

CITY COUNCIL AGENDA ITEM
CITY OF SHORELINE, WASHINGTON

AGENDA TITLE:	Thornton Creek Basin Flood Plain Mapping
DEPARTMENT:	Public Works
PRESENTED BY:	Mark Relph, Public Works Director Jesus Sanchez, Public Works Operations Manager Tricia Juhnke, PW Capital Projects Administrator

PROBLEM/ISSUE STATEMENT:

The City has been pursuing a series of storm water improvements throughout the city since its incorporation in 1995. The Thornton Creek/Ronald Bog Basin has been the subject of many of these improvements. This report, and staff's presentation on September 2nd, will review what the city has accomplished of our current Capital Improvement Program (CIP) for 2008, flood plain mapping now underway, Federal Emergency Management Agency (FEMA) involvement, and our strategies for the basin.

The residential area south of Ronald Bog is part of the much larger Thornton Creek drainage basin (attachment A). This basin drains through Shoreline and into the City of Seattle before it eventually outfalls to Lake Washington. Ronald Bog itself has historically flooded during significant rain events greater than a 50 year storm. Most recently this neighborhood was severely flooded during the December 3rd rain event which was an event greater than a 100 year storm event.

The City has pursued solutions since the flooding of many homes during a large rain-on-snow storm event that occurred in early 1997. Currently there is a \$3.1 million CIP project under construction utilizing primarily Public Works Trust Fund Loans. The first step, currently under construction, will replace the 3 restrictive culverts west of Corliss Place with fish passable boxes (attachment B). Work on the street drainage on the west side of Corliss Ave N, between 171st and 172nd, will be completed in the fall. Replacing failing infrastructure through these changes will assist in mitigating some degree of flooding, but it is not the complete solution for alleviating flooding in the Ronald Bog area.

Also underway is a joint effort with the City of Seattle to map the flood zones along Thornton Creek. This is a first step to completing a comprehensive basin plan. The completed mapping can be submitted to FEMA as a request to revise their flood zone maps. Once FEMA accepts the base flood elevations and flood risk zones, the City of Shoreline will have 6 months to adopt base flood elevations and reflect changes in the zoning and building code. FEMA designation as a flood zone improves our opportunity for federal funds to alleviate flooding, but it also carries a requirement for property

owners, with federally backed mortgages, to purchase insurance. Flood insurance will cost a typical home owner between \$300 and \$400 per year. Flood insurance rates will be higher and building requirements more stringent for new construction within higher risk flood zones. Existing structures will pay the same rate for insurance as they would before changes to flood mapping, but the owners will be required to document that their home existed before the change.

The flood plain mapping will be complete by the fall. At that point, we will begin evaluation of FEMA funding opportunities, along with coordination of the changes to existing city code. The final mapping, funding expectations and code revisions will be presented to council prior to submitting the mapping revisions to FEMA.

Finally, a study is now underway to fully model the entire basin, and evaluate the effectiveness of proposed improvements. This "basin plan" will allow the city to have a complete understanding of the projects necessary for maximum flood protection, plus allow the City to develop a more strategic approach to funding, including surface water rate structure and grant opportunities. The basin plan is scheduled for completion in the first quarter of 2009.

FINANCIAL IMPACT:

The 2008 – 2013 adopted CIP budget includes four significant projects with the basin that are intended to address the storm water problem. They include the \$3.1M Ronald Bog South project (under construction), the \$747,000 Cromwell Park Improvement Project (construction of 1 to 2 acre-feet of upstream detention in 2009), the \$264,000 Pump Station No.25 and the \$571,000 Ronald Bog Park Detention/Wetland Project. However, additional projects beyond the current CIP will be needed to at least provide the residents south of the Bog some reasonable level of flood protection.

Within the "Discussion" section of this report, there is a funding section that proposes how the city may approach completing the basin plan and the pursuit of other financial opportunities to complete a more detailed and comprehensive project approach for this basin.

RECOMMENDATION

No action is required by the City Council at this time. This report is for information only.



Approved By: City Manager _____ City Attorney _____

INTRODUCTION

On December 3rd, 2007, a rain storm dropped more than 4 inches of rainfall in about 21 hours on the City and Public Works crews responded to hundreds of calls from residents. This rainfall amount exceeded the 100-year storm, and thereby exceeded the design capacity of the stormwater infrastructure. The volume of runoff from this storm entering Ronald Bog was more than 20 acre-feet above flood stage. Consequently, flooding occurred in the residential area south of Ronald Bog. These homes were flooded with up to 3 feet of water for a second time in 11 years.

The City has pursued solutions to flooding since incorporation, and the Ronald Bog area has been a significant portion of the list. Currently, the City has a 2008 CIP project for improvements to the drainage totaling \$3,100,000. If these improvements had been implemented prior to December 3rd, it would not have eliminated the flooding that occurred in December. An additional \$3,000,000 in improvements, proposed as part of the 30% design and subsequently dropped due to budget, may have added further protection immediately South of Ronald Bog, but would more likely have caused additional flooding further downstream.

Public Works has prepared an action plan with immediate, near term, and long term approaches aimed at working within available and foreseeable funding to provide the greatest relief to this area. Part of the proposed strategy is the pursuit of grants. If the City is successful, then the completion of projects could be accelerated.

BACKGROUND

Early accounts of Shoreline tell how Native Americans collected wild cranberries at Ronald Bog. Named after Judge James Ronald, an early Shoreline philanthropist and Seattle mayor from 1892-93, Ronald Bog was historically a peat bog wetland. In 1923, the US Geological Survey estimated Ronald Bog peat deposits to be 40 feet deep over 25 acres. After World War II, George Webster obtained ownership of the land and it was mined for its peat, forming the square sided shape open water pond that is seen today.

The neighborhood to the south of present day Ronald Bog Park was originally part of the Bog. The area was platted for residential use by King County in 1955 and homes were built on fill not long afterwards. Construction of Interstate 5 began in the area in the early 1960's and fill from the construction was used to reduce the open water portion of the Bog. Runoff from development since then in the 690 acres upstream has been directed to the Bog since it is the low spot in the Upper Thornton Creek basin. Sometime after it began being used as a regional stormwater facility, the Bog was directly connected to Thornton Creek (Bogs are usually isolated and are only connected to other surface waters through groundwater flow).

The studies completed subsequent to the 1997 flood were conventional in design, and did not address the downstream effects, including backwater. None of the studies

account for the movement and impact of groundwater. It is clear from the event in December that maintenance completed on the drainage system has significantly restored the flow capacity of the system, but has had little impact on significant flooding events. This is a strong indication that simply building a bigger pipe or a wide open channel is not the entire solution to the flooding in the Ronald Bog area. A basin-wide study, from headwaters to the south city limit, is needed to fully assess the proposed solutions. This study may likely need to include backwater-and groundwater analysis of properties beyond the City limits.

In 2005, the city adopted its first Surface Water Master Plan. This Plan was in part an attempt to identify the significant basins within the city and then prioritize a list of projects addressing the history of known problems. This Plan was not a complete listing of all projects within the city that are going to be necessary to reduce flooding. This Plan does not provide a detailed correlation between the level of flood protection required and the magnitude of improvements. More specifically, the Plan states that additional engineering analysis will be required to properly determine the appropriate level of infrastructure given the desired level of flood protection¹.

The initial Ronald Bog Drainage Improvement Project was created by the City in response to the flooding of many homes during a large rain-on-snow storm event that occurred in early 1997. Attachment C provides a detailed chronology of events that surround Ronald Bog area.

DISCUSSION

As the threat of flooding continues, an immediate action plan is appropriate and measures have already been taken. The City has begun construction this summer on projects that will start to reduce the level of flooding. It is clear that more work beyond what is planned will be needed to resolve the issue. The City's response to the flooding issue has been divided into a three pronged approach:

1. Immediate Action
2. Near term construction
3. Long Term study and plan implementation

1. Immediate Action Plan: This includes installation of an early warning system to alert residents to the pending flooding. The City has placed sand bags at strategic locations and has an ongoing training plan for neighborhood response. A 6" pump will be located at the south end of Corliss Ave N to serve as a high-flow bypass on an as needed basis. Maintenance continues on the existing system downstream of the Bog to keep it free flowing. Staff has identified potential grant opportunities and will pursue applications including:

- King County Flood Control Zone District "Opportunity Fund"
- FEMA Disaster Mitigation grant
- FEMA Pre-Disaster Hazard Mitigation Grant.

¹ Surface Water Master Plan, Adopted July 11, 2005; Section 5.3 - Proposed Flood Protection Projects and Programs.

- Other State and Federal alternatives

2. Near Term Plan: This will continue with the replacement of the street drainage system along the west side of Corliss Avenue North. The existing system is in need of replacement and a new pipe will increase the effectiveness of the bypass pump. The replacement of the fish barriers on Thornton Creek, west of Corliss Place, will also reduce the likelihood that these will become debris barriers.

The maintenance of the downstream system and the elimination of the fish barriers are aimed at returning the Bog to its historic levels; about 2 feet lower than present. This could add as much as 5 acre-feet of storage at the Bog. Lowering areas within Ronald Bog Park could add an additional 5 acre-feet.

The design and construction of Cromwell Park improvements, scheduled to be completed in 2009, will include 1 to 2 acre-feet of upstream detention and will reduce flooding at Ronald Bog by that amount.

FEMA FLOOD PLAIN MAPPING. Shoreline is working in cooperation with the City of Seattle to map the flood zones along Thornton Creek. Once complete, the mapping will be evaluated against funding opportunities and requirements for changes to existing city code. The final mapping, funding expectations and code revisions will be presented to council prior to submitting the mapping revisions to FEMA.

3. Long-Term Plan: There exists a very shallow or limited hydraulic profile (2 feet of fall from the Bog to N 168th Street), which necessitates a detailed downstream evaluation and analysis; as does any solution that involves more pipe capacity. These dynamic factors have not been studied with the conventional modeling that has been completed.

The scope of the study will need to reach beyond this localized area and will require a look at all of Thornton Creek from the headwaters to the City Limit; and beyond as necessary for analysis. The Long Term Plan will need to analyze and evaluate a variety of alternatives and solutions including:

- Increasing Upstream detention
- Diversion of water away from Ronald Bog
- Terracing the Ronald Bog Park to store more water in the park area
- Additional detention facilities and acquisition of property
- Improving & increasing conveyance capacity of the downstream system
- Identify Grant Funding Opportunities and requirements including the FEMA Pre-Disaster and Hazard Mitigation Programs.
- Evaluate the Surface Water Rate Structure to help fund solutions

This proposed "basin plan" will allow the city to have complete understanding the projects necessary for maximum flood protection, plus allow the city to develop a more strategic approach to funding, including surface water rate structure and grant opportunities. The basin plan is scheduled for completion in the first quarter of 2009.

Funding

The following table shows the current funding that is available based on the 2008-2013 Capital Improvement Plan (CIP) for the Thornton Creek/Ronald Bog Basin.

Project	Scheduled Year(s)	Surface Water Funded	Public Works Trust Fund Loan	Total Amount
Ronald Bog South	2008	\$416,910	\$2,052,090	\$2,469,000
Ronald Bog Park Wetland	2009-2010	\$571,000		\$571,000
Cromwell Park Pond/Wet Pond/Wetland	2008-2009	\$747,000		\$747,000
Pump Station No. 25	2009	\$264,000		\$264,000
Total		\$1,998,910	\$2,052,090	\$4,051,000

Fundamentally, in developing long range planning for addressing flooding, water quality and habitat enhancements, one needs to understand the hydrologic behavior of the entire basin. To accomplish this, a quality master basin plan that will help guide the city in developing quality CIP projects with reasonably predictable costs will be developed. This will assist the City in understanding exactly what we can afford and where surface water rates need to be based on priorities developed on a basin-by-basin basis.

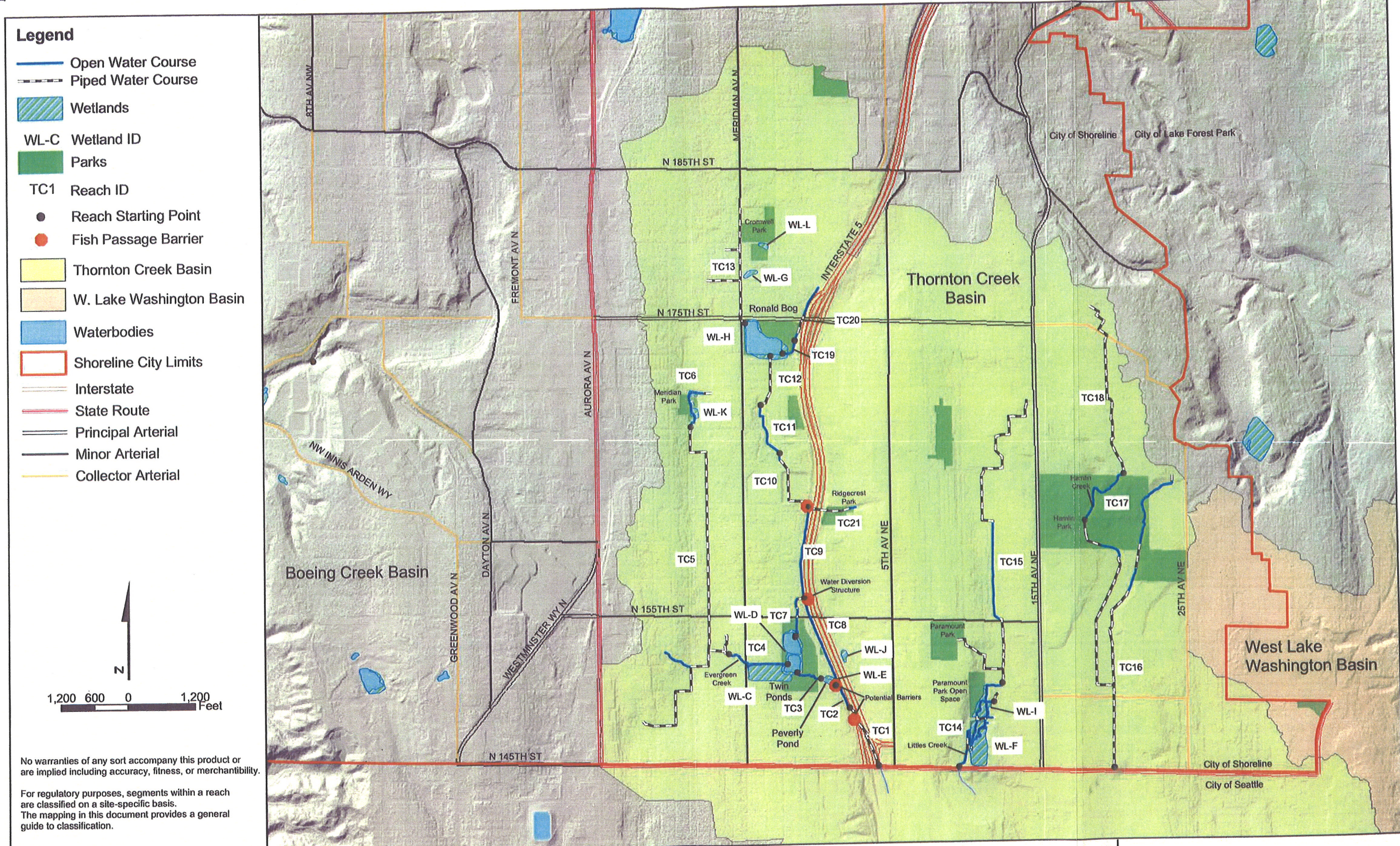
The ultimate goal is to provide the maximum flood protection possible to the residents directly south of the Bog, to those adjacent to Pump Station 25 on 2nd Place NE, to all residents upstream of the Bog who were impacted on December 3rd, and to the downstream residents in Shoreline and our neighbors in Seattle. This needs to be accomplished in accordance with all environmental requirements and within reasonable budgetary constraints.

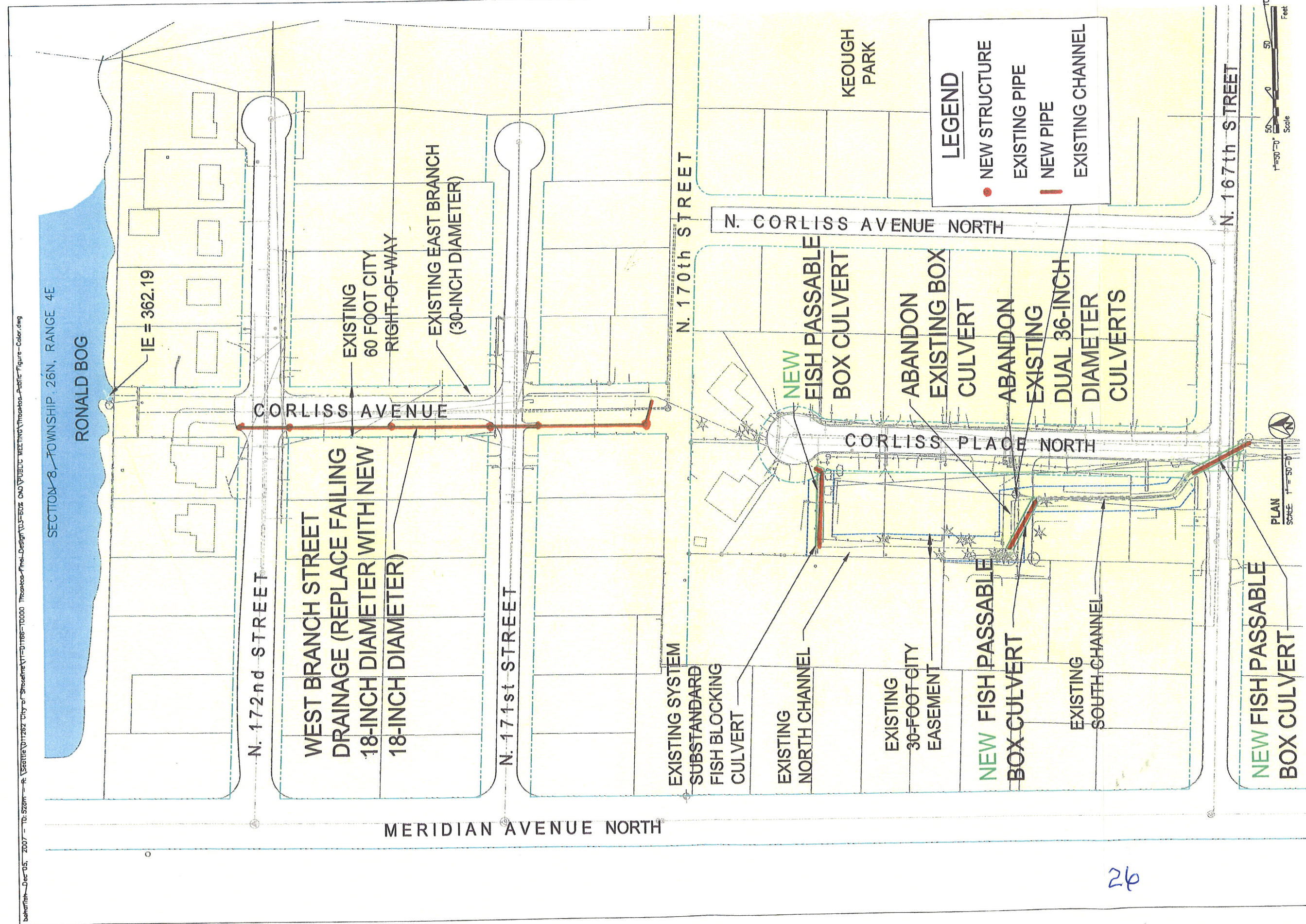
RECOMMENDATION

No action is required by the City Council at this time. This report is for information only.

Attachments:

- Attachment A – Thornton Creek Drainage Basin
- Attachment B – The 2008 CIP project of Ronald Bog South
- Attachment C – A Chronology of Events within the Thornton Creek/Ronald Bog Drainage Basin





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Project No.		Initials		Date		Description	
		Designed					
		Checked					
		Revisions					
		Revisions					
				Date	Signature		
		Accepted for construction by City Engineer					



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UPPER THORNTON CREEK

Basin Drainage Improvement

PUBLIC MEETING

EXHIBIT

Sheet - of -

Attachment C - A Chronology of Events within the Thornton Creek/Ronald Bog Drainage Basin.

- November 1998 - The City Council adopts City's first Capital Improvement Plan (CIP). This CIP includes three separate drainage projects within the Ronald Bog Drainage basin.
- June 1999 - Staff presents to Council the steps for the Ronald Bog project pre-design study titled the "Ronald Bog Subbasin Study." Council approves combining the three previously mentioned CIP projects into one. This Council agenda item authorized the City to hire Otak for a basin solutions analysis.
- Staff works with Technical and Citizen Advisory Committee (CAC) to review subbasin flooding options. Staff meets with citizen and technical advisory committees (Residents, the Departments of Ecology, Transportation, and Fish and Wildlife, and the Army Corps of Engineers) to discuss technical and citizen concerns at same time. This advisory committee meets on June 20, August 1, and October 5, 2000. The final CAC met on January 11, 2001.
- February 2001 - Staff requests Council select a combination of projects as the basin-wide preferred alternative based a document completed by Otak entitled "Ronald Bog Drainage Improvements Phase 1, Thornton Creek Tributary Flood Reduction Study." These basin-wide alternatives include two projects east of I-5 (upgrades to pump station 25 and drainage improvements near 10th Ave NE and Serpentine Place NE), two in Cromwell Park, one in Ronald Bog Park, and one downstream of the Bog.
- June 2001 - Council adopts the preferred basin-wide alternative and authorizes staff to move forward with the design and environmental work. Staff negotiates with Otak to begin 30% design and environmental permitting.
- Early 2002 - Former Shoreline City Manager Steve Burkett calls for independent review of Ronald Bog Drainage Improvements Project as well as four other large CIP projects. The 30% design and environmental permitting is stopped while independent review completed.
- Fall 2002 - Following the recommendations of the independent review by Gray & Osborn, the project is broken up into short term and long-term improvements by the Council during 2003-2008 CIP process. Short term improvements for 2003 included:
 - Cleaning/video of pipes and removal of roots in storm lines south of Ronald Bog, and at 10th NE/175th Street (completed in 2003).
 - Full design, permitting, and construction of the Serpentine Place improvements (see below).
- December 2002 - The City completes drainage improvements upstream of Ronald Bog along 1st Ave NE near NE 185th St to detain flows prior to reaching the Bog (oversized storm pipe with some in-line detention).
- March 2003 - The City begins the process of developing a Surface Water Master Plan that will include a discussion of which of the other Ronald Bog drainage improvements are appropriate.

- April 2003 – City decides that it is appropriate to construct the following “early outs” instead of the entire Serpentine Project. The two pieces of storm line to be constructed as early out improvements include: 175th Street (between 10th and 11th Avenues NE) and north on 10th Avenue from 175th Street to catch grade AND Serpentine Avenue from 5th Avenue NE west to 175th Street (this is a portion of the original Serpentine Project). These projects were completed in March of 2004 at a cost of \$1,100,000.
- Spring 2004 - City begins stepped up annual maintenance schedule for all pipe and catch basins in the Ronald Bog basin. All pipes are cleaned, root cut, and catch basins vacuumed out. This extends the useful life of the pipes.
- November 2004 – Additional drainage improvements are constructed by the City in the area of 10th Ave NE and NE 175th St. \$75,000.
- Late 2004 – WSDOT completes construction of detention/water quality pond at intersection of I-5 and N 175th St. that may help flows entering Ronald Bog.
- Summer 2005 – Council approves the first citywide Surface Water Master Plan that adopts the projects suggested in the 2001 “Ronald Bog Drainage Improvements Phase 1, Thornton Creek Tributary Flood Reduction Study,” with modifications. These projects are priority level 1 and scheduled to be completed during the first 6 years of the plan. The study also recommends further survey, hydrologic analysis, and hydraulic analysis be completed.
The Surface Water Master Plan did not contain detailed basin modeling. The prioritization of projects was based on known flooding, water quality and habitat problem areas from resident and business service requests.
- Early 2006 – City initiates design contract to design the portion of the Ronald Bog Drainage Improvements from the outlet from the Bog to N 167th St (Ronald Bog South Project).
- May 2006 – Parks bond measure passes that includes master plan for Cromwell Park. Ronald Bog Drainage Improvements that include Cromwell are integrated into the Parks Master Plan for Cromwell.
- November 2006 – Public Meeting held for preliminary design of Ronald Bog South Project.
- December 2006 – 30% design for Ronald Bog South Project is completed.
- January 2007 – The 30% plan is presented to Council.
- Spring 2007 – Washington Department of Fish & Wildlife insists on either an open channel or fish-passable box culverts from the Bog outlet to the open channel. The cost of this is far in excess of available resources (**doubled the costs**) and this approach would have increased downstream flows substantially South of the Bog and into the City of Seattle. This result was deemed unacceptable by Staff. A phased approach for completing the downstream portion of the project is currently underway.
- The rain event of December 3, 2007 provided significant insight into how the Bog functions. In early November 2006, a 50-year storm dropped 3.7 inches of rain on the City. The weather was relatively dry prior to this event and flooding downstream of the Bog did not occur. The December 3rd event was just over 4 inches with a snow and small rain event preceding it and this resulted in over 20 acre-feet of surface water over and around Ronald Bog beyond the capacity of

the system. This volume estimate does not include the high ground water that continued to recharge the flooded areas as the water was pumped and subsequently receded. This new information warrants re-looking at alternatives and solutions to include the groundwater contribution component.