by a testing agency specialized in fill placement and construction work. Testing frequency should be one test per every 250 square feet per lift of fill.

Building Foundations

Conventional footing foundations may be used to support the proposed buildings. The footing foundations should be constructed on or into the underlying undisturbed, very-dense glacial till soil and/or dense advance outwash soil and/or hard pre-Frazer sill soil. Water should not be allowed to accumulate in excavated areas of footing foundations or on-grade slabs. Disturbed and saturated soils in footing trenches or under on-grade slabs should be completely removed down to firm undisturbed till soil prior to pouring concrete for the footings and floor slabs. A minimum 4-inch layer of 2-inch-minus crushed rock should be placed over moisture sensitive footing bearing soils, as required, to protect the integrity of the soil from disturbance by construction traffic.

If the above recommendations are followed, our recommended design criteria for footing foundations are as follows:

- Allowable soil bearing pressure for footing foundations, including dead and live loads, should not exceed 5,000 psf. Footing bearing soil should be verified by a geotechnical engineer prior to pouring concrete for footing foundations.
- The minimum depth to bottom of perimeter footings below adjacent final exterior grade should be no less than 18 inches. The minimum depth to bottom of the interior footings below top of floor slab should be no less than 12 inches.
- The minimum width should be no less than 16 inches for continuous footings, and no less than 24 inches for individual footings, except those footings supporting light-weight porches and wood decks.

A one-third increase in the above recommended allowable soil bearing pressure may be used when considering short-term, transitory, wind or seismic loads. For the buildings supported on very-stiff to hard clayey silt soils under the above allowable soil bearing pressure, we estimate that the maximum total post-construction settlement of the buildings should be 3/4 inch or less and the differential settlement across building width should be 1/2 inch or less.

Lateral loads can be resisted by the friction force between the foundations and the subgrade soils or the passive earth pressure acting on the below-grade portion of the foundations. For the latter, the foundations must be poured "neat" against undisturbed soils or backfilled with a clean, free-draining, compacted structural fill. We recommend that an equivalent fluid density (EFD) of 300 pcf (pounds per cubic foot) for the passive earth pressure may be used for lateral resistance. The above passive pressure assumes that the backfill is level or inclines upward behind the foundations for a horizontal distance at least 1.5 times the depth of the foundations below final grade. A coefficient of friction of 0.55 between the foundations and the subgrade soils may be used. These soil parameters are unfactored ultimate values, and a proper factor of safety should be used in calculating the resistance against lateral loads on the buildings.

Detention Vault

We understand an underground concrete detention vault is to be constructed under the building to store stormwater. The vault is to be founded on undisturbed very-dense glacial till and/or dense advance outwash soil and/or hard pre-Frazer silt soils. The vault may be supported on footing foundations designed for an allowable soil bearing pressure not to exceed 5,000 psf. Other recommendations for building foundations in this report should also apply to the vault foundations.

The detention vault walls with a lid capping the vault to restrain lateral movement at the top of walls should be designed for at-rest lateral soil pressure. We recommend that an at-rest soil pressure of 55 pcf EFD (equivalent fluid density) be used for the design of vault walls with a level or descending backslope away from the walls. To counter the above at-rest pressure, a passive lateral soil pressure of 400 pcf EFD may be used. This passive pressure value is applicable only to walls with a level or ascending backslope away from the walls. To resist against sliding, the friction force between the footings and the subgrade soils may be calculated based on a coefficient of friction of 0.55. The above soil parameters are ultimate values based on a fully drained condition of the walls, and proper factors of safety should be applied in the design of the vault walls against sliding and overturning failures.

The vault walls should also be designed for seismic loading based on a 100-year seismic event. Based on the soil conditions in the detention vault area, we recommend the vault walls be designed for an additional uniform distribution lateral soil pressure of 8 H psf to the above static at-rest soil pressure for a 100-year seismic event, where H is the height from bottom of footing foundations to the finish grade above the vault in feet. A one-third increase in the above recommended allowable soil bearing pressure may be used when considering transitory seismic loading condition.

A vertical drainage blanket, at least 10-inch-thick horizontally, consisting of clean, free-draining, pea gravel or washed gravel should be placed against the back of vault walls to within 18 inches of the finish grade to prevent accumulation of groundwater behind and buildup of hydrostatic pressure against the walls. This drainage blanket fill should be compacted to a non-yielding state with a vibratory compactor. Alternatively, a vertical drain mat, such as Miradrain 6000 by Mirafi Inc. or equivalent, may be placed against the vault walls as vertical drainage blanket. The vertical drainage blankets or drain mats should be hydraulically connected to the drain lines at the base of the vault walls. Sufficient number of cleanouts at strategic locations should be installed for periodical cleaning of the vault wall drain lines to prevent clogging.

If the vault is constructed in a way that it is not feasible to completely drain groundwater behind the vault walls with a gravity drain line system, the hydrostatic pressure on the vault walls should also be taken into consideration for the design of the vault walls. For the condition that a perimeter drain line has to be placed higher than bottom of the footing level, the perimeter vault walls should be designed for a lateral soils pressure of 55 pcf EFD above the drain line level and a combined lateral soil and hydrostatic pressure of 105 pcf EFD below the drain line level. The above lateral pressures on the vault walls may be countered by a passive soil pressure of 375 pcf EFD above the drain line and 210 pcf EFD below.

Building footing foundations may impose additional lateral soil pressure on detention vault walls and vertical load on the vault footing foundations if a 3/4H:1V plane drawn from the edge of building footing foundations intercepts the vault walls and lies above vault wall footings. The additional lateral soil pressure on the vault walls and the additional vertical load on vault wall footings may be calculated by assuming the building footing bearing pressure is spreading downward in a 3/4H:1V envelope.

Slab-on-Grade Floors

Slab-on-grade floors, if used, should be placed on firm subgrade soils prepared as outlined in the SITE PREPARATION AND GENERAL EARTHWORK and the STRUCTURAL FILL sections of this report. Where moisture control is critical, the slab-on-grade floors should be placed on a capillary break which is in turn placed on the compacted subgrade. The capillary break should consist of a minimum four-inch-thick layer of free-draining gravel or crushed rock containing no more than 5% by weight passing the No. 4 sieve. We recommend that a vapor barrier, such as a 6-mil plastic membrane, be placed over the capillary break to keep moisture from migrating upwards.

Driveway/Parking Garage Pavement

Performance of driveway/parking area pavement is critically related to the condition of the underlying subgrade soils. We recommend that the subgrade soils under the driveway/parking area be treated and prepared as described in the SITE PREPARATION AND GENERAL EARTHWORK section of this report. Prior to placing base material, the subgrade soils should be compacted to a non-yielding state with a vibratory roller compactor and proof-rolled with a piece of heavy construction equipment, such as a fully-loaded dump truck. Any areas with excessive weaving or deflection should be over-excavated and re-compacted or replaced with a structural fill or crushed rock placed and compacted in accordance with the recommendations provided in the STRUCTURAL FILL section of this report.

We recommend that a 4-inch-thick minimum, compacted, crushed rock base (CRB), consisting of 7/8-inch-minus crushed rock, be constructed under the pavement of the driveway/parking area. The crushed rock base should be overlain with a minimum 5-inch-thick concrete pavement reinforced with a layer of welded wire fabric or steel rebars placed at its mid-depth.

Drainage Control

- Building Footprint Excavation

Groundwater seepage may be encountered in building footprint excavation for the proposed building. If encountered, the bottom of building footprint excavation should be sloped and ditches excavated along the base of the cut banks to direct collected groundwater into sump pits from which water can be pumped into a nearby storm sewer inlet. A layer of 2-inch crushed rock should be placed over footing bearing subgrade soils, as required, to protect the soils from disturbance by construction traffic. This crushed rock base should be built to a few inches above groundwater level, but not less than 6 inches thick. The crush rock base should be compacted in 12-inch lifts to a non-yielding state with a vibratory mechanical compactor.

- Runoff over Impervious Surfaces

Storm runoff over impervious surface, such as roofs and paved driveway/parking area, should be collected by underground drain line systems connected to downspouts and by catch basins installed in the driveway/parking area. Stormwater thus collected should be tightlined to discharge into the stormwater detention vault.

- Building Footing Drains

A subdrain should be installed, as required, around the perimeter footings of the building. The subdrains should consist of a 4-inch-minimum-diameter, perforated, rigid, drain pipe, laid a few inches below bottom of the perimeter footings. The trenches and the drain lines should have a sufficient gradient (0.5% minimum) to generate flow by gravity. The drain line should be embedded in washed gravel completely wrapped in non-woven filter fabric to within about 12 inches of finish grade. The remaining trenches may be backfilled with clean on-site soils. Water collected by the perimeter footing subdrain system should be tightlined, separately from the roof and surface stormwater drain line systems, to discharge into the stormwater detention vault.

- Surface Drainage

Water should not be allowed to stand in any areas where footings, on-grade-slabs, or pavement is to be constructed. Finish ground surface should be graded to direct surface runoff away from the proposed building. We recommend the finish ground be sloped at a gradient of 3 percent minimum for a distance of at least 10 feet away from the buildings, except in the areas to be paved.

- Cleanouts

Sufficient number of cleanouts at strategic locations should be provided for the underground drain line systems. The underground drain line systems should be maintained periodically to prevent clogging.

RISK EVALUATION STATEMENT

The site is underlain at shallow depth by very-dense glacial till, dense advance outwash, and hard pre-Frazer silt deposits. These competent soils have very-high to high shear strength, and are quite stable in confined situation if well drained. The key to maintain site stability is to provide proper and adequate drainage control during and after completion of construction. It is our judgment that provided the recommendations of this report are fully implemented and observed during and after completion of construction, the areas disturbed by construction will be stabilized, and will remain stable and not increase potential for soil movement. In our opinion, the risk for damage to the proposed development and from the development to adjacent properties from soil instability should be minimal.

LIMITATIONS

This report has been prepared for the specific application to this project for the exclusive use of Mr. Andy Wang and his partners, associates, representatives, consultants and contractors. We recommend that this report, in its entirety, be included in the project contract documents for the information of the prospective contractors for their estimating and bidding purposes and for compliance with the recommendations in this report during construction. The conclusions and interpretations in this report, however, should not be construed as a warranty of the subsurface conditions. The scope of this study does not include services related to construction safety precautions and our recommendations are not intended to direct the contractor's methods, techniques, sequences or procedures, except as specifically described in this report for design considerations. The geotechnical construction work should be monitored and inspected by a geotechnical engineer.

Our recommendations and conclusions are based on soil conditions encountered in the test pits, our engineering analyses, and our experience and engineering judgment. The conclusions and recommendations are professional opinions derived in a manner consistent with the level of care and skill ordinarily exercised by other members of the profession currently practicing under similar conditions in this area. No warranty, expressed or implied, is made.

The site subsurface conditions encountered in the test pits may vary from those actually encountered during construction. The nature and extent of such variations may not become evident until construction starts. If variations appear then, we should be retained to re-evaluate the recommendations of this report, and to verify or modify them in writing prior to proceeding further with the construction.

CLOSURE

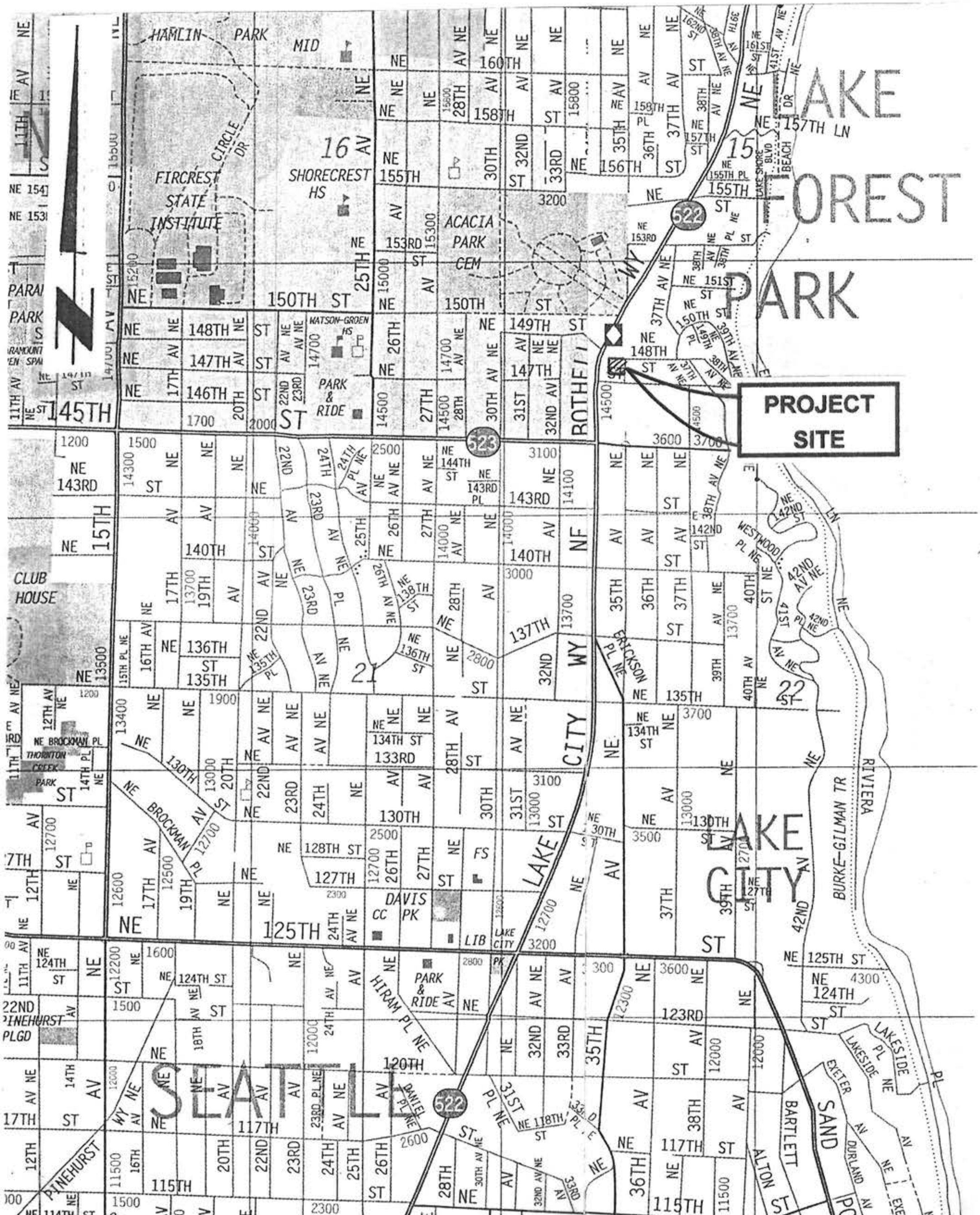
We are pleased to be of service to you on this project. Please feel free to contact us if you have questions regarding this report or need further consultation.

Yours very truly,
LIU & ASSOCIATES, INC.

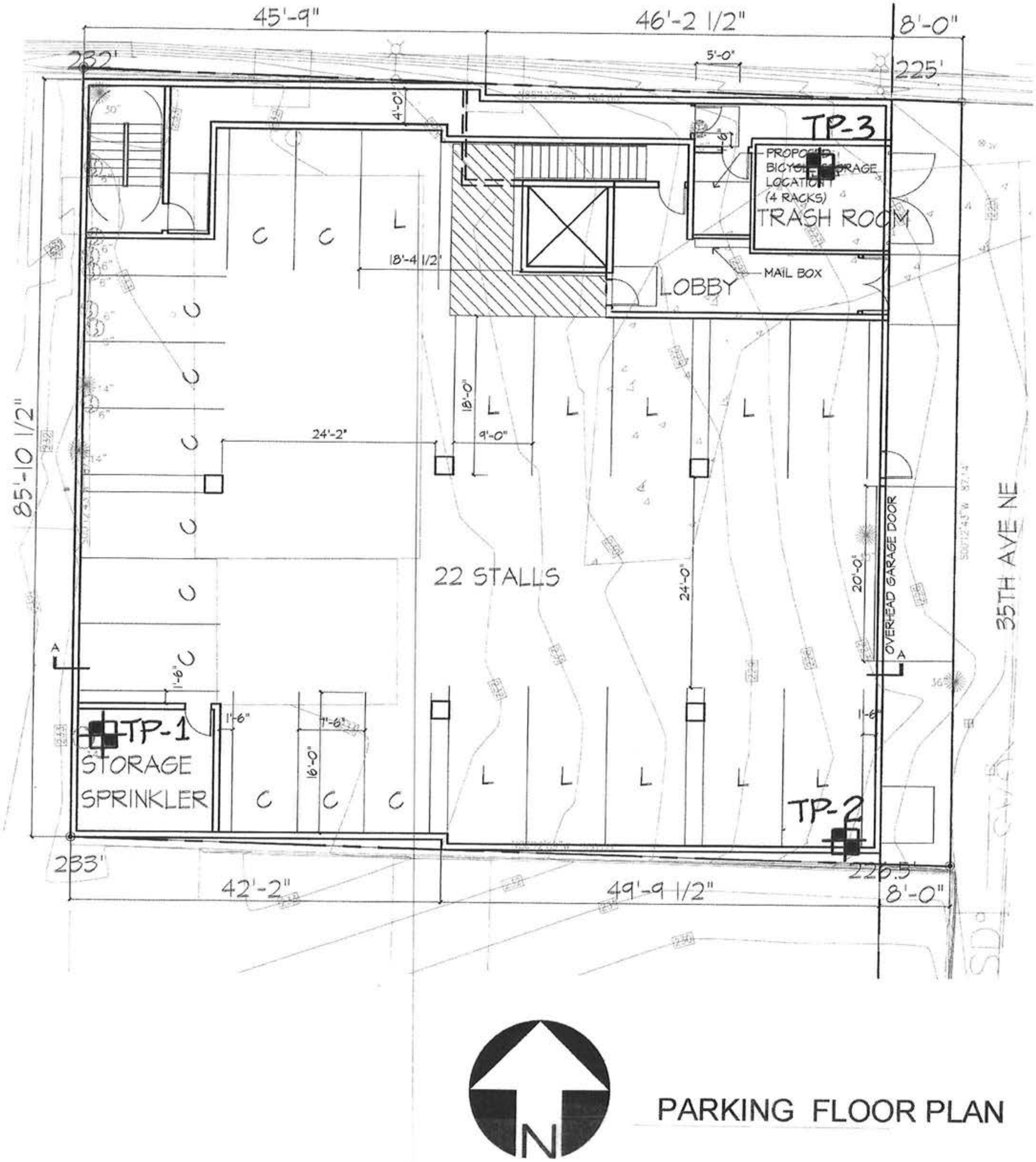
J. S. (Julian) Liu, Ph.D., P.E.
Consulting Geotechnical Engineer

5/7/2015

Five plates attached



LIU & ASSOCIATES, INC. Geotechnical Engineering · Engineering Geology · Earth Science	VICINITY MAP MIX-USE BUILDING 14727 - 35TH AVENUE NE LAKE FOREST PARK, WASHINGTON
	JOB NO. 15-036 | DATE 5/6/2015 | PLATE 1



PARKING FLOOR PLAN

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SITE AND EXPLORATION LOCATION PLAN
MIX-USE BUILDING
14727 - 35TH AVENUE NE
LAKE FOREST PARK, WASHINGTON

JOB NO. 15-036 | DATE 5/6/2015 | PLATE 2

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE-GRAINED SOILS MORE THAN 50% RETAINED ON THE NO. 200 SIEVE	GRAVEL MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY-GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE-GRAINED SOILS MORE THAN 50% PASSING ON THE NO. 200 SIEVE	SILT AND CLAY LIQUID LIMIT LESS THAN 50%	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILTY AND CLAY LIQUID LIMIT 50% OR MORE	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC SILT, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT AND OTHER HIGHLY ORGANIC SOILS

NOTES:

1. FIELD CLASSIFICATION IS BASED ON VISUAL EXAMINATION OF SOIL IN GENERAL ACCORDANCE WITH ASTM D2488-83.
2. SOIL CLASSIFICATION USING LABORATORY TESTS IS BASED ON ASTM D2487-83.
3. DESCRIPTIONS OF SOIL DENSITY OR CONSISTENCY ARE BASED ON INTERPRETATION OF BLOW-COUNT DATA, VISUAL APPEARANCE OF SOILS, AND/OR TEST DATA.

SOIL MOISTURE MODIFIERS:

DRY - ABSENCE OF MOISTURE, DUSTY, DRY TO THE TOUCH

SLIGHTLY MOIST - TRACE MOISTURE, NOT DUSTY

MOIST - DAMP, BUT NO VISIBLE WATER

VERY MOIST - VERY DAMP, MOISTURE FELT TO THE TOUCH

WET - VISIBLE FREE WATER OR SATURATED, USUALLY SOIL IS OBTAINED FROM BELOW WATER TABLE

TEST PIT NO. 1

Logged By: JSL   Date: 4/13/2016   Ground El. ±

Depth ft.	USCS CLASS.	Soil Description	Sample No.	W %	Other Test
0–1	OL	Dark-brown, loose, organic, silty fine SAND, abundant roots to 3-in diameter, moist (TOPSOIL)			
1–3	SM	Brown, medium-dense, silty fine SAND, trace gravel, abundant roots, moist			
3–8	SM	Light-gray, very-dense, gravelly, silty, fine SAND, occasional cobble, cemented, moist (GLACIAL TILL)			
8–10	SM	Brown, dense to very-dense, gravelly, silty, fine SAND, moist (ADVANCE OUTWASH)			
		Test pit terminated at 10.0 ft; groundwater not encountered.			

TEST PIT NO. 2

Logged By: JSL   Date: 4/13/2015   Ground El. ±

Depth ft.	USCS CLASS.	Soil Description	Sample No.	W %	Other Test
0–1	OL	Dark-brown, loose, organic, silty fine SAND, some roots, moist (TOPSOIL)			
1–4.5	SM	Brown, medium-dense, silty fine SAND, trace gravel, moist			
4.5–9	SM	Light-gray, very-dense, gravelly, silty, fine SAND, occasional cobble and sand beds, cemented, moist (GLACIAL TILL)			
		Test pit terminated at 9.0 ft; trickle groundwater seepage encountered @ 4.5 ft.			

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TEST PIT LOGS
MIX-USE BUILDING
14727 - 35TH AVENUE NE
LAKE FOREST PARK, WASHINGTON

JOB NO. 15-036 | DATE 4/13/2015 | PLATE 4

TEST PIT NO. 3

Logged By: JSL　　Date: 4/13/2015　　Ground El. ______ ±

Depth ft.		USCS CLASS.	Soil Description	Sample No.	W %	Other Test
0–1		OL	Dark-brown, loose, organic, silty fine SAND, few roots, moist (TOPSOIL)			
1–4.5		SM	Brown, medium-dense, silty fine SAND, trace gravel, moist			
4.5–7		SM	Light-gray, dense, silty fine SAND, some gravel, moist (ADVANCE OUTWASH)			
7–9		ML	Light-brown to light-gray, hard, SILT, blocky, slightly moist (pre-FRASER FINE-GRAINED deposit)			
10			Test pit terminated at 9.0 ft; groundwater not encountered.			

TEST PIT NO. ______

Logged By: ______　　Date: ______　　Ground El. ______ ±

Depth ft.		USCS CLASS.	Soil Description	Sample No.	W %	Other Test
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

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TEST PIT LOGS
MIX-USE BUILDING
14727 - 35TH AVENUE NE
LAKE FOREST PARK, WASHINGTON

JOB NO. 15-036　　DATE 4/13/2015　　PLATE 5

VII. OTHER PERMITS

Building permits will be required.

VIII. TESC ANALYSIS AND DESIGN

The potential for erosion within the site will be mitigated by use of erosion control measures during clearing, grading, and site development activities. Filter fences will be installed along the downhill perimeter of the site to protect adjacent properties from sediment-laden water. A rocked construction entrance will be installed at the entrance to the site to protect mud from entering the paved roadway. Stockpiles and exposed disturbed areas will be covered to protect from erosion and sediment runoff.

IX. BOND QUANTITIES and DECLARATION of COVENANT

Bond Quantities, Facility Summaries, Declaration of Covenant:

Will be provided with the final design.

X. OPERATION AND MAINTENANCE MANUAL

Will be provided with the final design.