PORTLAND METRO LEVEE SYSTEM FEASIBILITY STUDY

Draft Integrated Feasibility Report and Environmental Assessment

Public Informational Meeting

1948 Vanport flood (Photo courtesy of Oregon Historical Society, Lot 131_010)
PURPOSE OF THE STUDY & MEETING

1913-1921
• Four drainage Districts were constructed by locals

1936
• Congress authorized Corps to improve system

1950
• Congress authorizes Corps to raise and strengthen system

2018
• Congress authorized Corps to study the system to determine if additional Federal investment is needed

Today
• Seeking input to the study, preparing the system for the next 50 years and beyond
WAYS TO COMMENT

By email: PMLS-Feasibility@usace.army.mil

By mail: U.S. Army Corps of Engineers, Portland District
Attn: CENWP-PM, Laura Hicks
P.O. Box 2946
Portland, Oregon 97208-2946

In person: Written input can be provided tonight
CONSIDERATION OF ENVIRONMENTAL & CULTURAL RESOURCES

Obtain early feedback from stakeholders

• Open houses
• Early coordination and pre-consultation with agencies and federally recognized tribes

Evaluation of alternatives

• Description of affected environment
• Consideration and formulation alternatives
  • Integration of avoidance, minimization, or mitigation measures
  • Evaluation of environmental consequences

Agency & Public Review

• Ongoing consultation with agencies and federally recognized tribes
• Draft Integrated Feasibility Report and Environmental Assessment
  • Draft Finding of No Significant Impact (FONSI)
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STUDY AREA
PROBLEMS

Consequences of flood risk
– **Life Safety**: large population at risk; difficult to evacuate
– **Economic Losses**: critical infrastructure, structures, contents, vehicles, hazardous materials inundation

Weaknesses in existing system
– Overtopping of existing levees
– Weak points (e.g. Railroad embankment)
– Aging infrastructure
– Pump stations lack of adequate pumps
OBJECTIVES & CONSTRAINTS

Objectives (within the system, over the period of analysis)

– Reduce flood risk, in particular to critical infrastructure
– Reduce threats to life safety from flooding, and increase awareness of flood risk
– Increase resiliency of the flood management system
– Increase reliability of the flood management system
– Improve operability of the flood management system
– To the extent practicable, provide opportunities for recreation, natural resources, and cultural resources.

Constraints

– Cross-levees must stay in place
– Railroad embankment will not be considered a levee in the same alignment.
– Existing road infrastructure remains unchanged.
Increase Levee Height at NE Corner of PEN2
WHAT IS FLOOD RISK?

RISK = f (HAZARD, PERFORMANCE, CONSEQUENCE)
MODEL RESULTS: FUTURE WITHOUT PROJECT

Levee Failures by Flooding Mode

Percent of modeled failures

<table>
<thead>
<tr>
<th>Component</th>
<th>Total</th>
<th>Overtopping</th>
<th>Fragility (Breach before Overtop)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEN1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEN2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCDD_W</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCDD_E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SDIC</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Breach Prior to Overtopping**
- **Overtopping with Breach**
- **Component Malfunction or Improper Operation**
- **Overtopping without Breach**
0.2% Annual Exceedance Probability
1 in 500 chance of occurring, or being exceeded, in any year

0.1% Annual Exceedance Probability
1 in 1,000 chance of occurring, or being exceeded, in any year
INITIAL MEASURES

1. Elevate structures
2. Flood proof buildings
3. Buy outs
4. Relocation of residences/businesses/critical infrastructure
5. **Widen levees (improve levee performance)**
6. Flood warning system
7. Increase levee heights (this includes cross levees, mainstem, slough)
8. Maximize/increase flood storage capacity in the Willamette Basin Projects
9. Bigger facility
10. **Add pump capacity**
11. Add gates
12. Add ring levees
13. Riprap (Bank Protection)
14. **Improve Flood Fight: access roads, mobility of flood fighters, remove restrictions for equipment**
15. **Automate operations in the systems**
16. Improve permeability
17. Increase wetlands/retention ponds
18. Complete Seismic retrofits
19. Install Portable pumps similar to Brazil
20. **Add redundancy for pump system**
21. Install Submersible pump stations
22. **Improve/Increase debris control**
23. Relocate MCDD Headquarters out of floodplain
24. Reroute water/floodwater
25. Construct levee next to railway/highway to act as drainage seep
26. Aquatic invasive plants control/eradication
27. Recreation trails on top of levees
28. Install/Operate tide gates
29. **Improve/Increase seepage berms**
30. **Build additional levees/floodwalls**
31. Remove existing levee (specific to Pen 1)
32. **Rehab or replace mechanical/structural features**
33. Adjust/ensure levee slopes meet current standards
34. Relocate transportation corridors
35. Utilize setback levees
36. **Education on flood risk**
37. **Install/Improve Signs for evacuation**
38. Removal of Levee Vegetation
39. Address existing erosion/control future erosion on levees
40. Reduce Area of Protection
41. **Establish "safe zones" for evacuation life/safety**
42. Stem wall
43. Add relief or overflow areas
44. Zoning
45. Secure floating homes
ALTERNATIVE STRATEGIES

1. Without Project

2. Non-structural

3. Prioritize Public Health and Safety

4. Maximize Resilience and Reliability

5. Give the System a More Uniform Annual Exceedance Probability (AEP)
## FOCUSED ARRAY OF ALTERNATIVES – MEASURES MATRIX

<table>
<thead>
<tr>
<th>No.</th>
<th>Measure</th>
<th>Alt 3</th>
<th>Alt 4</th>
<th>Alt 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Improve Levee Performance and Reliability</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>7</td>
<td>Increase Levee Heights</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>30</td>
<td>Build Additional Levee/Floodwall</td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>10</td>
<td>Add Pump Capacity</td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>20A</td>
<td>Add Redundant power source</td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>20B</td>
<td>Replace SDIC Pump Station</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>32</td>
<td>Rehab/Replace Mechanical Structures (gates, etc.)</td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Flood Warning in Residential/PAR areas</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>14</td>
<td>Improve Flood Fight</td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>15</td>
<td>Automate Systems</td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Debris Removal (trash in water and trees/limbs)</td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>36</td>
<td>Education</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>37</td>
<td>Signage for Evacuation</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>41</td>
<td>Safe Zones</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>
Costs
$50 M
$1.9 M/yr.

Benefits
$6.0 M/yr.
Costs
$77 M
$2.9 M/yr.

Benefits
$8.5 M/yr.
Costs
$165 M
$6.2 M/yr.

Benefits
$13.8 M/yr.
CRITERIA FOR TENTATIVELY SELECTED PLAN (TSP)

• Alternatives are evaluated against the planning objectives

• The Principles & Guidelines
  o Completeness—The extent that the plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects.
  o Effectiveness—The extent that the plan meets the objectives.
  o Efficiency—The extent that the plan is the most cost-effective means of alleviating risk to the public.
  o Acceptability—The workability and viability of the plan with respect to acceptance by Federal and non-Federal entities and the public, and compatibility with existing laws, regulations, and public policies.
  o Life Safety—Reduction in life loss risk compared to Future Without-Project
  o Impacts to Natural Resources—Area of potential impacts to natural resources
  o Relative Risk—Implementation risk, real estate risks
  o Uncertainty—Discuss technical uncertainties, Modeling, etc.

• Summary of Alternatives Comparison using the 4 Accounts: National Economic Development, Regional Economic Development, Other Social Effects and Environmental Quality

• Maximizes Net Annual Federal Benefits
# ANNUAL COSTS AND BENEFITS ($1,000)

**FY 2020 PRICE LEVELS AND 2.75% DISCOUNT RATE**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Alternative 3</th>
<th>Alternative 4</th>
<th>Alternative 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Costs</td>
<td>$21,636</td>
<td>$35,172</td>
<td>$75,562</td>
</tr>
<tr>
<td>Preconstruction Engineering/Design</td>
<td>$2,597</td>
<td>$4,221</td>
<td>$9,068</td>
</tr>
<tr>
<td>Construction Management</td>
<td>$2,164</td>
<td>$3,518</td>
<td>$7,557</td>
</tr>
<tr>
<td>Contingency</td>
<td>$13,265</td>
<td>$21,693</td>
<td>$46,352</td>
</tr>
<tr>
<td>Real Estate (LERRDs)</td>
<td>$8,904</td>
<td>$9,513</td>
<td>$19,018</td>
</tr>
<tr>
<td><strong>Total Alternative Cost</strong></td>
<td>$48,566</td>
<td>$74,117</td>
<td>$157,557</td>
</tr>
<tr>
<td>Interest During Construction ¹</td>
<td>$1,285</td>
<td>$3,012</td>
<td>$7,536</td>
</tr>
<tr>
<td><strong>Total Investment Cost</strong></td>
<td>$49,851</td>
<td>$77,129</td>
<td>$165,093</td>
</tr>
<tr>
<td>Annualized Investment Cost ²</td>
<td>$1,847</td>
<td>$2,857</td>
<td>$6,115</td>
</tr>
<tr>
<td>Annual O&amp;M³</td>
<td>$19</td>
<td>$26</td>
<td>$34</td>
</tr>
<tr>
<td><strong>Total Annualized Investment Cost</strong></td>
<td>$1,866</td>
<td>$2,883</td>
<td>$6,149</td>
</tr>
<tr>
<td>Annual Benefits</td>
<td>$6,038</td>
<td>$8,448</td>
<td>$13,777</td>
</tr>
<tr>
<td><strong>Annual Net Benefits</strong></td>
<td>$4,169</td>
<td>$5,545</td>
<td>$7,628</td>
</tr>
<tr>
<td>Benefit-Cost Ratio</td>
<td>3.24</td>
<td>2.93</td>
<td>2.24</td>
</tr>
</tbody>
</table>

¹) Assumes equal annual outlays for construction periods of 24, 36, and 42 months for Alternatives 3, 4, and 5, respectively.

²) Annualized using the FY2020 Federal Discount Rate of 2.75% and 50-year period of analysis.

³) Additional routine work above the without-project conditions expected to occur each year over the life cycle of the project.
TENTATIVELY SELECTED PLAN (TSP)

ALTERNATIVE 5

HAZARDS
Minimal effect of the project on river levels

PERFORMANCE
Raise and strengthen levee, re-invest in the pump stations.
$165 M total investment
$6.1 M/yr

CONSEQUENCE
Reduces $13.8 M flood damages per year and reduce life loss risk

RISK = f (HAZARD, PERFORMANCE, CONSEQUENCE)
ALTERNATIVE #5 - PEN 1

1. Elevate levee and widen by 15-20 feet on landward side.
   (Measure 5: Improve levee reliability and performance & Measure 7: Increase levee height)

2. Extend floodwall under I-5 and elevate by ~3 ft.
   (Measure 7: Increase levee height)

3. Build ~3 ft floodwall along Columbia mainstem.
   (Measure 7: Increase levee height)

4. Build floodwall along Portland Rd from railroad embankment to Marine Dr. Raise existing flood closures to new level of protection.
   (Measure 30: Build additional levee or floodwall)

5. Construct a levee next to the railroad embankment that is ~3 ft taller than the current level of protection. Does not require railroad cooperation.
   ~16 acres affected (Measure 30: Build additional levee or floodwall)

6. Add a four-season maintenance path on the back levee.
   (Measure 14: Improve flood fight)

7. Elevate levee and widen by 15-20 feet on landward side.
   (Measure 5: Improve levee reliability and performance & Measure 7: Increase levee height)

8. Add a redundant power source to PIR pump station.
   (Measure 20A: Redundant power)

9. Add redundant power source to PIR pump station.
RAILROAD SEGMENT

– Site of levee breach during 1948 flood
– Unknown condition currently
– Currently assuming no cooperation is possible with railroad, though discussions continue
ALTERNATIVE #5 - PEN 2

- Increase height of levee along Columbia mainstem by installing a ~3 ft. floodwall (Measure 7: increase levee height & Measure 30: build additional levee or floodwall)
- Widen levee by 15-20 feet on landward side (Measure 7: increase levee height)
- Install redundant power source at Schmeer Rd. Pump Station (Measure 20A: redundant power source)
- On eastern side of the canal, widen the existing levee, add seepage controls (toe drains), or both. (Measure 5: improve levee reliability & performance)
- Add a four-season maintenance path on eastern side of canal (Measure 14: Improve flood fight)
- Install redundant power source at 13th Avenue Pump Station (Measure 20A: redundant power source)
- Extend floodwall under I-5 and elevate by 3 ft. (Measure 7: increase levee height)
- Install redundant power source at Schmeer Rd. Pump Station (Measure 20A: redundant power source)
- Extend floodwall under I-5 and elevate by 3 ft. (Measure 7: increase levee height)
- Increase height of levee along Columbia mainstem by installing a ~3 ft. floodwall (Measure 7: increase levee height & Measure 30: build additional levee or floodwall)
- Widen levee by 15-20 feet on landward side (Measure 7: increase levee height)
Concepts for Flood Wall Protection
Concepts for Flood Wall Protection
ALTERNATIVE #5 – MCDD West

- Increase levee height by 1 foot to address low spot near Gleason Boat Ramp parking lot. (Measure 7: increase levee height)

- On eastern side of the canal, widen the existing levee, add seepage controls (toe drains), or both. (Measure 5: improve levee reliability & performance)

- Replace trash rake and install redundant power source at Broadmoor Pump Station. (Measure 22: debris removal & Measure 20A: redundant power source)

- Replace trash rake and install redundant power source at AirTrans Pump Station. (Measure 22: debris removal & Measure 20A: redundant power source)

- Install redundant power source at Pump Station 1. (Measure 20A: redundant power source)

- Install redundant power source at Pump Station 2. (Measure 20A: redundant power source)
ALTERNATIVE #5 – MCDD East

Install redundant power source at Pump Station 4 (Measure 20A: redundant power source)

Elevate and replace SDIC’s one pump station, including installing redundant power supply (Measure 20B: replace pump station)
ALTERNATIVE #5 – SDIC

Elevate and replace SDIC’s one pump station, including installing redundant power supply (Measure 20B: replace pump station).

Raise levee at the upstream end of SDIC south of I-84 near the Troutdale outlet mall (Measure 2 - increase levee height: raise).

Address fragility by widening levee (Measure 5: improve levee reliability & performance)

Raise low spot in levee 4 feet (Measure 7: increase levee heights)

Elevate and replace SDIC’s one pump station, including installing redundant power supply (Measure 20B: replace pump station).

US Army Corps of Engineers

Columbia Corridor Drainage Districts
Total Project footprint

- 108 acres
- 135 parcels; 48 owners

Requires private and publicly owned lands

- Private residential/commercial landowners
- Three Railroads
- City of Portland
- BPA
- Metro
- Port of Portland
RECAP OF PROJECT

- Reduces the chance of a catastrophic flood, with associated loss of life and economic damages
- Prepares the system for changing future climate conditions
- Addresses long-standing system deficiencies, such as the railroad embankment
- Increases reliability of pump stations
- Increases awareness of the flood threat
- May add opportunities for recreation, natural/cultural resources
- Avoided and minimized impacts to environmental/cultural resources
- Consultation with resource agencies and tribes is ongoing
MILESTONE SCHEDULE

✓ FCSA Executed: 3 Oct 2018
✓ Alternatives Milestone: 9 Jan 2019
✓ TSP: 3 Oct 2019


- Agency Decision Milestone: 3 Apr 2020
- District Final Report Transmittal: 2 Apr 2021
- Chief’s Report Signed: 3 Oct 2021
THANK YOU FOR YOUR TIME AND INPUT

The Final Draft Feasibility Study Report is available online at https://www.nwp.usace.army.mil/levees/pmls/

Provide your Input

By email: PMLS-Feasibility@usace.army.mil

By mail: U.S. Army Corps of Engineers, Portland District
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