Allen Lake Outlet Stream Reconnaissance

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1.0 Purpose and Scope

King County Department of Natural Resources and Parks (KCDNRP) requested a survey of the outlet stream to observe channel erosion and stability, side slopes failures, land slide risks, knick point formations, and potential fish barriers. The survey will support the selection of drainage alternatives for the outlet.

The investigation scope included reviews of aerial photographs dated 1940, 1961, 1965, 1970, 1979, 1985, 1989, 1995, 1998, 2001, 2003, and 2010; video record from King County Sheriff, helicopter survey of January 2010 flooding; LiDAR images dating from 1998 through 2011; USGS topographical maps dated 1950 with 1968 and 1973 updates, and 1982; discussion with KC Department of Development and Environmental Services staff; City of Sammamish drainage project reports; historic Roads Map Vault maps for the area, published geologic maps as listed in the reference section, and field reconnaissance conducted on February 16 and 17, 2012, and March 7, 2012.

Rights of entry were not available for all properties and field review was not possible for portions of the drainage.

1.1 Project Location

The Allen Lake Outlet stream, WRIA 08.0111A (HUC 1711), drains Allen Lake (formerly known as Mud Lake) near Sammamish, Washington. The stream begins at Allen Lake in the northwest quarter of Section 35, Township 25 North, and Range 6 East in unincorporated King County.

The location and course of the stream has consistently been miss-mapped on the Washington State Department of Natural Resources and other maps over time, continuing to the present. Often the maps depict a westerly drainage connection through a series of wetlands to the north end of Lake Sammamish via George Davis Creek. There is in fact no current connection or stream flow to the west from Allen Lake. All of Lake Allen's outflow currently proceeds northerly across the plateau and down into the Evans Creek wetland complex, eventually joining Evans Creek then Bear Creek in the Lake Washington Basin. Historic Government Land Office maps show the Allen Lake outlet flowing eastward joining Patterson Creek in the Snoqualmie Basin. A trace of the earlier drainage location is visible on LiDAR.

The survey location (Figure 1) starts at the culvert under 244th Ave NE at NE 22nd Street and extends northwest in a ravine east of 239th Place NE to a large wetland complex associated with Evans Creek (Folio number 1822).

Allen Lake Outlet Stream Recon

Vicinity Map

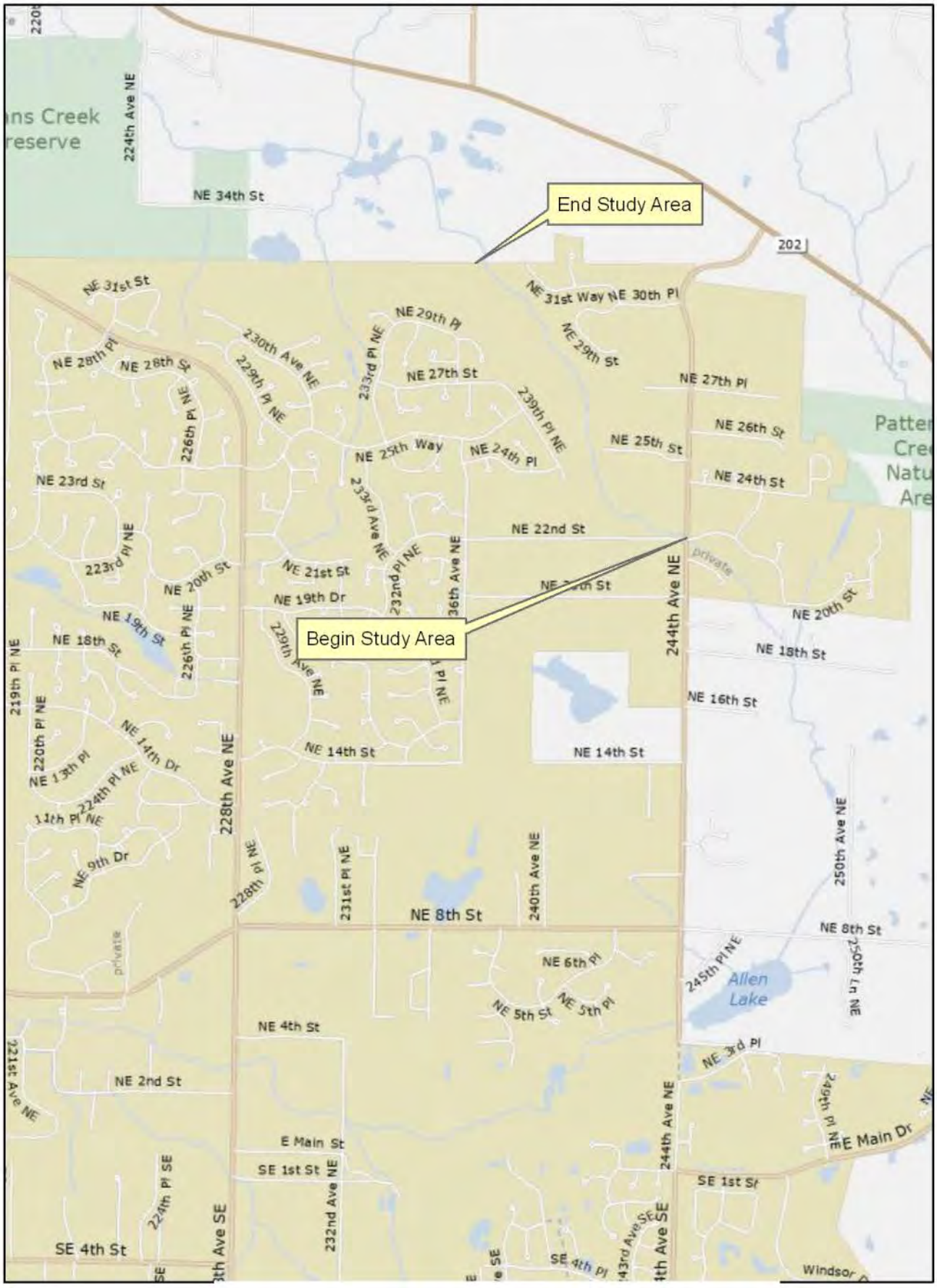


Figure 1

N

1,000 500 0 1,000 2,000 3,000 4,000 Feet

King County

2.0 Project Site Conditions

2.1 Topography

The Allen Lake Outlet is the outlet of a wetland on the Sammamish Plateau. Before development, the plateau was a hummocky and hilly surface shaped by glacial action and underlain by glacial deposits. Wetlands developed in closed depressions such as Allen Lake and drainage flowed to the east to Patterson Creek, and before development of the area, potentially to the west and north depending on the amount of runoff. The drainage directions have been altered by development (King County, 2011) and the Lake Allen Outlet now flows north to Evans Creek drainage. Because of the subtle elevation differences in these three possible drainage directions, consistent mapping errors have occurred, with State maps displaying a westerly drainage route to Lake Sammamish, and County maps showing the correct northerly route to Evans Creek.

The Allen Lake Outlet drainage drops from elevation 345 feet to 335 feet elevation at the culvert under 244th Ave NE. From 244th Ave the Outlet drops to the Evans Creek drainage at 130 feet elevation. The average gradient from 244th to Evans Creek wetland on the valley floor is 4% (4699 feet length and 205 foot drop in elevation). From 244th the drainage parallels 22nd and then turns north and enters a ravine that drains north off of the plateau. The elevation difference between the plateau and Outlet is approximately 100 feet at the north end of the plateau. The topographic map of the study area is shown in Figure 2.

Allen Lake Outlet Stream Recon

Parcel and Drainage Feature Locations

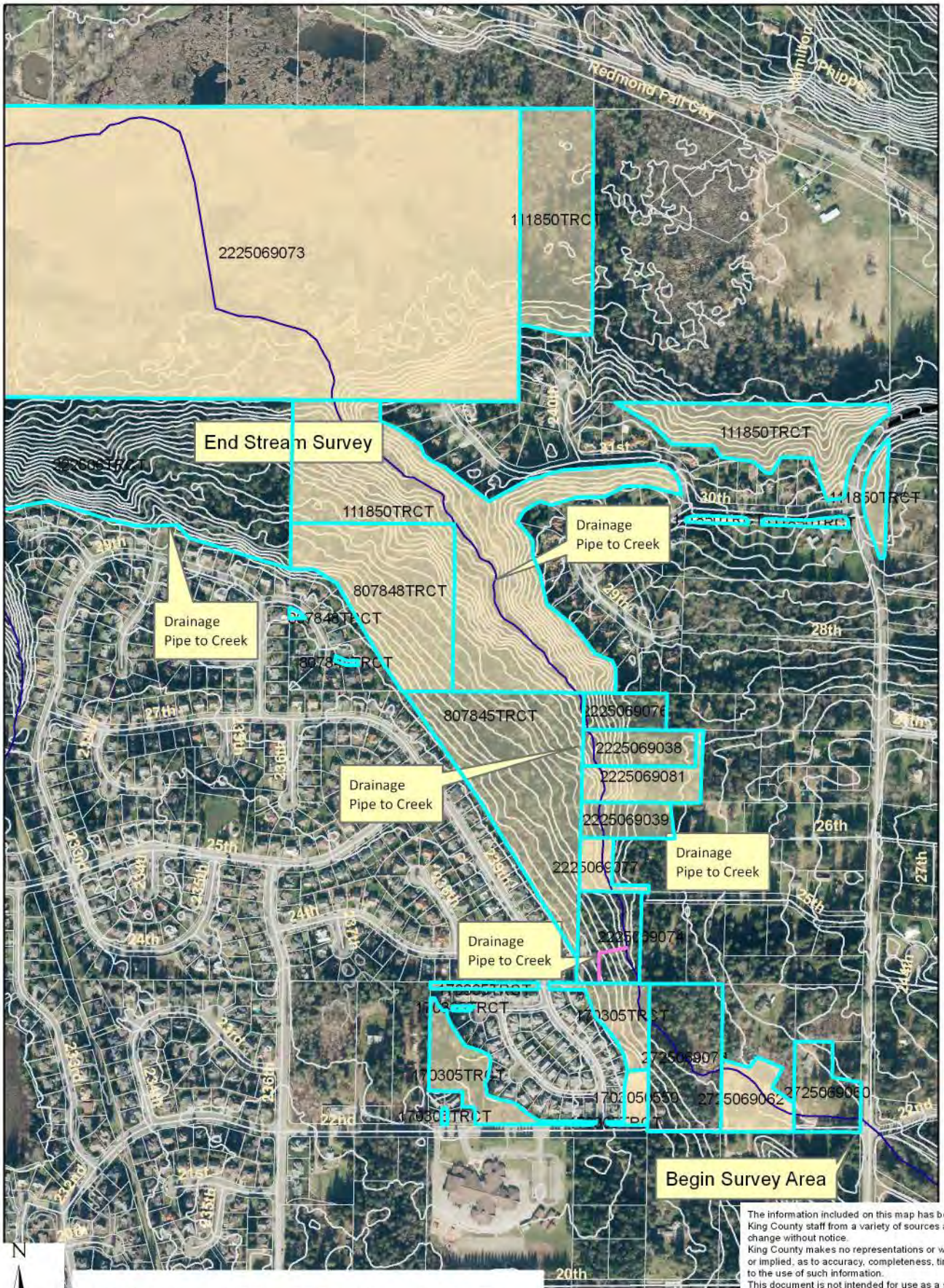


Figure 2

2.2 Land Use and Ownership

The study area is located partially in rural King County and partially in City of Sammamish From 244th the Outlet crosses four private parcels before entering the ravine. The ravine is bordered by residential developments and tracts of open space that buffer the ravine. Driveways cross the drainage at parcels 9074, 9077 and 9073. A residence is located at the lower end of the drainage on parcel 9073.

Open space tracts, owned by the City of Sammamish and homeowners associations, are located on the west side and slopes of the drainage. Access was given by City of Sammamish and four property owners to review the stream conditions.

The ravine is heavily forested with Douglas fir and Western Red Cedar. Alder and Black Cotton wood are also present. An understory of dogwood, salmon berry, and devils club are growing adjacent to the stream. Four storm water tight-line pipes discharge surface water to the drainage from nearby housing subdivisions. Parcels and drainage projects are shown on Figure 2.

Aerial photo review provides the following general history of land use (photos are reproduced in Appendix A. In 1940, the area south of what is presently NE 26th Street (estimated) has been logged. 244th Ave NE is present and a few clearings are visible for what appears to be ranches or residences. The drainage is visible but appears to be dry. In 1961 the areal photo shows additional side roads and buildings adjacent to 244th. The outlet drainage appears to meander northwest from the intersection of 244th and the future location of NE 22nd St. The slight meander trace in the aerial suggests that the drainage did not parallel 22nd at this time but followed a separate course to the northwest. The vegetation cover is dense but evidence of logging in the form of radiating lines where trees were dragged up slopes. The outlet drainage is indistinct north of North of NE 24th St. The 1965 aerials show tree cover at the intersection of 244th and NE 22nd. No buildings have been built near the ravine but development continued adjacent to 244th. The vegetation shows less evidence of logging and the density of vegetation appears to increase. This pattern continues in the 1970 aerial photo. However, residential development is increasing farther from 244th and roads extend from 244th to the ravine. In the 1979 aerial the forest cover is thicker but residential development has increased and several more lots have been cleared. The lot with the reported stock pond in Reach 3 has been cleared to the creek and a pond is visible. The 1989 aerials show that the larger developments on either side of the ravine are cleared for development and trees on the west facing slope in Reach 4 have been thinned. Property east of the ravine has been extensively cleared. The 1995 aerial photos show approximately the same pattern of development and number of lots, however the building foot prints are occasionally bigger as older residences are replaced with larger residences.

2.3 Geology and Geomorphic Setting

The project area geology has been mapped by the USGS (Minard, 1988) and University of Washington (Booth, in press). Figure 3 shows the mapped geologic formations in the area. The youngest deposits are alluvium and colluvium eroded from slopes and deposited in the valley bottom. Alluvial fan deposits at the mouth of the stream represent post glacial stream transported sediments. Glacial Till caps the plateau and is underlain by Advance Glacial Outwash, and transitional beds pre-Fraser Glacial Olympic Beds. The descriptions below represent published descriptions of these deposits and information on observations in the project area. Specific observations are noted in the stream drainage description.

Artificial Fill (af)
Based on document review and geographic conditions, the existing road sections along the uplands area of the Sammamish Plateau, generally follow the native grade for the area with transitions of minor cuts and fills associated with road construction and site development. Road fill within these areas are typically less than 12 feet in depth. Artificial fill is also present where private driveways cross the drainage outlet. These fills are too small to be mapped.

Younger Colluvium and Alluvium (Qal)
Younger colluvium is present adjacent to the Lake Allen drainage and is the predominant material on the valley slopes and bench above the stream channel. Qal consists of colluvial deposits of sediment eroded from the side slopes. This includes shallow landslides and slope failures. Alluvial deposits are composed organic rich fine sand, silt, and clay accumulated in the low energy part of the stream valley and are subject to seasonal flooding. Coarser grained channel sediments of cobbles, gravel and coarse sand are present in the channel and underlie finer grained sediments.

Landslide Deposits (Qls)
No landslides are shown on published geologic maps. Only large scale features are normally mapped. However, the LiDAR image (Puget Sound LiDAR, 2003) of the drainage exhibits features that are typical of landslide terrain. These features include uneven ground surface and subtle head scarp. The LiDAR image is shown in Figure 4.

Alluvial Fan Deposits (Qaf)
Alluvial fan deposits are late Holocene in age and are mapped at the base of the drainage where it enters the Evans Creek wetland complex. These deposits consist mostly of stratified silt, sand and pebble to cobble gravel at the mouths of stream gullies and along the bases of slopes. The deposits fan out into valley bottoms and typically receive material during stages of high water flow. In the Allen Lake Outlet, the fan is composed of fine sediment and organic material.

Allen Lake Outlet Stream Recon

Geology

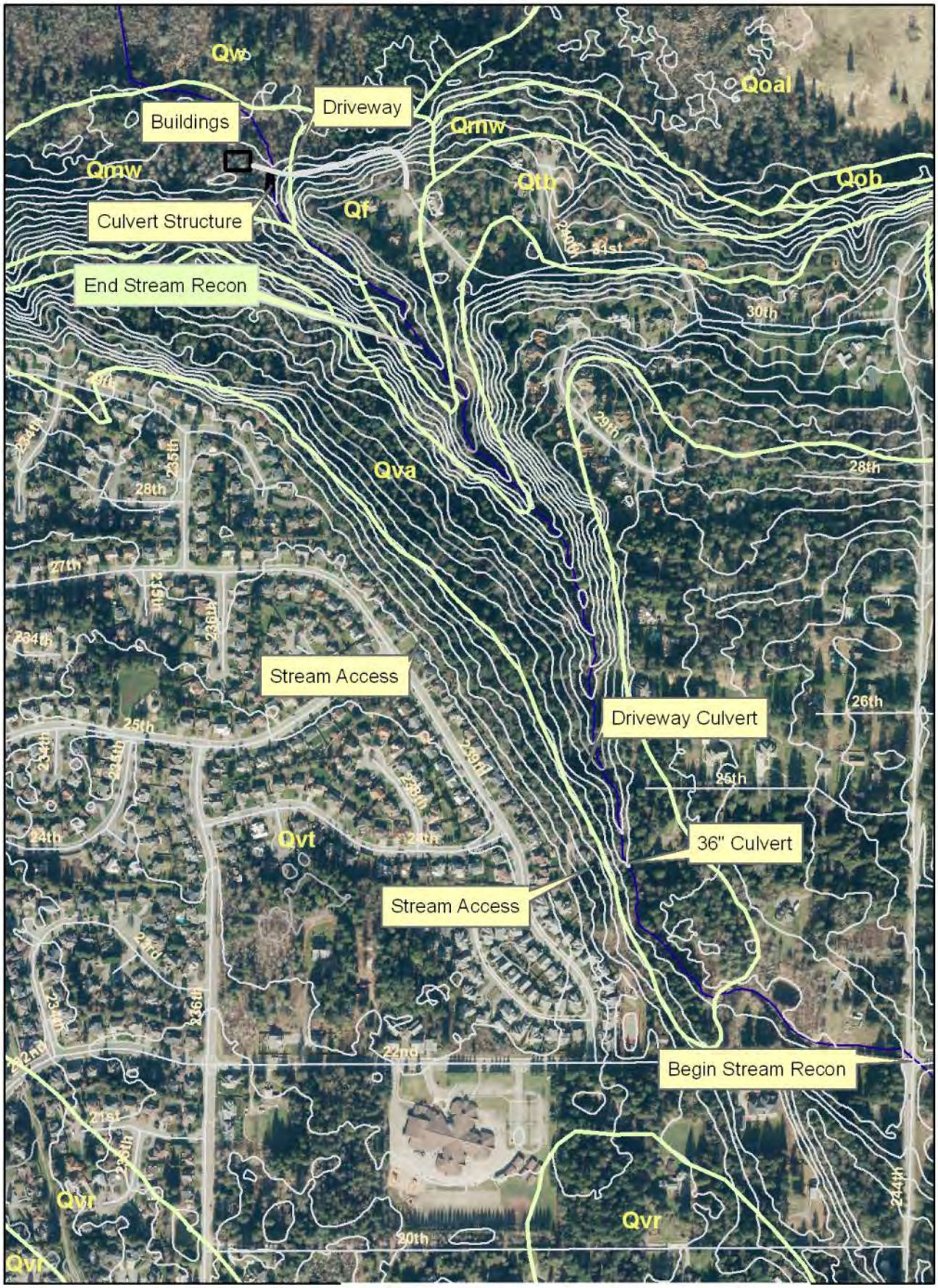


Figure 3

N

250 125 0 250 500 750 1,000 Feet

King County

Recessional Outwash Deposits (Qvr)
Deposition of these sediments followed the draining of Lake Bretz, the last of the major lakes impounded by the Puget Lobe of the Cordilleran ice sheet, when ice blocking the Strait of Juan De Fuca receded. Stratified sand and gravel, moderately well sorted to well sorted; less common silty sand and silt. Recessional outwash was deposited in broad anastomosing outwash channels that carried south-draining glacial meltwater away from ice margin during ice retreat. Qvr is typically slightly oxidized and locally subdivided into: Recessional lacustrine deposits—Very fine-grained sand, silt, and clay deposited in small lakes during ice recession and Ice-contact deposits—Deposits that are similar in texture to unit Qvr but commonly are less well sorted and have silt-rich matrix (Booth, et. al.,2004). In the Allen Lake Outlet, these sediments appear as stratified silty sand with gravel and cobbles.

Vashon Till (Qvt)
Qvt is the predominant near surface geologic unit in the upland area on either side of the ravine. Vashon till deposits consist mostly of a medium dense to very dense, unsorted mixture of sand and gravel in a binder of silt and clay, deposited and overridden by the retreating glacier. The till ranges from 3 to 80 feet in thickness. Water is generally unable to penetrate the low permeability interface of the till. This results in a perched ground water condition that is common in the flat areas of uplands. At the edge of the ravine, perched water can move downslope in weather surficial material forming seeps on the slopes. Boulders in the till weather out and form bands that remain in position and form pools in the drainage.

Vashon Advanced Outwash (Qva)
Vashon advanced outwash is mapped in the inner ravine section of the drainage. Vashon advanced outwash consists of sands and gravels deposited by streams and rivers issuing from the front of the advancing Fraser Glaciation. Fine-grained silty-sand is common in the lower part of the formation. This type of deposit is what is locally visible in the drainage. The deposits consist mostly of clean gray to oxidized pebbly sand with increasing gravels higher in the section are not prominent in the drainage. Qva underlies the till unit in the upland areas and may be up to 180 feet in thickness. These deposits are highly susceptible to erosion and are subject to downcutting when subjected to increased runoff. Qva is exposed in the stream from Reach 2 to 4. The fine grained sediments appear laminated to massive with occasional rounded gravel sized grains. The lower part of this unit is mapped as Lawton Clay in Puget Sound. A Drainage project at NE 29th Place was completed by King County after a single storm event caused 20 feet of downcutting into these sediments (personnel communication with homeowner).

Allen Lake Outlet Stream Recon

LiDar Image with Potential Landslide Features

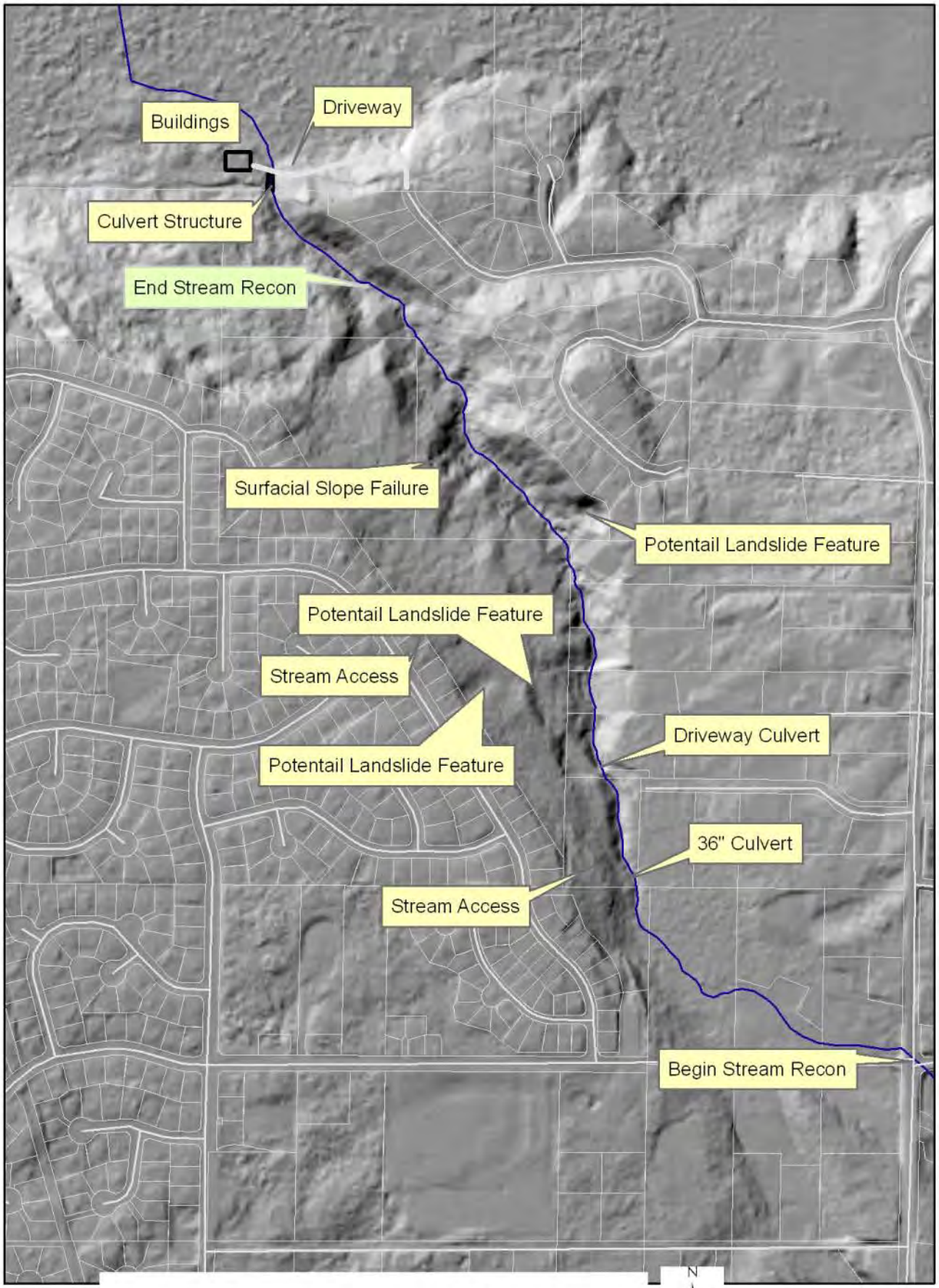


Figure 4

Transitional Beds (Qtb/ Qpf)
Transitional beds are mapped underlying Vashon advanced outwash in the northern portion of the ravine. Transitional beds of the Fraser glaciation and Olympia interglaciation consist of laminated thin to thick bedded blocky jointed clay and silty clay in the lower portion, and grading up to silt and fine grained sand in the upper part. The fine grained sediments were deposited in the ponded waters some distance from the ice front.

Geomorphology

The Allen Lake Outlet is located between two glacial runoff channels where glacial runoff followed the receding glacial front at the end of the last ice occupation. The older is the glacial Inglewood drainage channel that crossed from the Snoqualmie River to Lake Sammamish generally aligned with Inglewood Hill Road and NE 8th Street. This channel is not as deeply eroded and suggests the drainage was not occupied for a long period of time. As the glacier continued to melt and recede, the runoff channel move northward to the Redmond channel, the present location of the Patterson Creek and Evans Creek drainages. Deposits of Recessional Outwash north of NE 8th Street suggest that glacial runoff water followed the receding glacier northward, eroding the Allen Lake Outlet. The ravine occupied by the current Outlet drainage has a gently sloped upper valley and steeper inner valley. The upper valley may have been shaped by glacial ice and the inner drainage was likely carved by glacial runoff as the Inglewood channel transitioned to the Redmond channel as well as post glacial runoff. As noted in the discussion of landslide deposits, the slopes may have been modified by land sliding.

Prior to routing Allen Lake to this drainage in the 1970s, the drainage probably received discharge from groundwater and minor surface flows. The stream was probably intermittent, only having flows in the winter and spring. The Hanson's (Personal Communication, 3-7-12) stated that they moved to the property in 1981. They noted that the stream flowed from the fall to spring and was dry in the summer and fall. In their opinion there was not more runoff and the flows peaked rapidly.

Drainage from Allen Lake has increased the size of the drainage basin contributing to runoff. Larger housing developments were built in the 1980s and increased the stormwater runoff. Four drainage projects discharge stormwater runoff through tight-line pipes directly to the drainage near or at the stream's edge.

2.4 Stream Reach Descriptions

The project has been divided into four (4) reaches based on similar topography, and culvert locations which control the gradient. Reaches are shown in Figure 5. Parts of several reaches were not field checked because right of entry was not obtained from the owners. The total reach length is approximately 4625 feet.

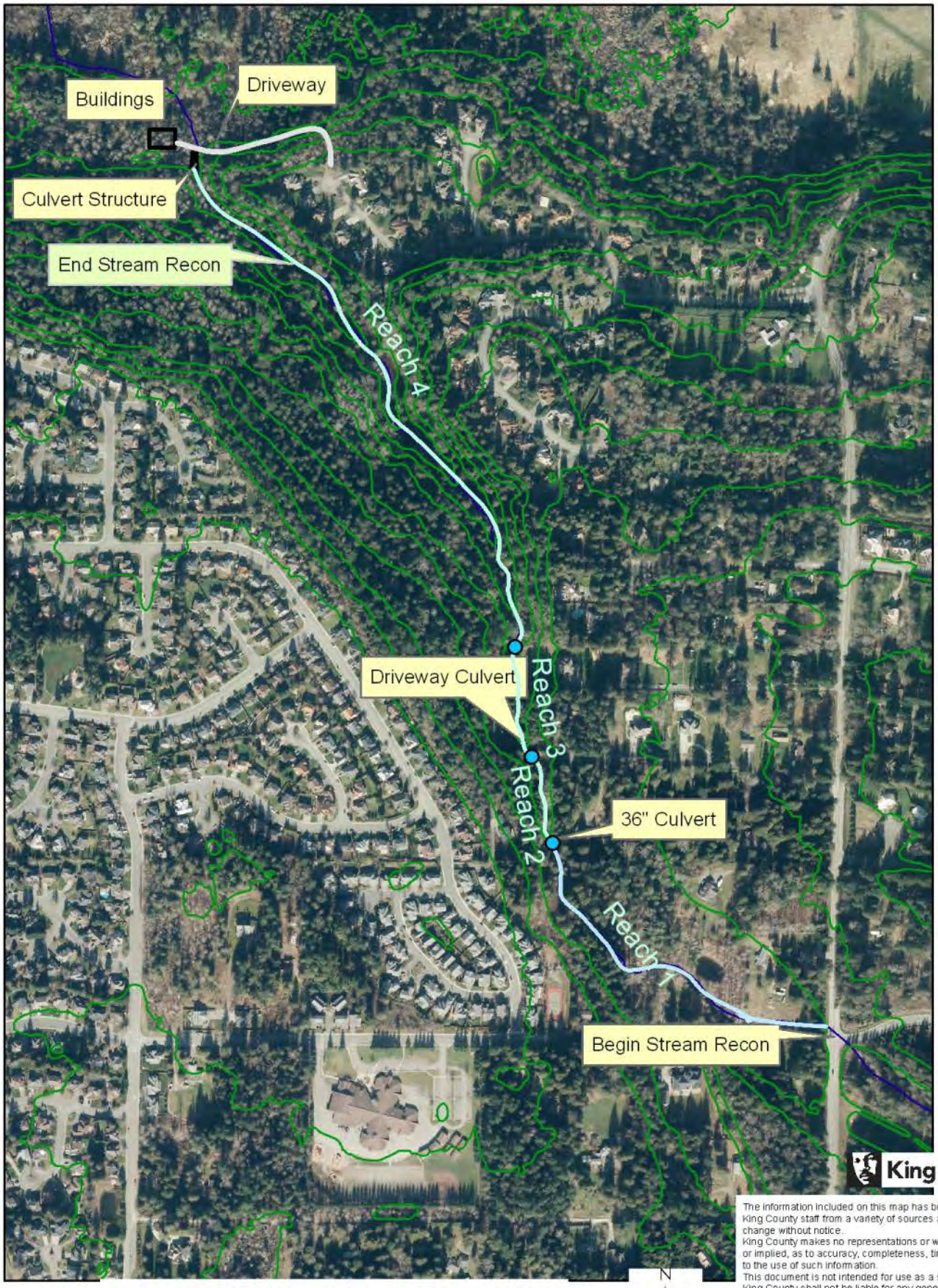
- **REACH 1:** This reach extends from the upstream end of the culvert at 244th Ave NE to the upstream end of the next culvert downstream between parcels 9043 and 2324, approximately 1400 feet. The culvert under 244th Ave NE has been identified as a 24 inch culvert and angles northwest from an inlet east of 244th Ave NE to the northwest intersection of 244th Ave NE and NE 22nd Street. The drainage parallels NE 22nd Street for approximately 320 feet before angling northwest behind the house on parcel 9062. The channel is shallow and grass lined. A shallow pond and wetland are located adjacent to the stream on the parcel. The area is predominately grass and ornamental plantings with some native trees. The channel is crossed by three (3) man-made structures made of logs in one case and garage door sections in two other locations. The garage door sections have trapped branches and debris. The gradient in this section is approximately 1.1% (10 feet of elevation drop over 858 feet, King County 10 foot contour interval). Hills rise on either side of the stream north of parcel 9073 and the gradient increases slightly to approximately 2% (field measurement). The vegetation transitions to forest with Western Red Cedar trees and an understory of Sword fern, Sallal, Dogwood, and Salmonberry. A stormwater drain (King County drainage project number D92638) discharges to the bank northwest of parcel 9073. Quarry spalls are visible on the left bank below a discharge line. A detention vault is located under a tennis court west and above the stream.

  Geology
  The geology in this reach is mapped as Recessional Outwash (see Photo 4). Light tan compacted sediments are exposed in the stream channel north of parcel 9073. The formation is composed of silt and fine sand with pebbles and appears composed of fine layers and the layers appear slightly contorted. The formation maybe lake deposits (lucustrine) overlain by a layer of stream gravel and cobbles which thins in the stream bed. The gravel and cobbles are sub-rounded to rounded and predominately granites and diorites derived from recessional outwash. Banks are incised 1.5 feet and undercut. Glacial Till caps the hills on either side of the lower drainage.

  Stream Conditions
  The stream reconnaissance for Reach 1 begins at the upstream end of the 244th Avenue NE road culvert and ends at the first culvert between Parcels 9043 and 2324. The culvert at 244th Avenue is 144 feet long, 24 inch diameter concrete pipe with a catch basin about halfway down, at an average grade of 0.75%. The culvert has a second catch basin on the upstream end that contains an emergency overflow structure (aka bird cage) that allows for seasonal stormwater ponding (see Photo 1). This upstream catch basin contains a straight pipe inlet at stream bed grade with a steel bar trashrack. If the trashrack is kept clean, the culvert appears to be fish passable both upstream and downstream due to its low gradient, ample plunge pool, and backflooded condition (see Photo 2). On 2/16/12, the downstream end of the 244th road culvert was 90% backflooded by a low, channel-spanning beaver dam at the tailout of the culvert's large plunge pool. No water fall sounds could be heard from inside the pipe on either end

Allen Lake Outlet Stream Recon

Stream Reach Locations



King County

Figure 5

during the 2/16/12 site visit, indicating no obvious waterfall inside the pipe. The only upstream fish passage problem could occur when there is a large pond on the upstream side of 244th and the road culvert becomes pressurized. Culvert velocities could impede adult coho upstream passage for brief high flow periods (assuming the downstream culvert barrier at NE 25th can be made fish passable).

This reach contains the first of four subdivision storm water outfall tight-line pipes found in the reconnaissance study area. The HDPE pipe outlet stops short of the stream channel and falls onto a rip rapped splash pad that runs along the left bank of the stream and extends into the bed. The linear impact distance along the stream is about 20 feet long. The splash pad is not well maintained and is covered with blackberry and other invasives.

Wood

Large Woody Debris (LWD) is in short supply in this cleaned and somewhat channelized reach of the stream. The area near 244th has reportedly been relocated, explaining the diagonal culvert alignment. Mostly small diameter woody debris and some smaller diameter alder were the only woody debris present. One large parcel (9073) along the creek (about 450 linear feet of stream) could not be accessed, but was viewed from parcels immediately upstream and downstream. Reach 1 flows across the plateau and is low gradient, pool/riffle and run habitat that is mostly gravel bedded. It contains two debris accumulations in parcel 9073, created by what appeared to be thin gauge steel storage cabinet doors (or possibly metal garage door segments) set up apparently as light weight bridge crossings. The metal doors have accumulated small branches, leafy, and woody debris. Both debris accumulations appeared fish passable, with low heights and fairly large and long plunge pools directly below each debris accumulation providing fish easy passage over, around, or through in either direction (see Photos 3 through 7).

Stream Channel Type

This reach is composed of about 80% pool/riffle habitat, with 20% glide habitat. The stream gradient is a low 1.1%, so no fish barriers are expected. Patches of suitable trout and coho size spawning gravel were observed at several locations in the tailouts of pools and riffles.

Potential Fish Use

Existing salmonid fish use of Reach 1 would most likely be seasonal cutthroat trout use by fish seeding downstream from Lake Allen. A cutthroat trout was captured by King County Roads Services Ecologists in the Allen Lake outlet on 12/8/11 upstream of 244th Avenue NE at the Michelman driveway culvert, located five parcels downstream of NE 8th. The Washington State Priority Habitat Species Database map (Appendix C) shows documented cutthroat trout use from Allen Lake's northern end downstream to NE 18th Street (about 1600 feet upstream from 244th Avenue NE). Additionally, for the area within 500 feet of the Lake Allen Outlet stream reach from NE 8th St to 244th Ave NE, the King County Sensitive Areas Notices on Title (NOT) show 5 different parcels upstream of 244th Ave NE with a Sensitive Areas Ordinance stream classification of Class 2 Salmonid, indicating a official determination of salmonid use of Allen Lake

outlet by DDES senior ecological staff. Interestingly, there are also three Sensitive Areas Notices on Title with no salmonid use but year round flows (Class 2 P (perennial)), and one Class 3 stream NOT which is seasonal flow with no salmonid fish use.

Other fish species likely to inhabit Allen Lake could also be present in Reach 1 while the stream is flowing, most likely bullhead catfish, sunfish, sculpins, and possibly bass and crappie. See Appendix C for Washington State Fish and Wildlife Collection Reports from King County Department of Transportation. Depending on fish passage conditions at driveway and road crossings upstream of 244th Avenue NE (which is a low gradient channel), seasonal fish movements up and downstream to and from the Lake can be expected in this reach. Other aquatic organisms captured in the creek included crayfish, northwest salamander, long-toed salamander, and bull frog and red-legged frog tadpoles.

It should be noted that per King County Critical Areas Ordinance (CAO) (replaced the Sensitive Areas Ordinance) Chapter **21A.24.355 Aquatic areas—water types,** in A.2. Type F waters include all segments of aquatic areas that are not type S waters and that contain fish or fish habitat. Allen Lake outlet would be currently classified as a CAO Type F stream, based on the current CAO definition.

Fish Passage Issues
No obvious fish barriers were observed in Reach 1. The debris accumulations from the steel cabinet door "bridges" were easily fish passable upstream and downstream to cutthroat trout and/or potentially coho salmon (potential use if downstream barrier at NE 25th Street culvert is fixed).

Stream Flow
Most accounts on the ground describe the stream going dry in Reach 1 in June or July of each year and beginning to flow in October or November. This varies depending on location within the reach, presence of groundwater or spring inflows, upstream beaver activity, and precipitation amount in any given year.

- **REACH 2:** This reach extends from the upstream end of the culvert between parcels 9043 and 2324 to the upstream end of the culvert under the residential driveway at parcel 9077 (at NE 25th St—if extended) approximately 425 feet long.

  The culvert at Parcel 9043 and 2324 is a 36 inch diameter, 10 to 12 foot long, smooth steel pipe (see Photos 8-11). The culvert is poorly constructed of thick steel pipe composed of short curved sections welded together that created several bends in the culvert, both horizontally and vertically. The culvert underlies a single lane old driveway or logging road that crosses the stream. It is covered with only about a foot of road fill material. Downed trees on the road bed suggest this road is no longer used. The culvert is set at a 2% to 3% grade and has a 1.6 foot drop at the downstream end (water surface to water surface) (see Photos 12 and 13). There is a fairly large culvert plunge pool that is 10 feet wide, 12 feet long, with a maximum depth of 1.5 feet. Based on the

short length, low gradient, length and depth of the plunge pool, upstream exit, and pools for resting within the pipe, this culvert is passable to cutthroat trout and coho salmon.

A second smaller culvert (18 inches diameter corrugated metal pipe) is visible in the upstream side of the fill, but is plugged a few feet into the culvert, with no visible outlet on the downstream side of the road fill prism.

The slopes above this reach are heavily wooded with second growth Western Red Cedar and Black cottonwood trees and an understory of Sword fern, Sallal, Dogwood, and Salmonberry. The drainage has a flat bottom 30 feet wide with steep sided side slopes (see Photos 14-20). Banks are incised up to two feet and the east bank is undercut approximately a foot. Cedar stumps in the stream bottom are not undercut indicating that significant downcutting has not taken place. In one location roots from a cedar tree cross the drainage and are undercut approximately a foot in depth (see Photos 21-23).The stream gradient is 5-7% below the logging road culvert and shallows at the lower end of the reach (see Photos 24-31). Stream gradient is 2 to 3% upstream of the logging road culvert.

Geology

The geology in this reach is mapped as Advance Outwash. In this area Advance Outwash is composted of silt to fine sand sized with minor pebbles (see Photos 18 and 19). The compacted sediments stand in vertical exposures up to 5 feet tall and are exposed in the east bank. Weathered soil and colluvium cover the slopes. The channel bottom is covered in firm sand to cobble sized sediments. The gravel and cobbles steam sediments are sub-rounded to rounded and predominately granites and diorites derived from recessional outwash. A zone or band of granitic boulders, two (2) to three (3) feet in diameter (see Photo 16), form steps in the channel. These have weathered from the overlying Till. In general banks are incised 1.5 feet and undercut about a foot. The gradient flattens above the culvert that forms the northern boundary of the reach. The valley bottom flattens and widens in response to deposition above the culvert. Glacial Till caps the hills on either side of the lower drainage.

Stream Conditions

Wood

The entire reach is heavily wooded and as such contains abundant large and small woody debris within the channel and on the terraces and stream banks. Several very large old growth trunks are present in the channel and on the banks. These contain springboard cuts (Photos 15, 17, 25).

Stream Channel Type

Given the 5% to 7% gradient, the channel is composed of 20% step pools created by LWD and boulder bands, 20% short riffles at the tailouts of the pools, and about 60% run habitat. The bed is mostly cobble and gravel bedded (see Photos 21, 24, and 26-29).

The stream gradient flattens considerably as it approaches the long driveway culvert and large fill prism at 25th Avenue NE (if extended) on parcel 9077. The driveway culvert and roadfill have caused a sediment deposition terrace in the stream channel, which is acting in combination with abundant LWD structure to form excellent instream fish habitat at this location (see Photos 26-30). This combination of features has created long fairly deep pools (up to 20 inches deep) and excellent spawning gravel riffles and runs. The available gravel streambed here is composed of excellent, abundant, suitably sized spawning gravel for cutthroat trout and coho salmon. The gravel is also suitably sized for sockeye salmon.

Potential Fish Use

The Hanson's (parcel 9077) described a large flood in 1981 that overtopped and blew out their driveway road fill, blocking access to their home. After the flood subsided, they recall finding three trout stranded and dead on a flood terrace just upstream of the driveway (within Reach 2). Their assumption was the fish washed down from upstream, and were trapped when the water dropped as the driveway fill prism suddenly washed away and unleashed a dam burst type flood. Seasonal cutthroat trout use for spawning and rearing is highly likely, along with potential coho salmon spawning and rearing if access is provided both within and directly below the Hanson's 25th Ave NE residential driveway culvert.

Fish Passage Issues

In the reach between the upstream end of the 25th Ave NE culvert and the next upstream culvert at Parcels 9043 and 2324, no fish barriers were found in what is the head end of the ravine portion of the stream.

Stream Flow

Stream flow in this reach is documented by a King County stream gauge (#18H) installed on October 12, 2011. The gauge measured a period of no flow during fall 2011 and part of the winter 2011/12. Flows have been as high as 19.54 cubic feet per second (cfs) on January 22, 2012 (see Appendix D for daily flow data October 2011-August 2012). The gauge is located immediately upstream of the 25th driveway culvert (see Photos 30-31). The stream gauge was recently installed (October 2011), so the record is short, and included some extraordinarily dry periods (i.e. December, 2011, driest on record). The long term residents at 25th recall the creek going dry every year for several months.

- **REACH 3**: This reach extends from the upstream end of the driveway culvert of parcel 9077 to parcel 9038; approximately 600 feet (see Photos 31-47). The driveway is an extension of NE 25th Street. The culvert under the driveway is a 36 inch diameter CMP on the upstream side and 54 inch diameter CMP on the downstream side. The center section of the culvert is smooth steel pipe that is 48 inch diameter. The culvert bottom is at stream grade on the upstream side of the driveway. The base of the culvert outlet is about 1 foot above the stream channel, the channel then drops approximately 10 feet over 15 feet of run (67% gradient). A King County installed and monitored stream gauge is located on the upstream side of the culvert. The gradient is approximately 7% derived

from King County contours and GIS map. The channel is composed of native rock, concrete, dimensional lumber and brick. The channel drops another 10 feet through a band of native boulders three (3) to four (4) feet in size (see Photos 40-45). The channel is relatively narrow and constricted by fill for approximately 160 feet on both banks. The remainder of the reach was not accessible because property owners had not responded to requests for entry. The property owner (personal communication, 3-7-2012) of parcel 9077 has lived in the area since 1980 provided some history on the stream. They noted that:

- The driveway had washed out in a storm, in the 1980s or 1990s.
- A log and earth dam to create a stock pond was located downstream on parcel 9039. A pond is visible on this parcel in 1998 aerial photographs (King County GIS).
- The same storm that washed out their driveway washed on the dam on the stock pond. The dam was constructed of logs and mud according to the Johnsons.
- The homeowner had hand dug a 25 foot deep well and his verbal description matched the mapped stratigraphic sequence of Till over Advanced Outwash.

The valley widens at the beginning of this reach. LiDAR image of the drainage below parcel 9077 suggests that the left bank has been graded in some way or may be a landslide. This area was not visited in the field as access was denied.

Geology

The geology in this reach is also mapped as Advanced Outwash. Limited areas of stream banks were observed due to limited right of entry. Fill bordered the stream channel in the upper portion of the reach (see Photo 34). The channel bottom is covered in cobble sized sediments. The cobbles steam sediments are sub-rounded to rounded and predominately granites and diorites derived from recessional outwash. A zone or band of granitic boulders, two (2) to three (3) feet in diameter, forms a step in the channel below the culvert. These have weathered from the overlying till. The gradient steepens below the culvert that forms the southern boundary of the reach. Glacial Till caps the plateau on the western side of the lower drainage and forms the steeper slope above the drainage.

Stream Conditions

This 600 foot stream reach begins at the private driveway that is an extension of NE 25th Street. The reach is at a 5 to 7% grade and starts out with a steep drop off the NE 25th culvert, transitions to a large boulder bed, then to the more typical gravel bedded, heavily vegetated, riffle/run type habitat, with occasional LWD or small woody debris created short pools with low drops. We were not able to access more than 150 feet downstream of the Johnson's driveway culvert outfall due to lack of allowed access. A log and mud dam for stock watering was located on the parcel immediately downstream from the Johnson parcel, until it blew out in the 1980s during a big flood event.

The stream reconnaissance picked up the lower end of Reach 3 near parcel 9038. The gradient at the downstream most part of this reach is between 4 and 6% looking upstream with a hand held clinometer. The channel is riffle/run with intermingled step pools formed by boulders and/or LWD—mainly alder and maple blowdown. There is a thick

overarching shrub layer of vine maple and salmonberry, providing dense shade and cover over the stream channel.

Wood
Only a few pieces of LWD and a moderate amount of small woody debris were observed in the short accessible part of Reach 3. More investigation is needed, if access could be obtained.

Stream Channel Type
Manmade debris and culvert caused cascades start at the upstream end of the reach at the culvert outfall erosion area, followed by a 5%-7% large boulder cascade/run with a series of low drops, then the channel transition to a 5% step pool/riffle and run channel down the ravine.

Potential Fish Use
Potential fish use of this reach include cutthroat trout spawning and rearing, coho salmon spawning and rearing, sockeye salmon spawning, and potentially steelhead spawning and rearing. The boulder drop segment is good steelhead yearling (juvenile) rearing habitat. Other non-salmonid fish species would be expected that move downstream from Allen Lake and its headwater wetlands.

Fish Passage Issues
Anadromous fish could access up to the NE 25th culvert outfall, but likely cannot ascend the steep debris strewn outfall cascade (see Photos 31-39). The culvert outfall drop is likely impassable, as well as the culvert itself due to multiple drops inside the pipe at the different diameter joints, and the overall steep gradient. The culvert total length is about 36 feet. The upstream end contains a step up to the existing streambed level and looks questionably passable due to leap height, bad hydraulics, and steep gradient.

Detailed Description- The residential driveway culvert at NE 25th is very likely a complete fish barrier to upstream fish migration (mainly coho salmon and cutthroat trout) due to multiple factors. The first fish passage problem is the result of stream bed erosion at the culvert outfall. It is a steep, eroded area that does not appear to be fish passable in the upstream direction due to several drops and falls over the steep rubble filled 67% grade (see Photos 38-39). The stream channel drops a foot off the driveway culvert bottom (Photo 35), then another 10 feet over 15 feet of run over concrete chunks, brick, railroad ties, woody debris, and a few logs (see Photos 34, 38,39). This outfall segment does not have adequate plunge pool depths or lengths for fish to navigate upstream. Addition fish passage problems result from: the culvert's steep gradient, about 5% to 7% (Photo 33 and 36); three different pipe diameters composed of two different pipe types (Photo 32,33,36), and the upstream end of the pipe (Photo 37).

While the downstream drop off the end of the pipe is only about a foot (pipe water surface to outfall pool water surface), the plunge pool from the 54 inch CMP is too shallow and too short for fish to attempt a jump up into the pipe. Inside the pipe, velocities are excessive due to the steep gradient, in combination with three water surface

drops, each with poor hydraulics for upstream fish passage. The first internal fish passage problem is a drop at the 48 inch smooth steel pipe connection to the larger (and newer) 54 inch diameter CPM. The second is a drop from the partially crushed 36 inch diameter CMP to the 48 inch smooth steel culvert at the hand grouted connection. This drop creates a reverse wave due to high velocity flow. The third fish passage problem is located at the pipe's upstream entrance at a drop from the aggraded streambed, down into the damaged (partially crushed and rusty) 36 inch diameter CMP (see Photo 32). Additionally, the 12 foot long smooth steel pipe presents velocity challenges due to not only steep gradient, but the smoothness of the pipe provides no hydraulic roughness to facilitate fish passage. The homeowners were surprised and unaware of the fish passage problems at this private driveway culvert, and expressed a desire to remedy the situation. Information on potential grant funding was forwarded from the County to the current owners.

Stream Flow

Intermittent stream flow has been documented at the County gauge at NE 25th, but has not been documented downstream of this point. At some point downstream of NE 25th the stream transitions from intermittent flow to year round flow. That point is not known, but likely changes from year to year, and season to season based on precipitation amount and timing, and upstream flow manipulations from Allen Lake downstream. Based on discussions with the long term owners and a short gauge history, the stream in this reach is intermittent, with flow for about 9 or 10 months per year. The owners of the next culvert downstream from 25th in Reach 4 near the valley floor, report year round flow at their road crossing culvert just above the valley floor at the edge of Evans Creek Wetland #22.

- **REACH 4**: This reach extends from parcel 9038 to and including the culvert and its outfall on the Happy Valley parcel 9073, approximately 2200 feet on approximate gradient of 5.5%. The valley in this reach is characterized by a less steep upper slopes and steeper inner drainage. This shape represents the broader glacially carved valley with the inner stream carved drainage. The steeper inner slopes are 48%. Upper slopes of the west side of the drainage (21%) slope less steeply than on the east (33%). Two storm drain lines from the subdivisions above the drainage discharge to the stream (King County Drainage Projects 91134 and D91675). The upper slopes are well forested with second growth Western Red Cedar, Western hemlock, Douglas Fir, Black cottonwood and Red Alder. Redtwig dogwood, Salmonberry, Sword fern, and Devils Club cover the inner drainage. Many branches are covered in thick layers of moss. The stream bottom is well vegetated. The stream channel is approximately six (6) to eight (8) feet wide and the valley bottom is approximately 30 to 40 feet wide. The substrate is sand to cobble sized material. Occasional boulders up to three (3) feet in diameter are present. Banks are six (6) inches to three (3) feet high. Soil and colluvial material is slumping into the stream where it meanders up against the slope. The stream banks and valley bottom is composed of very soft organic muck one (1) to two (2) feet thick over gravel. The valley bottom above the stream is saturated. Groundwater seeps are present on the side slopes and hyporheic zones are locally present in the channel with orange oxidized sediments.

Geology
This reach is underlain by alluvial fan deposits overlying Advance Outwash which in turn overlays older non-glacial Olympic interbed deposits. The alluvial fan deposits form benches on either side of the stream (see Photo 60) and are composed of saturated, fine sediment and organic muck. The alluvial fan has formed where the gradient has flattened above the lowest culvert on the drainage. The stream has incised a foot into the sediments. The high organic content suggests that the sediment is associated with the pond failure reported in Reach 3. The log dam failure would have deposited some large amount of the sediment in a single event. The relatively uniform size (age) of the bushes growing on the benches and re-incision of the stream into the sediment is consistent with a single event.

Where the stream meanders against the slopes Advance Outwash deposits are exposed in the upper half of the reach. Exposures are up to four (4) feet tall. Advance Outwash is light tan; massive to laminated deposits of fine sand with layers of gravel sized sediments (see Photos 61-63). Gravel and cobbles weathering from the formation provide a source of material to the stream.

Olympic interbed deposits underlay the Advance Outwash and are composed of laminated silt to clay sized sediments and are visible in the lower section of the reach (see Photo 64). Large fragments of buried wood are occasionally exposed by erosion (see Photo 62).Slopes above the stream are covered by colluvium. Shallow soil slips and landslides are present on the inner slopes of the drainage (see Photo 64). Groundwater seepage was noted at the contact between the Olympic interbeds and colluvium in several areas (see photo 63).

The lower part of the drainage and culvert at the base of this reach was not observed. The property owner (letter dated March 20, 2012) notes that there is a 36-inch culvert under the driveway with a boulder supported bridge over the culvert. This description matches the aerial photo (2010 King County GIS) and video views of the culvert (King County Sheriff, January 2011).

Stream Conditions
This reach has a nearly constant gradient, heavy vegetative cover, and at some point year round flow due to groundwater inputs. It also contains two stormwater tight-line outfall pipes from housing developments on the plateau's edges. Stormwater was required to be piped over the steep ravine slopes and directly into the stream to prevent catastrophic erosion of the valley walls.

<u>Wood</u>
The channel has moderate amounts of small woody debris from the scrub shrub cover layer, plus moderate amounts of LWD pieces of alder, maple, or cottonwood. There are also scattered large old-growth stumps on the stream bank and in the channel. The LWD pieces form the pool habitat observed in this fairly steep reach, also trapping and sorting patches of clean spawning gravel (Photos 49-51, 54-56, and 59).

Stream Channel Type

This 5.5% gradient reach is step pool, and pool/riffle, and run habitat with dense vegetation coverage and dense shade due to the deep ravine, large trees, and dense scrub-shrub layer (See Photos 47-60). Patches of suitable coho, cutthroat, sockeye, and potentially steelhead spawning gravel are present in the reach in pool tail outs, and in run sections (see Photos 49, 51, 54-56, 59 and 60). The stream channel size is on the small end for steelhead spawning however, but could be used by juveniles for rearing. The amount of total stream flow increases over the length of the reach, as groundwater inflows from both banks and bed add to flow.

Potential Fish Use

Anadromous fish can apparently ascend to the private driveway culvert on the Hanson's parcel at NE 25th Street- if extended. This determination assumes there is fish passage through the Evans Creek Wetland #22, a reasonable assumption given the stream flows through the large, flat valley floor wetland. The Washington State Priority Habitat Species Database map shows coho salmon use of Reach 4 up to about NE 29th Street (if extended), which is several hundred feet up the ravine reach from the valley floor wetland. Coho spawning and rearing is likely, given the presence of suitably sized spawning gravel, year round flows, dense vegetation, and a fairly undisturbed, deep ravine. There is little sign of any human use of the ravine bottom upstream of the Happy Valley parcel, due to steep and difficult access.

Fish Passage Issues

There do not appear to be any natural or manmade fish passage issues in this reach. The downstream most culvert is a residential road crossing at the valley floor. While access was repeatedly denied to this parcel, a detailed description and several photos were provided to the County by the Happy Valley parcel owners. The gravel road crossing has a 12 foot long, 36 inch diameter CMP in the stream, and a 6 foot fill prism with concrete curbs on top; with large boulders forming the headwalls (see Photos 65-68). Based on the photos and detailed information provided there is no fish passage issue at this crossing. The drop off the downstream end of the culvert is 8 inches into an 8 foot diameter plunge pool that is a maximum of about 20 inches deep. The owners note the culvert never ponds water on the inlet side of the culvert. But, the owners noted that is the first year that water is flowing through the gravel on the inlet side and flowing underneath the culvert. They noted that repairs need to be made to seal the inlet side. The photos show one three foot diameter headwall boulder on the downstream side of the fill prism has dislodged and fallen into the plunge pool. The culvert appears very old and is very rusty on the bottom half. This pipe should be a candidate for replacement and possibly upgrading to prevent complete failure.

Stream Flow

In a normal year, there is intermittent flow at the upstream end of Reach 4. At some point within the reach, flow becomes year round due to groundwater, spring inputs, and hyporheic flows. The King County installed gauge at NE 25th- if extended, should provide additional information on flows at the head of Reach 4, if "normal years" of precipitation are measured. The actual location of year round flow likely varies from year to year within the ravine. A flow gauge at the Happy Valley culvert would provide useful information to establish a baseline. The owners of Happy Valley noted the stream flows year round with a minimum flow of about 30 gallons per minute.

2.5 Sensitive Areas and Geologic Hazards

Erosion Hazards

Erosion is the displacement of soil, mud, and rock by the processes of water, wind, ice, and gravity. Erosion hazard areas are regulated by King County Code 21A.24.210. The King County CAO defines erosion hazard areas as those soils that may experience severe to very severe erosion. Steeper slopes generally have higher susceptibility to erosion since surface water will achieve high velocities and energy to erode and transport soil. All soils on slopes steeper than 40 percent have high potential for erosion. Soils on slopes inclined between 15 and 40 percent may have a medium or high erosion potential depending on the character of the soils.

The slopes are mapped as erosion hazard areas (DDES) and shown on Figure 6. The majority of the slopes west of the stream have slopes that are 20% or greater and would therefore be considered to have moderate to high erosion potential. In the upper slopes where till predominates, the erosion potential of these steep slopes would typically impact only the surficial weathered zone of the dense till. This weathered till zone would have rapid runoff and is susceptible to erosion from sheet or channel flow while the underlying till would be considered to have low erosion potential due to its high density and cohesive properties. The advanced outwash materials are highly prone to erosion and sediment transport during high-channel flows. Sever erosion has occurred from single rain events where culverts discharge on the steep slopes in the area. The advanced outwash is visible in the channel and has eroded where the stream has migrated against the slope. The colluvium and soils on the slopes is highly susceptible to erosion. The fine organic sediments on Reach 4 valley bottom are unconsolidated highly susceptible to erosion.

Landslide Hazards

Landslide hazard areas are defined as follows: (1) slopes with greater than 40 percent inclinations, (2) areas with slopes greater than 15 percent that are underlain by impermeable soils that include springs or groundwater seepage, (3) landslide areas that have moved during the Holocene epoch (last 10,000 years), (4) areas where rapid stream or wave erosion has created potentially unstable conditions, or (5) alluvial fans that are subject to inundation by debris or similar deposition of sediment.

King County has mapped the drainage slopes as landslide hazard areas as shown in Figure 6 (DDES and 2005 SWDM Landslide Hazard Drainage Areas Designations). In general, the steep drainage slopes are well vegetated with trees and underbrush. However, intermittent areas of unstable ground were observed based on visual evidence of weather scarps, tilted and bent trees, hummocky ground topography, and over steepened slopes with thick soil cover. Associated Earth Sciences identified the steep slope of the Cedar Park Subdivision, Reach 2 of this report, as a moderate to high risk of shallow landslides in the form of debris flows. The report noted a past debris flow on adjacent property. The Associated Earth Sciences report stated there was a low risk of deep seated landslides. Based on current observations, the valley and inner drainage slopes are susceptible to landsliding. LiDAR imaging supports this finding based on the terrain in Figure 4.

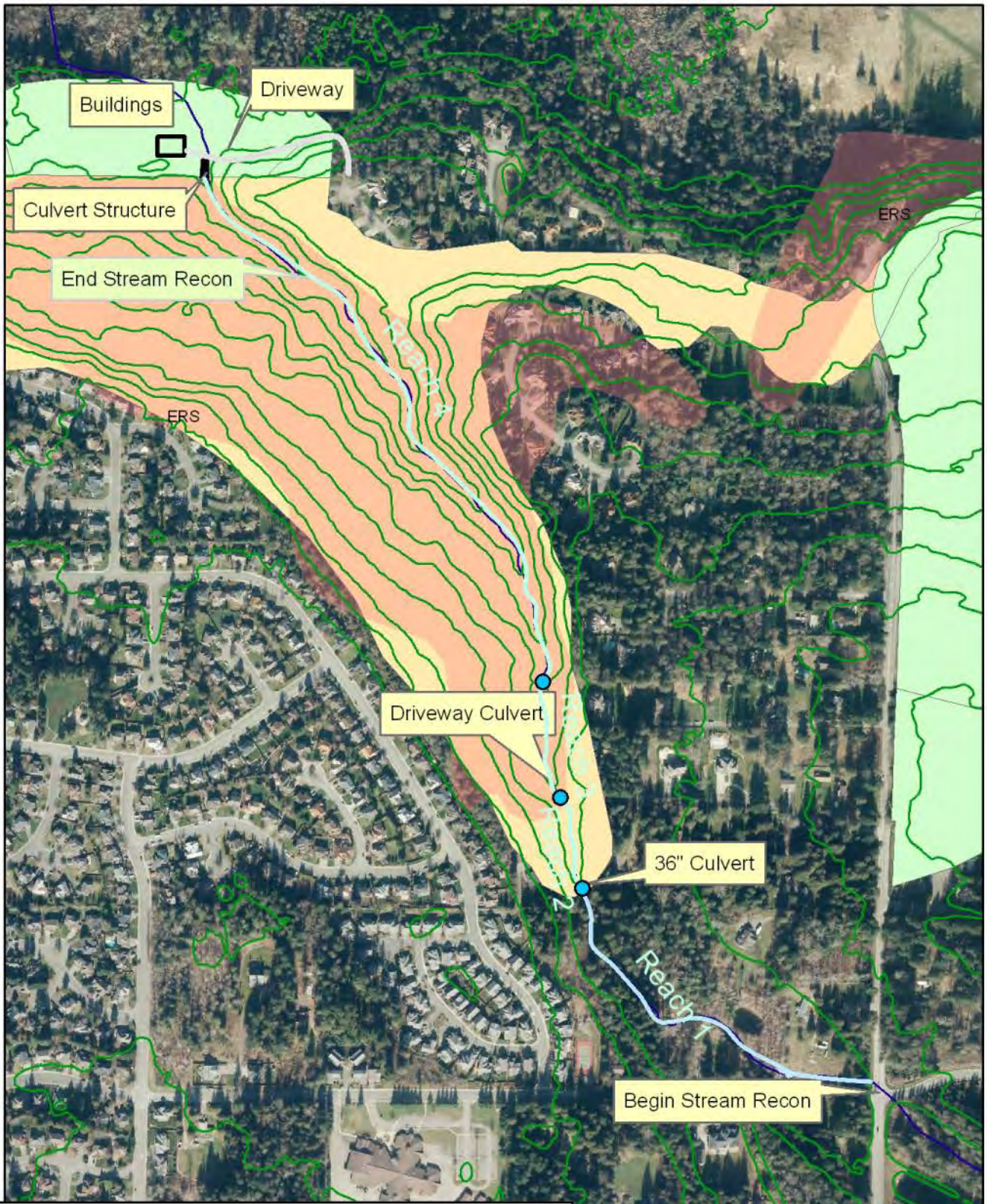
Seismic Hazards

The CAO defines seismic hazard areas as those areas of King County subject to severe risk of earthquake damage as a result of seismically induced settlement or soil liquefaction. Seismically induced settlement or soil liquefaction can occur in areas underlain by cohesionless soils of low density, usually in conjunction with a shallow groundwater table. Potential landslide hazard areas are also at an increased risk of sliding during an earthquake.

King County has mapped seismic hazards coinciding with the alluvial fan deposits in the lower portion of the drainage (Figure 6).

Allen Lake Outlet Stream Recon

King County CAO Hazard Areas



Legend Figure 6

- Streams and Rivers
- 2005 SWDM Landslide Hazard Drainage Areas Designations
- Erosion Hazard Area
- Landslide Hazard Areas

King County

N

2.6 Culverts and Fish Passage Summary

In the Study Site from 244th Avenue NE to the Evans Creek valley floor wetland, no natural fish passage barriers were found, but one fish impassable residential driveway culvert was found at NE 25th, if extended. Four culverts were found and evaluated for fish passage by an American Fisheries Society Certified Fisheries Scientist with over 30 years experience evaluating salmonid habitat and fish passage issues. Following is a brief culvert detail summary, with the fish passage determination.

1. 244th Avenue NE road culvert- 144 feet long CMP, 24 inch diameter, no outlet drop- backflooded, at 0.75% grade. Fish passable.

2. Parcel 9074/9043 logging road culvert- 10-12 feet long steel, 36 inch diameter, 1.6 foot outlet drop, at 2-3% grade. Fish passable.

   Second CMP, 18 inch diameter, totally plugged and inoperable. Only visible on left side of upstream roadfill prism.

3. Parcel 9077 (NE 25th Street if extended) private driveway culvert- about 36 feet long, 36 inch CMP/48 inch steel/54 inch CMP diameter composite pipe with each segment about 12 feet long, grouted together. Three drops inside pipe at upstream end and pipe joints, plus 1 foot outlet drop onto 67% gradient incline 15 feet long. Not fish passable.

4. Parcel 9073 (Happy Valley) private road culvert- 12 foot long CMP, 36 inch diameter, 8 inch outlet drop, estimated gradient 1%. Fish passable.

3.0 Discussion and Recommendations

3.1 Channel Stability

Urban stream channels with the greatest susceptibility to rapid vertical change shared four characteristics (Booth and Henshaw, 2000).

1) Erosion-susceptible geologic substrate.
2) Moderate to high gradient.
3) Absence of natural or artificial grade controls.
4) Predevelopment runoff predominately from groundwater which change to surface or point discharge in developed conditions.

The advance outwash fine consolidated sediments in the drainage slopes are highly susceptible to erosion and oversteepening. Shallow colluvium on the slopes is susceptible to landsliding. There are a number of small active slope failures in the lower section of the drainage (above the last culvert above the Evans Creek wetland complex) where the slopes have been steepened by channel erosion. Additional down cutting could contribute to slope failure. There is a large amount of fine organic sediment in the flood plain adjacent to the channel in the lower reach. It's not entirely clear why there is 1.5 to 2 feet of very fine organic sediment is present on the valley bottom. It may be related to the log stock pond dam that failed just below NE 25th in the early 1990s. This is highly erodible and will easily mobilize with higher flows.

The drainage gradient varies from approximately 1% to over 7% between reaches, a relatively low gradient.

From 244th to the Evans Creek wetland complex there are four culverts. The culvert under 244th is the smallest of the culverts. The 24" culvert seems to have been in place since the 1940s based on road plans (KC Roads Map Vault). These culverts seem to be partially responsible for controlling the gradient and flows. Bands of glacially deposited boulders are present in zones across the drainage, providing additional grade controls. The log dam may have also provided grade stabilization.

Discharge has increased to the drainage over time. The routing of Allen Lake in the 1970s was followed by four (4) storm water drainage control projects in the 1980s and 1990s. These stormwater runoff discharge project provide point discharge to the creek. Development has increase surface water runoff and landscaping such as lawns has increased groundwater infiltration. The subdivisions on the east side of the drainage have on-lot septic systems. The Till layers underlying the hills does not allow deep infiltration and groundwater discharges to the slopes above the drainage.

Grade controls in the form of culverts and boulder bands, stormwater detention, and a well established forest cover appear to have protected the drainage from significant downcutting. Although discharge from Allen Lake would have increased flow to the drainage, the culvert size under 244th was never increased; this appears to have helped buffer the increase in flow

to the ravine below. Changing the first culvert (and the smallest) in the system increases the peak flow to the drainage.

Potentially Sensitive Structures

- The culvert at NE 25th failed in a high flow event (Hanson's, Personal Communication, 3-7-12) in early 1990s.
- There is a culvert under a stream crossing between parcels 9043 and 9074. This crossing does not appear to be used for access at this time.
- There is a bridge/culvert at the lower end of the drainage that we have not visited. Pictures of the culvert show that loose boulders surround the culvert. One boulder has fallen out into the stream from around the culvert. There are also a number of structures in this area (Happy Valley property). There is a driveway of unknown height across the stream on the upstream side of the structures. The King County (GIS) elevations are140 feet for the entire area indicating that the buildings maybe close to the creek elevation.

Recommendations

1. Develop historic, current and future stream/stormwater flows.
2. Use flow data to evaluate channel stability.
3. Keep peak flows as closely as possible to original forested conditions before the introduction of the upper basin.
4. Perform a complete survey with access to all of the drainage.
5. Remove yard waste and introduced trash from the ravine slopes and channel.
6. Include a monitoring plan to monitor channel response to changes brought on by reduced/increased flows.

3.2 Fish Passage

The effects of changing the hydrologic regime should be evaluated on; the periodicity of flows, existing stream bed and bank conditions, and existing fish passage and culverts.

Recommendations

1. Contact owners and evaluate continued need for stream crossing at apparently abandoned road between parcels 9074 and 9043. If no longer needed, remove cobbled together culvert, and restore stream at road crossing.
2. Evaluate cost of replacement of the private driveway culvert at NE 25th Street and assist owners in grant application to replace with fish passable crossing. Consider County paid replacement due to 36 inch crushed and rusted pipe section, or entire crossing. Could be very expensive to provide fish passable culvert that meets City and State requirements.
3. Evaluate cost of replacement of the Happy Valley culvert and assist owners (if willing) with grant application to replace failing culvert.
4. Evaluate desire of state and local resource agencies, and tribal governments to provide coho salmon access to utilize rearing potential in Allen Lake and its associated wetland habitats, given relatively high costs compared to other higher priority habitat passage projects.
5. Install a flow gauge at the Happy Valley culvert to establish a flow baseline.

4.0 Literature Cited

Aerial Photographs, 1940, 1961, 1965, 1970, 1979, 1985, 1989, 2001, various sources, various scales, loan from the University of Washington Library.

Associated Earth Sciences, Inc, 2000, Subsurface Exploration, Geologic Hazards, and Geotechnical Engineering Report, Cedar Park Subdivision, Prepared for CamWest Development.

Booth, D. B., 1990, Stream-channel incision following drainage-basin urbanization: Water Resources Bulletin, v. 26, p. 407-417.

Booth, D. B., 1991, Urbanization and the Natural Drainage System--Impacts, Solutions, and Prognoses: Northwest Environmental Journal, v. 7, p. 93-118.

Booth, D.B. and Henshaw P., 2000, Rates of Erosion in Small Urban Streams, in M. Wigmosta ed., Stream Channels in Disturbed Environments: AGU Monograph Series.

Booth, D. B., D. Hartley, and C. R. Jackson, 2002, Forest cover, impervious-surface area, and the mitigation of stormwater impacts: Journal of the American Water Resources Association, v. 38, p. 835-845

Booth, D.B., Haugerud, R.A., and Sacket, J., in press, Geologic map of King County, Washington: scale 1:100,000.

Castro, J.M. and P.L. Jackson. 2001. Bankfull discharge recurrence intervals and regional hydraulic geometry relationships: Patterns in the Pacific Northwest, USA. Journal of the American Water Resources Association 37(5):1249-1262.

Fox, Martin and S. Bolton. 2007. A regional and geomorphic reference for quantities and volumes of instream wood in unmanaged forested basins of Washington State. North American Journal of Fisheries Management 27:342-359, 2007. American Fisheries Society.

Giles Engineering Associates, 1997, Limited Subsurface Exploration and Engineering Opinion, Setbacks for Lots 4 and 5, Cedar Park Subdivision, King County Washington, Project Number 6G-9610005, Obtained from City of Sammamish Drainage Records

King County, 2011, Allen Lake Rapid Assessment Report, Stormwater Services CIP Feasibility Program, Capital Services Unit.

King County, 2002, Draft Mullen Slough Capital Improvement Project Study and Action Plan. Includes Appendix B, Basin Geology and Geomorphology, by John Bethel

King County Assessor, iMAP, parcel viewer.

King County Department of Development and Environmental Services, Permit Data Base Records for parcels 0221049163, 0221049003

King County Road Map Vault, Subdivision Drainage Records, downloaded from: http://roadrunner.metrokc.gov/mappy/

Leopold, L., et. al., 1992, Fluvial Processes in Geomorphology, 522p.

Minard and Booth, 1988, Redmond Quadrangle Geology Map USGS Misc. Investigation Series

Pacific Northwest Center for Geologic Mapping Studies, 2006, Geologic map of King County, Washington: D.B. Booth and A. P. Wisher, compilers, scale 1:100,000 (available at http://geomapnw.ess.washington.edu/services/publications/map/data/KingCo_composite.pdf) .

U.S Forest Service. October 2010, Alluvial Fan Process Group, Channel Type User Guide down loaded from http://dspace.nitle.org/bitstream/handle/10090/20008/Channel-Type-User-Guide-Revision.pdf?sequence=16 April 8, 2011.

U.S. Geological Survey, StreamStats, Washington, Streamflow Statistics and Basin Characteristics for Long Marsh Creek, down loaded from http://water.usgs.gov/osw/streamstats/Washington.html , accessed between February 2011 and August 2011.

U.S. Geological Survey, 1950, 1968, and 1973, Redmond Quadrangle 1:24,000 scale topographical maps, loan from the University of Washington Library.

U.S. Geological Survey, 1982, Bellevue North Washington, 1:25,000-scale metric topographic-bathymetric map, load from the University of Washington Library.

WDF (Washington State Department of Fisheries). 1975. Catalogue of Washington Streams and Salmon Utilization, Lake Washington-Sammamish Basin. Olympia, Washington.

Washington State Department of Fish and Wildlife. 2000. Fish Passage Barrier and Surface Water Diversion Screening Assessment and Prioritization Manual. Olympia, Washington.

Washington State Department of Fish and Wildlife. 2000. Fishway Guidelines for Washington State – Draft Report. K. Bates. Olympia, Washington. 57 pp.

Washington State Department of Fish and Wildlife, 2003. Design of road culverts for fish passage. http://wdfw.wa.gov/hab/engineer/cm/.

Wydoski, R. S. and R. R. Whitney. 1979. Inland Fishes of Washington. University of Washington Press, Seattle, Washington.

Appendix A

Aerial Photographs

RESTRICTED

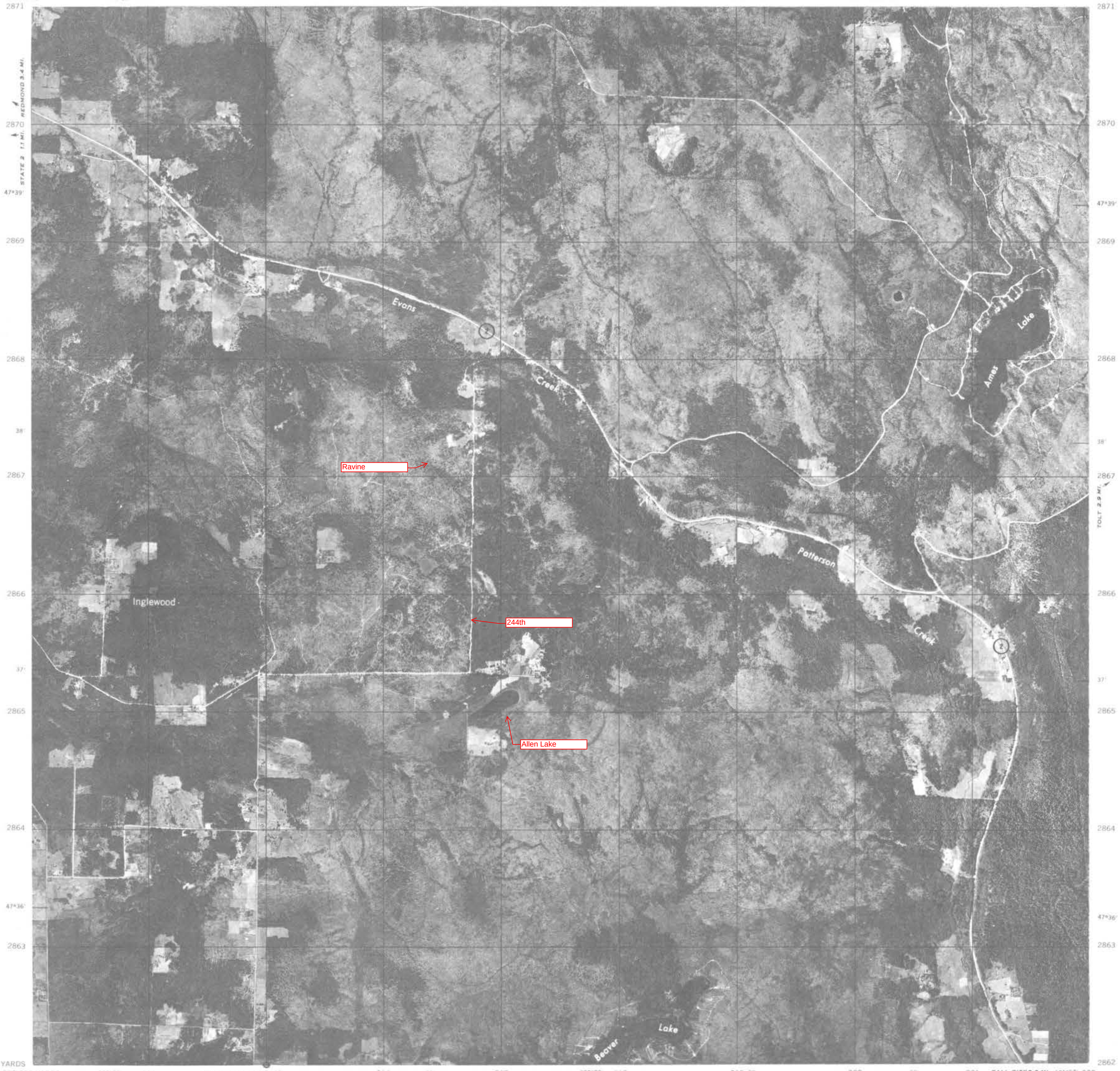
WASHINGTON 1:20,000

WAR DEPARTMENT
CORPS OF ENGINEERS, U. S. ARMY

FIRST EDITION - AMS 1

NORTHWEST SECTION NO. 20-27

KING COUNTY, WASH.



First Edition 1944

Prepared under the direction of the Chief of Engineers, U. S. Army.
Controlled mosaic by the Army Map Service (AS), Washington, D. C., 1944.
Control by U. S. C. & G. S., U. S. G. S., U. S. E. D., 29th Engineers and U. S. F. S.
Aerial photography for U. S. A. A. F., under contract, August 1942.
Polyconic Projection, North American Datum 1927.

RESTRICTED

INDEX TO SHEETS

19-26	19-27	19-28
20-26	20-27	20-28
21-26	21-27	21-28

Scale 1:20,000 (Approximate)

½ 0 ½ 1 Mile

1000 500 0 500 1000 1500 Yards

ONE THOUSAND YARD GRID COMPUTED FROM "GRID SYSTEM FOR PROGRESSIVE MAPS IN THE U. S.", ZONE "G", U. S. C. & G. S. SPECIAL PUBLICATION NO. 59
THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED

NOTE: OFFICERS USING THIS MAP WILL MARK HEREON CORRECTIONS AND ADDITIONS WHICH COME TO THEIR ATTENTION AND MAIL DIRECT TO THE CHIEF OF ENGINEERS, WASHINGTON, D. C.

Use diagram only to obtain numerical values. To determine magnetic north line, connect the pivot point "P" on the south edge of the map with the value of the angle between grid and magnetic north, as plotted on the degree scale at the north edge of the map.

ARMY MAP SERVICE, U. S. ARMY, WASHINGTON, D. C. 109261
1/63 M.L. 1944

NORTHWEST SECTION NO. 20-27

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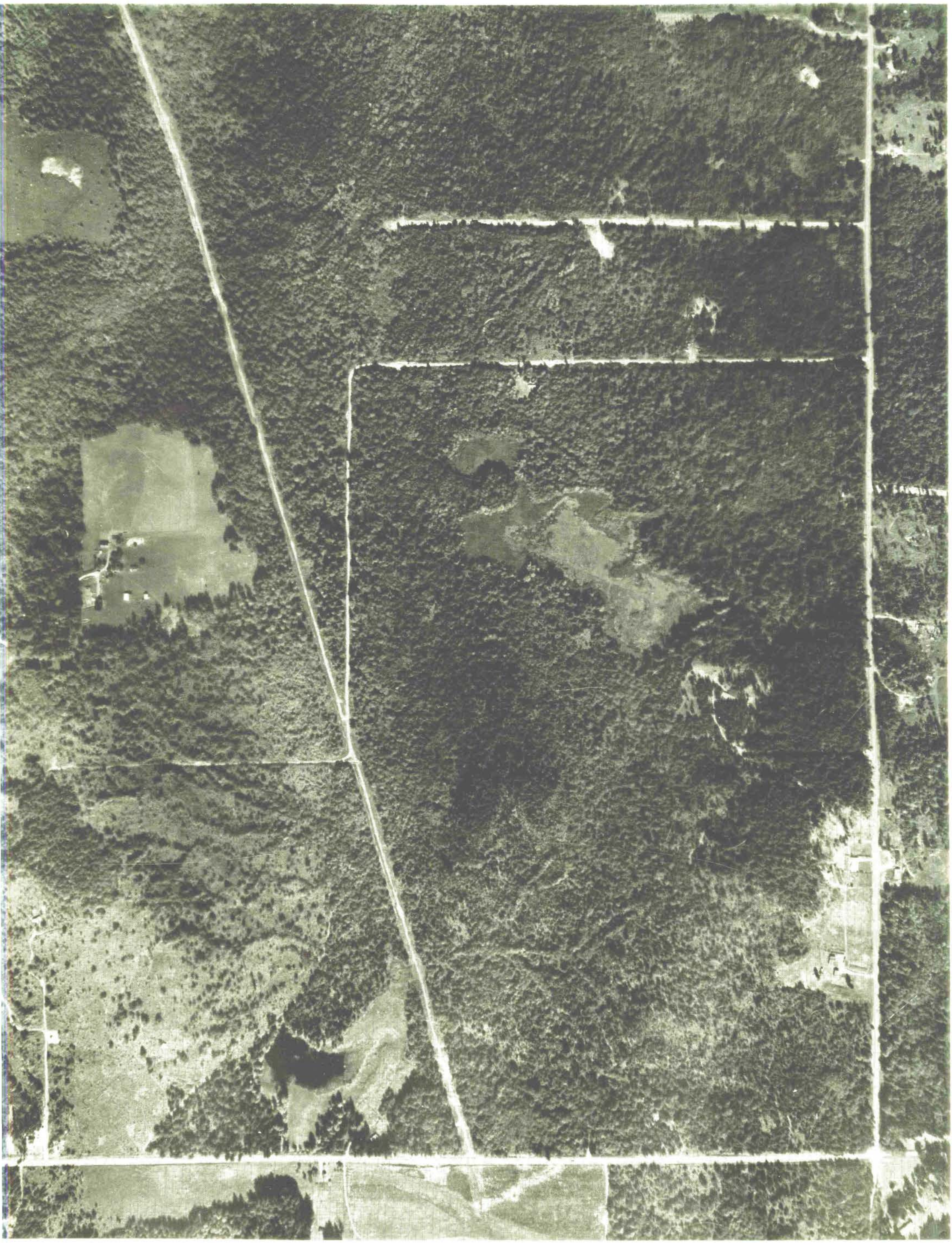

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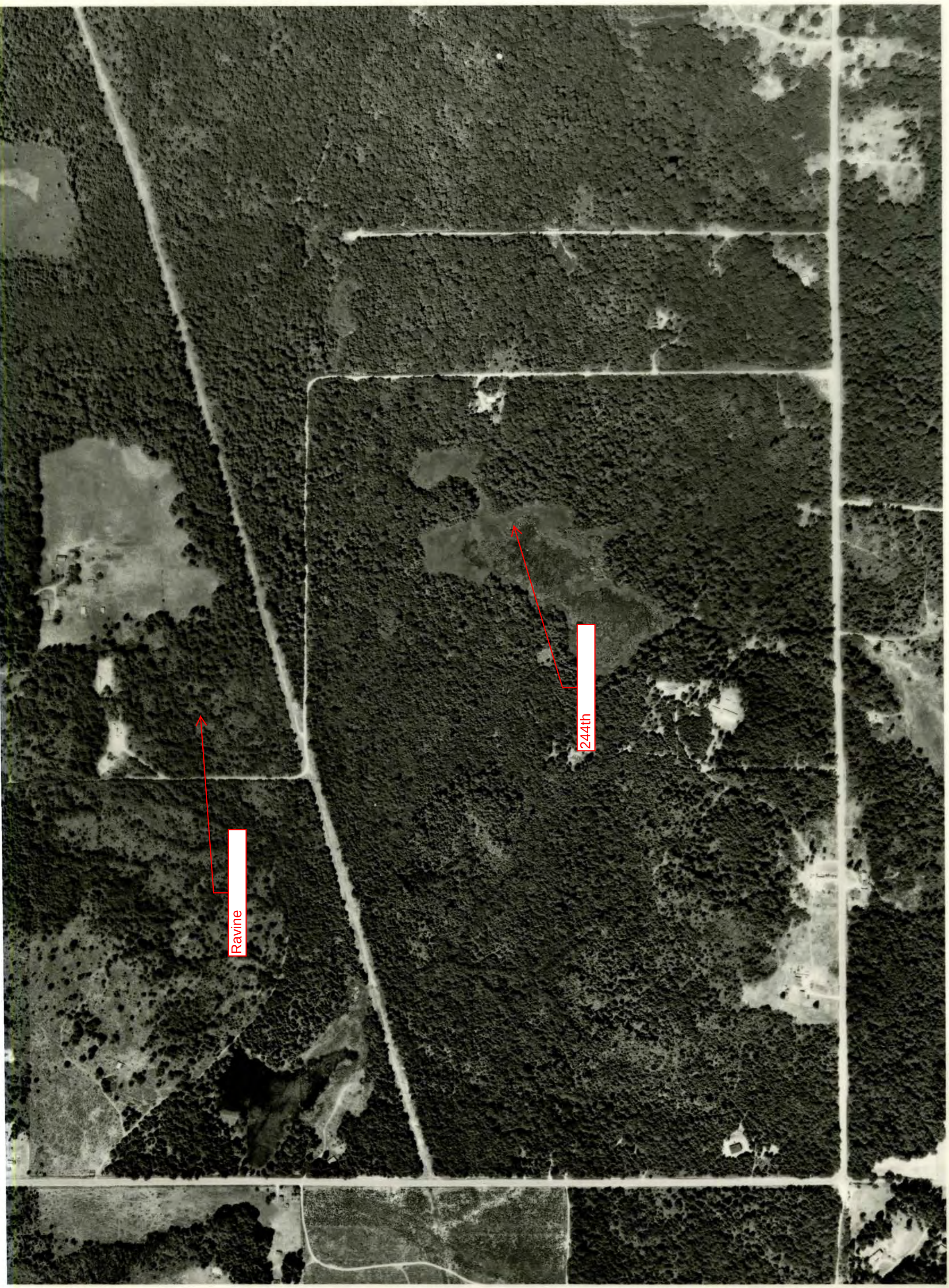


NE, OREGON K-SN-65 FL. 24A-53 ; FLOWN 7 - 6 -65; SCALE 1"=400' SEC 27, T 25 N-R 6 E


244th
Ravine
22-25N-R6E

27-25N-6E
1970


Stockpond
244th
Drainage channel


Ravine
244th


7-22-89 12,800' 12"

NW-C-01
T25N R6E Sec 22


NW-C-01
T25N R6E Sec27
Stormwater ponds
Outlet above 244th
Drainage channel
and culvert
crossing

Appendix B

Stream and Culvert Photos

APPENDIX A. PHOTOS

Photo 1. Reach 1 – Culvert at 244th Avenue crossing, upstream end catch basin with overflow and birdcage. A lower side pipe is underwater in this photo, and allows fish passage upstream, if kept clean of debris.

Photo 2. Reach 1 – Culvert (downstream end) at 244th Avenue crossing. Note old concrete pipe, backflooded condition (no water drop), and large plunge pool. Culvert has a low gradient and appears fish passable.

Photo 3. Reach 1 – Reach above beginning of ravine looking upstream at low gradient stream in well forested area.

Photo 4. Reach 1 – Stream bed exposure of fine consolidated sediments in the stream bank. (mapped as Recessional Outwash)

Photo 5. Reach 1 – Small woody debris accumulations at small metal bridges. Fish passable around and through debris.

Photo 6. Reach 1 - Close up of upper small metal bridge creating small woody debris accumulation in stream channel.

Photo 7. Reach 1 – Close up of debris accumulation created by small metal bridge.

Photo 8. Reach 2 – Downstream end of logging road crossing pipe. Pipe is composed of curved smooth steel segments welded together. Low gradient, fairly low outlet drop, resting areas within pipe, and deep plunge pool make pipe fish passable. Road does not appear to be in use any longer, and fill over pipe is about 1 foot deep.

Photo 9. Reach 2 – View through curvy pipe under old logging road.

Photo 10. Reach 2 – View inside old logging road smooth steel pipe showing fish resting areas in curves, and low gradient. Fish passable.

Photo 11. Reach 2 – Downstream end of smooth steel logging road pipe looking upstream.

Photo 12. Reach 2 – Deep (0.6 meter, 23 inch) plunge pool at downstream end of old logging road pipe, enabling upstream fish passage.

Photo 13. Reach 2 – 0.6 meter deep plunge pool at old logging road pipe.

Photo 14. Reach 2 – Typical habitat at upper end of ravine reach. Note large old growth stump in channel bottom.

Photo 15. Reach 2 - Typical stream channel descending into upper end of ravine reach, with large woody debris (LWD) stump in stream bed, small drops, pools, and riffles.

Photo 16. Reach 2 – Close up of drop pool caused by large boulders and large woody debris in the channel. This is a close up of the drop pool visible in Photo 15 (lower right corner).

Photo 17. Reach 2 – Ravine reach containing LWD, boulders and dense riparian vegetation. Note 6-foot diameter old growth stump adjacent to stream bed.

Photo 18. Reach 2 – Ravine reach with area of erosion into hard pan, plus debris.

Photo 19. Reach 2 – Short segment of eroded bank in ravine reach.

Photo 20. Reach 2 – Slight downcutting of stream bed, with matrix of tree roots intertwining bank.

Photo 21. Reach 2 – Gravel terrace riffle (with suitable size salmonid spawning gravel) and pool created by large tree root and several pieces of large woody debris. Note well vegetated and stable right bank. Pipe was a stray piece and was not hooked up.

Photo 22. Reach 2 – Close up of tree root caused gravel terrace, drop and plunge pool. Fish passable due to short drop, deep and long plunge pool.

Photo 23. Reach 2 – Close up of good quality salmonid spawning gravel in tree root caused pool.

Photo 24. Reach 2 – Old growth stump in channel at grade with creek bed, indicating very little downcutting and erosion of stream bed. Note suitable sized salmonid spawning gravel in pool and tailout. Good spawning habitat for cutthroat trout and coho salmon (if accessible to salmon).

Photo 25. Reach 2 – Large old growth stump in stream channel. Note lack of downcutting and erosion around sides of stump.

Photo 26. Reach 2 – Downstream end of Reach 2 just upstream of NE 25th private residential driveway crossing. Note excellent pool and riffle habitat with abundant salmonid spawning gravel and high volume of large woody debris providing cover.

Photo 27. Reach 2 – Lower end of Reach 2 looking downstream at the upstream end of the NE 25th private driveway culvert and King County gauge site. Note the abundant salmonid sized spawning gravel deposits, and excellent spawning riffles. Coho salmon cannot access this spawning habitat due to this impassable culvert.

Photo 28. Reach 2 – At the lower end of Reach 2, looking upstream at high quality pool/riffle combination with very good instream and overhead cover created by large woody debris.

Photo 29. Reach 2 – Excellent spawning habitat suitable for coho salmon and cutthroat trout at lower end of reach 2, just upstream from NE 25th culvert.

Photo 30. Reach 2 – Downstream end of Reach 2, looking downstream into the 36-inch diameter corrugated metal pipe at NE 25th private residential driveway. The pipe graduates from 36-inch diameter cpm, to 48-inch smooth steel, and then to 54-inch diameter cmp, all within driveway prism. The King County stream flow gauge is on the right, next to pipe. Note partially crushed, rusty, old pipe.

Photo 31. Reach 2 – NE 25th private driveway culvert, upstream end showing height of roadfill prism (about 6 feet above top of 3 foot diameter culvert).

Photo 32. Reach 2 – Close up of NE 25th private driveway culvert (corrugated metal pipe) showing poor condition of upper pipe segment. Pipe is rusty, partially crushed, and appears to have been crimped to fit inside the larger 48-inch diameter smooth steel pipe in the center. There is a one foot drop off the 36-inch pipe segment into the 48-inch pipe that impairs upstream fish passage due to high velocity, turbulence, and no pool.

Photo 33. Reach 3 - Upstream end of Reach 3, inside 36-inch diameter pipe at NE 25th, looking downstream. Note the two drops at both connection points of the successively larger diameter pipe segments, and the high velocity flow inside the 5% to 7% steep pipe. These factors impair upstream fish passage.

Photo 34. Reach 3 – Downstream outlet of 54 inch diameter corrugated metal pipe at NE 25th private driveway. One foot drop in combination with shallow, small plunge pool, and debris (concrete chunks, brick, railroad timbers) strewn steep cascade do not allow fish passage. The first fish passage barrier on this stream.

Photo 35. Reach 3 – Close up of poor fish passage conditions at private driveway 54 inch diameter culvert. Steep gradient of culvert produces high water velocities, and one foot drop into shallow, small plunge pool does not allow adequate depth to leap into or navigate through culvert.

Photo 36. Reach 3 – Upstream end of Reach 3 at impassable culvert at NE 25th private drive. Culvert is composed of 54 inch diameter cmp, 48 inch diameter steel pipe, and 36 inch diameter cmp. Note high velocity flow due to steep 5% to 7% grade.

Photo 37. Reach 3- Upstream end of Reach 3 looking into culvert at NE 25th private drive. Note upper 36 inch diameter corrugated map pipe section is crushed and bent, creating a one foot waterfall inside pipe. Entrance into pipe is also steep and creates an additional fish passage obstacle.

Photo 38. Reach 3 – Fish impassable culvert outlet at NE 25th private driveway. This view looks through pipe, so is slightly different viewpoint than Photo 39.

Photo 39. Reach 3 – Downstream end of NE 25th private driveway's 54 inch diameter culvert and steep outfall area of rubble. Determined to be fish impassable. This is the first impassable upstream migration barrier to fish on the Allen Lake outlet stream.

Photo 40. Reach 3 – Natural boulder cascade. Note pools and steps that allow fish passage. The large boulder band provides streambed stability.

Photo 41. Reach 3 – Just downstream of NE 25th private drive. Note boulder band caused short cascade, determined to be fish passable. Also note large old growth stump at edge of stream channel.

Photo 42. Reach 3 - Fish passable boulder cascade segment just downstream from NE 25th private driveway culvert.

Photo 43. Reach 3 – Downstream end of boulder cascade. Good trout habitat. Good water oxygenation.

Photo 44. Reach 3 – LWD in channel just downstream of NE 25th private driveway culvert, providing instream and overhead cover for fish.

Photo 45. Reach 3 – Downstream end of fish passable boulder cascade segment.

Photo 46. Reach 3 – Transition from boulder cascade to pool/riffle ravine reach at 3% to 5% stream channel gradient. Note heavy shrub layer cover component.

Photo 47. Reach 4 - Deep ravine reach with dense vegetation cover and 3% to 5% stream channel gradient.

Photo 48. Reach 4 - Pool/riffle section near downstream end of ravine reach. Note LWD, pools, suitable salmonid spawning gravel, instream cover, and natural boulder patch.

Photo 49. Reach 4 – LWD and boulder created pool and riffle.

Photo 50. Reach 4 – Pool/riffle complex.

Photo 51. Reach 4 – Cobble and gravel stream bed with suitable cutthroat trout spawning habitat.

Photo 52. Reach 4 – Temporary small woody debris accumulation creating pool habitat and small sediment terrace. Fish passable. Accumulation fell apart when stepped on due to composition of small sticks, leaves, and small debris.

Photo 53. Reach 4 – One of several tightline stormwater runoff pipe outfalls into creek from upland subdivisions located on plateau.

Photo 54. Reach 4 – Pool/riffle habitat in lower end of Reach 4. Note good quality, suitable salmonid spawning gravel. Cobbles provide good aquatic insect substrate and hydraulic refuge for salmonid juveniles.

Photo 55. Reach 4 - Gravel bedded stream suitable for salmonid spawning. Year round flow area.

Photo 56. Reach 4 - Near downstream end of reach 4, about 300 feet upstream of Happy Valley Eastside Inc. 70 acre parcel on valley floor.

Photo 57. Reach 4 – Lower end of Reach 4 with abundant small woody debris in channel providing pool/riffle habitat and high levels of detritus.

Photo 58. Reach 4 – Lower gradient at downstream end of ravine reach with gravel/cobble bed and very dense overhead vegetation in stream buffer.

Photo 59. Reach 4 – Downstream end of Reach 4, pool/riffle complex with suitable spawning habitat for salmon and trout.

Photo 60. Reach 4 – Near downstream end of ravine reach. Note the abundant shrub buffer layer growing on the broad, soft, saturated sediment terrace. Fine sediment terraces supporting a dense shrub layer were common throughout Reach 4 on one or both banks.

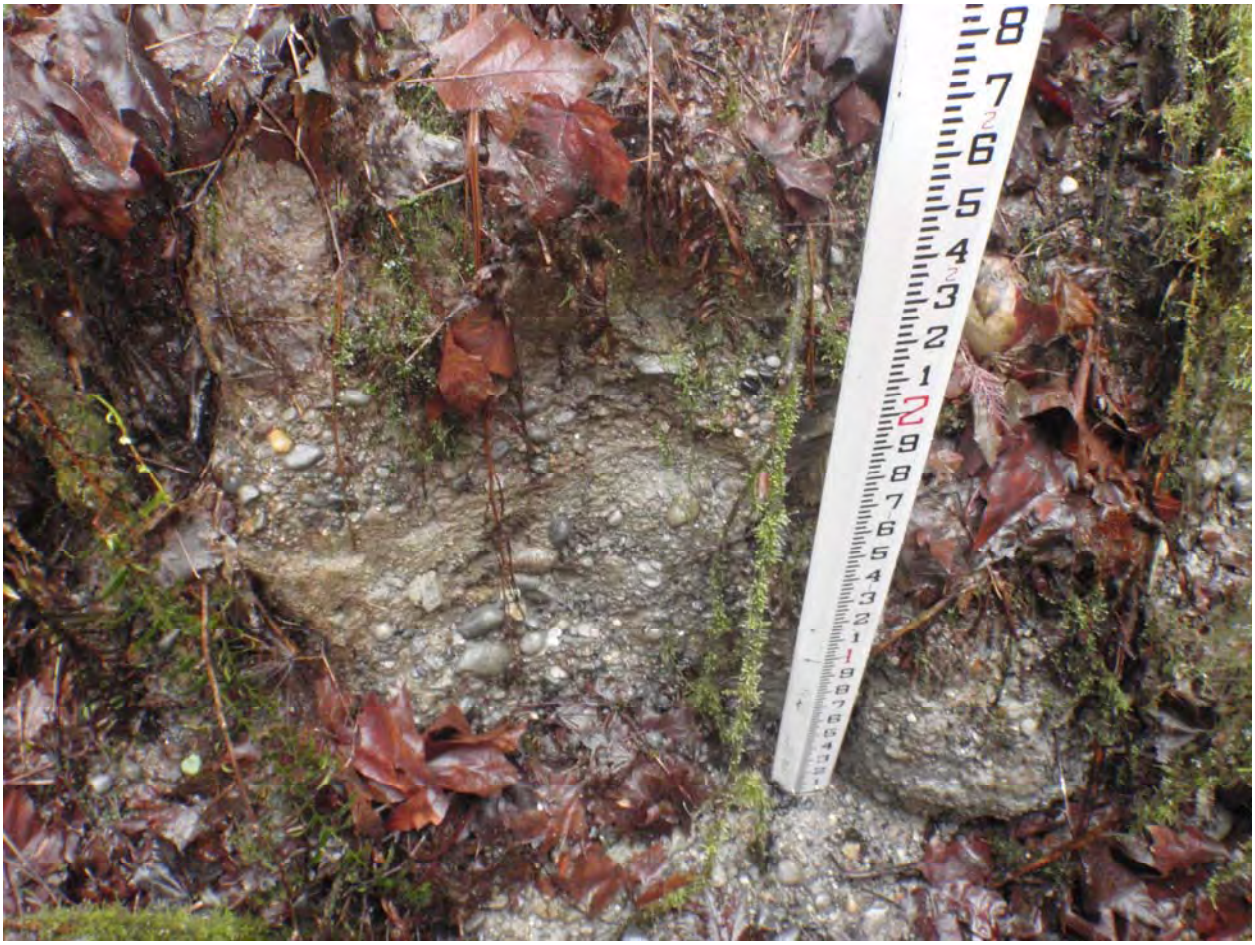


Photo 61. Reach 4 – Near downstream end of ravine reach. Advance Outwash.

Photo 62. Reach 4 – Advance Outwash with wood fragment.

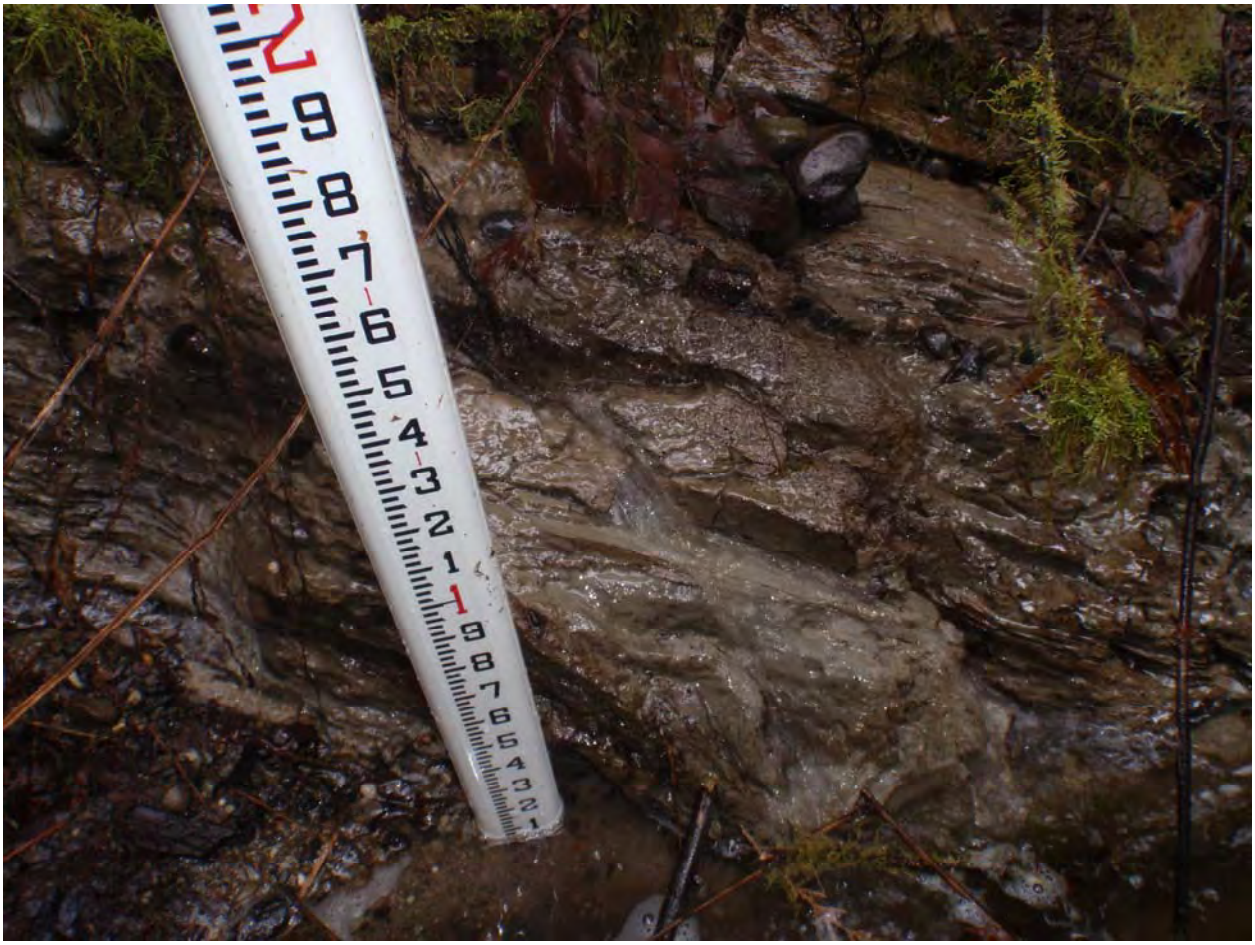


Photo 63. Reach 4 – Olympic interbeds with groundwater seepage from colluvium contact.

Photo 64. Reach 4. Shallow slope failure and tilted tree trunks show evidence of slope instability.

NOTE: The cover page to the following photographs (#65-68) is provided below for context. It was received from the owners of the Happy Valley Eastside Inc. Parcel # 222506-9073, which is located on the valley floor at the edge/in the Evans Creek Wetland complex. Access to County staff was denied.

King County
Water and Land Resources Division
Open Space Acquisitions Unit
201 South Jackson Street, Suite 600
Seattle, WA 98104-3855
206.296.8012 Fax 206.296.0192
TTY Relay: 711

April 3, 2012

Nirav Parinama
Happy Valley Eastside Inc.
P.O. Box 548
Fall City, WA 98024

Re: Allen Lake Outflow Stream Study

Dear Mr. Parinama,

Thank you for your letter dated March 20, 2012 responding to our request for temporary right to enter. We appreciate you contacting the new owner, Paul and sharing our request with him. We also are thankful for the information that was offered and will respect the new owner's wishes regarding privacy. The King County hydrologist that is conducting the stream study has asked if it would be possible for you to share a few additional facts about the character of the culvert/bridge located on the property. I have attached a list of questions that they are hoping you could answer. These questions are not for the purpose of identifying non-compliance issues. This information is solely for the purpose of adding continuity to the study that is being conducted. If you or the new owner would desire more information about this study, please feel free to call and discuss this further with the managing project engineer, Claire Jonson at (206) 296-8040. Thank you and we look forward to your response.

Sincerely,

Brad Schabert
Open Space Acquisitions

Enclosures

cc: Claire Jonson, Senior Engineer, Department of Natural Resources and Parks, Water and Land Resources Division

Hi Nirav, Re: Allen Lake Outflow Stream Study April 19, 2012

Here is additional information about the culvert/bridge located on the Happy Valley Eastside Inc. property. It was requested by King County Water and Land Resources Division for the King County hydrologist who is conducting the stream study. We do not know who built the bridge.

1) The creek runs year around with a minimum flow of about 30 gallons per minute.
2) The culvert is a typical corrugated metal pipe 12 feet long and 36 inches in diameter.
3) There is a small drop off from the outlet to the stream bed.
4) The water fall from the culvert to the stream surface is 8 inches.
5) At the outlet of the culvert is a pool of water.
6) The pool is about 8 feet in diameter.
7) The center of the pool is about 20 inches deep.
8) The creek water never forms a pond on the inlet side of the culvert.
9) Dimensions of the bridge is 30 feet long, 12 feet wide, and 6 feet high.
10) The visible structure is made with large boulders. There is evidence of concrete.
11) On the outlet side, one of the boulders has rolled out.
12) This is the first year that water is flowing through the gravel on the inlet side and flowing underneath the culvert. Repairs need to be made to seal the inlet side.
13) Small repairs have been made to the top of the bridge with concrete. More are needed.

Illustration 1: Outlet – Road - Inlet

Illustration 2: Inlet

Illustration 3: Outlet

Illustration 4: Outlet zoom

Sincerely, Paul

Appendix C

Fish Use and Collection Report

Finney, Don

From: Vanderhoof, Jennifer
Sent: Wednesday, February 16, 2011 11:34 AM
To: Finney, Don
Subject: cutts

Don,

Looks like WDFW in one of their datasets has cutthroat mapped down near the lake (thin dark line), and coho up near the wetlands (thick gray line). The thin dark line at the top appears to be a mistake – no fish are attached to it.

FPARS - ARCIMS Mapping Application | DNR Home | FPARS Home | Forest Practices | FP Rules |

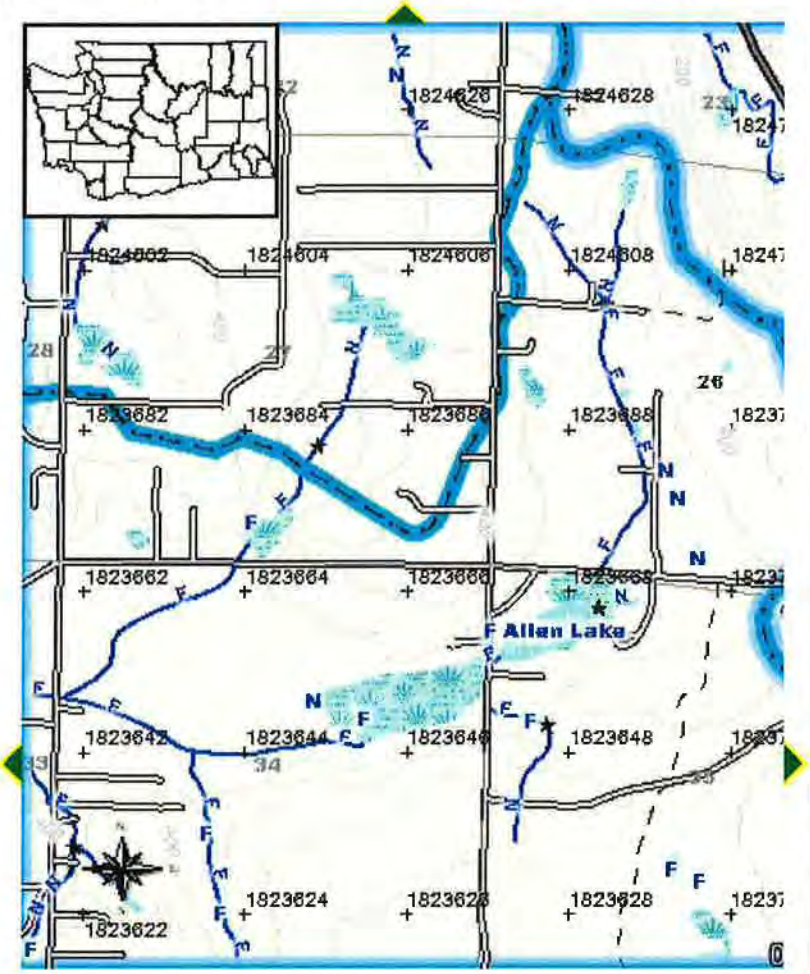
WASHINGTON STATE DEPARTMENT OF Natural Resources

Forest Practices Application Review System

Select a map: Activity Map

Legal Description: T 0 R 0

Get Map | Refresh Site | Layers | Legend



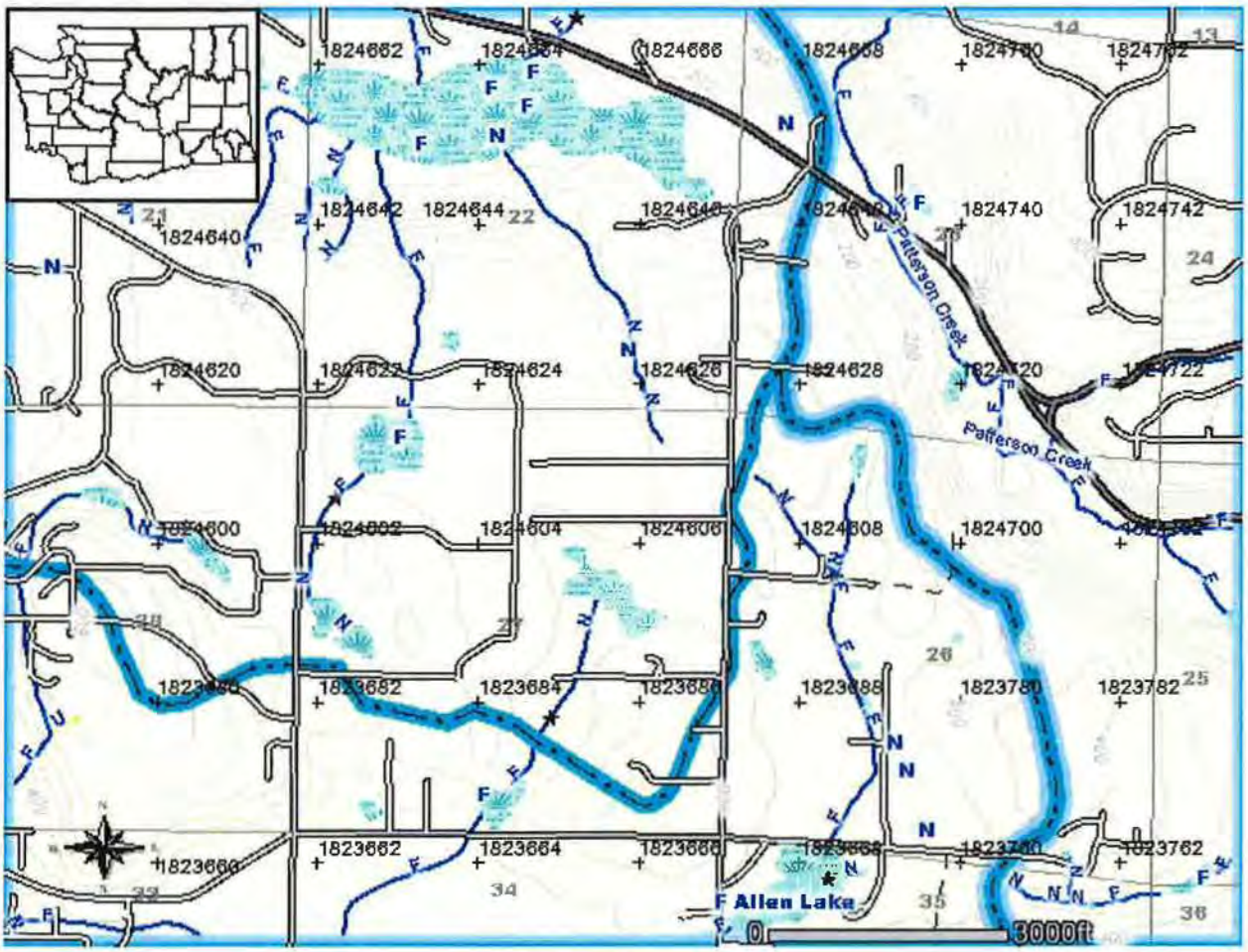
Layers

Visible Active

- Townships
- Section Survey Lines
- Map Registration Tics
- Water Type Break
- Transportation
- Watershed Analysis
- WAU
- WRIA
- Streams
- Water Bodies
- Fire Shutdown Zones
- Contours - 40ft. interval
- County Boundary

Refresh Map

Privacy Policy | Disclaimer | Help | Webmaster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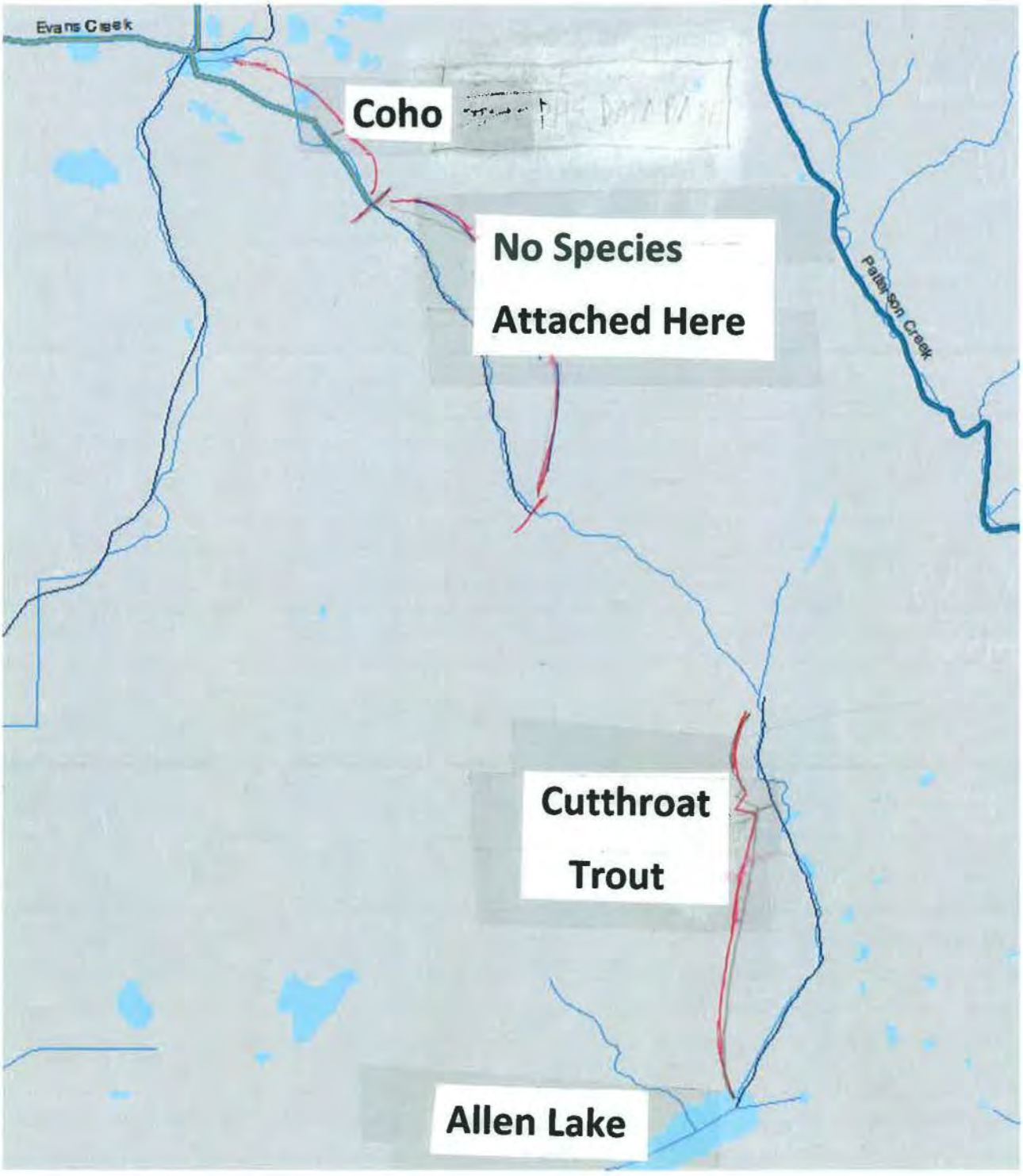

Jennifer Vanderhoof, Senior Ecologist | King County Water and Land Resources Division | Ph: 206-263-6533 | jennifer.vanderhoof@kingcounty.gov

Source: King County Geographic Information System; Washington State Department of Fish and Wildlife Priority Habitats and Species (PHS) Database.

King County
Department of Transportation
Roads Services Division
Roads Maintenance Section
Environmental Unit

2012 Washington Fish and Wildlife Annual Collection Report

Permittee Name: Rob Fritz

Permit No.: #11-098

Project Description (For internal use only. Write a brief description below including project name, type of project, agency/customer, and any issues or comments associated to fish exclusion as needed):

Tracking Number	Project Number	Date of Collection	Investigator(s)	Site Location	Vicinity	County	WRIA	Stream Name	S - T - R	Common Name <Double Click for large type>	Scientific Name	Length (mm)	Number of Individuals	Method of Removal	Disposition	Comments	Number of Mortalities
	1114872	3/1/2012	GSMI	1201 - 250th Ave NE at HSE #1201	Sammamish, WA	King	8	Allen Lake outlet - Unnamed Evans Creek tributary	26-25-06	Tadpole, Unidentified	Order = Caudata		4	Dewatering	Released		0
	1114872	3/1/2012	GSMI	1201 - 250th Ave NE at HSE #1201	Sammamish, WA	King	8	Allen Lake outlet - Unnamed Evans	26-25-06	Salamander, Long-toed	ambystoma macrodactylum		1	Dewatering	Released		0
											#N/A						
											#N/A						
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											#N/A						
											#N/A						
											#N/A						

Date: _____ Signature: _____
Address: 155 Monroe Ave. NE; Renton, WA 98058-4199

King County
Department of Transportation
Roads Services Division
Roads Maintenance Section
Environmental Unit

2010 Washington Fish and Wildlife Annual Collection Report

Permittee Name: Rob Fritz
Permit No.: #11-098

<<Double Click>> on the cell to a larger drop down menu

Tracking Number	Project Number	Date of Collection	Investigator(s)	Site Location	Vicinity	County	WRIA	Stream Name	S - T - R	Common Name	Scientific Name	Length (mm)	Number of Individuals	Method of Removal	Disposition	Comments	Number of Mortalities	GPS Coordinates	
																		Latitude	Longitude
	P20052	12/8/2011	GSM/JJOH	1021 - 250th Avenue NE	Sammamish	King	8	Allen Lake outlet - Unnamed Evans Creek tributary	26-25-06	Crayfish	Pacifastacus sp.		1	dewatering	released		0	47.51[illegible]	-122.00635
	P20052	12/13/2011	GSM/JJOH	1201 - 250th Avenue NE	Sammamish	King	8	Allen Lake outlet - Unnamed Evans Creek tributary	26-25-06	Bullhead Catfish	Ameiurus sp.		3	dewatering	released		0	47.52004	-122.00632
	P20052	12/13/2011	GSM/JJOH	1201 - 250th Avenue NE	Sammamish	King	8	Allen Lake outlet - Unnamed Evans Creek tributary	26-25-06	Frog, Red Legged	Rana aurora		1	dewatering	released		0	47.52004	-122.00632
	P20052	12/13/2011	GSM/JJOH	1201 - 250th Avenue NE	Sammamish	King	8	Allen Lake outlet - Unnamed Evans Creek tributary	26-25-06	Frog, Bull Frog	Rana catesbeiana		2	dewatering	released		0	47.52004	-122.00632
	P20052	12/13/2011	GSM/JJOH	1201 - 250th Avenue NE	Sammamish	King	8	Allen Lake outlet - Unnamed Evans Creek tributary	26-25-06	Salamander, Northwestern	Ambystoma gracile		1	dewatering	released		0	47.52004	-122.00632
	P20052	12/13/2011	GSM/JJOH	1201 - 250th Avenue NE	Sammamish	King	8	Allen Lake outlet - Unnamed Evans Creek tributary	26-25-06	Tadpole, unknown	Class = Amphibia		5	dewatering	released		0	47.52004	-122.00632
	P20052	12/14/2011	GSM/JJOH	1125 - 250th Avenue NE	Sammamish	King	8	Allen Lake outlet - Unnamed Evans Creek tributary	26-25-06	Crayfish	Pacifastacus sp.		1	dewatering	released		0	47.51919	-122.00622
	P20052	12/14/2011	GSM/JJOH	1125 - 250th Avenue NE	Sammamish	King	8	Allen Lake outlet Unnamed Evans	26-25-06	Trout, Cutthroat	Oncorhynchus clarki	120	1	dewatering	released	crushing injury	1	47.51919	-122.00622
												TOTAL CAPTURED	12			TOTAL MORTALITY	3		

Date: _____ Signature: _____
Address: 155 Monroe Ave. NE; Renton, WA 98058-4199

Finney, Don

From: Finney, Don
Sent: Friday, June 22, 2012 3:45 PM
To: Jonson, Claire
Cc: Althauser, Don; Kelly, Tim; Kelly, Shannon; Turney, Julia; Miller, Scott
Subject: Phone Discussion with Mr. Tony Vitale: What Fish are in their Pond?

Claire,

In an effort to seek firsthand information on fish and fish use of Allen Lake and the Allen Lake outlet, I contacted Tony and Marylyn Vitale directly to discuss fish use on their property and any fish observations they had in the Allen Lake Outlet or Allen Lake. Turns out, that both he and his wife are master flyfishermen, and Marilyn is a master flycasting instructor. Tony Vitale returned my inquiry on 3/13/12 and we had a nice discussion, with the following highlights:

1) They plant one (about 12 inches long) and five pound (about 20 inches) rainbow trout in the pond on their parcel, which in just downstream of the Michelman parcel. The source of the fish was originally the University of Washington (Donaldson rainbow and steelhead crosses), and more recently the fish are purchased from Trout Creek (a local private company).
2) The pond is used for the neighborhood's recreational fishing (99% catch and release), and private flycasting instruction.
3) The fish live in the pond year round. Only fish losses are those eaten by eagles or ospreys.

Don F.

Ps. I wrote this up as a draft and forgot to send it out in March, 2012. So am sending it now.

Finney, Don

From: Smith, Grant
Sent: Friday, January 07, 2011 9:16 AM
To: Finney, Don
Subject: Allen Lake outlet stream

Hey Don:

I was near by so I took a quick look at the culvert under NE 18th Street downstream of Allen Lake. The culvert at this location is a 6-foot wide CMP. The pipe is in good condition. Turns out that NE 18th St. is a private road. While this culvert is a bit small compared to a current stream simulation design, it is not perched, has streambed gravel through it and is not a fish passage barrier. According to the iMap image it looks like there may be a crossing under 247th place NE (another private road).

Maybe we can get together sometime this spring and do some quick electrofishing to determine species at your site. In the meantime, you could use minnow traps (as long as you can check them every day).

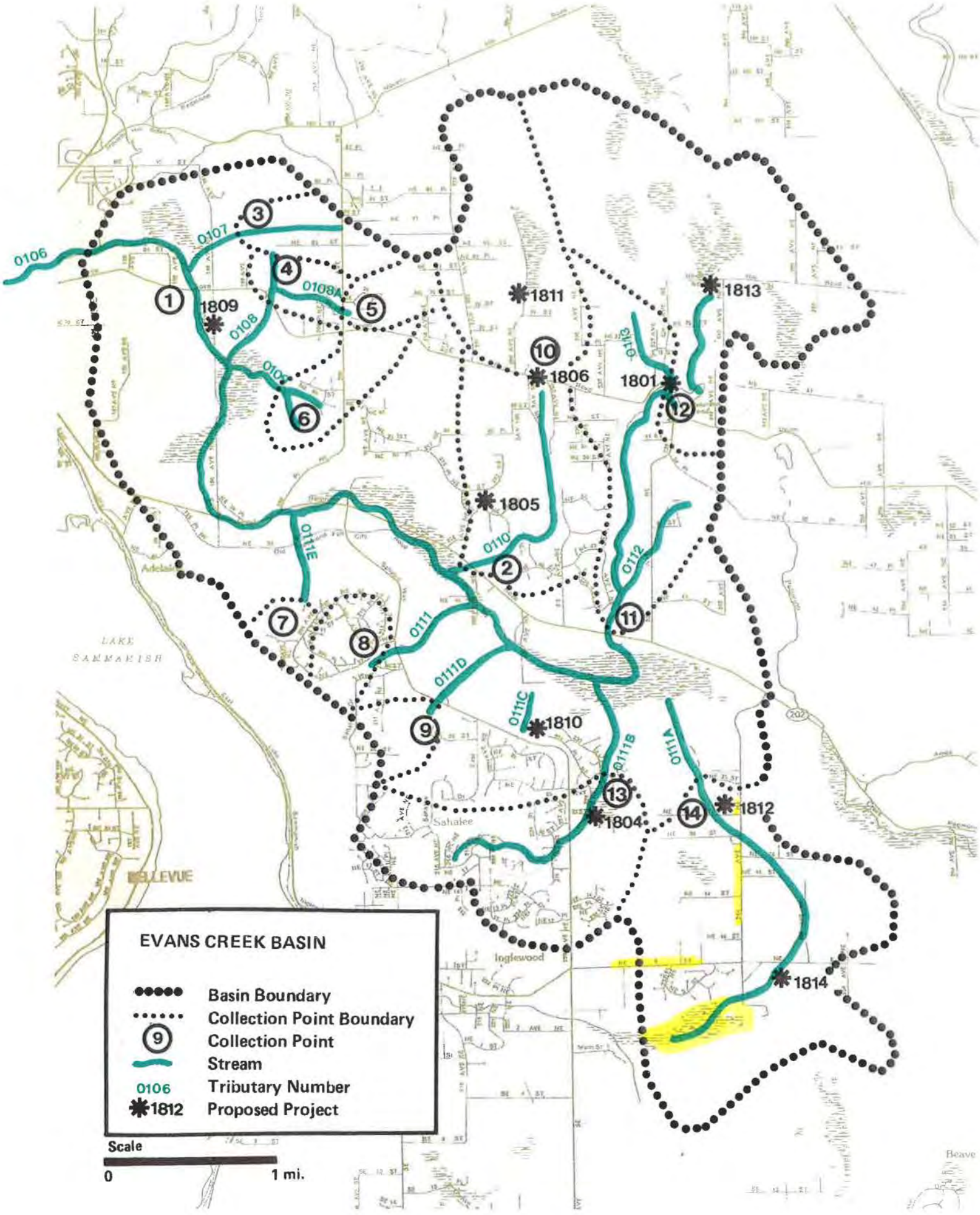
Hope this helps,
Grant

RECONNAISSANCE REPORT NO. 28

LAKE WASHINGTON BASIN

JUNE 1987

Natural Resources and Parks Division
and Surface Water Management Division
King County, Washington


EVANS CREEK BASIN
Basin Boundary
Collection Point Boundary
Collection Point
Stream
0106 Tributary Number
1812 Proposed Project
Scale
0
1 mi.
0106
0107
0108
0108A
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13
14
LAKE SAMMAMISH
BELLEVUE
Sahalee
Inglewood
Adelaide
Beave

Appendix D

Allen Lake Outlet at 25th Gauge #18h Record

Timestamp	Mean_Flow	Max_Flow	Min_Flow_cfs	Estimate	Warning
10/12/2011	0	0	0		
10/13/2011	0	0	0		
10/14/2011	0	0	0		
10/15/2011	0	0	0		
10/16/2011	0	0	0		
10/17/2011	0	0	0		
10/18/2011	0	0	0		
10/19/2011	0	0	0		
10/20/2011	0	0	0		
10/21/2011	0	0	0		
10/22/2011	0	0	0		
10/23/2011	0	0	0		
10/24/2011	0	0	0		
10/25/2011	0	0	0		
10/26/2011	0	0	0		
10/27/2011	0	0	0		
10/28/2011	0	0	0		
10/29/2011	0	0	0		
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11/18/2011	0	0	0		
11/19/2011	0	0	0		
11/20/2011	0	0	0		
11/21/2011	0	0	0		
11/22/2011	0.05	0.21	0		
11/23/2011	2.09	5.03	0.14		
11/24/2011	6.81	8.41	4.92		
11/25/2011	8.21	8.81	7.4		
11/26/2011	6.79	7.78	5.77		
11/27/2011	5.5	6	5.13		
11/28/2011	5.65	5.88	5.23		
11/29/2011	5.28	5.77	4.82		
11/30/2011	4.51	4.92	4.13		
12/1/2011	3.77	4.13	3.4		

12/2/2011	3.19	3.49	2.98
12/3/2011	2.78	3.06	2.5
12/4/2011	2.2	2.65	1.8
12/5/2011	1.61	2.06	1.26
12/6/2011	1.2	1.46	1
12/7/2011	0.86	1.08	0.65
12/8/2011	0.62	0.71	0.54
12/9/2011	0.58	1	0.4
12/10/2011	0.56	1	0.4
12/11/2011	0.4	0.44	0.35
12/12/2011	0.36	0.4	0.31
12/13/2011	0.33	0.38	0.29
12/14/2011	0.27	0.33	0.23
12/15/2011	0.19	0.25	0.12
12/16/2011	0.14	0.17	0.12
12/17/2011	0.15	0.17	0.12
12/18/2011	0.23	0.29	0.14
12/19/2011	0.29	0.31	0.23
12/20/2011	0.24	0.29	0.21
12/21/2011	0.18	0.21	0.14
12/22/2011	0.14	0.18	0.11
12/23/2011	0.1	0.14	0.07
12/24/2011	0.13	0.18	0.09
12/25/2011	0.17	0.23	0.1
12/26/2011	0.04	0.11	0
12/27/2011	0.04	0.29	0
12/28/2011	0.49	0.92	0.27
12/29/2011	1.2	1.68	0.84
12/30/2011	2.27	3.06	1.68
12/31/2011	3.51	3.94	2.98
1/1/2012	3.2	3.49	2.89
1/2/2012	2.75	3.14	2.2
1/3/2012	3.11	3.31	2.89
1/4/2012	3.5	4.23	3.06
1/5/2012	4.82	5.23	4.23
1/6/2012	4.93	5.23	4.62
1/7/2012	4.12	4.62	3.67
1/8/2012	3.33	3.76	2.98
1/9/2012	2.76	3.06	2.5
1/10/2012	2.49	2.65	2.2
1/11/2012	2.12	2.5	1.68
1/12/2012	1.67	2.06	1.26
1/13/2012	1.26	1.57	0.92
1/14/2012	1.35	1.93	0.92
1/15/2012	2	2.2	1.8
1/16/2012	2.04	2.35	1.8
1/17/2012	2.07	2.35	1.8
1/18/2012	2.34	2.73	1.8
1/19/2012	2.73	2.89	2.58
1/20/2012	2.8	3.31	2.5
1/21/2012	5.27	7.28	3.31
1/22/2012	11.21	19.54	6.68

1/23/2012	10.28	11.03	9.21
1/24/2012	8.37	9.48	7.53
1/25/2012	7.68	8.16	7.28
1/26/2012	7.51	7.78	7.16
1/27/2012	6.95	7.78	6.22
1/28/2012	5.58	6.34	4.92
1/29/2012	5.11	6	4.72
1/30/2012	7.82	9.21	5.88
1/31/2012	8.95	9.48	8.28
2/1/2012	8.54	9.34	7.78
2/2/2012	8.88	9.48	8.16
2/3/2012	7.03	8.28	6
2/4/2012	5.33	6	4.62
2/5/2012	4.23	4.72	3.85
2/6/2012	3.42	3.94	2.98
2/7/2012	2.8	3.14	2.5
2/8/2012	2.46	2.65	2.06
2/9/2012	2.04	2.35	1.57
2/10/2012	1.74	2.06	1.57
2/11/2012	1.6	1.8	1.46
2/12/2012	1.41	1.57	1.26
2/13/2012	1.37	1.46	1.26
2/14/2012	1.59	1.93	1.36
2/15/2012	1.79	2.06	1.57
2/16/2012	1.47	1.68	1.26
2/17/2012	1.37	1.93	1
2/18/2012	2.83	3.85	1.8
2/19/2012	5.06	5.88	3.85
2/20/2012	5.64	5.88	5.23
2/21/2012	6.35	7.65	5.34
2/22/2012	8.05	8.54	7.65
2/23/2012	6.93	7.78	6.11
2/24/2012	5.68	6.22	5.23
2/25/2012	6.33	7.28	5.34
2/26/2012	6.85	7.4	6.57
2/27/2012	5.9	6.57	5.45
2/28/2012	5.04	5.56	4.52
2/29/2012	4.28	4.92	3.85
3/1/2012	3.64	3.94	3.31
3/2/2012	3.11	3.31	2.89
3/3/2012	3	3.14	2.81
3/4/2012	2.66	2.89	2.35
3/5/2012	2.61	2.89	2.35
3/6/2012	2.77	2.89	2.58
3/7/2012	2.66	2.89	2.35
3/8/2012	2.2	2.65	1.8
3/9/2012	1.79	2.06	1.57
3/10/2012	2.32	2.81	1.8
3/11/2012	3.59	4.13	2.73
3/12/2012	4.27	5.23	3.67
3/13/2012	7.52	8.67	5.45
3/14/2012	8.22	8.67	7.9

3/15/2012	10.16	14.94	8.03
3/16/2012	17.69	18.8	14.77
3/17/2012	16.74	18.25	14.94
3/18/2012	13.2	15.28	11.33
3/19/2012	9.44	11.18	7.9
3/20/2012	7.15	8.03	6.22
3/21/2012	5.64	6.34	5.13
3/22/2012	5.25	5.56	5.03
3/23/2012	4.79	5.34	4.32
3/24/2012	4.05	4.52	3.67
3/25/2012	3.62	3.94	3.31
3/26/2012	3.43	3.76	3.14
3/27/2012	2.85	3.4	2.2
3/28/2012	2.48	3.06	1.8
3/29/2012	2.56	3.58	1.93
3/30/2012	6.05	7.4	3.58
3/31/2012	7.2	7.4	6.92
4/1/2012	6.67	7.53	5.88
4/2/2012	5.17	6	4.32
4/3/2012	4.11	4.42	3.94
4/4/2012	3.8	4.13	3.49
4/5/2012	3.55	3.67	3.4
4/6/2012	3.33	3.58	3.14
4/7/2012	2.77	3.23	2.35
4/8/2012	2.32	2.65	1.93
4/9/2012	3.13	3.4	2.5
4/10/2012	2.13	3.23	1
4/11/2012	1.01	1.17	0.92
4/12/2012	1.63	2.98	0.92
4/13/2012	2.6	3.14	1.93
4/14/2012	1.45	2.06	0.92
4/15/2012	1.98	2.5	1.57
4/16/2012	1.51	2.58	0.78
4/17/2012	0.84	1.26	0.49
4/18/2012	0.98	1.36	0.65
4/19/2012	1.9	2.5	1.36
4/20/2012	2.9	3.67	2.2
4/21/2012	3.33	3.67	3.06
4/22/2012	2.86	3.23	2.5
4/23/2012	1.86	2.65	1.17
4/24/2012	1.34	2.35	0.65
4/25/2012	2.45	2.65	2.06
4/26/2012	2.92	3.31	2.65
4/27/2012	3.36	3.58	3.23
4/28/2012	3.22	3.4	3.06
4/29/2012	2.4	3.06	1.46
4/30/2012	2.05	2.65	1.46
5/1/2012	2.7	2.89	2.58
5/2/2012	2.53	2.81	2.2
5/3/2012	2.02	2.73	1.57
5/4/2012	4.29	6.11	2.73
5/5/2012	5.57	6.22	4.92

5/6/2012	4.21	4.92	3.76
5/7/2012	4.16	5.03	3.49
5/8/2012	3.3	4.72	2.35
5/9/2012	2.63	2.89	2.2
5/10/2012	2.65	2.98	2.35
5/11/2012	1.74	2.58	1.26
5/12/2012	1.1	1.46	0.84
5/13/2012	0.74	1	0.49
5/14/2012	0.6	0.84	0.44
5/15/2012	0.5	0.65	0.4
5/16/2012	0.34	0.49	0.23
5/17/2012	0.37	0.44	0.31
5/18/2012	0.32	0.38	0.27
5/19/2012	0.26	0.33	0.18
5/20/2012	0.16	0.2	0.11
5/21/2012	0.2	0.33	0.11
5/22/2012	0.41	0.49	0.33
5/23/2012	0.48	0.54	0.4
5/24/2012	0.56	0.84	0.44
5/25/2012	0.76	1	0.59
5/26/2012	0.42	0.65	0.29
5/27/2012	0.46	0.54	0.4
5/28/2012	0.39	0.49	0.33
5/29/2012	0.23	0.33	0.12
5/30/2012	0.1	0.31	0.02
5/31/2012	0.33	0.35	0.23
6/1/2012	0.28	0.33	0.21
6/2/2012	0.2	0.25	0.17
6/3/2012	0.28	0.35	0.17
6/4/2012	0.33	0.38	0.27
6/5/2012	0.44	0.71	0.29
6/6/2012	1.18	2.2	0.65
6/7/2012	2.43	2.65	2.06
6/8/2012	2.06	2.65	1.8
6/9/2012	1.45	1.8	1.17
6/10/2012	1.15	1.26	1
6/11/2012	0.97	1.17	0.71
6/12/2012	0.64	0.78	0.49
6/13/2012	0.42	0.54	0.35
6/14/2012	0.3	0.38	0.21
6/15/2012	0.17	0.25	0.08
6/16/2012	0.11	0.33	0.04
6/17/2012	0.33	0.35	0.29
6/18/2012	0.3	0.35	0.25
6/19/2012	0.23	0.29	0.2
6/20/2012	0.17	0.21	0.11
6/21/2012	0.06	0.12	0
6/22/2012	0.01	0.06	0
6/23/2012	0.17	0.38	0.03
6/24/2012	0.41	0.49	0.35
6/25/2012	0.57	1	0.44
6/26/2012	1.17	1.36	0.92

6/27/2012	1.22	1.57	0.92
6/28/2012	0.55	0.92	0.29
6/29/2012	0.45	0.65	0.23
6/30/2012	0.11	0.21	0.04
7/1/2012	0.4	0.59	0.03
7/2/2012	0.51	0.65	0.4
7/3/2012	0.47	0.65	0.27
7/4/2012	0.34	0.44	0.21
7/5/2012	0.11	0.21	0.01
7/6/2012	0	0.01	0
7/7/2012	0	0	0
7/8/2012	0	0	0
7/9/2012	0	0	0
7/10/2012	0.03	0.1	0
7/11/2012	0	0	0
7/12/2012	0	0	0
7/13/2012	0	0	0
7/14/2012	0	0	0
7/15/2012	0	0	0
7/16/2012	0	0	0
7/17/2012	0	0	0
7/18/2012	0	0	0
7/19/2012	0	0	0
7/20/2012	0	0	0
7/21/2012	0	0	0
7/22/2012	0	0	0
7/23/2012	0	0	0
7/24/2012	0	0	0
7/25/2012	0	0	0
7/26/2012	0	0	0
7/27/2012	0	0	0
7/28/2012	0	0	0
7/29/2012	0	0	0
7/30/2012	0	0	0
7/31/2012	0	0	0
8/1/2012	0	0	0
8/2/2012	0	0	0
8/3/2012	0	0	0
8/4/2012	0	0	0
8/5/2012	0	0	0
8/6/2012	0	0	0
8/7/2012	0	0	0
8/8/2012	0	0	0