# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 Project Background and Description</td>
<td>1</td>
</tr>
<tr>
<td>2.0 Study Area</td>
<td>1</td>
</tr>
<tr>
<td>3.0 Approach</td>
<td>3</td>
</tr>
<tr>
<td>4.0 Clear Creek Floodplain Reconnection Project Description</td>
<td>4</td>
</tr>
<tr>
<td>5.0 Agricultural Viability</td>
<td>5</td>
</tr>
<tr>
<td>6.0 Potential Farmland Impacts</td>
<td>6</td>
</tr>
<tr>
<td>6.1 How would the new ring levee affect flood risk to agricultural</td>
<td>6</td>
</tr>
<tr>
<td>properties from Puyallup River floodwaters entering the Clear</td>
<td></td>
</tr>
<tr>
<td>Creek area at the outlet of Clear Creek?</td>
<td></td>
</tr>
<tr>
<td>6.2 How would the proposed ring levee affect flood risk to farms if</td>
<td>8</td>
</tr>
<tr>
<td>River Road Levee overtops or breaches?</td>
<td></td>
</tr>
<tr>
<td>6.3 How would the proposed ring levee affect flood risk if Puyallup</td>
<td>10</td>
</tr>
<tr>
<td>River flows increase in the future?</td>
<td></td>
</tr>
<tr>
<td>6.4 How would the proposed ring levee affect flood risk if Clear Creek</td>
<td>11</td>
</tr>
<tr>
<td>flows increase in the future?</td>
<td></td>
</tr>
<tr>
<td>6.5 Would flooding occur on the dry side of the levee where streams</td>
<td>12</td>
</tr>
<tr>
<td>cross the levee?</td>
<td></td>
</tr>
<tr>
<td>6.6 Would the proposed ring levee change the designation of the Clear</td>
<td>14</td>
</tr>
<tr>
<td>Creek area as floodway?</td>
<td></td>
</tr>
<tr>
<td>6.7 Would modification of the tide gates and/or construction of a levee</td>
<td>15</td>
</tr>
<tr>
<td>alter groundwater-surface water interactions in the Clear Creek area?</td>
<td></td>
</tr>
<tr>
<td>Would those changes affect agriculture?</td>
<td></td>
</tr>
<tr>
<td>6.8 Would the new levee affect drainage from the Clear Creek agricultural area?</td>
<td>16</td>
</tr>
<tr>
<td>6.9 How much would the project reduce farm acreage?</td>
<td>18</td>
</tr>
<tr>
<td>6.10 How would the levee affect the viability of Drainage District 10?</td>
<td>19</td>
</tr>
<tr>
<td>6.11 What are the impacts of vacant parcels adjacent to farms in the</td>
<td>21</td>
</tr>
<tr>
<td>time between purchase of properties and construction of the project?</td>
<td></td>
</tr>
<tr>
<td>6.12 Would the new levee cause the loss of the Riverside Fire District?</td>
<td>22</td>
</tr>
<tr>
<td>6.13 How would combining a trail with the levee affect farms in the</td>
<td>23</td>
</tr>
<tr>
<td>area?</td>
<td></td>
</tr>
<tr>
<td>6.14 Would the levee reduce agricultural viability in the Clear Creek</td>
<td>24</td>
</tr>
<tr>
<td>area to the extent that agriculture in Pierce County as a whole is</td>
<td></td>
</tr>
<tr>
<td>damaged?</td>
<td></td>
</tr>
<tr>
<td>6.15 How would the new levee and removal of the tide gates interact</td>
<td>25</td>
</tr>
<tr>
<td>with climate change?</td>
<td></td>
</tr>
<tr>
<td>6.16 How will other proposed projects in the Clear Creek area combine</td>
<td>28</td>
</tr>
<tr>
<td>with the Clear Creek Floodplain Reconnection Project to affect farms?</td>
<td></td>
</tr>
<tr>
<td>6.17 Would it be possible to conduct agriculture on the wet side of the</td>
<td>29</td>
</tr>
<tr>
<td>levee?</td>
<td></td>
</tr>
<tr>
<td>7.0 Recommendations for the Master Planning Process</td>
<td>31</td>
</tr>
<tr>
<td>8.0 References</td>
<td>33</td>
</tr>
</tbody>
</table>
1.0 Project Background and Description

The purpose of this technical memorandum is to identify the general types of impacts that could occur to farmlands from a levee constructed as part of Pierce County Surface Water Management’s (SWM’s) proposed Clear Creek Floodplain Reconnection Project. This memorandum also identifies issues that should be considered in the master planning process for the Floodplain Reconnection Project, such as considerations for design of the project and additional studies needed to understand potential impacts. Information in this memorandum is preliminary and is based on a general understanding of the current scope of the Clear Creek Floodplain Reconnection Project. Additional studies and impact analysis would be conducted as the project moves forward.

This technical memorandum has been prepared as part of Phase 2 of the Farming in the Floodplain Project (FFP). The FFP is one of four components of the Floodplains for the Future: Puyallup, White, and Carbon Rivers project, which is funded by a Floodplains by Design grant from the Washington Department of Ecology (Ecology). The purpose of the FFP is to advance progress toward a collectively agreed upon plan for the Clear Creek area that improves agricultural viability in the area while also meeting goals for flood risk reduction and salmon habitat enhancement. The FFP is intended to clarify the needs and interests of the agricultural community within the Clear Creek area.

2.0 Study Area

The study area for this memorandum is the Clear Creek area, part of the Clear Creek Subbasin of the Puyallup River Watershed (Figure 1). The Clear Creek Subbasin is within the Puyallup River Watershed and is located south of the Puyallup River, north of 128th Street East, west of 66th Avenue East, and east of McKinley Avenue East. The Clear Creek area is roughly 1,140 acres in size and bounded by the Puyallup River to the north, Pioneer Way East to the south and west, and 52nd Street East to the east. The Clear Creek area is located primarily within unincorporated Pierce County, with the northern tip of the area within the City of Tacoma and the southern tip within the City of Puyallup. It encompasses a portion of State Route 167 (SR 167), a section of the BNSF Railway, agricultural lands, single-family residential neighborhoods, a recreational vehicle (RV) park, a few commercial properties, the Riverside Fire District, and two schools (Chief Leschi High School and ReLife School).
Clear Creek Basin and Area

Figure 1

PCCFT Farming in the Floodplain. 150678

SOURCE:
ESA 2016, ESRI 2016
3.0 Approach

When this technical memorandum was originally scoped in summer 2016, Pierce County had presented two proposed levee alignments for the Clear Creek Floodplain Reconnection Project (one at roughly the 14 foot contour and the other at roughly the 18 foot contour NAVD\(^1\)). At that time, the proposed approach for this memorandum was to analyze the two levee alignments Pierce County had presented at a programmatic level and to qualitatively evaluate their potential impacts on farmland and agricultural viability. However, since that time, the planning process for the Clear Creek Floodplain Reconnection Project has changed. Pierce County has agreed to revisit the conceptual design of the project with a facilitated and collaborative master planning process for the Clear Creek area. During this process, the alignment of the levee and other project elements will be open to revision.

Because the direction of the Clear Creek Floodplain Reconnection Project is changing, the approach for this memorandum has changed. The proposed project is no longer defined in specific detail, so there are no specific impacts to evaluate. The purpose of this memorandum has evolved to be a tool to inform the master planning process and to help the County develop a project that avoids or minimizes impacts to farmland, and, ideally, improves agricultural viability in the Clear Creek area. This memorandum discusses impacts to farmland that could occur from a proposed project that would create aquatic habitat in the lower Clear Creek area by modifying the tide gates and constructing a ring levee. The extent, type, and degree of impacts will depend on the location, design, scope, scale, and timing of the Floodplain Reconnection Project; therefore, this assessment is preliminary because details of the Reconnection Project are not yet known. The memorandum identifies some of the issues that should be considered in the master planning process to address agricultural concerns.

This memorandum documents questions about potential impacts of the Clear Creek Floodplain Reconnection Project raised by farmers in the Clear Creek area. These questions were raised in a letter to the Pierce County Executive (Johnson et al., 2016), in a letter to PCC Farmland Trust from the Clear Creek Farmer’s Collective (Clear Creek Farmer’s Collective, 2016), at Technical Advisory Group (TAG) meetings (TAG meeting reports are available online), and in direct conversations with PCC Farmland Trust and ESA staff. The letter from the Farmer’s Collective states, “Our collective has united around a platform that emphasizes ‘no net loss of farm function’” (Clear Creek Farmer’s Collective, 2016). The concept of farm function is broader than direct loss of farm acreage and includes potential impacts to physical conditions that relate to agricultural viability (such as drainage, sediment, and groundwater) and other factors that impact farming (such as illegal activities on vacant lands or continued viability of Drainage District 10). These topics are addressed in this memorandum. The memorandum also addresses potential impacts that have arisen in the course of research conducted for the Farming in the Floodplain Project.

---

\(^1\) NAVD stands for North American Vertical Datum of 1988. Pierce County Surface Water Management uses the NAVD 88 datum for all elevation data in the Puyallup Watershed.
This memorandum describes the areas on the Clear Creek side of the ring levee as being on the “wet side” of the levee and areas on the landward side of the ring levee as being on the “dry side” of the levee. Figure 2 shows a conceptual diagram of the proposed levee with the wet side and dry side labeled.

**Figure 2. Levee Wet Side and Dry Side Diagram**

Pierce County has suggested that, depending on the alignment of the levee, it may be possible for some lands on the wet side of the levee to be farmed. This potential is assessed below in Section 6.17. All other sections of this memorandum focus on potential impacts to farmland on the dry side of the levee.

**4.0 Clear Creek Floodplain Reconnection Project Description**

Pierce County Surface Water Management is proposing to implement the Clear Creek Floodplain Reconnection Project (Clear Creek Project) as part of its Rivers Comprehensive Flood Hazard Management Plan (Pierce County, 2013) and the Puyallup Watershed Floodplains for the Future initiative. The purpose of the project is to relieve flooding issues, improve habitat for wildlife, and potentially improve agricultural viability. The proposed project would remove the tide gates at the mouth of Clear Creek to allow Puyallup River water to flow into the Clear Creek area, reconnecting the river to a portion of its historic floodplain. The reconnected floodplain would establish a more natural connection with the Puyallup River and allow free passage for fish in and out of Clear Creek. To reduce property damage, Pierce County would acquire property from willing sellers and construct a ring levee around the reconnected floodplain to protect property on the dry side of the levee.
The Clear Creek Project consists of three related components:

- Acquiring frequently flooded property in the Clear Creek area from willing sellers--the County has purchased over 20 properties in the area and is using grant funding (including Floodplains by Design funding) to acquire additional property that would be affected by the proposed Clear Creek Project,
- Modifying (potentially removing) the tide gates at the confluence of Clear Creek and the Puyallup River to allow the Puyallup River to flow into the reconnected floodplain area, and
- Constructing a ring levee around the area to protect properties that would be flooded by modifying the tide gates.

The Clear Creek Project is still in the early planning stages and the County has not yet conducted the necessary engineering studies or prepared design plans for the tide gate modifications or ring levee. The project would be implemented in phases and Pierce County anticipates that the project would take at least a decade to complete, largely because it is dependent on the acquisition of property from willing sellers and the availability of grant funding to purchase those properties. Pierce County is in the process of initiating a master planning process to determine the best approach to reconnect the floodplain in the Clear Creek area.

5.0 Agricultural Viability

This memorandum is based on two key concepts that set the context for evaluating potential impacts – agricultural viability and risks to agriculture.

The Farming in the Floodplain Project is focused on the concept of agricultural viability. Agricultural viability can be defined as the ability of a farmer or group of farmers to:

- Productively farm on a given piece of land or in a specific area,
- Maintain an economically viable farm business,
- Keep the land in agriculture long-term, and
- Steward the land so it will remain productive into the future.

This memorandum does not identify specific thresholds for physical conditions under which farms in the area would no longer be viable. During Phase 1 of the FFP, farmers in the area expressed that conditions, crops, techniques, and plans vary so much between farms, even neighboring farms, that setting thresholds for farming as a whole would be neither possible nor useful. The same flooding conditions can be devastating for a farmer growing perennial crops but be a minor two-day nuisance for a farmer focusing on seasonal crops. Drainage conditions that render entire fields unusable for one farmer can be a benefit to a neighboring farm with a different soil type and different topography (ESA, 2016a).
Instead, this memorandum uses the concept of risks to agricultural viability to identify potential impacts from the Clear Creek Floodplain Reconnection Project. Farmers in the Clear Creek area have explained that farmers constantly deal with risks, including weather, flooding and drainage problems, and market conditions. In any given year, some crops are successful and others are not. Farmers individually determine what an acceptable level of risk is and adjust their farming practices accordingly (ESA, 2016a). The Clear Creek Floodplain Reconnection Project would increase some risks to agricultural viability and would decrease other risks.

6.0 Potential Farmland Impacts

This section is divided into 17 questions related to potential effects of the Clear Creek Floodplain Reconnection Project on agriculture in the Clear Creek area. The questions have been raised by farmers and residents in the Clear Creek area or have arisen in ESA’s research for the Farming in the Floodplain Project. For each question, the concern and potential impacts are described. Where applicable, considerations for the master planning process are described for each question.

Questions 6.1 through 6.4 address flood risk. Flood risk in the Clear Creek area is complex; farms face flood risk from several different directions. More information on flood risk is included in the Existing Flood Risk Conditions for Agriculture in the Clear Creek Area Technical Memorandum (Flood Risk Memorandum). Sections 6.1 through 6.4 of this memorandum address the following flood risks to farms:

- The risk of Puyallup River floodwaters entering the Clear Creek area at the outlet of Clear Creek (Section 6.1)
- The risk of River Road Levee overtopping (Section 6.2)
- The risk of Puyallup River flows increasing in the future (Section 6.3)
- The risk of Clear Creek flows increasing in the future (Section 6.4)

6.1 How would the new ring levee affect flood risk to agricultural properties from Puyallup River floodwaters entering the Clear Creek area at the outlet of Clear Creek?

Existing Conditions and Trends

Currently, the tide gates at the Clear Creek outlet protect the Clear Creek area properties from Puyallup River flood flows. Modeling conducted by NHC for the Clear Creek Floodplain Reconnection Project included a variety of scenarios for the outlet of Clear Creek into the Puyallup River. The modeling results allow comparison of existing conditions to conditions with two open culverts (i.e., removal of the tide gates) (NHC, 2016). Model results indicate that removal of the tide gates would:

- Increase the 10-year flood stage from approximately 16.9 feet to approximately 18.6 feet (1.7-foot increase);
- Increase the 50-year flood stage from 19 feet to approximately 20 feet; and
- Increase the 100-year flood stage from approximately 20.1 feet to approximately 20.4 feet (NHC, 2016).

NHC is currently updating this modeling, and flood stages could change by several inches. Generally, however, these results indicate that the tide gates, when operating properly, protect agricultural properties (particularly those at elevations between 17 and 21 feet) from more frequent flood inundation.

Pierce County SWM’s understanding, based on information reported by Clear Creek area residents, is that one or both tide gates were not functioning properly during the 2009 flood event and that Puyallup River floodwaters were able to enter the Clear Creek area. While this cannot be confirmed, aerial photographs of the Clear Creek area show that floodwaters were brown, suggesting that they included water from the Puyallup River. By comparison, floodwaters from the 2015 flood were clear (Hunger and Schmidt, 2017).

**Considerations for the Clear Creek Floodplain Reconnection Project**

The proposed Clear Creek Floodplain Reconnection Project would remove the tide gates and construct a ring levee to protect agricultural and other properties from Puyallup River flood flows entering the area at the outlet of Clear Creek. Levees are designed to withstand specific flows, forces, and events and provide different levels of flood protection depending on the design criteria. The design criteria for the ring levee would likely account for how the levee would function under changing climate conditions such as increased precipitation and altered streamflows. The design criteria would also minimize the possibility of structural failures over time, though structural failures would be a possibility, especially if proper maintenance was not done. Also, agricultural land on the dry side of a levee is still at risk of flooding from other means (e.g., inadequate site drainage during a heavy storm event), so a ring levee would not guarantee that the remaining farmland would be unaffected by storm events in the future.

While residual flood risk would remain with the proposed ring levee, the levee would provide more reliable flood protection to the areas on the dry side of the levee than the existing tide gates. Therefore, the proposed project would increase the reliability of protection from Puyallup River floodwaters entering the area at the outlet of Clear Creek.

**Summary of Potential Impacts to Agriculture:** Construction of the Clear Creek levee would increase the reliability of protection for the dry side of the levee from Puyallup River floodwaters entering the area at the outlet of Clear Creek.

**Considerations for the Master Planning Process:**

- The level of flood protection provided by the new levee depends on several components of the levee design, including, but not limited to, the levee alignment, the flow recurrence the levee is designed to (i.e., whether the levee designed for a 100-year flood or a 500-year flood), whether climate change is factored into the design, and the amount of freeboard provided.
• Updated hydrologic and hydraulic modeling would provide more detailed information on the benefits the proposed levee could provide to farmland in the Clear Creek area. Unlike the modeling already conducted by NHC, the modeling would need to focus on conditions on the dry side of the levee.

6.2 How would the proposed ring levee affect flood risk to farms if River Road Levee overtops or breaches?

Existing Conditions and Trends

As described in the Flood Risk Memorandum, River Road Levee does not provide adequate freeboard for a 100-year flood event and has been de-accredited by FEMA for this reason. There is no available information on the probability of River Road Levee overtopping. No analysis of whether River Road Levee would meet other accreditation standards (such as stability analyses or settlement analyses) has been conducted at this time (ESA, 2017b). A process is in place through the Corps of Engineers General Investigation to evaluate options to increase freeboard on the levee and reduce the risk of levee overtopping.

The Flood Risk Memorandum concludes that the potential for River Road Levee to overtop or breach represents the biggest flood-related threat to farms in the Clear Creek area. Overtopping of the levee could significantly affect farms (as well as human health and safety) in the Clear Creek area. Homes, barns, fields, and equipment throughout the Clear Creek area could be inundated. People in the area could be physically at risk and Pierce County would be required to implement its evacuation protocol based on flood forecasts. Livestock would also be threatened by an overtopping flood event (ESA, 2017b).

Considerations for the Clear Creek Floodplain Reconnection Project

As noted above, there is a Corps of Engineers General Investigation process currently underway to address the freeboard issues on River Road Levee. However, General Investigation processes tend to be lengthy and it is possible the proposed ring levee could be constructed before the freeboard problem on River Road Levee is solved. This question examines the potential risks to the agricultural area if the proposed ring levee is constructed prior to solving the River Road Levee freeboard problem.

If the proposed Clear Creek ring levee were constructed and River Road Levee were to overtop or breach, the land between the two levees could potentially be substantially damaged because floodwaters from the Puyallup River would be impounded between the two levees. Under existing conditions, if River Road Levee were to overtop, the floodwaters would flow across farmlands while draining to Clear Creek. If the Clear Creek ring levee were in place, it would slow the floodwaters from draining into Clear Creek, so the land would be inundated by higher water and for a longer period of time, thus increasing the amount of damage in the area. In this scenario, Puyallup River waters would be high enough to close the Clear Creek tide gates and Clear Creek would back up, flooding lower-lying portions of the Clear Creek area. This could limit the ability of floodwaters overtopping River Road Levee to drain to lower elevations.
regardless of whether a Clear Creek ring levee was in place or not. Additional analysis and modeling of overtopping scenarios for River Road Levee would help clarify this issue.

If flood projections suggest that River Road Levee could overtop, Pierce County would implement its evacuation protocol for the area (as was done in 2006 and 2009). The presence of the Clear Creek levee would not alter the triggers for an evacuation. Therefore, construction of the Clear Creek levee would not increase the threat to human safety from an overtopping event. However, the higher water levels and increased length of inundation could increase the threat to livestock, farm infrastructure, and soils.

High velocity floodwaters that could result from a breach or overtopping of River Road Levee could cause substantial scour in the area, which could have detrimental effects such as damaging transportation routes and removing topsoil. For agricultural fields, impacts caused by floodwaters coming from a breach or the overtopping of River Road Levee would be partially dependent on how recently the soil was tilled and what crop was providing land cover (Morton and Olson, 2014). If River Road levee were to fail with the proposed ring levee in place, these impacts (which are a risk regardless of whether a ring levee is built or not) would be focused on the agricultural land between the two levees. With less area in which the Puyallup River floodwaters could spread, the agricultural land protected by the two levee systems could experience a higher degree of detrimental impacts such as land scour, sediment deposition, and topsoil removal.

**Summary of Potential Impacts to Agriculture:** The Clear Creek Floodplain Reconnection Project is not intended to address the biggest flood risk to agricultural properties in the Clear Creek area. That is being addressed through a separate Corps of Engineers process. Constructing the Clear Creek levee before adequate freeboard is provided on River Road Levee would likely increase the level of risk to agricultural structures (like barns and farmhouses), equipment, livestock, and soil if River Road Levee is overtopped.

**Considerations for the Master Planning Process:**

- The timeline of the Corps of Engineers General Investigation needs to be considered as part of the Clear Creek master planning process.
- Pierce County SWM and Clear Creek residents should continue to be involved in the General Investigation process and encourage the Corps of Engineers to address the River Road Levee problems.
- If the ring levee is constructed before the River Road Levee problems are addressed, design of flood gates in the ring levee should consider performance standards to reduce the amount of time floodwaters are impounded between the levees.
6.3 How would the proposed ring levee affect flood risk if Puyallup River flows increase in the future?

Existing Conditions and Trends

Past flood events are not always reliable predictors of future events. Several factors could increase flood risks to the Clear Creek area in the future. These include events that would increase flows and flood levels in the Puyallup River such as climate change, changed operation of Mud Mountain Dam, and increased sediment aggradation in the Puyallup River. These events would increase water levels in the Puyallup River and likely keep them higher for longer. This would increase flooding in the Clear Creek area by backwatering Clear Creek for longer periods of time.

As described in the Flood Risk Memorandum, climate change could make inundation of farmland in the Clear Creek area more likely in the future as heavy precipitation events become more intense (ESA, 2017b). Sea level rise could also increase water levels on the Lower Puyallup River which could increase the duration of backwater flooding in the Clear Creek area. Additional information on potential risks from climate change is included in Section 6.15.

As described in the Sediment Conditions in the Puyallup River and Clear Creek Technical Memorandum, aggradation (deposition of sediment) in the Puyallup River channel has raised the river bed and reduced the channel capacity for floodwaters, which can raise flood levels (ESA, 2016b). The Flood Risk Memorandum describes how aggradation in the channel of the White River has caused the Corps of Engineers to release floodwaters held behind Mud Mountain Dam more slowly, causing the Lower Puyallup River to be at elevated levels for longer, in turn delaying water from draining through the Clear Creek tide gates (ESA, 2017b).

Considerations for the Clear Creek Floodplain Reconnection Project

All of the factors discussed above (modified operation of Mud Mountain Dam, projected climate change, and aggradation) could increase the duration and elevation of backwater flooding in the Clear Creek area, even if the tide gates are functioning properly. However, if the Clear Creek Floodplain Reconnection Project were constructed, the new ring levee would provide an extra level of protection from these risks. Backwater flooding would be contained on the wet side of the proposed ring levee.

Summary of Potential Impacts to Agriculture: Increased Puyallup River water levels in the future could increase flood risk to agriculture in the Clear Creek area. The proposed ring levee could help reduce these risks to the dry side of the ring levee.

Considerations for the Master Planning Process:

- In order to provide flood protection, the proposed ring levee would need to meet design standards for flood protection as described in Section 6.1.
• Climate change information tailored to the Clear Creek area would provide more information on the benefits of the proposed levee. More detail on what climate change information is needed is provided in Section 6.15.

• Information about future operation of Mud Mountain Dam, which considers current and projected future levels of aggradation in the channel downstream of the dam and future changes in peak flow, would provide more information on the benefits of the proposed levee.

6.4 How would the proposed ring levee affect flood risk if Clear Creek flows increase in the future?

Existing Conditions and Trends

Under current conditions, when water levels on the Puyallup River are high (such as during a flood event), the tide gates close and water from Clear Creek and its tributaries backwater, inundating the lower lying portions of the Clear Creek area. When the tide gates on Clear Creek have functioned properly to keep Puyallup River floodwaters out of the Clear Creek area, farm function in the Clear Creek area has not been affected by flooding in recent memory. Therefore, under current hydrologic conditions, farms in the Clear Creek area do not require additional protection from Clear Creek backwater flooding. However, past flood events are not always a predictor of future events.

Even without climate change, larger storm and flood events are possible. For example, the catastrophic flooding in the Chehalis River basin in December 2007 was from a flood event estimated to be a 500- to 800-year flood. And, as described in the Flood Risk Memorandum, climate change could make inundation of farmland in the Clear Creek area more likely in the future as heavy precipitation events become more intense (ESA, 2017b). Additional information on climate change is available in Section 6.15.

In the future, with larger flood events and/or climate change, more water would flow through Clear Creek and its tributaries, increasing the amount of water that would backwater and raising the elevation of floodwaters in the Clear Creek area. Without detailed climate change projections for Clear Creek and its tributaries, it is impossible to say whether increased backwater flooding would heavily inundate Clear Creek farms. However, it is a legitimate risk to farms in the area in the future that should be considered.

Considerations for the Clear Creek Floodplain Reconnection Project

Higher flows in Clear Creek would increase flooding of the Clear Creek area both directly from flows overflowing Clear Creek and by slowing agricultural drainage. With the proposed Clear Creek Floodplain Reconnection Project, farms on the dry side of the levee would be protected from these flows by the proposed levee. Localized flooding where tributaries cross the levee could also be a concern and is discussed below in Section 6.5.
In the scenarios described above for high flows on Clear Creek (an extreme flood event or larger flood events due to climate change), flows on the Puyallup River would likely also be very high. This would prolong backwater flooding in the Clear Creek area and would increase the potential for River Road Levee to overtop. Potential impacts to farms from River Road Levee overtopping if the proposed ring levee were constructed before freeboard issues on River Road Levee are addressed are discussed above in Section 6.2. The proposed ring levee is unlikely to provide protection to the Clear Creek area in the event of increased future flooding on Clear Creek unless the issues with River Road Levee are also addressed.

**Summary of Potential Impacts to Agriculture:** Increased flood flows in the future could increase flooding of the Clear Creek area from Clear Creek. The proposed ring levee could help reduce this risk.

**Considerations for the Master Planning Process:**

- In order to provide flood protection from Clear Creek, the proposed ring levee would need to be designed to appropriate flood standards as described in Section 6.1. The design would need to include an outlet that would promote drainage of Clear Creek.

- Climate change information tailored to the Clear Creek area would provide more information on the benefits of the proposed levee. More detail on the climate change information needed is provided in Section 6.15.

6.5 **Would flooding occur on the dry side of the levee where streams cross the levee?**

**Existing Conditions and Trends**

The Clear Creek area generally slopes downhill from the Puyallup River and River Road Levee to Clear Creek. Therefore, floodwaters in the area drain to Clear Creek. While there are some localized impediments to drainage of floodwaters, currently there are no major barriers to floodwaters draining into Clear Creek as flooding subsides.

**Considerations for the Clear Creek Floodplain Reconnection Project**

In a report released in March 2015, NHC summarized modeling conducted to determine how the stage and duration of flooding in the Clear Creek area would be impacted in the event the tide gates were removed and a ring levee were constructed. These findings are summarized in the *Clear Creek Floodplain Reconnection Hydrologic and Hydraulic Modeling Final Report* (NHC, 2015). Regardless of where it was constructed, the levee would need to allow for stream crossings for the four creeks that flow into Clear Creek. NHC modeled the potential for inundation on the dry side of the new ring levee at the stream crossings during a 100-year flood event if the levee were constructed at the 18-foot contour.

The NHC report found that there would be inundation on the dry side of the levee at the Clear Creek and Canyon Creek stream crossings during a 100-year flood. The inundation at the
crossing of Clear Creek would not affect farmland, though it could affect the Clear Creek hatchery. Inundation upstream of the crossing of Canyon Creek would inundate agricultural lands on the south side of 52nd Street.

Figure 3, adapted from NHC’s report, shows the potential inundation at the Canyon Creek stream crossing.

**Figure 3. Potential Inundation at Canyon Creek Stream Crossing**

**Summary of Potential Impacts to Agriculture:** During a 100-year flood, there could be inundation of agricultural lands on the dry side of the levee where streams cross the levee.

**Considerations for the Master Planning Process:**

- Design of the ring levee could include measures to minimize or eliminate flooding at stream crossings, including constructing ponds or forebays where water from the streams could pond before flowing through the levee. Pumps could also be installed at stream crossings to reduce the time that streams would pond at the confluences.

- Modeling similar to that conducted by NHC for the 18-foot contour levee alignment should be conducted for any levee alignments considered during the master planning process. This modeling should incorporate climate change projections to account for projected increased flows from Clear Creek and its tributaries.
6.6 Would the proposed ring levee change the designation of the Clear Creek area as floodway?

**Existing Conditions and Trends**

The Clear Creek area is currently regulated as a floodway by Pierce County because River Road Levee has been de-accredited by FEMA. While the floodway designation makes it difficult to build farm infrastructure, it follows best practices for resilient floodplain management by keeping new infrastructure and people out of high risk floodplain areas.

The lack of freeboard on River Road Levee is likely to be addressed in the future by the Corps of Engineers in a separate project. As described in the [Flood Risk Memorandum](#), some portions of the Clear Creek area would be regulated as a floodway based on the deep and/or fast flowing water criterion regardless of the accreditation of River Road Levee because flood depths in those areas would be greater than 3 feet (Pierce County, 2016a). Because the Clear Creek area was not included in FEMA’s recently updated maps, the most recent flood data for the Clear Creek area are from the 1987 Flood Insurance Study. This study showed a base flood elevation in the Clear Creek area of 17.6 feet. Based on this information, areas at an elevation of 14.6 feet or lower would have flood depths of 3 feet or greater.

If River Road Levee were to become reaccredited, FEMA would presumably remap the Clear Creek area with newer data, establish a new base flood elevation, and update floodway mapping.

**Considerations for the Clear Creek Floodplain Reconnection Project**

Because the floodway designation is based on deficiencies of River Road Levee, constructing the Clear Creek ring levee would not directly affect the floodway designation.

If lack of freeboard on River Road Levee was addressed in the future, areas with flood depths greater than 3 feet would still be regulated as floodway. In the Clear Creek area, this would include areas at an elevation of 14.6 feet or lower. Little agriculture occurs below this elevation in the Clear Creek area, and the majority of these areas would likely be within the footprint of the proposed Clear Creek Floodplain Reconnection Project. Therefore, construction of the proposed ring levee is unlikely to change the floodway designation for any agricultural lands in the Clear Creek area even if River Road Levee becomes reaccredited in the future.

**Summary of Potential Impacts to Agriculture:** Construction of the Clear Creek Floodplain Reconnection Project would not change the floodway designation for agricultural lands in the Clear Creek area.

**Considerations for the Master Planning Process:** This concern does not require major consideration during the master planning process.
6.7 Would modification of the tide gates and/or construction of a levee alter groundwater-surface water interactions in the Clear Creek area? Would those changes affect agriculture?

**Existing Conditions and Trends**

Groundwater in the Clear Creek area is important to agricultural viability because it can affect both water supply and drainage. Some farmers in the Clear Creek area rely on groundwater for irrigation. Information on groundwater and on groundwater-surface water interaction in the Clear Creek area is limited.

**Considerations for the Clear Creek Floodplain Reconnection Project**

Any actions that would alter the surface water flow, such as removing tide gates or building a levee, could alter groundwater-surface water interactions and could cause changes to the groundwater table. The most likely effect on groundwater levels is that a levee could block groundwater flow if the flow direction is toward the levee. This could result in higher groundwater levels, especially in the area near the levee. Any factor that raises the already-shallow groundwater levels could further impede agricultural drainage and increase the frequency of groundwater ponding on the ground surface in some areas (ESA, 2016a). The higher groundwater levels near the levee could increase soil saturation and ponding on the dry side of the levee. Sea level rise associated with climate change could also raise groundwater levels in the Clear Creek area, further impeding agricultural drainage. The potential for saltwater intrusion into groundwater with sea level rise should also be considered.

Because information on groundwater in the Clear Creek area is limited, it is not clear at this time how the proposed Clear Creek Floodplain Reconnection Project might affect groundwater.

**Summary of Potential Impacts to Agriculture:** The proposed project could affect groundwater levels in the area and increase drainage problems on the dry side of the levee.

**Considerations for the Master Planning Process:**

- Several levee design options could minimize impacts to groundwater, including:
  - Locating the levee to minimize groundwater ponding by considering local topography
  - Positioning drainage ditches to intercept groundwater flow that may be blocked by the levee
- Additional studies would help to understand and minimize the impacts to groundwater:
  - An evaluation of hydrogeologic properties (hydraulic conductivity, flow direction, etc.) in the Clear Creek area to establish baseline conditions
Determination of the current interaction of Clear Creek surface water and groundwater throughout the year

An analysis of the impact of sea level rise on groundwater levels in the Clear Creek area

6.8 Would the new levee affect drainage from the Clear Creek agricultural area?

Existing Conditions and Trends

The Existing Conditions Report identified poor drainage as the biggest current risk to agricultural viability in the Clear Creek area (ESA, 2016a). The Drainage Inventory Memorandum identified a number of conditions that impede agricultural drainage, including deferred maintenance, noxious vegetation in ditches, accumulated sediment, and undersized culverts (ESA, 2017a).

The Drainage Inventory Memorandum also identified reliance on Clear Creek for drainage as a major constraint on the drainage system. Currently, all agricultural drainage from the Clear Creek area flows into Clear Creek before eventually draining to the Puyallup River. Relying on Clear Creek, a natural waterway, to drain agricultural fields creates several problems for agriculture in the Clear Creek area.

Considerations for the Clear Creek Floodplain Reconnection Project

The proposed Clear Creek Floodplain Reconnection Project could increase agricultural drainage problems by routing agricultural drainage through a levee and into a habitat project. How agricultural ditches could drain through the levee is a matter of project design (see Section 6.5). For example, pumps could be installed to pump water from agricultural ditches through the levee. If the pumps were properly maintained, agricultural drainage through the levee could be ensured. However, the habitat area and channels on the wet side of the levee would not be maintained for drainage. The Sediment Memorandum identified the potential for the wet side of the levee to become a depositional area for sediment from the Puyallup River (ESA, 2016b). The effect of increased deposition in the habitat area on drainage from the agricultural area is uncertain. Depending on how much sediment is deposited in the habitat area and how channels are formed in the area by tidal water fluctuations, drainage from the dry side of the levee could be impeded. More information is needed on how sediment dynamics and channel forming processes could affect the habitat area and drainage on the wet side of the levee.

If construction of the levee slows the rate of agricultural drainage, it could affect sediment deposition in the ditches. If sediment deposition increased aggradation in the ditches, the capacity of the ditches to move runoff would be reduced. Slowing agricultural drainage could also impact culverts, many of which appear to be undersized under current conditions (ESA, 2017a).

The Drainage Inventory Memorandum recommends separating the agricultural drainage system from the stream system. If the agricultural drainage system in the Clear Creek area had a separate outlet to the Puyallup River, with fish screens installed, it would be easier to permit maintenance
activities because most if not all of the ditches would likely be considered non-fish-bearing. Drainage District 10 and individual farmers would have more control over the drainage system. A new drainage system would have less flows since flows from the Clear Creek tributaries would continue to drain to Clear Creek and not the new system. A separate drainage system would reduce the impacts of the Clear Creek Floodplain Reconnection Project on agricultural drainage, and would improve agricultural drainage in the area above current conditions. A separate drainage system would also benefit the habitat project. Removing agricultural drainage from Clear Creek would reduce sediment and other pollutants entering the habitat area. Separating the drainage system from Clear Creek would also allow options for restoring the stream to more natural conditions. This action would be difficult to permit and would likely trigger water quality concerns.

**Summary of Potential Impacts to Agriculture:** Requiring the agricultural drainage system to flow through the Clear Creek levee and the habitat area on the wet side of the levee would likely exacerbate the largest current constraint to agricultural drainage in the Clear Creek area and would be a major impact to agricultural drainage. Incorporating a large-scale change to agricultural drainage system to improve drainage could eliminate or substantially reduce this potential impact. For example, creating a separate outlet to the Puyallup River for the agricultural drainage system could improve agricultural drainage over current conditions and improve habitat conditions in the stream.

**Considerations for the Master Planning Process:**

- Several issues related to agricultural drainage need to be considered in the master planning process, including:
  - How water would be drained through the levee, and whether pumps would be needed, should be determined during project design.
  - Ownership and maintenance responsibilities for any infrastructure (such as pumps) associated with draining agricultural ditches through the levee need to be determined.
  - The possibility of rerouting the agricultural drainage system so it would drain directly to the Puyallup River and not through the levee and habitat area should be considered as a potential component of the Clear Creek Floodplain Reconnection Project.
  - Modeling is needed to predict sediment dynamics on the wet side of the proposed levee. This should include a determination of how the combination of sediment deposition and fluctuating water levels on the wet side of the levee would affect agricultural drainage from the dry side of the levee.
6.9 How much would the project reduce farm acreage?

**Existing Conditions and Trends**

Many of the farms in the Clear Creek area are located above the 18-foot elevation, particularly the larger wholesale farms. However, about a half dozen smaller, sustainable, direct-market farms are located or partially located between the 14- and 18-foot elevations in the area.

**Considerations for the Clear Creek Floodplain Reconnection Project**

The Clear Creek Floodplain Reconnection Project would require substantial acreage for the habitat area and for the levee footprint. This land would no longer be available for agriculture or other uses (see Section 6.17 for a discussion of potential agricultural use of the wet side of the levee).

The amount of acreage required for the habitat area and for the levee footprint would depend on the levee design and alignment chosen. The portion of that acreage currently in use for agriculture would also depend on the design and alignment.

In order to provide examples of the amount of acreage the project could require, ESA used GIS to estimate the amount of acreage required for the two levee alignments originally presented by Pierce County. The original levee alignments were at approximately the 14-foot and 18-foot elevation contours.

For the purposes of the estimate, ESA made the following assumptions about the levee:

- The top of the levee would be at an elevation of 22 feet
- The top width of the levee would be 15 feet
- The slope of the dry side of the levee would be 5 to 1
- The slope of the wet side of the levee would be 3 to 1

Based on these assumptions, a levee at the 14-foot elevation would be 8 feet high and 79 feet wide. A levee built at this conceptual alignment (but tying into the River Road Levee and the BNSF Railway embankment where appropriate) would require approximately 25 acres for the levee footprint. The acreage of the wet side of the levee would be approximately 225 acres. A levee built at this alignment would cross through some parcels currently used for agriculture, and some agricultural parcels would be within the wet side of the levee.

Based on the assumptions above, a levee at the 18-foot elevation would be 4 feet high and 47 feet wide. A levee built at this conceptual alignment (but tying into existing levees where appropriate) would require approximately 11 acres for the levee footprint. The acreage of the wet side of the levee would be approximately 525 acres. This levee alignment would include many more acres of land currently in use as agriculture than a levee at the 14-foot elevation.

These estimates do not include the acreage that would be required for modifications to the system to ensure proper drainage, including new ditches following the levee alignment on the dry side, new storage areas, or infrastructure such as pumps to ensure drainage across the levee. It also
does not include any roads or paths constructed to provide maintenance access to the levee, which may be required. These needs should be considered in the master planning process.

**Summary of Potential Impacts to Agriculture:** The project could convert substantial acreage of land in the Clear Creek area. The amount of agricultural land converted to other uses would depend on the levee alignment chosen. Under any potential levee alignment, the project would likely require conversion of some agricultural lands to other uses. If conversion of agricultural land were minimized, other potential impacts to agricultural lands were avoided, and elements that improve key conditions for agriculture were included in the project design, the project could avoid loss of farm function.

**Considerations for the Master Planning Process:**

- This potential impact is entirely dependent on the levee alignment selected. Additional studies of impacts to agricultural lands should be undertaken as part of the master planning process when specific levee alignments are proposed.

**6.10 How would the levee affect the viability of Drainage District 10?**

**Existing Conditions and Trends**

Drainage District 10 is an agricultural drainage district in the Clear Creek area. It receives revenues from taxes assessed on properties in the District. Taxes are assessed on the benefit a property receives from the District and are not assessed on the property value. The commissioners of the Drainage District are authorized to construct, straighten, widen, deepen, and improve existing drains or ditches in the District, as well as dig or construct additional drains or ditches. Additionally, the District may divert, dam, or carry off the waters of any stream or water endangering or causing damage in the District (RCW 85.06.640). Because poor agricultural drainage is the biggest current threat to agricultural viability in the Clear Creek area, the viability of Drainage District 10 is critical to the viability of agriculture in the area.

Drainage District 10 faces a number of challenges in maintaining and improving agricultural drainage for the Clear Creek area. As described in the Drainage Inventory Memorandum, relying on Clear Creek for drainage is a concern because Clear Creek is a salmon-bearing stream with two wetland mitigation sites downstream of the agricultural areas, limiting maintenance activities that can be completed in the stream (ESA, 2017a). Drainage maintenance activities in Clear Creek are difficult to permit and have to be completed within a limited fish window. The boundary lines for Drainage District 10 do not include all areas that benefit from drainage maintenance activities within the District, and there are a number of issues with how areas responsible for paying assessments to the District are recorded. Drainage District 10 has recently reformed after being dormant for many years.
Considerations for the Clear Creek Floodplain Reconnection Project

The Clear Creek Floodplain Reconnection Project requires acquisition of a large portion of the land base of Drainage District 10 as described in Section 6.9. The exact portion would depend on the levee alignments selected.

Pierce County’s property acquisition in the Clear Creek area does not affect the tax base for Drainage District 10 because the county pays full assessments to Drainage District 10 for the property it owns (Redmond, 2017). However, each property purchased reduces the pool of landowners who can serve as commissioners of the District.

Because of the uncertainty of the long-term future of the Clear Creek area with the proposed Clear Creek Floodplain Reconnection Project, the District is currently having difficulty establishing support for assessing properties to fund drainage maintenance or development of a Drainage Management Plan. The uncertainty has impacted the ability of the District to tax its constituents.

The proposed project could include infrastructure designed to ensure agricultural drainage, such as pumps to improve ditch drainage through the levee. Ownership and maintenance responsibilities for the new infrastructure would need to be clarified. Drainage District 10 may not be able to assume ownership or maintenance responsibilities for this infrastructure.

Some landowners in the Clear Creek area are currently looking into the possibility of expanding the boundaries of Drainage District 10 in order to expand the District’s tax base and area of service. If this action moves forward, the new District boundaries should be considered in the master planning process.

The Floodplains for the Future Program, which includes the proposed Clear Creek Floodplain Reconnection Project, has provided support to Drainage District 10 through funding of the Drainage Inventory Memorandum (conducted by the Farming in the Floodplain Project) and by supply WCC field crews to remove reed canarygrass from Clear Creek.

Summary of Potential Impacts to Agriculture: Property acquisition reducing the pool of landowners who can serve as commissioners of Drainage District 10 and uncertainty around the long-term future of the Clear Creek area due to the proposed Floodplain Reconnection Project has impacted the viability of the District, and therefore has impacted maintenance of agricultural drainage in the area. The fact that the county pays assessments to Drainage District 10 for the property it owns within the District helps offset these impacts, but the uncertain future of the area continues to impact the District.

Considerations for the Master Planning Process:

- Considerations include:
  - Ownership and maintenance responsibilities for any drainage-related infrastructure installed as part of the proposed project would need to be clarified in advance.
o Whether drainage-related infrastructure, such as pumps, would be required as part of the proposed project.

o Whether the boundaries of Drainage District 10 will expand.

6.11 What are the impacts of vacant parcels adjacent to farms in the time between purchase of properties and construction of the project?

**Existing Conditions and Trends**

Criminal activity, trespass, and illegal dumping have been observed in the Clear Creek area, both on flood damaged and abandoned properties and on vacant properties owned by Pierce County. As described above, Pierce County has been implementing a policy to purchase frequently flooded property from willing sellers (Pierce County, 2013). In the Clear Creek area, Pierce County has purchased over 20 flood prone properties in the last two decades. Pierce County has removed homes and infrastructure from the purchased properties and the properties have been left vacant. Vacant land is often a target for criminal activity, trespass, and illegal dumping. These activities have been observed in the Clear Creek area on vacant lands owned by Pierce County.

**Considerations for the Clear Creek Floodplain Reconnection Project**

As part of the Clear Creek Floodplain Reconnection Project, Pierce County is currently acquiring more properties in the Clear Creek area with grant funding from several sources, including the Floodplains by Design program. As the amount of vacant land in the area increases, observed impacts (such as criminal activity, trespass, and illegal dumping) could increase as well.

Pierce County SWM is currently exploring the possibility of renting vacant parcels it owns near 47th Avenue in the Clear Creek area for agricultural production. Compacted soils on these parcels would need to be tilled and rehabilitated, and all infrastructure (including 47th Avenue) would need to be removed. It is unclear at this time whether it is possible to farm these parcels because they may be regulated as wetlands. However, if possible, conducting agriculture on otherwise vacant parcels owned by SWM in the interim period before the Clear Creek Floodplain Restoration Project is constructed would reduce the threat of trespass, crime, and illegal dumping.

Habitat projects can also be a target for trespass and dumping. For example, the Port of Tacoma Clear Creek Mitigation Site, located within the Clear Creek area, has been the location of homeless encampments. Locating a large habitat project adjacent to farms in the Clear Creek area could encourage trespass, which could reduce property values and create nuisances that could affect the farms. A plan should be in place to discourage trespass and dumping in the completed project.

**Summary of Potential Impacts to Agriculture:** Vacant parcels in the Clear Creek area that were acquired by SWM have been a target for criminal activity that has negatively affected farms and residences in the Clear Creek area. This activity will likely continue as long as the properties
are vacant. Opportunities to utilize those lands in the interim period before the Clear Creek Floodplain Restoration Project was constructed should be explored. A plan to discourage trespass in the completed project should be developed.

Considerations for the Master Planning Process:

- Elements that discourage trespass, criminal activity, and dumping should be included in the project design.

6.12 Would the new levee cause the loss of the Riverside Fire District?

Existing Conditions and Trends

Fire service for the Clear Creek area is provided by the Riverside Fire District. The Fire District extends from the city limits of Puyallup to the city limits of Tacoma, and from the Puyallup River to Pioneer Way. The Fire District also provides fire protection to the Chief Leschi Schools. It is funded by the Riverside Fire and Rescue tax district and by the Puyallup Tribal Nation. Most of the staff are volunteers.

In December 2012, the Fire District stopped providing services and instead contracted with Central Pierce Fire & Rescue. A notice letter to the District’s constituents stated that the District was contracting out services due to “the economy, flooding problems, flood management future plans, lack of advanced life support services ‘paramedics’, reduced revenue, and increasing costs” (Riverside Fire District, 2012). The notice stated that revenue was reduced because of a reduction in the assessed value of properties within the District. The notice letter also stated that Pierce County’s proposed floodplain reconnection project would further reduce the assessed value of the fire district. In February 2014, the Riverside Fire District terminated its interlocal agreement with Central Pierce Fire & Rescue and resumed operation. The agreement was canceled because the community was unhappy with the service provided by Pierce Fire & Rescue (Hugo, 2017).

Considerations for the Clear Creek Floodplain Reconnection Project

Pierce County pays a contractual rate to the Fire District for the property it owns within the District. The rate is reviewed on an annual basis (Redmond, 2017). Therefore, the Clear Creek Floodplain Reconnection Project has not affected the revenue of the Fire District and is not anticipated to in the future. However, the uncertainty around the long-term future of the area could potentially cause the Fire District to suspend services in the future, as happened in 2012.

Summary of Potential Impacts to Agriculture: The Clear Creek Floodplain Reconnection Project would not affect the revenue of the Fire District, but uncertainty around the long-term future of the area could potentially cause the Fire District to suspend services in the future.

Considerations for the Master Planning Process:

- Options to maintain the viability of the Fire District should be explored.
6.13 How would combining a trail with the levee affect farms in the area?

Existing Conditions and Trends

Clear Creek area farmers presented information about their farms as part of a tour of the area on March 9, 2016. As part of that presentation, farmers presented a “Vision for the future of Clear Creek,” which included a trail system “that works with habitat, flood, and farm interests” (Clear Creek Farmers, 2016). At a Technical Advisory Group meeting, a Clear Creek area farmer stated that this idea represents an opportunity to connect the public with habitat and with local farms and to highlight Pierce County as an agricultural district in Washington (ESA, 2016a).

Considerations for the Clear Creek Floodplain Reconnection Project

Combining a trail with the Clear Creek Floodplain Reconnection Project would provide a recreational amenity for farmers and other residents in the Clear Creek area. It could help bring residents of Tacoma, Puyallup, and other areas to Clear Creek, increasing the visibility of farms in the area. The trail could allow for educational opportunities as well. For direct market farms, particularly those with a focus on agritourism or with a farm stand, a trail could increase business.

Other farmers in the area might feel that bringing trail users to the area could interfere with farm activities. A trail on flat land adjacent to the levee would take up additional land, some of which may currently be used for agriculture. Locating a trail atop the levee would require additional design and safety considerations for the levee and could require a wider levee. Additional land could also be required for parking, restrooms, and other trail facilities.

Summary of Potential Impacts to Agriculture: A trail connecting habitat areas with farms could help increase the viability of agriculture in the Clear Creek area, but the footprint of the trail and its facilities could take up additional agricultural land.

Considerations for the Master Planning Process:

- The idea of including a trail connecting habitat areas with farms should be considered as part of the master planning process.

- The idea of a trail through the Clear Creek area should be explored with Pierce County Parks and Recreation to determine its feasibility.

- A trail would need to meet trail design and safety standards.
6.14 Would the levee reduce agricultural viability in the Clear Creek area to the extent that agriculture in Pierce County as a whole is damaged?

Existing Conditions and Trends

Pierce County is home to almost 1,500 local farms that produce $91 million worth of products, including vegetables, livestock, poultry, eggs, flowers and bulbs, and aquaculture (Pierce County, 2016b). Farmland throughout the county has historically been converted into residential and other uses and that trend is continuing. Remaining agricultural lands are often adjacent to residential or commercial structures. The Puyallup Valley in particular has experienced a rapid increase in development. As of the writing of the 2006 Pierce County Agriculture Strategic Plan, 25 percent of agricultural land in the Puyallup Valley was located within incorporated areas or urban growth boundaries as of 2006 (Pierce County, 2006). In 2004, American Farmland Trust published a report titled: “The Suitability, Viability, Needs, and Economic Future of Pierce County Agriculture,” which found that agriculture in the county was shifting from industrial, wholesale agriculture to value-added, direct market “urban edge” farming. This shift was caused by the urbanization and fragmentation of the agricultural land base and was made possible by the favorable climate and soil in the county (American Farmland Trust, 2004). More recent reports suggest that the trends identified in the 2004 report have continued throughout the Puyallup River Valley (WSU et al., 2015).

As a Puyallup Valley lowland agricultural area not located within an urban growth area, the Clear Creek area is important for Pierce County agriculture as a whole. The Clear Creek area reflects the trend in Pierce County of a transition to smaller, local market-driven urban edge farming. The area also has several large wholesale farms that have been in the same family for generations. The area’s proximity to consumers and highly productive soils also are attracting new farmers to Pierce County, with new farmers starting farms or becoming owners of existing smaller farms.

The Strategic Conservation Partnership (SCP) is a collaborative group working to increase the pace and durability of agricultural conservation in Pierce County. SCP members include the Pierce County Agricultural Program, PCC Farmland Trust, Forterra, and the Pierce Conservation District. To help guide their work, SCP members funded a GIS-based prioritization of farmlands in Pierce County. Factors included in the prioritization included zoning and comprehensive plan designations; soil types and quality; parcel size; threat of conversion based on proximity to Urban Growth Areas; adjacency to other agricultural lands; and the presence of critical areas. The GIS prioritization identified many high-priority farms in the Clear Creek area. Maintaining agriculture in the Clear Creek area is important for meeting the SCP goal of conserving and increasing the farmland acreage base. Because many of the farmlands that are high priority for agricultural conservation are in the Clear Creek area, maintaining agriculture in the area is also critical for meeting the SCP’s 10-year voluntary conservation goal of 6,000 acres.
Considerations for the Clear Creek Floodplain Reconnection Project

As described throughout this memorandum, the Clear Creek Floodplain Reconnection Project could negatively impact agriculture in the Clear Creek area in a variety of ways, including direct loss of agricultural acreage. There are no benchmarks for determining whether loss of agricultural lands reaches a “tipping point” for the agricultural industry in a county or region. However, it is important to note that the Clear Creek area is unique for farmland in the county due to its proximity to urban areas and to I-5.

Summary of Potential Impacts to Agriculture: If agriculture in the Clear Creek area were lost, it would have an impact on agriculture in the county as a whole. Therefore, it is important that the Clear Creek Floodplain Reconnection Project be designed to minimize impacts to agriculture.

Considerations for the Master Planning Process:

- Designs that minimize impacts to farmland would help maintain agricultural viability in Pierce County as well as in the Clear Creek area.

6.15 How would the new levee and removal of the tide gates interact with climate change?

Climate change will affect the physical conditions that impact agricultural viability in the Clear Creek area, including hydrology, water supply, groundwater, sediment, and sea level rise. Regional climate change projections can suggest a range of potential impacts (there is no climate information specific to the Clear Creek area), which makes it challenging to identify impacts and to incorporate climate change into design of the Clear Creek Floodplain Reconnection Project.

Hydrology and Flood Risk

Existing Trends and Projections

Hydrology in the Puyallup River Watershed and in the Clear Creek Subbasin is expected to change as snowpack is reduced and precipitation patterns shift. The depth of snowpack on April 1 (the approximate current timing of peak annual snowpack in Northwest mountains) in the Puyallup River Watershed is projected to decline between 52 and 58 percent by the 2050s. Winter streamflows in the Puyallup River are projected to increase by 27 to 34 percent by the 2050s (CIG, 2015a).

Flood risk is projected to increase in the Puyallup River watershed and across Puget Sound. Peak river flows are projected to increase between 18 and 55 percent by the 2080s, and heavy rainfall events will become heavier (CIG, 2015b). The volume of the 10-year flood in the Puyallup River is projected to increase by 12 to 85 percent by the 2080s (CIG, 2016). Increased flooding would increase the cost of flood protection and stormwater management. Highways and other roads adjacent to rivers would flood more frequently. Existing flood control infrastructure, such as levees and tide gates, would likely be less effective as more frequent and larger floods exceed the
events the infrastructure was designed for (CIG, 2015b). Flood risk on Clear Creek and its tributaries can also be expected to increase with climate change.

Considerations for the Clear Creek Floodplain Reconnection Project

Increasing flood risk with climate change increases the importance of projects that would make the flood system in the Clear Creek area more resilient, such as the Clear Creek Floodplain Reconnection Project and addressing deficiencies in River Road Levee. Increased winter flows will also affect drainage in the Clear Creek area. Pursuing improvements to the agricultural drainage system as part of the Clear Creek Floodplain Reconnection Project could help offset these impacts. Conversely, if the project were constructed in a way that negatively impacted agricultural drainage, climate change could magnify those negative impacts in the future.

Surface and Groundwater Supply

Existing Trends and Projections

While winter streamflows are expected to increase, summer streamflows would decrease. Summer streamflows in the Puyallup River are projected to decrease by 18 to 20 percent by the 2050s (CIG, 2015a). Most agriculture in the Clear Creek area relies on groundwater for irrigation rather than the Puyallup River. Flows in the Clear Creek area are also likely to decrease in the summer, which could potentially affect groundwater. Changes in sea level and hydrology would also impact groundwater in the Clear Creek area. As described in Section 5.4, the information about groundwater in the Clear Creek area is currently limited and more information is needed to characterize these potential changes. More information about how changes in summer streamflows could affect water supply in the Clear Creek area would help farmers develop strategies to protect agricultural viability in the long-run.

Considerations for the Clear Creek Floodplain Reconnection Project

The Clear Creek Floodplain Reconnection Project is not anticipated to affect surface water supply in the Clear Creek area, but could affect groundwater supply. More information on existing groundwater conditions is required to understand this potential impact. Studies of groundwater should include climate change projections.

Sediment

Existing Trends and Projections

Erosion and the transport of sediment from the upper Puyallup River Watershed are both expected to increase in the future as heavy rainfall causes increased erosion and sediment transport and as higher streamflows and larger floods transport more sediment downstream. Changes in hydrology are also expected to change erosion rates and sediment in Clear Creek and its tributaries. Increased sediment in the Puyallup River and in Clear Creek and its tributaries could cause additional channel aggradation. Aggradation of the Puyallup River could increase flood risk in the Clear Creek area and could raise groundwater levels because the carrying capacity of the river would be reduced. Aggradation of Clear Creek could reduce drainage capacity.
Considerations for the Clear Creek Floodplain Reconnection Project

Any analysis of how the proposed Clear Creek Floodplain Reconnection Project would affect agricultural drainage should also consider the fact that sediment levels in the drainage system could increase with climate change.

Sea Level Rise

Existing Trends and Projections

Sea level is projected to rise an additional 14 to 54 inches in the Puget Sound region by 2100 (compared to 2000), although changes at specific locations will vary (CIG, 2015b). Sea level rise and reduced summer flows are projected to increase the risk of saltwater intrusion into groundwater, especially if groundwater extraction increases (CIG, 2015b). Sea level rise could slow the drainage of agricultural lands across Puget Sound.

Currently, the saltwater wedge in the Puyallup River is downstream from the mouth of Clear Creek. Sea level rise could cause the saltwater wedge to extend farther up the Puyallup River, potentially reaching the Clear Creek area. Sea level rise could also cause saltwater intrusion into groundwater in the area, affecting groundwater quality. Sea level rise could also increase the surface elevations of the Puyallup River adjacent to the Clear Creek area.

Considerations for the Clear Creek Floodplain Reconnection Project

Understanding sea level rise is key to identifying the impacts of the proposed Clear Creek Floodplain Reconnection Project on groundwater, drainage, and flood risk and needs to be considered in project design.

Summary of Potential Impacts to Agriculture: Climate change will have many and varied effects on physical conditions that contribute to agricultural viability in the Clear Creek area, including flood risk, drainage, water supply, and groundwater. These conditions would also be affected by the Clear Creek Floodplain Reconnection Project. Existing climate change information for the Clear Creek area is based on regional datasets. No climate change information specific to the Clear Creek area has been developed. This information needs to be developed in order to better understand the impacts to agriculture of the proposed project, as well as habitat needs and future flood risk conditions in the area.

Considerations for the Master Planning Process:

- Climate change projections and modeling need to be considered in the design of the proposed project. This should include:
  - Dynamic downscaling of predicted precipitation patterns to provide a more accurate forecast of heavy rainfall statistics than provided by the statistical downscaling methods used for the Puyallup River watershed.
  - Translating precipitation projections into streamflow levels.
  - Developing a flood projection model for the Puyallup River watershed and the Clear Creek area.
o Analyzing the implications of projected sediment transport increases from the tributaries of Clear Creek.

o Analyzing water availability in the summer during low flows under climate change scenarios.

o Analyzing the impact of sea level rise on groundwater including salinity impacts in the Clear Creek area.

o Analyzing sediment loading on the Puyallup River to project changes in the depositional and erosional environment in the Puyallup River near Clear Creek.

6.16 How will other proposed projects in the Clear Creek area combine with the Clear Creek Floodplain Reconnection Project to affect farms?

Other current and future projects in the Clear Creek area have the potential to impact agriculture and create cumulative impacts with the Clear Creek Floodplain Reconnection Project. This section addresses two known transportation projects proposed in the area: the extension of Canyon Road and the expansion of the BNSF Railroad line. Other future projects may also affect agricultural viability.

Existing Conditions and Trends

Pierce County Roads plans to extend Canyon Road from Pioneer Way to 52nd Street and to build a new bridge over Clarks Creek and the Puyallup River. This would require construction of a four to five lane road that would cross agricultural fields in the Clear Creek area south of Chief Leschi Schools. Construction is scheduled for 2020 to 2022, depending on funding (Pierce County, 2017). The project would reduce the amount of agricultural land in the area and could bisect agricultural fields creating access problems.

The BNSF Railway has indicated that it plans to expand its rail line through the Clear Creek area to the north, near where Clear Creek is located. Little is known about BNSF’s plans at this time. Any impacts to Clear Creek would need to be mitigated, which could provide an opportunity to fund a realignment of the creek that could provide better habitat and drainage. However, expanding the railway line and potentially realigning Clear Creek could require use of land that is currently in agriculture. This potential action by BNSF needs to be tracked closely moving forward.

Considerations for the Clear Creek Floodplain Reconnection Project

Impacts to agricultural lands from the Clear Creek Floodplain Reconnection Project need to be considered in context of the adjacent loss of agricultural land to the Canyon Road extension and the potential loss of agricultural land to the BNSF Railway.

Summary of Potential Impacts to Agriculture: Upcoming transportation projects would have a negative impact on farming in the Clear Creek area unless adequately mitigated. Any impacts to
agriculture from the Clear Creek Floodplain Reconnection Project need to be considered cumulatively with impacts from transportation projects.

Considerations for the Master Planning Process:

- The master planning process should track these projects and consider the cumulative impacts.

6.17 Would it be possible to conduct agriculture on the wet side of the levee?

Pierce County has suggested that, depending on the levee alignment, it may be possible to farm on the wet side of the levee. For example, if the levee were constructed at the 18-foot contour, lands between elevations of about 15 to 18 feet NAVD could potentially be farmed (though it is not clear at this time whether these areas would be frequently inundated). This presents an opportunity to preserve farmland or potentially to increase the acreage of farmland in the Clear Creek area. It is unclear at this point exactly what conditions would be on the wet side of the levee with the tide gates removed and a levee constructed. If more information is developed, it may be possible to determine that agriculture would be feasible on the wet side of the levee. However, with current information, there appear to be several challenges to agriculture on the wet side of the levee that suggest it would not be feasible. This section details those potential challenges. At the end of the section, a list of conditions that would make agriculture on the wet side of the levee feasible is presented.

This section refers only to potential farming on the wet side of the proposed levee. The discussion in this section does not apply to farming on the dry side of the proposed levee.

One of the purposes of the Clear Creek Floodplain Reconnection Project is to open the Clear Creek area to tidally-influenced inundation. Currently, the tide gates close once or twice daily, suggesting that tidally-influenced inundation would enter the Clear Creek area up to twice a day if the tide gates were removed. If the tide gates were removed now, the Clear Creek area would be inundated with freshwater because the saltwater wedge in the Puyallup River only extends to the I-5 crossing. However, with anticipated sea level rise, the saltwater wedge will likely move upstream, potentially reaching the outlet of Clear Creek. The combination of removal of the tide gates and sea level rise could potentially cause the Clear Creek area to be inundated with saltwater, which would cause agriculture in the inundated area to no longer be viable.

As described above in Section 6.8, the wet side of the levee would likely become a depositional area for sediment from the Puyallup River. In high water events, sediment could potentially be deposited on agricultural fields. More analysis of sediment dynamics on the wet side of the levee is needed to understand the extent of potential sediment deposition. Sediment deposition would likely affect agricultural drainage for farms on the wet side of the levee as channels are filled in with sediment and new channels are formed. Agricultural drainage would require maintenance, which would likely be incompatible with best stewardship practices for a habitat restoration area.
Farms on the wet side of the levee would be subject to more frequent inundation from tidally influenced water than under current conditions. NHC modeling shows that, with the tide gates removed and a levee at the 18-foot contour, the 10-year flood stage would reach an elevation of approximately 18.6 feet NAVD (NHC, 2016). This means that all agricultural lands on the wet side of the levee would be fully inundated by at least 0.5 foot of water approximately once every 10 years. This modeling analysis does not consider increased winter streamflows or sea level rise under climate change, which would likely increase the frequency that these lands would be inundated.

Many farmers rely on cover crops to increase soil fertility and to protect soil from erosion in winter months. Inundation on the wet side of the levee could threaten the viability of cover crops and could cause farmers to use chemical methods to maintain or enhance soil fertility and health. These chemicals are unlikely to be compatible with a habitat restoration area.

Because of the frequency of flood inundation on the wet side of the levee, it would be inadvisable to build farm infrastructure, including farm houses, or to store equipment on the farms. This could limit the area to being farmed by large-scale farmers who rent and own fields in various locations. Smaller-scale, direct market farmers who live on their farms would not be inclined to farm properties on the wet side of the levee. Farms currently operating in the Clear Creek area between the 14 and 18 foot contours are primarily smaller-scale farms, so they could be displaced by the Clear Creek Floodplain Reconnection Project even if areas on the wet side of the levee could be farmed.

Because storing equipment on the wet side of the levee would risk damage to the equipment, farmers would regularly need to transport equipment to and from farms on the wet side of the levee. Access to the wet side of the levee would likely be limited. The more access points that are included in the project design, the larger footprint of the project would need to be. Roads and other impervious surfaces on the wet side of the levee would likely be incompatible with a habitat restoration area.

Farming could not occur on the parcels on the wet side of the levee and in the construction zone during the multi-year construction period of the project. Farming throughout the area could be disrupted during construction.

Farmers on the wet side of the levee could also face regulatory hurdles to farming. While existing farms in the Clear Creek area (and elsewhere) are not subject to critical area regulations, new farms on the wet side of the levee would likely have to comply with regulations to protect wetlands and other critical areas. Large portions of the area on the wet side of the levee would likely be designated as wetland or as fish habitat, and the required buffers around these areas would further reduce the area available to be farmed.

Some Clear Creek Floodplain Reconnection Project stakeholders have suggested that farmers could adapt their crop choices to allow farming on the wet side of the levee and have suggested crops such as rice or cranberries. Neither of these specialized crops is suited to the tidal fluctuations that would occur on the wet side of the levee. Cranberries need to be grown in specific conditions with acidic peat soil. Cranberries are not grown underwater; instead, cranberry bogs are flooded with water only before harvesting. Rice needs to be grown in conditions where
uniform flooding and controlled drainage are possible. This is often achieved through use of
diking, machinery, and irrigation. Fertilizers are typically used to grow rice. The practices and
conditions required for growing rice and cranberries could not be achieved on the wet side of the
levee nor would they be compatible with the proposed habitat restoration area.

Summary of Potential Impacts to Agriculture: Due to the frequency of inundation, the
potential for saltwater inundation in the future, access issues, and potential regulatory hurdles,
farming on the wet side of the levee is unlikely to be feasible. In addition, some agricultural
activities, such as use of chemicals and drainage maintenance, would not be compatible with a
habitat restoration area.

Considerations for the Master Planning Process:

- The master planning process should assume that farming on the wet side of the levee
  would not be feasible.

- The idea of farming on the wet side of the levee could be revisited in the future if the
  following conditions are met:

  o The levee alignment chosen would allow adequate areas on the wet side of the
    levee at suitable elevations to be farmed;

  o Access to the fields could be provided;

  o The frequency with which the dry areas would be inundated by floodwaters was
    known;

  o Sediment deposition on the wet side of the levee was well understood and
    adequate drainage could be ensured;

  o It was known that the saltwater wedge would not travel far enough upstream to
    inundate the area with saltwater; and

  o The habitat restoration area on the wet side of the levee would not be adversely
    impacted by agricultural practices.

7.0 Recommendations for the Master Planning Process

This memorandum has identified several potential impacts of the Clear Creek Floodplain
Reconnection Project that could negatively affect agricultural viability in the Clear Creek area.
This memorandum has also identified design considerations for the Floodplain Reconnection
Project that could reduce these negative impacts, and in some cases, provide benefits to
agricultural viability. The master planning process for the project should take a comprehensive
approach so that the issues affecting agriculture are considered along with the potential flood and
habitat benefits. The master planning process should give special consideration to these issues in
order to maintain agricultural viability:
• Design the project to minimize the conversion of agricultural land.

• Incorporate an effective agricultural drainage system into the project design. Projects that would benefit both agricultural drainage and fish habitat, such as separating agricultural drainage from Clear Creek, should be considered.

• Maximize the amount of flood protection provided to agricultural lands on the dry side of the ring levee. This should include consideration of climate change projections and factors such as the River Road Levee freeboard issues.

• Incorporate climate change projections into the project design so that the project provides long-term benefits for agriculture and other interests.

• Develop plans to minimize the indirect impacts of the project that could affect agricultural viability, including preventing criminal activity on vacant lands and maintaining the viability of Drainage District 10 and the Riverside Fire District.
8.0 References


Johnson, Rawley, Rebecca Taxier, Mark Green, Katie Green, Holly Foster, Valerie Foster, John Inch, and Heather Donald. 2016. Letter to Pat McCarthy, Pierce County Executive. February 17, 2016.


Engineers. Prepared on behalf of Pierce County Surface Water Management. March 2015.


WSU (Washington State University), The Evergreen State College, Pierce Conservation District, Pierce County Agriculture Program, and Pierce County Agricultural Roundtable. 2015. Agriculture Infrastructure Study: Pierce County 2015.