COMMUNITY DEVELOPMENT
333 Broadalbin Street SW, PO Box 490, Albany, Oregon 97321-0144 | BUILDING & PLANNING 541-917-7550

# Staff Report

Floodplain Development Review

FP-08-23 July 15, 2024

## Summary

This staff report evaluates a Floodplain Development Review application to replace Bridge 691.7 in the Brooklyn Subdivision. The bridge is located along the Brooklyn Subdivision of Union Pacific Railroad (UPRR) spanning Albany, Oregon. More specifically the site is located where the UPRR track crosses Periwinkle Creek at coordinates 44.637060° North, 123.086354° West (see Attachment A). There are two tracks at this location, but only the southern bridge is owned and scheduled for replacement by UPRR. The bridge serves UPRR's single mainline track running generally in a north-east to south-west direction through the study area. Bridge 691.7 crosses Periwinkle Creek with a drainage area of 6.27 square miles. Approximately 500 feet upstream of Bridge 691.77 is a 12 by 9-foot corrugated metal pipe arch (CMPA) culvert serving Santiam Road SE. The downstream structure is a 12.00-foot corrugated metal pipe (CMP) culvert (not owned by UPRR).

Based on the effective FEMA Flood Insurance Rate Map 41043C0214H (dated December 8, 2016), the proposed project is located within FEMA Zone A Special Flood Hazard Area (SFHA) for Periwinkle Creek. No base flood elevations or regulatory floodway have been established for this reach (Attachment D).

Currently, Bridge 691.77 consists of a 9-span 135 foot long, Timber Stringer Trestle (TST) bridge. The proposed replacement structure consists of a 3-span, 90 foot long, Prestressed Concrete Box Girder bridge. Minimal vegetation removal is required for installation of the temporary working bridge. The watercourse will not be altered by the project. Bridge replacement only requires placement of pilings. According to the applicant, no federal 404 or state 401 permits will be required for this project.

The applicant has provided an Encroachment HEC-RAS Analysis concluding the proposed activities will cause no-rise to base flood or floodway water surface elevations (Attachment D). The submitted 'no-rise' analysis was reviewed by Ken Puhn PE, CFM, West Consultants, who found the application material adequately addressed the applicable review criteria (Attachment E).

Applicable floodplain development review criteria are *Floodway Restrictions* (ADC 6.100), *Alteration of a Watercourse* (ADC 6.101), *Grading, Fill, Excavation, and Paving* (ADC 6.111), and *Natural Resource Impact Review, Exempt Activities* (ADC 6.290(4)). These criteria are addressed in this report and must be satisfied to grant approval for this application.

## Application Information

| | |
|---|---|
| Proposal: | Floodplain Development Review to replace an existing Union Pacific Railroad bridge crossing the Periwinkle Creek channel, and the associated flood fringe and floodway. |
| Review Body: | Staff (Type II review) |
| Property Owner/Applicant: | City of Albany; 333 Broadalbin Street SW, Albany, OR 97321 |
| Address/Location: | Unassigned; Union Pacific Railroad Crossing |

| | |
|---|---|
| Map/Tax Lot: | North of Linn County Assessor's Map No. 11S-03W-05CC Tax Lot 4200 |
| Zoning: | Residential Medium Density (RM) with Floodplain (/FP), Riparian Corridor Overlay (/RC), and Hillside Overlay (/HD) |
| Existing Land Use: | Railroad Right-of-way |
| Neighborhood: | Willamette Neighborhood |
| Surrounding Zoning: | North: Residential Medium Density (RM)<br>South: RM<br>East: RM<br>West: RM |
| Surrounding Uses: | North: Residential and Railroad Storage Lot<br>South: Residential<br>East: Residential<br>West: Residential |
| Prior History: | None |

# Staff Decision

The application for Floodplain Development Review referenced above is **Approved with Conditions** as described in this staff report.

# Public Notice

A Notice of Filing was mailed to surrounding property owners within 300 feet of the subject property on December 14, 2023. At the time the comment period ended on December 28, 2023, the Albany Planning Division had not received any comments regarding the proposed project.

# Analysis of Development Code Criteria

The Albany Development Code (ADC) includes the following review criteria, which must be met for this application to be approved. Code criteria are written in **bold** followed by findings, conclusions, and conditions of approval where conditions are necessary to meet the review criteria.

# Floodplain Development Review

## Floodway Restrictions (ADC 6.100)

**No development is allowed in any floodway except when the review body finds that the development will not result in any increase in flood levels during the occurrence of the 100-year flood. The finding shall be based upon applicant-supplied evidence prepared in accordance with standard engineering methodology approved by FEMA and certified by a registered professional engineer and upon documentation that one of the following criteria has been met:**

**(1) The development does not involve the construction of permanent or habitable structures (including fences).**

**(2) The development is a public or private park or recreational use or municipal utility use.**

**(3) The development is a water-dependent structure such as a dock, pier, bridge, or floating marina.**

**For temporary storage of materials or equipment:**

**(4) The temporary storage or processing of materials will not become buoyant, flammable, hazardous explosive or otherwise potentially injurious to human, animal, or plant life in times of flooding.**

**(5) The temporary storage of material or equipment is not subject to major damage by floods and is firmly anchored to prevent flotation or is readily removable from the area within the time available after flood warning.**

**If a floodway boundary is not designated on an official FEMA map available to the City, the floodway boundary can be estimated from available data and new studies. Proposed development along the estimated floodway boundary shall not result in an increase of the base flood level greater than one foot as certified by a registered professional engineer.**

## Findings of Fact and Conclusion

1.1 Effective Flood Insurance Study Number 41043CV001B (FEMA 6016a), the Flood Insurance Rate Map (FIRM) covers the reach from the Willamette River upstream to Salem Avenue, Panel Number 41043C0214H (FEMA 2016b). This shows the proposed bridge replacement location to be located within both the floodway and floodplain. The applicant proposes to replace a 9-span, 135-foot-long timber trestle structure with a 3-span, 90-foot-long concrete box girder structure. The UPRR bridge (Bridge 691.77) provides a crossing of Periwinkle Creek which is located within FEMA Zone A of the Special Flood Hazard Area (SFHA) with work to be completed within the channel of Periwinkle Creek. A vicinity map is included as Attachment A.

1.2 No habitable structures or fences are proposed within the floodway. The proposed bridge replacement is a public transportation municipal use, which is allowed in the floodway per ADC 6.100(3).

1.3 The proposed bridge structure is located within the Union Pacific Railroad Right of Way.

1.4 The proposed development is a bridge. Temporary storage or processing of materials will not become buoyant, flammable, hazardous explosive or otherwise potentially injurious to human, animal, or plant life in times of flooding. Bridge construction will be completed within nine (9) months from construction equipment mobilization to demobilization.

1.5 To meet these requirements, the applicant has provided No-Rise certification signed by a professional engineer certifying that development will not increase the base flood elevations, floodway elevations, and floodway widths on Periwinkle Creek.

1.6 To meet these requirements, the applicant has provided a HEC-RAS No-Rise Analysis signed by a professional engineer certifying that development will not increase the base flood elevations, floodway elevations, and floodway widths of Periwinkle Creek. This report was produced by Coldwater Engineering C/O Alexandra McDonald, dated June 5, 2024, and included as Attachment D. The report concludes that "*Based on the results of the hydraulic investigation, the proposed bridge will result in a 0.01' decrease in the 100-year WSE at the upstream face of the structure and no rise throughout the model*".

1.7 The City of Albany requested a review of this 'no-rise' analysis by Ken Puhn P.E, CFM, of WEST Consultants. Ken Puhn states in a memorandum dated July 2, 2024 (Attachment E): "*A hydraulic no-rise analysis was conducted by the applicant's engineer, Coldwater Engineering. According to the analysis, the proposed replacement structure and associated grading and fill will cause no-rise to the 100-yr floodplain elevations, which satisfies the requirement that the flood carrying capacity of the watercourse is not diminished by the proposed fill and grading activities. The no-rise memo includes a description of the UPRR bridge structure inspection program which has provisions to ensure that watercourse conveyance is maintained, and the channel remains clear and stable through the structure…Based on my review of the floodplain permit materials, the application adequately addresses the floodplain component provisions of 6.100, 6.101(1) & (4), and 6.111 of the City of Albany – Development Code.*"

## Floodway Restrictions Conclusion

As proposed, the development will not result in an increase of the base flood level greater than one foot in accordance with ADC 6.100. This conclusion is based upon applicant-supplied evidence prepared in accordance with standard engineering methodology approved by FEMA and certified by a registered professional engineer. This criterion satisfied.

## Alteration of a Watercourse (ADC 6.101)

**A Watercourse is considered altered when any changes occur within its banks, including installation of new culverts and bridges, or size modifications to existing culverts and bridges:**

## Criterion 1

**No development shall diminish the flood-carrying capacity of a watercourse.**

## Findings of Fact and Conclusion

1.1 The applicant proposes to replace an existing Union Pacific Railroad bridge crossing Periwinkle Creek. The existing bridge is a 9-span, 135-foot-long timber trestle structure. The proposed replacement bridge is a 3-span, 90-foot-long concrete box girder structure. The proposed replacement bridge will modify the size of the bridge within the creek's waterway and is considered alteration of a watercourse per ADC 6.101.

1.2 A watercourse is considered altered by installation of new bridges or size modifications to existing bridges. The project will replace the existing bridge with a new bridge. Currently, Bridge 691.7 consists of a 9-span 135 foot long, timber trestle structure. The proposed replacement structure consists of a 3-span 90-foot-long concrete box girder bridge.

1.3 The UPRR bridge replacement project at Brooklyn 691.7 will include pile driving associated with pier replacement below the existing Ordinary High-Water Mark (OHWM).

1.4 According to 33 CFR 323.3.c.(2), *Placement of pilings in waters of the United Staes that does not have or would not have the effect of discharge of fill material shall not require a section 404 permit. Placement of pilings for linear projects, such as bridges, elevated walkways, powerline structures, generally does not have the effect of a discharge of fill material. Furthermore, placement of pilings in waters of the United States for piers, wharves, and an individual house on stilts generally does have the effect of a discharge of fill material.*

## Criterion 2

**Subject to the foregoing regulation, no person shall alter or relocate a watercourse without necessary approval from the Floodplain Administrator.**

## Findings of Fact and Conclusion

2.1 Through this Floodplain Development Review, the Floodplain Administrator grants the necessary approval for the proposed development.

## Criterion 3

**Prior to approval, the applicant shall provide a 30-day written notice to the City, any adjacent community, the Natural Hazards Program of the Oregon Department of Land Conservation and Development, and the DSL.**

## Findings of Fact and Conclusion

3.1 Written notice has been provided to the necessary communities and agencies at least 30 days prior to issuing a decision for the proposed development.

## Criterion 4

**The applicant shall be responsible for ensuring necessary maintenance of the altered or relocated portion of said watercourse so that the flood carrying capacity is not diminished.**

## Findings of Fact and Conclusion

4.1 The existing railroad bridge owned by the Union Pacific Railroad. Future inspections and maintenance of the bridge will be conducted by the UPRR bridge structure inspection program. Based on these factors, the flood-carrying capacity of the Periwinkle Creek watercourse will be maintained and will not be diminished.

4.2 The proposed project is considered an alteration of a watercourse. Union Pacific Railroad acknowledges City Code and affirms that the watercourse will not be altered by federal standards.

## Alteration of a Watercourse Conclusion

As proposed, the development will not diminish the flood-carrying capacity of the watercourse and the review criteria for ADC 6.101 are satisfied.

## Grading, Fill, Excavation, and Paving in the Floodplain (ADC 6.111)

**A floodplain development permit is required for grading, fill, excavation, and paving in the Special Flood Hazard Area (100-year floodplain), except activities exempted in Section 6.094 of this Article. No grading will be permitted in a floodway, except when the applicant has supplied evidence prepared by a professional engineer that demonstrates the proposal will not result in any increase in flood levels during the occurrence of the 100-year flood. The permit will be approved if the applicant has shown that each of the following criteria that are applicable have been met:**

## Criterion 1

**Provisions have been made to maintain adequate flood-carrying capacity of existing watercourses, including future maintenance of that capacity.**

## Finding of Fact and Conclusion

1.1 The location of the proposed bridge replacement project is described in detail under Findings 1.1 under ADC 6.100 (above); those findings are included here by reference.

1.2 Provisions have been made to maintain adequate flood-carrying capacity of existing watercourses, including future maintenance of that capacity. The new bridge structure will slightly increase flood-carrying capacity compared to the existing structure.

1.3 Criterion 6.111 allows grading in a floodway if the applicant has supplied evidence prepared by a professional engineer that demonstrates the proposal will not result in any increase in flood levels during the occurrence of the 100-year flood.

1.4 The applicant provided an Encroachment HEC-RAS No-Rise Analysis. This report was produced by COLDWATER Engineering, dated February 29, 2024, and included as Attachment D. The report concludes that that "*Based on the results of the hydraulic investigation, the proposed bridge will result in a 0.01' decrease in the 100-year WSE at the upstream face of the structure.*"

1.5 The City of Albany requested a review of this 'no-rise' analysis by Ken Puhn, PE, CFM, of WEST Consultants. Ken Puhn states in a memorandum dated July 2, 2024 (Attachment E): "*A hydraulic no-rise analysis was conducted by the applicant's engineer, Coldwater Engineering. According to the analysis, the proposed replacement structure and associated grading and fill will cause no-rise to the 100-yr floodplain elevations, which satisfies the requirement that the flood carrying capacity of the watercourse is not diminished by the proposed fill and grading activities. The no-rise memo includes a description of the UPRR bridge structure inspection program which has provisions to ensure that watercourse conveyance is maintained, and the channel remains clear and stable though the structure.*

*Based on my review of the floodplain permit materials, the application adequately addresses the floodplain component provisions of 6.100, 6.101(1) & (4), and 6.111 of the City of Albany – Development Code.*"

## Condition of Approval

Condition 1 At the conclusion of the proposed project, the following documentation shall be submitted to the Community Development Department:

a) As-built drawings with elevations provided; and

b) Letter from the Engineer of Record who is licensed in the state of Oregon, stating the fill was placed in accordance with the signed plans.

## Criterion 2

**The proposal will be approved only where adequate provisions for stormwater runoff have been made that are consistent with the Public Works Engineering standards or are otherwise approved by the City Engineer.**

## Findings of Fact and Conclusion

2.1 City utility maps show no piped public storm drainage facilities in this area. The bridge spans Periwinkle Creek between Santiam Road SE and Salem Avenue SE. Periwinkle Creek is the main drainage facility in this area.

2.2 The applicant has submitted a No-Rise analysis indicating that the proposed project will not result in a change in the existing FEMA floodplain elevation.

2.3 The applicant states that the proposed project will not result in significant additional stormwater runoff from historical levels.

2.4 This criterion is satisfied.

## Criterion 3

**No grading, fill, excavation, or paving will be permitted over an existing public storm drain, sanitary sewer, or water line unless it can be demonstrated to the satisfaction of the City Engineer that the proposed grading, fill, excavation, or paving will not be detrimental to the anticipated service life, operation, and maintenance of the existing utility.**

## Findings of Fact and Conclusion

3.1 City utility maps show no public sanitary sewer or water facilities in this area.

3.2 This criterion is satisfied.

## Criterion 4

**In areas where no floodway has been designated on the applicable FIRM, grading will not be permitted unless it is demonstrated by the applicant that the cumulative effect of the proposed grading, fill, excavation, or paving when combined with all other existing and planned development, will not increase the water surface elevation of the base flood more than a maximum of one foot (cumulative) at any point within the community.**

## Findings of Fact and Conclusion

4.1 Based on the effective FEMA Flood Insurance Rate Map 41043C0214H (dated December 8, 2016), the proposed project is located within FEMA Zone A of the Special Flood Hazard Area (SFHA). No base flood elevations or regulatory floodway have been established for this area. According to the FIS, the one-percent annual chance floodplain for Periwinkle Creek is generally limited to a narrow corridor along the channel in the vicinity of the project site.

4.2 Detailed findings are provided under ADC 6.111(1) that show the proposed bridge will not cause a change in water surface elevation by more than one foot. The findings under ADC 6.111(1) are included here by reference.

4.3 Based on the factors above, the cumulative effect of the proposed grading, fill, excavation, or paving when combined with all other existing and planned development, will not increase the water surface elevation of the base flood more than a maximum of one foot (cumulative) at any point within the community.

4.4 This criterion is satisfied.

## Criterion 5

**The applicant shall notify the City of Albany, any adjacent community, and the Natural Hazards Mitigation Office of the Oregon Department of Land Conservation and Development of any proposed grading, fill, excavation, or paving activity that will result in alteration or relocation of a watercourse (See Section 6.101).**

## Findings of Fact and Conclusion

5.1 Notice was provided to Linn County and the Natural Hazards Program of the Oregon Department of Land Conservation and Development, at least 30 days prior to issuance of a decision on this project.

5.2 This criterion is satisfied.

## Criterion 6

**All drainage facilities shall be designed to carry waters to the nearest practicable watercourse approved by the designee as a safe place to deposit such waters. Erosion of ground in the area of discharge shall be prevented by installation of non-erosive down spouts and diffusers or other devices.**

## Findings of Fact and Conclusion

6.1 No drainage facilities are associated with the existing bridge or the proposed bridge.

6.2 The construction of piers within the low flow channel of Periwinkle Creek may restrict low flows and have the potential to increase erosion within the creek.

## Condition of Approval

Condition 2 The applicant will need to install Best Management Practices as needed to protect the existing stream channel from erosion.

## Criterion 7

**Building pads shall have a drainage gradient of two percent toward approved drainage facilities, unless waived by the Building Official or designee.**

## Findings of Fact and Conclusion

7.1 No building pads are proposed to be constructed with this Floodplain Review application.

7.2 This criterion is not applicable.

## Natural Resource Impact Review, Exempt Activities (ADC 6.290(3))

**The following activities are exempt from Natural Resource Impact Review as would otherwise be required within the Significant Natural Resource overlay districts. Many of these exemptions are provided in recognition of the Albany ESEE analyses and pre-existing uses. Land use reviews as required by other sections of this Code and compliance with other local (floodplain, fill, encroachment, etc.), state, and federal regulations is still required. As a result, these activities should still be conducted in a manner that minimizes impact to Albany's significant natural resources.**

## Criterion 3

**City construction of public infrastructure, such as transportation, stormwater, sewer, and water utilities. This exemption requires unimproved but disturbed areas to be replanted with native vegetation.**

## Findings of Fact and Conclusion

3.1 The applicant proposes to replace an existing UPRR bridge crossing Periwinkle Creek. As shown on

the location map (Attachment A), this project passes through the Riparian Corridor Natural Resources Overlay.

3.2 The proposed bridge replacement will be located entirely within the existing UPRR right-of-way. This project is exempt from Natural Resource Impact Review if unimproved but disturbed areas are replanted with native vegetation.

3.3 This criterion can be satisfied with the following condition of approval.

### Condition of Approval

Condition 3 The applicant shall submit a plan to the Community Development Department to replant unimproved but disturbed areas of the bridge project area with native vegetation. The replanting plan shall be implemented prior to the conclusion of the proposed project.

## Overall Conclusion

As proposed and conditioned, the application for Floodplain Development Review to replace UPRR Bridge 691.7 crossing Periwinkle Creek which is located within a Special Flood Hazard Area satisfies all applicable review criteria as outlined in this report.

### Conditions of Approval

Condition 1 At the conclusion of the proposed project, the following documentation shall be submitted to the Community Development Department:

a) As-built drawings with elevations provided; and

b) Letter from the Engineer of Record who is licensed in the state of Oregon, stating the fill was placed in accordance with the signed plans.

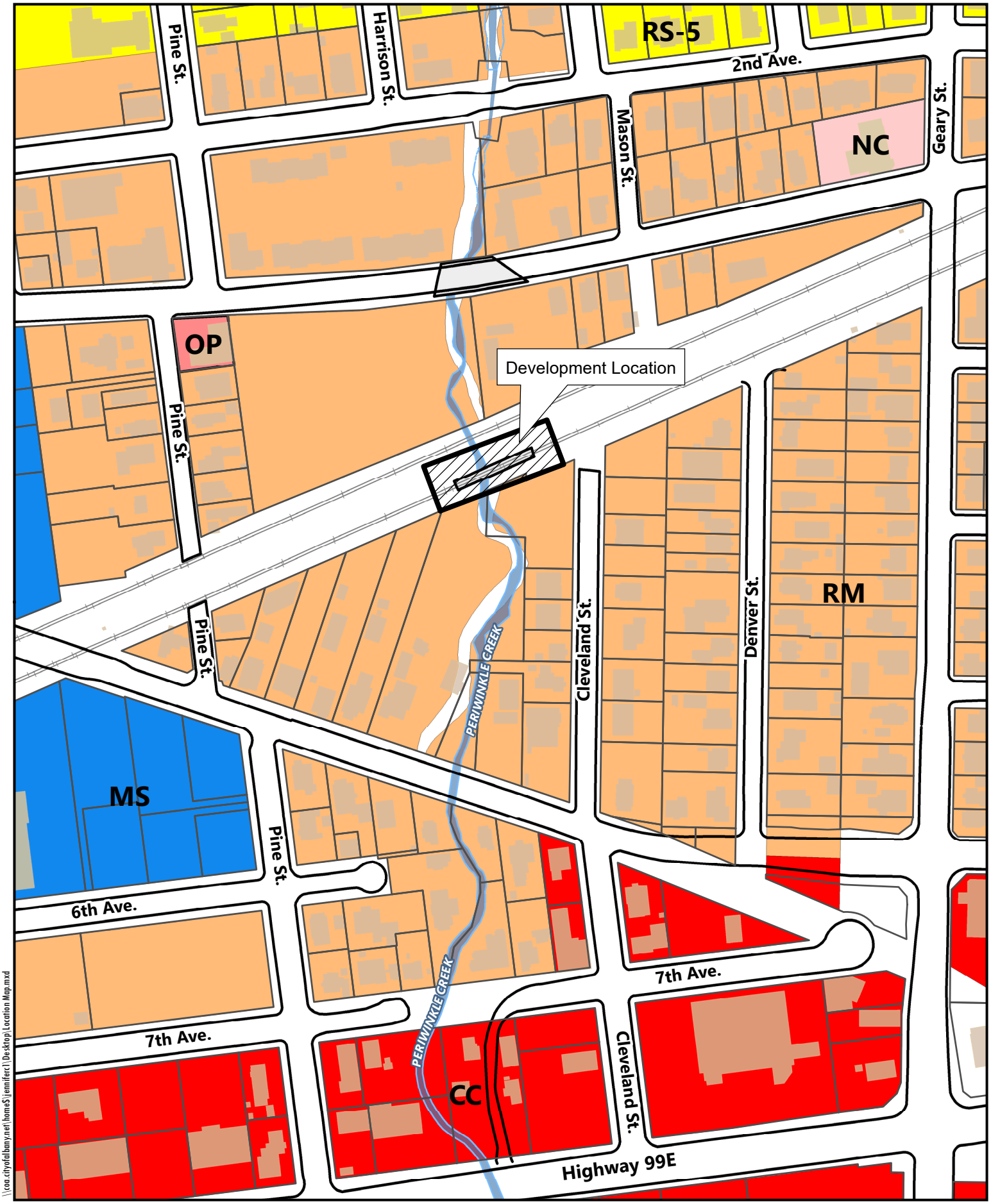
Condition 2 The applicant will need to install Best Management Practices as needed to protect the existing stream channel from erosion.

Condition 3 The applicant shall submit a plan to the Community Development Department to replan unimproved but disturbed areas of the bridge project area with native vegetation. The replanting plan shall be implemented prior to the conclusion of the proposed project.

Condition 4 Development shall occur consistent with the plans and studies submitted by the applicant and shall comply with all applicable state, federal, and local laws.

## Attachments

A. Location Map
B. Preliminary Replacement Bridge Plans
C. Applicant's Findings of Fact
D. Hydraulics Report (dated February 29, 2024)
E. Floodplain Review by Ken Puhn, WEST Consultants (dated July 5, 2024)
F. Effective FIRM Panel




\\coa.cityofalbany.net\home$\jennifercl\Desktop\Location Map.mxd

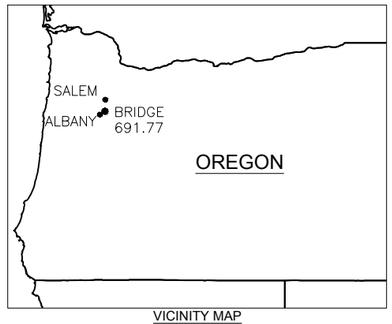
N

0 50 100 200 Feet

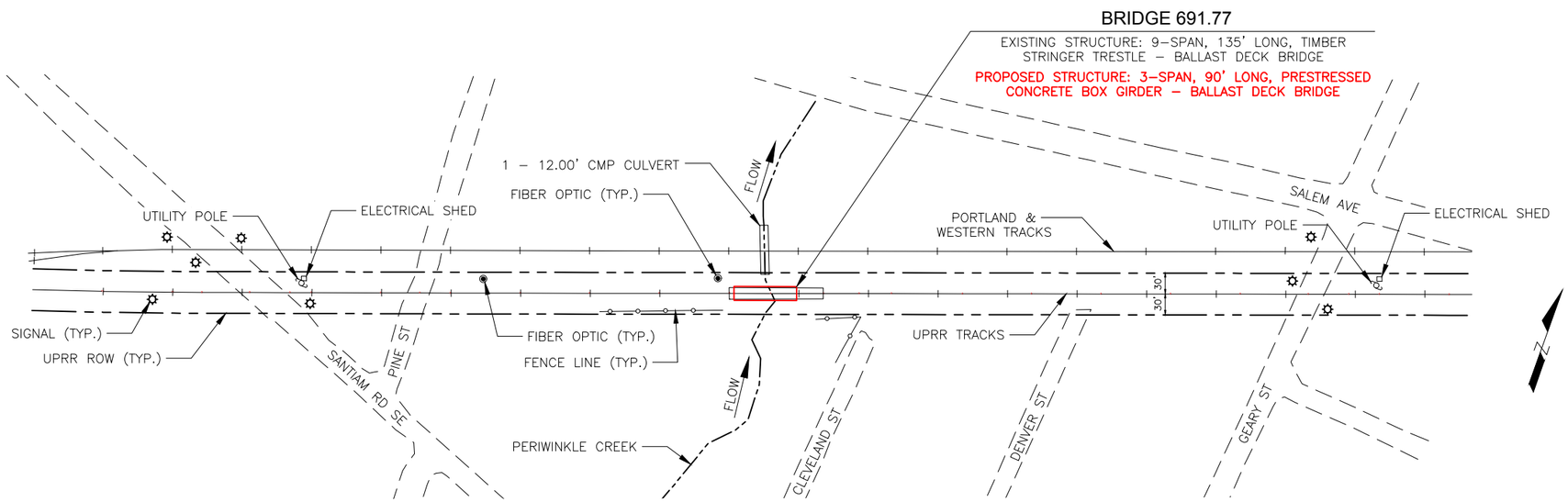
# Unassigned; Bridge 691.77

Date: 11/7/2023 Map Source: City of Albany

Location Map



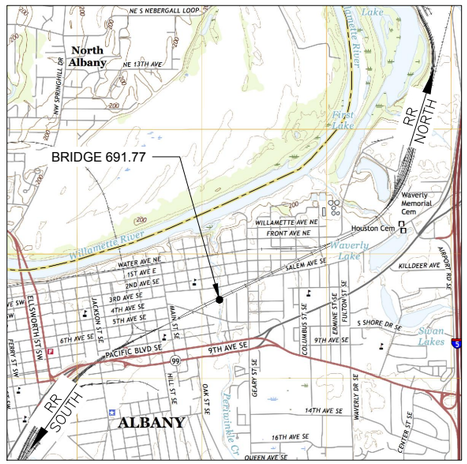

VICINITY MAP
(NOT TO SCALE)



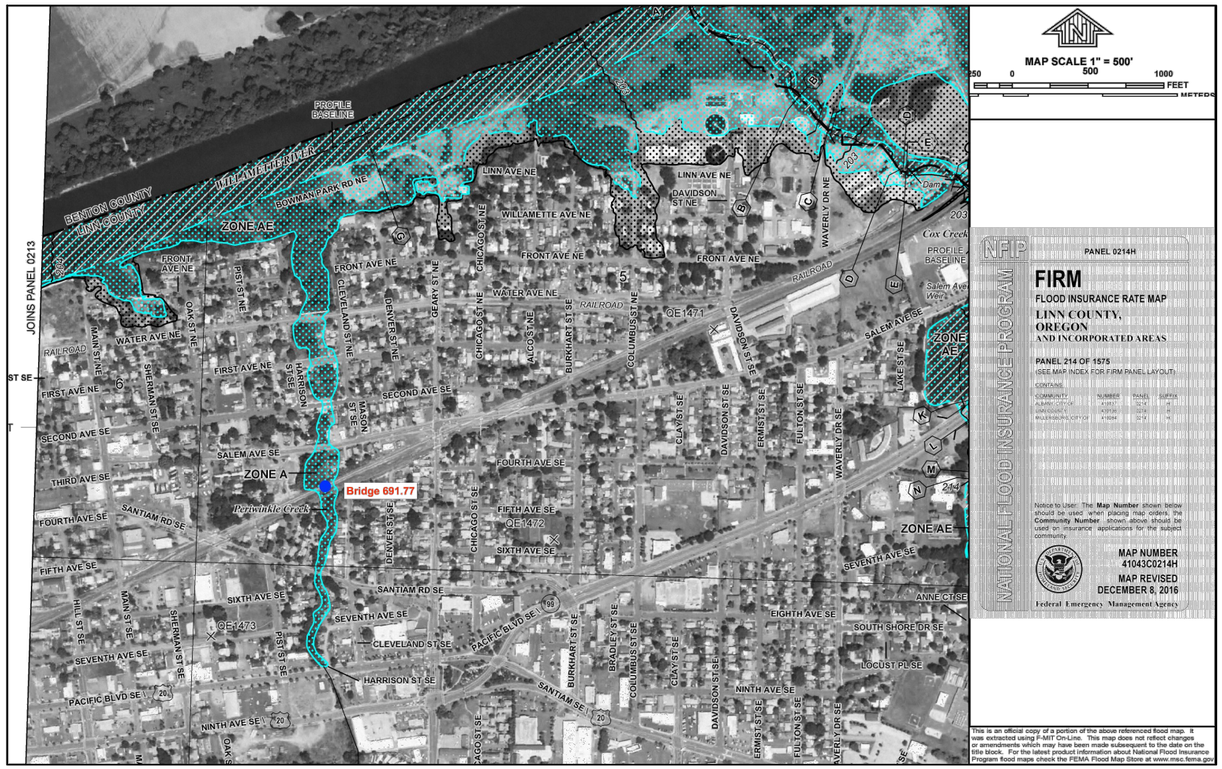

LOCATION PLAN
50 0 100 200

## LEGEND

- CENTERLINE RAILROAD TRACK
- UPRR RIGHT–OF–WAY
- FLOWLINE
- EDGE OF ROAD
- FENCE LINE
- TEMPORARY BENCHMARK
- UTILITY POLE
- FIBER OPTIC
- SIGNAL




LOCATION MAP
1000 0 2000 4000
SOURCE: USGS 7.5–MINUTE QUADRANGLE MAP, ALBANY, OR (2017)




FLOODPLAIN MAP




GENERAL NOTES

1. ELEVATION DATUM ESTABLISHED AT BASE OF RAIL AT UPRR BRIDGE 691.77 SOUTH ABUTMENT. TO CONVERT TO NAVD '88 ELEVATION DATUM, ADD 118.59'.
2. BRIDGE 691.77 SPANS PERIWINKLE CREEK WITH A DRAINAGE AREA OF 6.27 SQUARE MILES.
3. TEMPORARY STAGING AREAS TO BE PLACED WITHIN UPRR RIGHT–OF–WAY, OUTSIDE OF THE FLOODPLAIN.
4. THE TOTAL LOT AREA WITHIN THE FLOODPLAIN IS APPROXIMATELY 0.38 ACRES.
5. LOT AREA IMPACTED WITHIN THE FLOODPLAIN IS TO BE LESS THAN 0.10 ACRES.

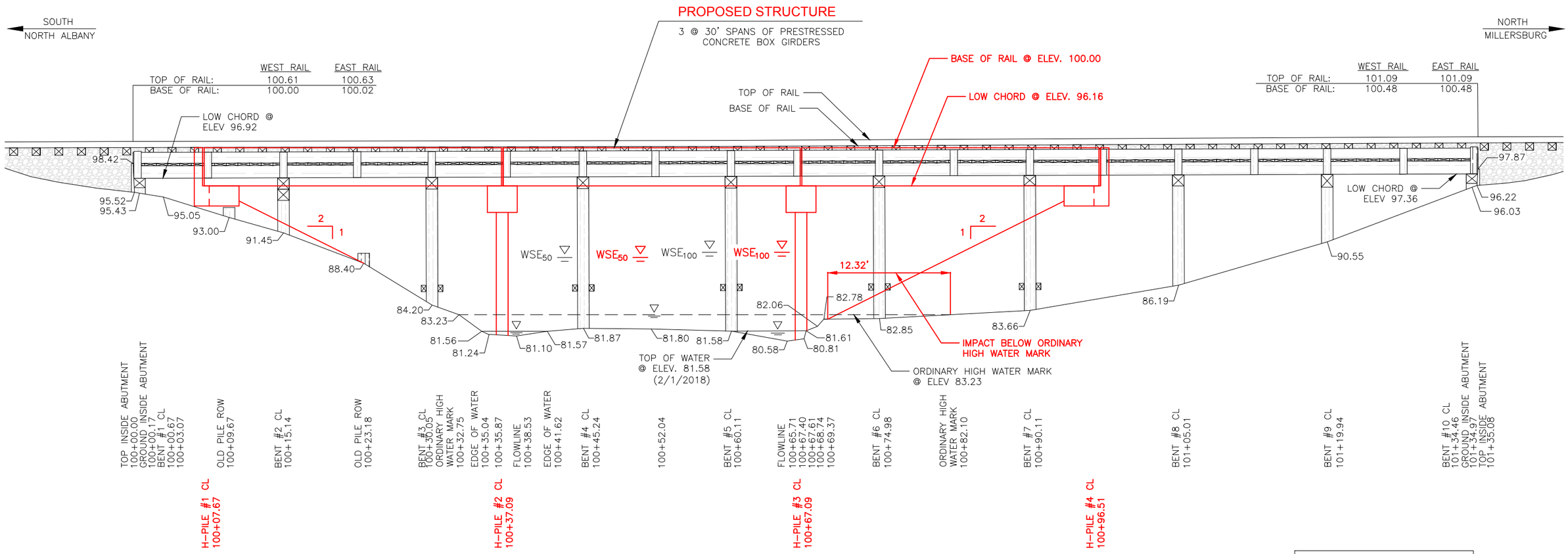
| REV. NO. | DATE | REMARKS |
|---|---|---|
| | | |

COLDWATER ENGINEERING
21 NORTH LAST CHANCE GULCH, SUITE 201
HELENA, MONTANA 59601

DESIGNED BY: T. ASKIN
DRAWN BY: A. EGAN
CHECKED BY: T. ASKIN
CROSS CHK'D BY: T. COWAN
APPROVED BY: T. COWAN
DATE: JANUARY 2019
PROJECT NO. 2018010
SHEET NO. 1
FILE NAME: FP Permit (Bridge 691.77).dwg

# BRIDGE REPLACEMENT LOCATION SURVEY

BRIDGE 691.77, BROOKLYN SUBDIVISION
9 - SPAN, 135' LONG, TIMBER STRINGER TRESTLE - BALLAST DECK

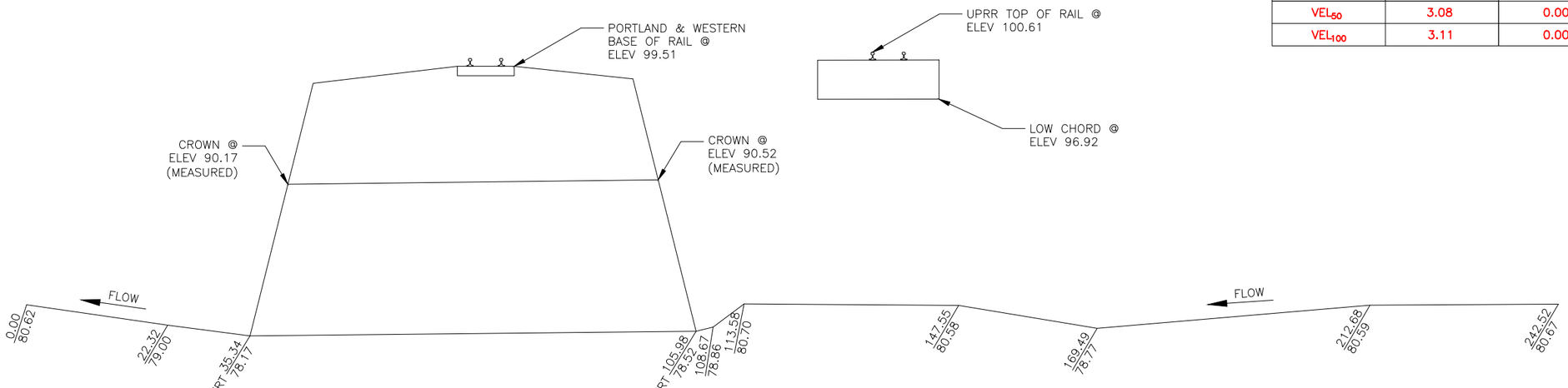



## BRIDGE ELEVATION VIEW

(VIEW LOOKING RR WEST – DOWNSTREAM)

2.5 0 5 10

NOTE: FIRST FLOOR ELEVATION OF ADJACENT RESIDENCE: 97.37




## PROFILE ALONG STREAMLINE

HORIZONTAL SCALE 5 0 10 20

VERTICAL SCALE 2.5 0 5 10

| FLOW VELOCITIES AT DOWNSTREAM BRIDGE FACE (ft/sec) | | |
|---|---|---|
| $VEL_{50}$ | 3.08 | Δ EXISTING CONDITIONS: |
| $VEL_{100}$ | 3.11 | |
| **$VEL_{50}$** | **3.08** | 0.00 |
| **$VEL_{100}$** | **3.11** | 0.00 |

| WATER SURFACE ELEVATIONS AT UPSTREAM BRIDGE FACE (ft) | | |
|---|---|---|
| OHWM | 83.23 | |
| $WSE_{50}$ | 88.98 | Δ EXISTING CONDITIONS: |
| $WSE_{100}$ | 89.50 | |
| **$WSE_{50}$** | **88.98** | 0.00 |
| **$WSE_{100}$** | **89.50** | 0.00 |

| REV. NO. | DATE | REMARKS |
|---|---|---|
| | | |

COLDWATER ENGINEERING
21 NORTH LAST CHANCE GULCH, SUITE 201
HELENA, MONTANA 59601

DESIGNED BY: T. ASKIN
DRAWN BY: A. EGAN
CHECKED BY: T. ASKIN
CROSS CHK'D BY: T. COWAN
APPROVED BY: T. COWAN
DATE: JANUARY 2019

SHEET NO. 2

PROJECT NO. 2018010

FILE NAME: FP Permit (Bridge 691.77).dwg

# BRIDGE REPLACEMENT LOCATION SURVEY

BRIDGE 691.77, BROOKLYN SUBDIVISION
9 - SPAN, 135' LONG, TIMBER STRINGER TRESTLE - BALLAST DECK

COLDWATER
ENGINEERING

August 3, 2023

Jennifer Cepello
Floodplain Administrator
Albany, Oregon
333 Broadalbin Street SW
Albany, OR 97321

Subject: Notice of Intent for Union Pacific Railroad Company
Replacement of Bridge 691.77, Brooklyn Subdivision
Albany, Oregon

Dear Ms. Cepello,

The Union Pacific Railroad Company (UPRR) is proposing to replace Bridge 691.77 on the Brooklyn Subdivision. On behalf of UPRR, Coldwater Engineering has prepared this letter to provide your office with pertinent project information and is requesting review and issuance of a Floodplain Development Permit. All other local, state, and federal permits will be applied for and obtained as required.

## *Location*

Bridge 691.77 is located along the Brooklyn Subdivision in Linn County, Oregon. More specifically, the project site is located within the city limits of Albany, Oregon with coordinates of,

44.637060° North, 123.086354° West

## *Flood Designation*

The area in the immediate vicinity of Bridge 691.77 is located within a FEMA-designated, Zone A, special flood hazard areas subject to inundation by the 100-year flood, no base flood elevations determined, as shown on the Flood Insurance Rate Map for Linn County, Oregon and Incorporated Areas (Map Number, 41043C0214H, effective date December 8, 2016).

## *Site*

UPRR's single mainline track runs generally in a northeast-southwest direction through the study area. Bridge 691.77 serves Periwinkle Creek with a drainage area of 6.27 $mi^2$. The channel is well-defined in the vicinity of the bridge. A Portland and Western (P&W) track runs parallel to UPRR downstream of Bridge 691.77. The downstream P&W structure is 1 – 12.00' corrugated metal pipe (CMP) culvert. Additionally, approximately 500' upstream of Bridge 691.77 is 1 – 12.00' x 9.00' corrugated metal pipe arch (CMPA) culvert serving Santiam Road SE.

## *Structure Summary*

Existing Structure: 9-span, 135' long, Timber Stringer Trestle – Ballast Deck bridge
Proposed Structure: 3-span, 90' long, Prestressed Concrete Box (PCB) Girders bridge

## *Hydraulic Results*

A hydrologic and hydraulic investigation was conducted to determine if the proposed structure meets or exceeds local, state, and federal floodplain regulations, as well as UPRR's

standards for passing the 50- and 100-year flood events. The proposed structure was designed to meet these criteria and withstand expected high flows and prohibit restriction of low flows.

The following table summarizes the results of the hydraulic investigation at the upstream face of the existing and proposed structures. The elevations are set to an arbitrary datum of Base of Rail = 100.00.

| | Existing Structure | Proposed Structure |
|---|---|---|
| **Base of Rail** | 100.00 | 100.00 |
| **Low Chord** | 96.92 | 96.16 |
| **$WSE_{100}$** | 89.50 | 89.50 |

Based on the results of the hydraulic investigation, the proposed bridge will result in no rise in the 100-year WSE at the upstream face of the structure.

### *General Construction Notes*

The watercourse will not be altered. Any debris and excavated material from the construction will be hauled off and disposed of off-site and away from the stream channel on an upland area. All construction shall take place within the UPRR right-of-way or acquired easement.

Any entry into UPRR's property will require personal protective measures and prior arrangements with Mr. Keith Wagner, Manager of Bridge Maintenance. Mr. Wagner may be reached at (503) 249-3007.

### *Attachments*

The following is provided for your permit determination:

- Planning Application
- Findings of Fact
- Project Location Maps (Figure No. 1 and No. 2)
- Flood Insurance Rate Map (FIRMette)
- Proposed Bridge Plans

Please provide this office (Coldwater Engineering) with the appropriate floodplain development permit to allow UPRR to proceed with the proposed construction. Your timely response to this application will be appreciated.

If you have any questions concerning this project, or need additional information, please contact me at (406) 459-9597, at your earliest convenience. Please refer your future correspondence to **Bridge 691.77, Brooklyn Subdivision.**

Sincerely,

Tom Askin, P.E.
Coldwater Engineering

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# Review Criteria and Development Standards Responses

## *Criterion*

**Alteration of a Watercourse (ADC 6.101) A watercourse is considered altered when any changes occur within its banks, including installation of new culverts and bridges, or size modifications to existing culverts and bridges.**

## *Findings of Fact*

Bridge 691.77 serves Periwinkle Creek, which flows through the City of Albany before emptying into the Willamette River, 2,100 feet downstream of the UPRR tracks.

There is 1 - 12.00' x 9.00' Corrugated Metal Pipe Arch (CMPA) culvert approximately 500 feet upstream of the tracks serving Santiam Road SE.

Portland & Western (P&W) tracks run parallel to the UPRR tracks, 60 feet downstream. The P&W structure is a 12.00' diameter Corrugated Metal Pipe (CMP) culvert.

The existing 9-span, 135' long, Timber Stringer Trestle (TST) bridge is to be replaced with a 3-span, 30' long, Prestressed Concrete Box (PCB) Girder bridge for a total length of 90 feet.

The proposed structure provides 29% less opening area below the WSE100 as compared to the existing bridge (341.1 ft2 vs. 481.8 ft2).

Most of the opening area lost due to replacement is ineffective flow area caused by the presence of the downstream P&W culvert. This accounts for the loss of opening area having very little effect of WSEs and velocities.

This bridge option lines up better than the existing structure with the upstream channel, as banks are approximately 80' apart.

Any new fill is not to be placed within the active channel bottom.

Based on a hydraulic analysis using HEC-RAS, the replacement results in no rise (0.00') for both the 50- and 100-year floods.

## *Conclusions*

The proposed PCB bridge will decrease the UPRR structure size over Periwinkle Creek; however, due to the size of the channel and the downstream P&W structure, the area lost is ineffective flow area and will not diminish the flood-carrying capacity of Periwinkle Creek. The watercourse is not to be relocated.

## *Criterion*

**Grading, Fill, Excavation, and Paving (ADC 6.111) A floodplain development permit is required for grading, fill, excavation, and paving in the Special Flood Hazard Area (100-year floodplain), except when the applicant has supplied evidence prepared by a professional engineer that demonstrates the proposal will not result in any increase in flood levels during the occurrence of the 100-year flood.**

## *Findings of Fact*

Bridge 691.77 is located within a FEMA-designated, Zone A, special flood hazard areas inundated by the 100-year flood, no base flood elevations determined, as shown on the Flood Insurance Rate Map for Linn County, Oregon and Incorporated Areas (Map Number 41043C0214H, 12/8/2016).

The existing 9-span, 135' long, Timber Stringer Trestle (TST) bridge is to be replaced with a 3-span, 30' long, Prestressed Concrete Box (PCB) Girder bridge for a total length of 90 feet.

Based on a hydraulic analysis using HEC-RAS, the replacement results in no rise (0.00') for both the 50- and 100-year floods.

## *Conclusions*

The proposed replacement is located in a floodplain; however, based on the attached engineer's report, it will not create a rise in 50- or 100-year flood elevations.

# Memorandum

COLDWATER ENGINEERING

To: Jennifer Cepello, Floodplain Administrator – Albany, OR
From: Alex McDonald, P.E., Coldwater Engineering
Subject: Floodplain Development Permit Application – Hydraulics Memo
UPRR Bridge 691.77, Brooklyn Subdivision (FP-08-23)
Albany, OR
Date: June 5, 2024
CC: Ken Puhn, PE, CFM - West Consultants


## PROJECT OVERVIEW

The Union Pacific Railroad Company (UPRR) is proposing to replace Bridge 691.77 on the Brooklyn Subdivision. On behalf of UPRR, Coldwater Engineering has prepared this memorandum to provide your office with pertinent project information as requested for the review and issuance of a Floodplain Development Permit. All other local, state, and federal permits will be applied for and obtained as required by a separate consultant.

### Location

Bridge 691.77 is located along the Brooklyn Subdivision in Linn County, Oregon. More specifically, the project site is located within the city limits of Albany, Oregon with coordinates of,

44.637060° North, 123.086354° West

### Flood Designation

The area in the immediate vicinity of Bridge 691.77 is located within a FEMA-designated, Zone A, special flood hazard areas subject to inundation by the 100-year flood, no base flood elevations determined, as shown on the Flood Insurance Rate Map for Linn County, Oregon and Incorporated Areas (Map Number, 41043C0214H, effective date December 8, 2016).

### Site

UPRR's single mainline track runs generally in a northeast-southwest direction through the study area. Bridge 691.77 serves Periwinkle Creek with a drainage area of 6.27 $mi^2$. The channel is well-defined in the vicinity of the bridge. A Portland and Western (P&W) track runs parallel to UPRR downstream of Bridge 691.77. The downstream P&W structure is 1 – 12.00' corrugated metal pipe (CMP) culvert. Additionally, approximately 500' upstream of Bridge 691.77 is 1 – 12.00' x 9.00' corrugated metal pipe arch (CMPA) culvert serving Santiam Road SE.

### Structure Summary

Existing Structure: 9-span, 135' long, Timber Stringer Trestle – Ballast Deck bridge

Proposed Structure: 3-span, 90' long, Prestressed Concrete Box (PCB) Girders bridge

Refer to **Appendix C** for site photos.

## Hydrology

| | |
|---|---|
| Stream Name: | Periwinkle Creek |
| USGS Quadrangle: | Albany, Oregon (2017) |
| Methodology: | NRCS's Technical Release 55 (TR-55) |
| Drainage Area: | 6.27 $mi^2$ |
| Average Slope: | 0.0022 ft/ft |
| Total Flow Length: | 6.98 mi |
| CN: | 87 |
| Tc: | 8.11 hrs |
| Design Storm Duration: | 24-hour |
| Design Storm Intensity: | |
| | 50-yr: 4.4 in (NOAA Atlas 2) |
| | 100-yr: 4.5 in (NOAA Atlas 2) |

**Design Discharges:**
$Q_{50}$ = 810 cfs
$Q_{100}$ = 830 cfs

### Comments:

The **NRCS's Technical Release 55 (TR-55)** was used in calculating the above design discharges. Using TR-55, a $Q_{50}$ = 810 cfs and $Q_{100}$ = 830 cfs were obtained.

The **Scientific Investigations Report (SIR) 2005-5116**, Estimation of Peak Discharges for Rural, Unregulated Streams in Western Oregon was also used to estimate discharges. This method uses regression equations to predict the magnitude of peak discharges at various frequencies based on observed peak discharges fitted to the Pearson Type III theoretical probability distribution.

- Discharges of $Q_{50}$ = 155 cfs and a $Q_{100}$ = 180 cfs were obtained. However, the Mean Basin Slope parameter for this drainage is below the required watershed characteristics.
- Increasing the Mean Basin Slope parameter to the minimum slope value within the range results in a $Q_{50}$ = 580 cfs and $Q_{100}$ = 655 cfs.
    - These adjusted discharges compare reasonably well with the TR-55 values. TR-55 was chosen to be slightly more conservative.

The **Oregon Department of Transportation (OrDOT)** was contacted about the upstream and downstream highway structures, but no relevant hydrologic information was provided.

A comparison of **Area Stream Gages** with similar drainage basin parameters yielded $Q_{50}$ = 109 cfs/$mi^2$ and $Q_{100}$ = 124 cfs/$mi^2$, resulting in a $Q_{50}$ = 685 cfs and a $Q_{100}$ = 780 cfs. These values compare favorably with the TR-55 values.

Refer to **Appendix B** for the TR-55 and SIR 2005-5116 calculations spreadsheets.

## Hydraulic Results

A hydrologic and hydraulic investigation was conducted to determine if the proposed structure meets or exceeds local, state, and federal floodplain regulations, as well as UPRR's standards for passing the 50- and 100-year flood events. The proposed structure was designed to meet these criteria and withstand expected high flows and prohibit restriction of low flows. HEC-RAS v. 6.4.1 was used to develop a hydraulic model of existing and proposed conditions. Channel cross sections were constructed based on a site survey performed by Coldwater Engineering on 1/29/18 with overbank elevations supplemented from a USGS 1/3 arc-sec digital elevation model. Existing UPRR bridge and P&W culvert dimensions were based on the site survey. Normal depth slope of S = 0.001 ft/ft, measured from surveyed cross sections, was selected for use in downstream control. Manning's n values of 0.04 (clean, winding) were used for the channel, 0.06 (light brush and trees) for overbank areas, and 0.03 for placed riprap. Manning's values are based on determination from site visit and photos.

The following table summarizes the results of the hydraulic investigation at the upstream face of the existing and proposed structures. The elevations are set to NAVD '88.

| | **Existing Structure** | **Proposed Structure** |
|---|---|---|
| **Base of Rail** | 218.59 | 218.59 |
| **Low Chord** | 215.51 | 215.20 |
| **Upstream Face $WSE_{100}$** | 207.60 | 207.59 |

Based on the results of the hydraulic investigation, the proposed bridge will result in a 0.01' decrease in the 100-year WSE at the upstream face of the structure and no rise throughout the model. Refer to **Appendix A** for the existing vs. proposed hydraulics summary table and plan view of modeled reach.

## Bridge and Channel Maintenance

A sensitivity analysis was performed on the downstream boundary condition to ensure the water surface elevations upstream of the proposed bridge do not affect any upstream structures (buildings, bridges, etc.). Flattening the downstream boundary condition by a factor of ten (nds = 0.0001 ft/ft) still results in upstream water surface elevations below the surrounding high ground where structures are located. Refer to Appendix A for a figure showing the floodplain on top of aerial imagery.

## Bridge and Channel Maintenance

Section 6.101 (4) of the City of Albany Floodplain Development Code states: *The applicant shall be responsible for ensuring necessary maintenance of the altered or relocated portion of said watercourse so that the flood carrying capacity is not diminished. [Ord. 5746, 9/29/10].*

UPRR maintains a robust inspection program across their system in accordance with the Federal Railroad Administration (FRA) to ensure safe passage of freight railroad. All bridge structures are inspected annually or bi-annually which includes provisions to ensure a clear, stable watercourse through the structure, free of drift and debris. In addition, inspectors are dispatched as needed

following large weather events, floods, fires, or derailments to ensure structures were not compromised as a result of the event.

## Attachments

The following separate files have also been provided for your permit determination:

- HEC-RAS Model
- Proposed Bridge Plans

If you have any questions concerning this project, or need additional information, please contact me at (406) 531-4251, at your earliest convenience.

Sincerely,

Alexandra McDonald

Alexandra McDonald, P.E.
Coldwater Engineering

# Appendix A: Hydraulic Figures

HEC-RAS River: Periwinkle Cr Reach: Brooklyn_691_77 Profile: Q100

| Reach | River Sta | Profile | Plan | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Brooklyn_691_77 | 396 | Q100 | 3 @ 30' PCBs | 830.00 | 199.47 | 207.62 | | 207.79 | 0.000688 | 3.55 | 297.50 | 65.82 | 0.23 |
| Brooklyn_691_77 | 396 | Q100 | Existing | 830.00 | 199.47 | 207.62 | | 207.79 | 0.000686 | 3.55 | 297.75 | 65.85 | 0.23 |
| Brooklyn_691_77 | 316 | Q100 | 3 @ 30' PCBs | 830.00 | 199.26 | 207.54 | | 207.73 | 0.000716 | 3.67 | 271.82 | 55.60 | 0.24 |
| Brooklyn_691_77 | 316 | Q100 | Existing | 830.00 | 199.26 | 207.54 | | 207.74 | 0.000714 | 3.66 | 272.03 | 55.63 | 0.24 |
| Brooklyn_691_77 | 226 | Q100 | 3 @ 30' PCBs | 830.00 | 199.17 | 207.59 | 202.70 | 207.66 | 0.000270 | 2.25 | 452.93 | 92.81 | 0.15 |
| Brooklyn_691_77 | 226 | Q100 | Existing | 830.00 | 199.17 | 207.60 | 202.70 | 207.66 | 0.000270 | 2.25 | 453.20 | 92.83 | 0.15 |
| Brooklyn_691_77 | 213 | | | Bridge | | | | | | | | | |
| Brooklyn_691_77 | 200 | Q100 | 3 @ 30' PCBs | 830.00 | 199.29 | 207.46 | 202.79 | 207.60 | 0.000523 | 3.06 | 276.57 | 91.26 | 0.20 |
| Brooklyn_691_77 | 200 | Q100 | Existing | 830.00 | 199.29 | 207.46 | 202.79 | 207.60 | 0.000523 | 3.06 | 276.57 | 91.26 | 0.20 |
| Brooklyn_691_77 | 190 | Q100 | 3 @ 30' PCBs | 830.00 | 197.45 | 207.17 | 201.99 | 207.53 | 0.000918 | 4.80 | 172.76 | 72.31 | 0.28 |
| Brooklyn_691_77 | 190 | Q100 | Existing | 830.00 | 197.45 | 207.17 | 201.99 | 207.53 | 0.000918 | 4.80 | 172.76 | 72.31 | 0.28 |
| Brooklyn_691_77 | 150 | | | Culvert | | | | | | | | | |
| Brooklyn_691_77 | 110 | Q100 | 3 @ 30' PCBs | 830.00 | 197.59 | 204.26 | 202.11 | 205.12 | 0.003661 | 7.44 | 111.55 | 47.54 | 0.53 |
| Brooklyn_691_77 | 110 | Q100 | Existing | 830.00 | 197.59 | 204.26 | 202.11 | 205.12 | 0.003661 | 7.44 | 111.55 | 47.54 | 0.53 |
| Brooklyn_691_77 | 0 | Q100 | 3 @ 30' PCBs | 830.00 | 197.47 | 204.41 | 201.50 | 204.59 | 0.001001 | 3.50 | 278.42 | 75.31 | 0.27 |
| Brooklyn_691_77 | 0 | Q100 | Existing | 830.00 | 197.47 | 204.41 | 201.50 | 204.59 | 0.001001 | 3.50 | 278.42 | 75.31 | 0.27 |

Existing vs. Proposed Hydraulic Table


Plan View of Modeled Reach (Periwinkle Creek)

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Plan View of Modeled Reach - 100-year Floodplain with Proposed Conditions

# Appendix B: Hydrology Calculations

**TR55 Method**
**Worksheet 2: Runoff curve number and runoff**

**DO NOT ENTER VALUES IN COLORED BOXES!**

| | | | |
|---|---|---|---|
| Project: | Brooklyn Sub, Bridge 691.77 | | |
| Location: | Albany, OR | | |
| By: | TMA | Date: | 2/8/18 |
| Checked: | | Date: | |
| Circle one: | Present | Developed | |

1. Runoff curve number (CN)

| Soil Name & Hydrologic Group | Cover Description | CN 1/ Table 2-2 | CN 1/ Fig. 2-3 | CN 1/ Fig. 2-4 | Area | Product of CN x Area |
|---|---|---|---|---|---|---|
| Amity Silt Loam, C/D | SR Crops, Poor | 89.5 | | | 21 | 1879.5 |
| Concord Silt Loam, C/D | SR Crops, Poor | 89.5 | | | 16 | 1432 |
| Dayton Silt Loam, D | SR Crops, Poor | 91 | | | 14 | 1274 |
| Amity Silt Loam, C/D | Resid. 1/4 acre lots | 85 | | | 10 | 850 |
| Concord Silt Loam, C/D | Resid. 1/4 acre lots | 85 | | | 8 | 680 |
| Dayton Silt Loam, D | Resid. 1/4 acre lots | 87 | | | 6 | 522 |
| Willamette Silt Loam, B | Resid. 1/4 acre lots | 75 | | | 3 | 225 |
| Woodburn Silt Loam, C | Resid. 1/4 acre lots | 83 | | | 22 | 1826 |
| 1/ Use only one CN source per line | | | | Totals = | 100 | 8688.5 |
| | | | | | CN weighted = | 86.885 |
| | | | | | **use CN =** | **87** |

2. Runoff

| | | Storm #1 | Storm #2 | Storm #3 |
|---|---|---|---|---|
| Frequency | yr | 2 | 50 | 100 |
| Rainfall, P (24-hour) | in | 2.50 | 4.40 | 4.50 |
| S | | 1.49 | 1.49 | 1.49 |
| Runoff, Q | in | 1.31 | 3.01 | 3.10 |

(use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4)

**TR55 Method**
**Worksheet 3: Time of Concentration ($T_c$) or Travel Time ($T_t$)**

**DO NOT ENTER VALUES IN COLORED BOXES!**

| | | | | | |
|---|---|---|---|---|---|
| Project: | | | Brooklyn Sub, Bridge 691.77 | | |
| Location: | | | Albany, OR | | |
| By: | | | TMA | Date: | 2/8/18 |
| Checked: | | | | Date: | |
| Circle one: | | | Present | Developed | |
| Circle one: | | | $T_c$ | $T_t$ | through subarea |

| **Sheet Flow (Applicable to $T_c$ only)** | **Segment ID** | | | | |
|---|---|---|---|---|---|
| 1. Surface Description (table 3-1) | | | Range (natural) | | |
| 2. Manning's roughness coefficient, n (table 3-1) | | | 0.13 | | |
| 3. Flow length, L (total L <= 300 ft) | | ft | 300 | | |
| 4. Two-yr 24-hr rainfall, $P_2$ | | in | 2.50 | | |
| 5. Land slope, s | | ft/ft | 0.0023 | | |
| 6. $T_t = 0.007(nL)^{0.8} / P_2^{0.5} s^{0.4}$ | Compute $T_t$ | hr | 0.94 | 0.00 | **0.94** |

| **Shallow Concentrated Flow** | **Segment ID** | | | | |
|---|---|---|---|---|---|
| 7. Surface description (paved or unpaved) | | | Unpaved | | |
| 8. Flow length, L | | ft | 8435 | | |
| 9. Watercourse slope, s | | ft/ft | 0.0023 | | |
| 10. Average velocity, V (figure 3-1) | | ft/s | 1.20 | | |
| 11. $T_t = L / 3600V$ | Compute $T_t$ | hr | 1.95 | 0.00 | **1.95** |

| **Channel Flow** | **Segment ID** | | | | |
|---|---|---|---|---|---|
| 12. Cross sectional flow area, a | | $ft^2$ | | | |
| 13. Wetted perimeter, $p_w$ | | ft | | | |
| 14. Hydraulic radius, $r = a / p_w$ | Compute r | ft | #DIV/0! | 0.00 | |
| 15. Channel slope, s | | ft/ft | 0.0022 | | |
| 16. Manning's roughness coefficient, n | | | 0.13 | | |
| 17. $V = 1.49 r^{2/3} s^{1/2} / n$ | Compute V | ft/s | 1.50 | 0.00 | |
| 18. Flow length, L | | ft | 28142 | | |
| 19. $T_t = L / 3600V$ | Compute $T_t$ | hr | 5.21 | 0.00 | **5.21** |
| 20. Watershed or subarea $T_c$ or $T_t$ (add $T_t$ in steps 6, 11, and 19) | | | | | **8.11** hr |

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**TR55 Method**
**Worksheet 4: Graphical Peak Discharge method**

**DO NOT ENTER VALUES IN COLORED BOXES!**

| | | | |
|---|---|---|---|
| Project: | Brooklyn Sub, Bridge 691.77 | | |
| Location: | Albany, OR | | |
| By: TMA | Date: 2/8/18 | | |
| Checked: | Date: | | |
| Circle one: | Present | Developed | |

1. Data:

| | | | |
|---|---|---|---|
| Drainage area | $A_m$ = | 6.27 | $mi^2$ (acres/640) |
| Runoff curve number | CN = | 87 | (From worksheet 2) |
| Time of concentration | $T_c$ = | 8.11 | hr (From worksheet 3) |
| Rainfall distribution type | = | 2 | (I, IA, II, III: See Key) |
| Pond and swamp areas spread throughout watershed | = | 0 | percent of Am |

| | | | Storm #1 | Storm #2 | Storm #3 |
|---|---|---|---|---|---|
| 2. | Frequency | yr | 2 | 50 | 100 |
| 3. | Rainfall, P (24-hour) | in | 2.5 | 4.4 | 4.5 |
| 4. | Initial abstraction, $I_a$ (Use CN with table 4-1) | in | 0.299 | 0.299 | 0.299 |
| 5. | Compute $I_a/P$ | | 0.12 | 0.10 | 0.10 |
| 6. | Unit peak discharge, $q_u$ (Use $T_c$ and $I_a/P$ with exhibit 4-____) | csm/in | 41.73 | 42.85 | 42.85 |
| 7. | Runoff, Q (From worksheet 2) | in | 1.31 | 3.01 | 3.10 |
| 8. | Pond and swamp adjustment factor, $F_p$ (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.) | | 1.00 | 1.00 | 1.00 |
| 9. | Peak discharge, $q_p$ (Where $q_p = q_u A_m Q F_p$) | cfs | 340 | 810 | 830 |

COLDWATER ENGINEERING

## Estimation of Peak Discharges for Rural, Unregulated Streams in Western Oregon

*Scientific Investigations Report 2005–5116*

U.S. Department of the Interior U.S. Geological Survey

Prepared in cooperation with the Oregon Water Resources Department

| | | |
|---|---|---|
| Drainage Area | 6.27 | $mi^2$ |
| Maximum Watershed Relief | | ft |
| Mean Watershed Slope | 5.62 | ° |
| Mean Watershed Elevation | 246 | ft |
| Mean January Precipitation | | in |
| Mean July Precipitation | | in |
| 2-year 24-hour Precipitation Intensity | 2.5 | in |
| Annual Snowfall | | in |
| Mean Minimum January Temperature | | °F |
| Mean Minimum July Temperature | | °F |
| Mean Maximum Januray Temperature | 46.2 | °F |
| Mean Maximum July Temperature | | °F |
| Soil Storage Capacity | | in |
| Soil Permeability | | in/hr |
| Soil Depth | | in |

*Subdivision:* Brooklyn
*Bridge:* 691.77
*By:* TMA
*Date:* 1/18/18

Region 1

| | | |
|---|---|---|
| Q2 | #DIV/0! | cfs |
| Q50 | #DIV/0! | cfs |
| Q100 | #DIV/0! | cfs |
| Q500 | #DIV/0! | cfs |

Region 2A

| | | |
|---|---|---|
| Q2 | 0 | cfs |
| Q50 | 0 | cfs |
| Q100 | 0 | cfs |
| Q500 | 0 | cfs |

Region 2B

| | | |
|---|---|---|
| Q2 | 233.404866 | cfs |
| Q50 | 582.029005 | cfs |
| Q100 | 654.617306 | cfs |
| Q500 | 826.986294 | cfs |

***Region 1***

| | | |
|---|---|---|
| Q2 | **#DIV/0!** | **cfs** |
| Q50 | **#DIV/0!** | **cfs** |
| Q100 | **#DIV/0!** | **cfs** |
| Q500 | **#DIV/0!** | **cfs** |

***Region 2A***

| | | |
|---|---|---|
| Q2 | **#NUM!** | **cfs** |
| Q50 | **#NUM!** | **cfs** |
| Q100 | **#NUM!** | **cfs** |
| Q500 | **#NUM!** | **cfs** |

***Region 2B***

| | | |
|---|---|---|
| Q2 | **233** | **cfs** |
| Q50 | **582** | **cfs** |
| Q100 | **655** | **cfs** |
| Q500 | **827** | **cfs** |

# Appendix C: Site Photos

Upstream Face of Existing UPRR Bridge 691.77

Inlet of P&W Culvert (1 – 12.00' dia. Corrugated Metal Pipe)

# TECHNICAL MEMORANDUM

**WEST Consultants, Inc.**
2601 25th St. SE
Suite 450
Salem, OR 97302-1286
(503) 485-5490
(503) 485-5491 Fax
www.westconsultants.com

WEST CONSULTANTS
WATER | ENVIRONMENTAL | SEDIMENTATION | TECHNOLOGY


EXPIRES: 12/31/2024

**To:** Jennifer Cepello
**Company:** City of Albany, Oregon
**Date:** July 2, 2024
**From:** Ken Puhn, PE, CFM
**Subject:** Review of Floodplain Development Permit Application FP-08-23 – UPRR Bridge 691.77

## Background

WEST Consultants has completed a review of relevant materials from the Floodplain Development Permit Application no. FP-08-23. The application is for a proposed replacement of the existing UPRR Bridge 691.77 over Periwinkle Creek, located between SE Salem Ave and Santiam Rd SE. Based on the effective FEMA Flood Insurance Study for Linn County (FIRM 41043C0214H, 12/8/2016), the replacement structure is located within the FEMA Zone A Special Flood Hazard Area (SFHA) for Periwinkle Creek. No base flood elevations or regulatory floodway have been established for this reach.

The existing bridge is a 9-span, 135 ft long timber trestle structure and the proposed replacement bridge is a 3-span, 90 ft long concrete box girder structure. Since the replacement structure is narrower, fill for the sloping abutments will be placed within the FEMA 1% annual-chance floodplain (100-yr), primarily along the right (east) bank. Since the size of the bridge is being changed and grading and fill activities are happening within the channel banks, this is considered as an “alteration of a watercourse” per the City of Albany - Development Code (CADC). Accordingly, the application must meet the requirements set forth in sections 6.100, 6.101, and 6.111 of the CADC.

Per the CADC, grading and fill are allowed within the Zone A floodplain, provided the following conditions are met:

- The Development does not diminish the flood-carrying capacity of a watercourse.
- The applicant shall be responsible for ensuring necessary maintenance of the altered or relocated portion of said watercourse so that the flood carrying capacity is not diminished.
- Demonstrate the cumulative effect of the proposed grading, fill, excavation, or paving when combined with all other existing and planned development, will not increase the water surface

elevation of the base flood more than a maximum of one foot (cumulative) at any point within the community.

## Findings

A hydraulic no-rise analysis was conducted by the applicant's engineer, Coldwater Engineering. According to the analysis, the proposed replacement structure and associated grading and fill will cause no-rise to the 100-yr floodplain elevations, which satisfies the requirement that the flood carrying capacity of the watercourse is not diminished by the proposed fill and grading activities. The no-rise memo includes a description of the UPRR bridge structure inspection program which has provisions to ensure that watercourse conveyance is maintained and the channel remains clear and stable through the structure.

Although the provided information shows that the proposed activity will cause no-rise to the 100-yr floodplain elevations, since the replacement structure is narrower that the existing structure and the project requires fill within the floodplain, I conducted additional review to determine if the proposed replacement is reasonable for this reach of the watercourse.

There is a noticeable widening of the 100-yr floodplain at the existing bridge, within the right overbank. The proposed fill would largely be within this locally wider area of the floodplain (Figure 1). Immediately downstream of the subject bridge, flow is confined to a 12' diameter culvert that passes water under the parallel Portland & Western railroad track. A plot of the existing channel cross section (at the proposed bridge location) along with the proposed cross section and upstream cross sections shows that the proposed cross section with fill is similar to the upstream reach (Figure 2).

It is noted that the cross sections downstream of the two railroad crossings are wider than the upstream reach. Accordingly, as another check for reasonableness, the 100-yr floodplain top widths of the proposed (filled) bridge cross sections was compared to other cross sections within the reach, from the HEC-RAS model. The comparison shows that the top width of the proposed filled cross section (57 ft) is similar to the average top width of other reach cross sections (60 ft) for the 500 ft long reach upstream of the bridge. The next downstream structure below the two railroad structures is the SE Salem Ave bridge. Based on available LiDAR data, the estimated top width (top of bank, not 100-yr floodplain) is about 75 ft, which is slightly narrower than the proposed replacement structure width (Figure 3).

Finally, since a regulatory floodway has not been developed for this reach, I developed a draft floodway using a 1 ft surcharge target and found that the fill associated with the proposed replacement structure is likely to be outside of a potential future floodway, should one be developed. Based on these additional analyses and comparisons, the proposed bridge and its associated cross sectional shape appears reasonable for the reach in the vicinity of the bridge.

Based on my review of the floodplain permit materials, the application adequately addresses the floodplain component provisions of 6.100, 6.101(1) & (4), and 6.111 of the City of Albany - Development Code. The Floodplain Permit Review Checklist is shown in Appendix A. Supporting documentation is included in Appendix B.

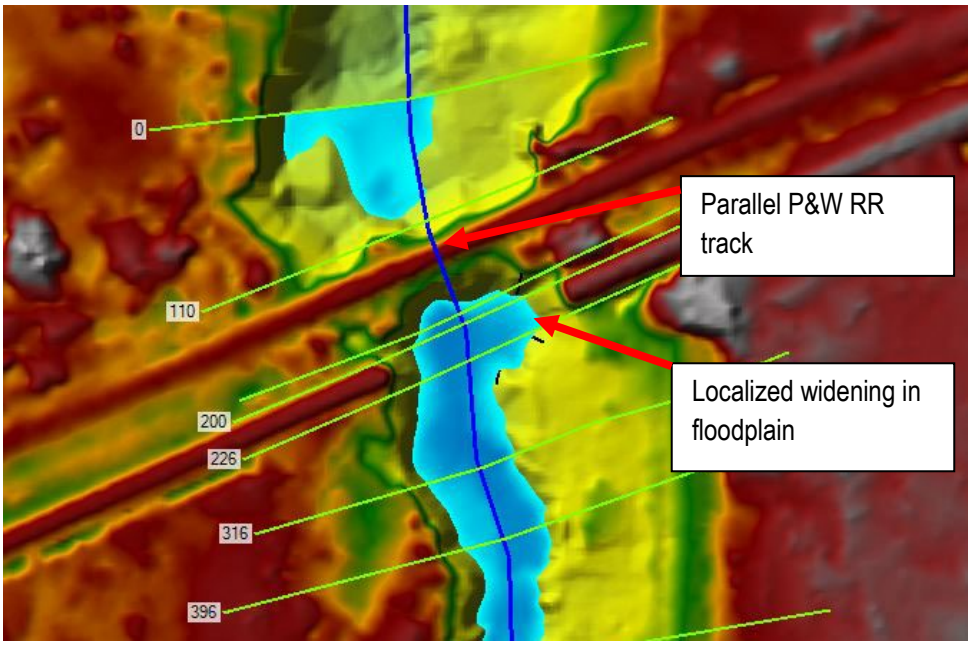



Figure 1. Approximate 100-yr floodplain from Coldwater HEC-RAS model.

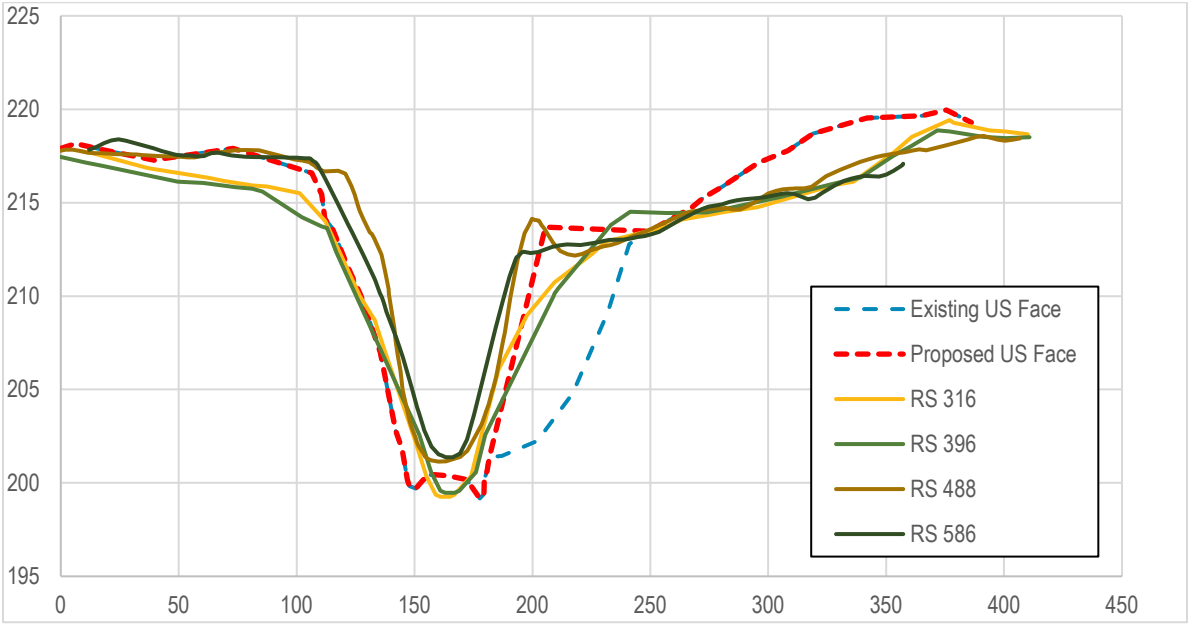



Figure 2 – Cross section comparison

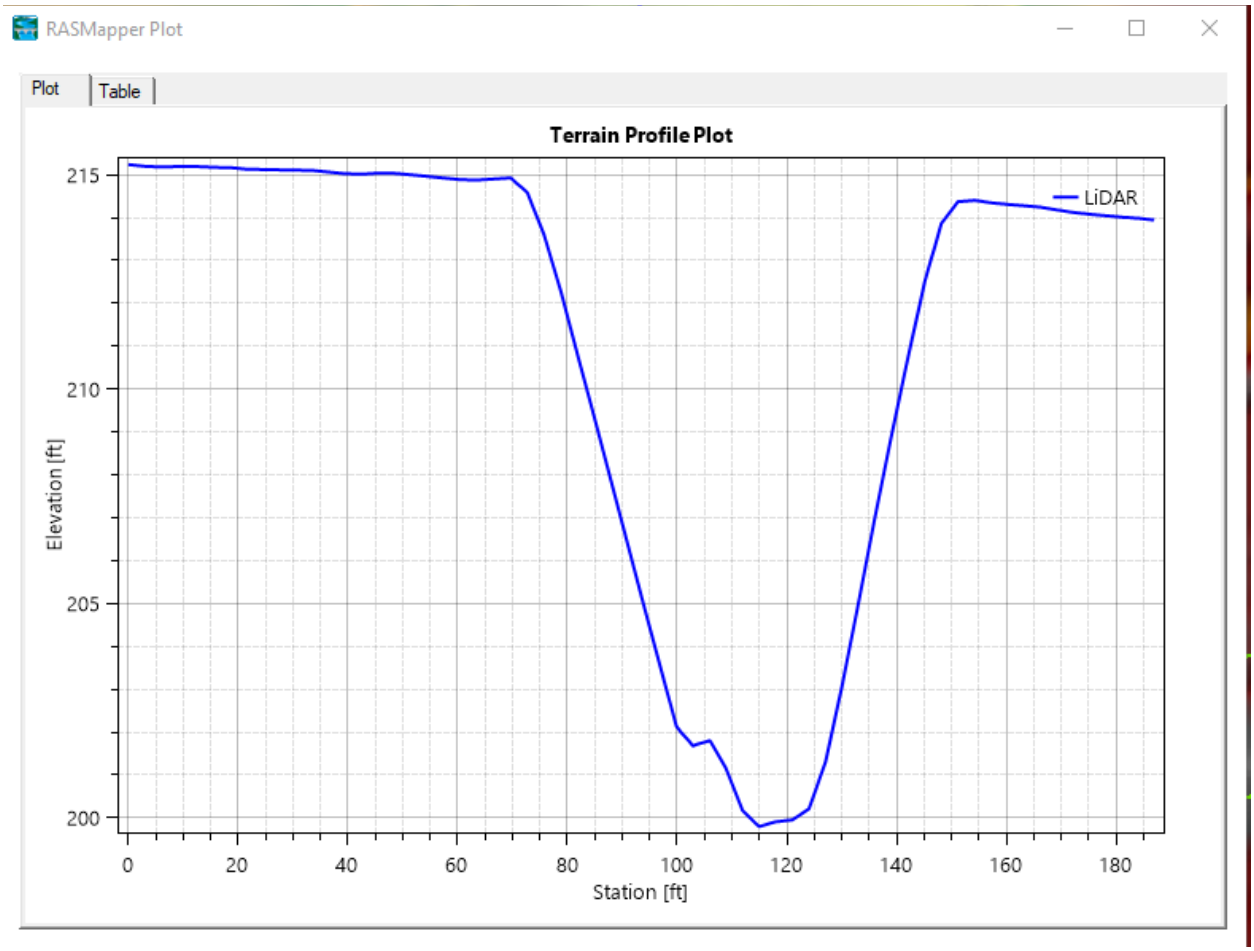



Figure 3. LiDAR cross section of channel at SE Salem Ave Bridge.

# APPENDIX A – Floodplain Review Checklist

# City of Albany, Oregon
# Floodplain Permit Review Checklist

***Permit Reference No:*** **FP-08-23**
***Project:*** **UPRR Bridge 691.77 Replacement**
***Stream:*** **Periwinkle Creek**
***Projection Description:*** **Replacement of Union Pacific RR Bridge 691.77 over Periwinkle Creek**
***Reviewed By:*** **Ken Puhn, P.E., CFM**

## 6.100 Floodway Restrictions.

☐ **FEMA Designated Floodway**

- ☐ Development is outside the designated floodway
- ☐ Development within floodway does not result in any increase in 100-year flood levels
- ☐ Finding based upon applicant-supplied evidence
- ☐ Certified by a registered professional engineer
- ☐ Allowed Floodway Development
  - ☐ 6.100(1) Does not involve the construction of permanent or habitable structures (including fences)
  - ☐ 6.100(2) A public or private park or recreational use or municipal utility use
  - ☐ 6.100(3) A water-dependent structure such as a dock, pier, bridge, or floating marina.
  - ☐ 6.100(4) The temporary storage or processing of materials will not become buoyant, flammable, hazardous explosive or otherwise potentially injurious to human, animal or plant life in times of flooding.
  - ☐ 6.100(5) The temporary storage of material or equipment are not subject to major damage by floods and is firmly anchored to prevent flotation or is readily removable from the area within the time available after flood warning.

☒ **Regulated Floodplain (Non designated FEMA Floodway)**

- ☒ Development along estimated floodway boundary shall not result in an increase of the base flood level greater than 1-foot
- ☒ Finding based upon applicant-supplied evidence
- ☒ Certified by a registered professional engineer

## 6.101 Alteration of a Watercourse

☒ **Watercourse altered**

- ☒ changes occur within its banks
- ☐ installation of new culverts and/or bridges
- ☒ size modifications to existing culverts and bridges

☒ 6.101(1) Development does not diminish the flood-carrying capacity of a watercourse. Finding based upon applicant-supplied evidence.

☒ 6.101(4) The applicant shall be responsible for ensuring necessary maintenance of the altered or relocated portion of said watercourse so that the flood carrying capacity is not diminished.

## 6.111 Grading, Fill, Excavation, and Paving

☐ **FEMA Designated Floodway**

- ☐ Grading is outside the floodway.
- ☐ Grading is inside the floodway and does not result in any increase in flood levels within the floodway during the occurrence of the 100-year flood.
- ☐ Finding based upon applicant-supplied evidence
- ☐ Certified by a registered professional engineer

☒ **Special Flood Hazard Area (100-year floodplain)**

☒ 6.111(1) Provisions have been made to maintain adequate flood-carrying capacity of existing watercourses, including future maintenance of that capacity.

☒ **Regulated Floodplain (Non designated FEMA Floodway)**

☒ 6.111(4) Demonstrate the cumulative effect of the proposed grading, fill, excavation, or paving when combined with all other existing and planned development, will not increase the water surface elevation of the base flood more than a maximum of one foot (cumulative) at any point within the community.

# APPENDIX B – Supporting Documentation

# Memorandum

COLDWATER ENGINEERING

To: Jennifer Cepello, Floodplain Administrator – Albany, OR
From: Alex McDonald, P.E., Coldwater Engineering
Subject: Floodplain Development Permit Application – Hydraulics Memo
UPRR Bridge 691.77, Brooklyn Subdivision (FP-08-23)
Albany, OR
Date: June 5, 2024
CC: Ken Puhn, PE, CFM - West Consultants


## PROJECT OVERVIEW

The Union Pacific Railroad Company (UPRR) is proposing to replace Bridge 691.77 on the Brooklyn Subdivision. On behalf of UPRR, Coldwater Engineering has prepared this memorandum to provide your office with pertinent project information as requested for the review and issuance of a Floodplain Development Permit. All other local, state, and federal permits will be applied for and obtained as required by a separate consultant.

### Location

Bridge 691.77 is located along the Brooklyn Subdivision in Linn County, Oregon. More specifically, the project site is located within the city limits of Albany, Oregon with coordinates of,

44.637060° North, 123.086354° West

### Flood Designation

The area in the immediate vicinity of Bridge 691.77 is located within a FEMA-designated, Zone A, special flood hazard areas subject to inundation by the 100-year flood, no base flood elevations determined, as shown on the Flood Insurance Rate Map for Linn County, Oregon and Incorporated Areas (Map Number, 41043C0214H, effective date December 8, 2016).

### Site

UPRR's single mainline track runs generally in a northeast-southwest direction through the study area. Bridge 691.77 serves Periwinkle Creek with a drainage area of 6.27 $mi^2$. The channel is well-defined in the vicinity of the bridge. A Portland and Western (P&W) track runs parallel to UPRR downstream of Bridge 691.77. The downstream P&W structure is 1 – 12.00' corrugated metal pipe (CMP) culvert. Additionally, approximately 500' upstream of Bridge 691.77 is 1 – 12.00' x 9.00' corrugated metal pipe arch (CMPA) culvert serving Santiam Road SE.

### Structure Summary

Existing Structure: 9-span, 135' long, Timber Stringer Trestle – Ballast Deck bridge

Proposed Structure: 3-span, 90' long, Prestressed Concrete Box (PCB) Girders bridge

Refer to **Appendix C** for site photos.

## Hydrology

| | |
|---|---|
| Stream Name: | Periwinkle Creek |
| USGS Quadrangle: | Albany, Oregon (2017) |
| Methodology: | NRCS's Technical Release 55 (TR-55) |
| Drainage Area: | 6.27 $mi^2$ |
| Average Slope: | 0.0022 ft/ft |
| Total Flow Length: | 6.98 mi |
| CN: | 87 |
| Tc: | 8.11 hrs |
| Design Storm Duration: | 24-hour |
| Design Storm Intensity: | |
| | 50-yr: 4.4 in (NOAA Atlas 2) |
| | 100-yr: 4.5 in (NOAA Atlas 2) |

**Design Discharges:**
$Q_{50}$ = 810 cfs
$Q_{100}$ = 830 cfs

### Comments:

The **NRCS's Technical Release 55 (TR-55)** was used in calculating the above design discharges. Using TR-55, a $Q_{50}$ = 810 cfs and $Q_{100}$ = 830 cfs were obtained.

The **Scientific Investigations Report (SIR) 2005-5116**, Estimation of Peak Discharges for Rural, Unregulated Streams in Western Oregon was also used to estimate discharges. This method uses regression equations to predict the magnitude of peak discharges at various frequencies based on observed peak discharges fitted to the Pearson Type III theoretical probability distribution.

- Discharges of $Q_{50}$ = 155 cfs and a $Q_{100}$ = 180 cfs were obtained. However, the Mean Basin Slope parameter for this drainage is below the required watershed characteristics.
- Increasing the Mean Basin Slope parameter to the minimum slope value within the range results in a $Q_{50}$ = 580 cfs and $Q_{100}$ = 655 cfs.
    - These adjusted discharges compare reasonably well with the TR-55 values. TR-55 was chosen to be slightly more conservative.

The **Oregon Department of Transportation (OrDOT)** was contacted about the upstream and downstream highway structures, but no relevant hydrologic information was provided.

A comparison of **Area Stream Gages** with similar drainage basin parameters yielded $Q_{50}$ = 109 cfs/$mi^2$ and $Q_{100}$ = 124 cfs/$mi^2$, resulting in a $Q_{50}$ = 685 cfs and a $Q_{100}$ = 780 cfs. These values compare favorably with the TR-55 values.

Refer to **Appendix B** for the TR-55 and SIR 2005-5116 calculations spreadsheets.

## Hydraulic Results

A hydrologic and hydraulic investigation was conducted to determine if the proposed structure meets or exceeds local, state, and federal floodplain regulations, as well as UPRR's standards for passing the 50- and 100-year flood events. The proposed structure was designed to meet these criteria and withstand expected high flows and prohibit restriction of low flows. HEC-RAS v. 6.4.1 was used to develop a hydraulic model of existing and proposed conditions. Channel cross sections were constructed based on a site survey performed by Coldwater Engineering on 1/29/18 with overbank elevations supplemented from a USGS 1/3 arc-sec digital elevation model. Existing UPRR bridge and P&W culvert dimensions were based on the site survey. Normal depth slope of S = 0.001 ft/ft, measured from surveyed cross sections, was selected for use in downstream control. Manning's n values of 0.04 (clean, winding) were used for the channel, 0.06 (light brush and trees) for overbank areas, and 0.03 for placed riprap. Manning's values are based on determination from site visit and photos.

The following table summarizes the results of the hydraulic investigation at the upstream face of the existing and proposed structures. The elevations are set to NAVD '88.

| | **Existing Structure** | **Proposed Structure** |
|---|---|---|
| **Base of Rail** | 218.59 | 218.59 |
| **Low Chord** | 215.51 | 215.20 |
| **Upstream Face $WSE_{100}$** | 207.60 | 207.59 |

Based on the results of the hydraulic investigation, the proposed bridge will result in a 0.01' decrease in the 100-year WSE at the upstream face of the structure and no rise throughout the model. Refer to **Appendix A** for the existing vs. proposed hydraulics summary table and plan view of modeled reach.

## Bridge and Channel Maintenance

A sensitivity analysis was performed on the downstream boundary condition to ensure the water surface elevations upstream of the proposed bridge do not affect any upstream structures (buildings, bridges, etc.). Flattening the downstream boundary condition by a factor of ten (nds = 0.0001 ft/ft) still results in upstream water surface elevations below the surrounding high ground where structures are located. Refer to Appendix A for a figure showing the floodplain on top of aerial imagery.

## Bridge and Channel Maintenance

Section 6.101 (4) of the City of Albany Floodplain Development Code states: *The applicant shall be responsible for ensuring necessary maintenance of the altered or relocated portion of said watercourse so that the flood carrying capacity is not diminished. [Ord. 5746, 9/29/10].*

UPRR maintains a robust inspection program across their system in accordance with the Federal Railroad Administration (FRA) to ensure safe passage of freight railroad. All bridge structures are inspected annually or bi-annually which includes provisions to ensure a clear, stable watercourse through the structure, free of drift and debris. In addition, inspectors are dispatched as needed

following large weather events, floods, fires, or derailments to ensure structures were not compromised as a result of the event.

## Attachments

The following separate files have also been provided for your permit determination:

- HEC-RAS Model
- Proposed Bridge Plans

If you have any questions concerning this project, or need additional information, please contact me at (406) 531-4251, at your earliest convenience.

Sincerely,

Alexandra McDonald

Alexandra McDonald, P.E.
Coldwater Engineering

# Appendix A: Hydraulic Figures

HEC-RAS River: Periwinkle Cr Reach: Brooklyn_691_77 Profile: Q100

| Reach | River Sta | Profile | Plan | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Brooklyn_691_77 | 396 | Q100 | 3 @ 30' PCBs | 830.00 | 199.47 | 207.62 | | 207.79 | 0.000688 | 3.55 | 297.50 | 65.82 | 0.23 |
| Brooklyn_691_77 | 396 | Q100 | Existing | 830.00 | 199.47 | 207.62 | | 207.79 | 0.000686 | 3.55 | 297.75 | 65.85 | 0.23 |
| Brooklyn_691_77 | 316 | Q100 | 3 @ 30' PCBs | 830.00 | 199.26 | 207.54 | | 207.73 | 0.000716 | 3.67 | 271.82 | 55.60 | 0.24 |
| Brooklyn_691_77 | 316 | Q100 | Existing | 830.00 | 199.26 | 207.54 | | 207.74 | 0.000714 | 3.66 | 272.03 | 55.63 | 0.24 |
| Brooklyn_691_77 | 226 | Q100 | 3 @ 30' PCBs | 830.00 | 199.17 | 207.59 | 202.70 | 207.66 | 0.000270 | 2.25 | 452.93 | 92.81 | 0.15 |
| Brooklyn_691_77 | 226 | Q100 | Existing | 830.00 | 199.17 | 207.60 | 202.70 | 207.66 | 0.000270 | 2.25 | 453.20 | 92.83 | 0.15 |
| Brooklyn_691_77 | 213 | | | Bridge | | | | | | | | | |
| Brooklyn_691_77 | 200 | Q100 | 3 @ 30' PCBs | 830.00 | 199.29 | 207.46 | 202.79 | 207.60 | 0.000523 | 3.06 | 276.57 | 91.26 | 0.20 |
| Brooklyn_691_77 | 200 | Q100 | Existing | 830.00 | 199.29 | 207.46 | 202.79 | 207.60 | 0.000523 | 3.06 | 276.57 | 91.26 | 0.20 |
| Brooklyn_691_77 | 190 | Q100 | 3 @ 30' PCBs | 830.00 | 197.45 | 207.17 | 201.99 | 207.53 | 0.000918 | 4.80 | 172.76 | 72.31 | 0.28 |
| Brooklyn_691_77 | 190 | Q100 | Existing | 830.00 | 197.45 | 207.17 | 201.99 | 207.53 | 0.000918 | 4.80 | 172.76 | 72.31 | 0.28 |
| Brooklyn_691_77 | 150 | | | Culvert | | | | | | | | | |
| Brooklyn_691_77 | 110 | Q100 | 3 @ 30' PCBs | 830.00 | 197.59 | 204.26 | 202.11 | 205.12 | 0.003661 | 7.44 | 111.55 | 47.54 | 0.53 |
| Brooklyn_691_77 | 110 | Q100 | Existing | 830.00 | 197.59 | 204.26 | 202.11 | 205.12 | 0.003661 | 7.44 | 111.55 | 47.54 | 0.53 |
| Brooklyn_691_77 | 0 | Q100 | 3 @ 30' PCBs | 830.00 | 197.47 | 204.41 | 201.50 | 204.59 | 0.001001 | 3.50 | 278.42 | 75.31 | 0.27 |
| Brooklyn_691_77 | 0 | Q100 | Existing | 830.00 | 197.47 | 204.41 | 201.50 | 204.59 | 0.001001 | 3.50 | 278.42 | 75.31 | 0.27 |

Existing vs. Proposed Hydraulic Table


Plan View of Modeled Reach (Periwinkle Creek)


Plan View of Modeled Reach - 100-year Floodplain with Proposed Conditions

# Appendix B: Hydrology Calculations

**TR55 Method**
**Worksheet 2: Runoff curve number and runoff**

**DO NOT ENTER VALUES IN COLORED BOXES!**

| | | | |
|---|---|---|---|
| Project: | Brooklyn Sub, Bridge 691.77 | | |
| Location: | Albany, OR | | |
| By: | TMA | Date: | 2/8/18 |
| Checked: | | Date: | |
| Circle one: | Present | Developed | |

1. Runoff curve number (CN)

| Soil Name & Hydrologic Group | Cover Description | CN 1/ Table 2-2 | CN 1/ Fig. 2-3 | CN 1/ Fig. 2-4 | Area | Product of CN x Area |
|---|---|---|---|---|---|---|
| Amity Silt Loam, C/D | SR Crops, Poor | 89.5 | | | 21 | 1879.5 |
| Concord Silt Loam, C/D | SR Crops, Poor | 89.5 | | | 16 | 1432 |
| Dayton Silt Loam, D | SR Crops, Poor | 91 | | | 14 | 1274 |
| Amity Silt Loam, C/D | Resid. 1/4 acre lots | 85 | | | 10 | 850 |
| Concord Silt Loam, C/D | Resid. 1/4 acre lots | 85 | | | 8 | 680 |
| Dayton Silt Loam, D | Resid. 1/4 acre lots | 87 | | | 6 | 522 |
| Willamette Silt Loam, B | Resid. 1/4 acre lots | 75 | | | 3 | 225 |
| Woodburn Silt Loam, C | Resid. 1/4 acre lots | 83 | | | 22 | 1826 |
| 1/ Use only one CN source per line | | | | Totals = | 100 | 8688.5 |
| | | | | | CN weighted = | 86.885 |
| | | | | | **use CN =** | **87** |

2. Runoff

| | | Storm #1 | Storm #2 | Storm #3 |
|---|---|---|---|---|
| Frequency | yr | 2 | 50 | 100 |
| Rainfall, P (24-hour) | in | 2.50 | 4.40 | 4.50 |
| S | | 1.49 | 1.49 | 1.49 |
| Runoff, Q | in | 1.31 | 3.01 | 3.10 |

(use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4)

**TR55 Method**
**Worksheet 3: Time of Concentration ($T_c$) or Travel Time ($T_t$)**

**DO NOT ENTER VALUES IN COLORED BOXES!**

| | | | | | |
|---|---|---|---|---|---|
| Project: | | | Brooklyn Sub, Bridge 691.77 | | |
| Location: | | | Albany, OR | | |
| By: | | | TMA | Date: | 2/8/18 |
| Checked: | | | | Date: | |
| Circle one: | | | Present | Developed | |
| Circle one: | | | $T_c$ | $T_t$ | through subarea |

| **Sheet Flow (Applicable to $T_c$ only)** | **Segment ID** | | | | |
|---|---|---|---|---|---|
| 1. Surface Description (table 3-1) | | | Range (natural) | | |
| 2. Manning's roughness coefficient, n (table 3-1) | | | 0.13 | | |
| 3. Flow length, L (total L <= 300 ft) | | ft | 300 | | |
| 4. Two-yr 24-hr rainfall, $P_2$ | | in | 2.50 | | |
| 5. Land slope, s | | ft/ft | 0.0023 | | |
| 6. $T_t = 0.007(nL)^{0.8} / P_2^{0.5} s^{0.4}$ | Compute $T_t$ | hr | 0.94 | 0.00 | **0.94** |

| **Shallow Concentrated Flow** | **Segment ID** | | | | |
|---|---|---|---|---|---|
| 7. Surface description (paved or unpaved) | | | Unpaved | | |
| 8. Flow length, L | | ft | 8435 | | |
| 9. Watercourse slope, s | | ft/ft | 0.0023 | | |
| 10. Average velocity, V (figure 3-1) | | ft/s | 1.20 | | |
| 11. $T_t = L / 3600V$ | Compute $T_t$ | hr | 1.95 | 0.00 | **1.95** |

| **Channel Flow** | **Segment ID** | | | | |
|---|---|---|---|---|---|
| 12. Cross sectional flow area, a | | $ft^2$ | | | |
| 13. Wetted perimeter, $p_w$ | | ft | | | |
| 14. Hydraulic radius, $r = a / p_w$ | Compute r | ft | #DIV/0! | 0.00 | |
| 15. Channel slope, s | | ft/ft | 0.0022 | | |
| 16. Manning's roughness coefficient, n | | | 0.13 | | |
| 17. $V = 1.49 r^{2/3} s^{1/2} / n$ | Compute V | ft/s | 1.50 | 0.00 | |
| 18. Flow length, L | | ft | 28142 | | |
| 19. $T_t = L / 3600V$ | Compute $T_t$ | hr | 5.21 | 0.00 | **5.21** |
| 20. Watershed or subarea $T_c$ or $T_t$ (add $T_t$ in steps 6, 11, and 19) | | | | | **8.11** hr |

**TR55 Method**
**Worksheet 4: Graphical Peak Discharge method**

**DO NOT ENTER VALUES IN COLORED BOXES!**

| | | | |
|---|---|---|---|
| Project: | Brooklyn Sub, Bridge 691.77 | | |
| Location: | Albany, OR | | |
| By: TMA | Date: 2/8/18 | | |
| Checked: | Date: | | |
| Circle one: | Present | Developed | |

1. Data:

| | | | |
|---|---|---|---|
| Drainage area | $A_m$ = | 6.27 | $mi^2$ (acres/640) |
| Runoff curve number | CN = | 87 | (From worksheet 2) |
| Time of concentration | $T_c$ = | 8.11 | hr (From worksheet 3) |
| Rainfall distribution type | = | 2 | (I, IA, II, III: See Key) |
| Pond and swamp areas spread throughout watershed | = | 0 | percent of Am |

| | | | Storm #1 | Storm #2 | Storm #3 |
|---|---|---|---|---|---|
| 2. | Frequency | yr | 2 | 50 | 100 |
| 3. | Rainfall, P (24-hour) | in | 2.5 | 4.4 | 4.5 |
| 4. | Initial abstraction, $I_a$ (Use CN with table 4-1) | in | 0.299 | 0.299 | 0.299 |
| 5. | Compute $I_a/P$ | | 0.12 | 0.10 | 0.10 |
| 6. | Unit peak discharge, $q_u$ (Use $T_c$ and $I_a/P$ with exhibit 4-____) | csm/in | 41.73 | 42.85 | 42.85 |
| 7. | Runoff, Q (From worksheet 2) | in | 1.31 | 3.01 | 3.10 |
| 8. | Pond and swamp adjustment factor, $F_p$ (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.) | | 1.00 | 1.00 | 1.00 |
| 9. | Peak discharge, $q_p$ (Where $q_p = q_u A_m Q F_p$) | cfs | 340 | 810 | 830 |

COLDWATER ENGINEERING

## Estimation of Peak Discharges for Rural, Unregulated Streams in Western Oregon

*Scientific Investigations Report 2005–5116*

U.S. Department of the Interior U.S. Geological Survey

Prepared in cooperation with the Oregon Water Resources Department

| | | |
|---|---|---|
| Drainage Area | 6.27 | $mi^2$ |
| Maximum Watershed Relief | | ft |
| Mean Watershed Slope | 5.62 | ° |
| Mean Watershed Elevation | 246 | ft |
| Mean January Precipitation | | in |
| Mean July Precipitation | | in |
| 2-year 24-hour Precipitation Intensity | 2.5 | in |
| Annual Snowfall | | in |
| Mean Minimum January Temperature | | °F |
| Mean Minimum July Temperature | | °F |
| Mean Maximum Januray Temperature | 46.2 | °F |
| Mean Maximum July Temperature | | °F |
| Soil Storage Capacity | | in |
| Soil Permeability | | in/hr |
| Soil Depth | | in |

*Subdivision:* Brooklyn
*Bridge:* 691.77
*By:* TMA
*Date:* 1/18/18

Region 1

| | | |
|---|---|---|
| Q2 | #DIV/0! | cfs |
| Q50 | #DIV/0! | cfs |
| Q100 | #DIV/0! | cfs |
| Q500 | #DIV/0! | cfs |

Region 2A

| | | |
|---|---|---|
| Q2 | 0 | cfs |
| Q50 | 0 | cfs |
| Q100 | 0 | cfs |
| Q500 | 0 | cfs |

Region 2B

| | | |
|---|---|---|
| Q2 | 233.404866 | cfs |
| Q50 | 582.029005 | cfs |
| Q100 | 654.617306 | cfs |
| Q500 | 826.986294 | cfs |

***Region 1***

| | | |
|---|---|---|
| Q2 | **#DIV/0!** | **cfs** |
| Q50 | **#DIV/0!** | **cfs** |
| Q100 | **#DIV/0!** | **cfs** |
| Q500 | **#DIV/0!** | **cfs** |

***Region 2A***

| | | |
|---|---|---|
| Q2 | **#NUM!** | **cfs** |
| Q50 | **#NUM!** | **cfs** |
| Q100 | **#NUM!** | **cfs** |
| Q500 | **#NUM!** | **cfs** |

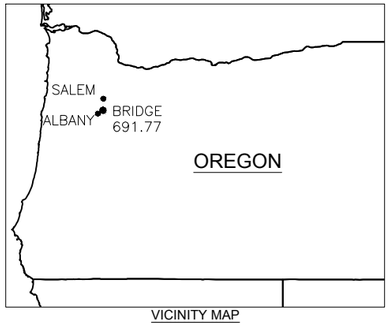
***Region 2B***

| | | |
|---|---|---|
| Q2 | **233** | **cfs** |
| Q50 | **582** | **cfs** |
| Q100 | **655** | **cfs** |
| Q500 | **827** | **cfs** |

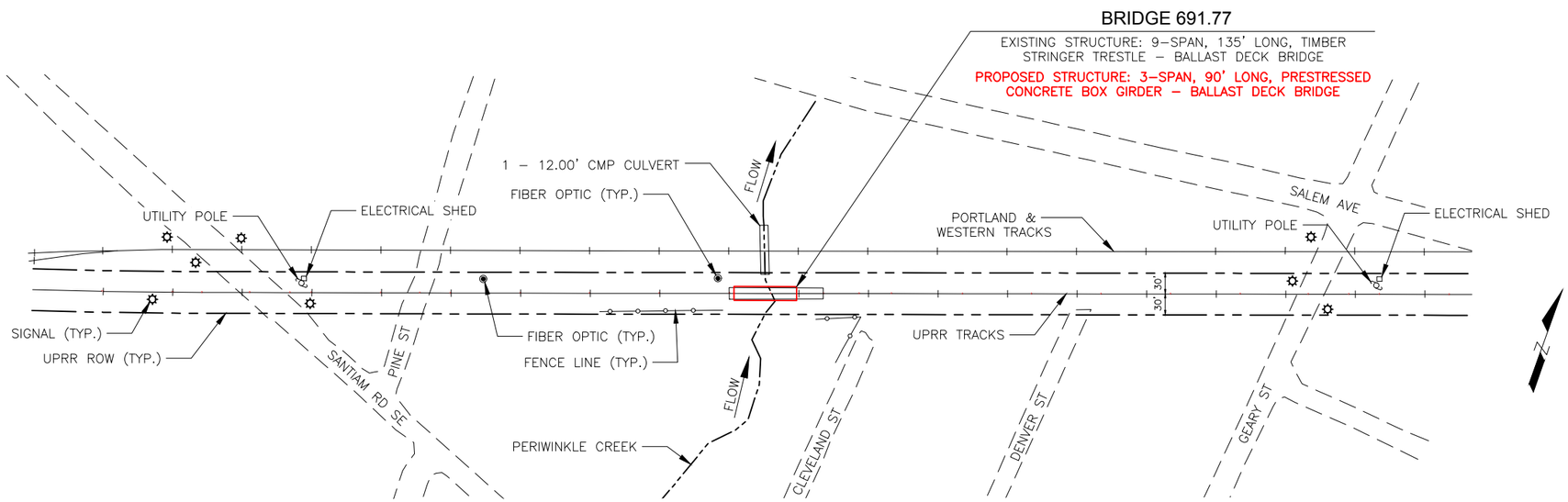
# Appendix C: Site Photos

Upstream Face of Existing UPRR Bridge 691.77

Inlet of P&W Culvert (1 – 12.00' dia. Corrugated Metal Pipe)



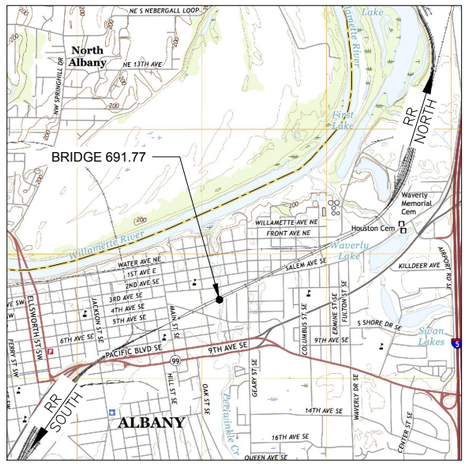

VICINITY MAP
(NOT TO SCALE)



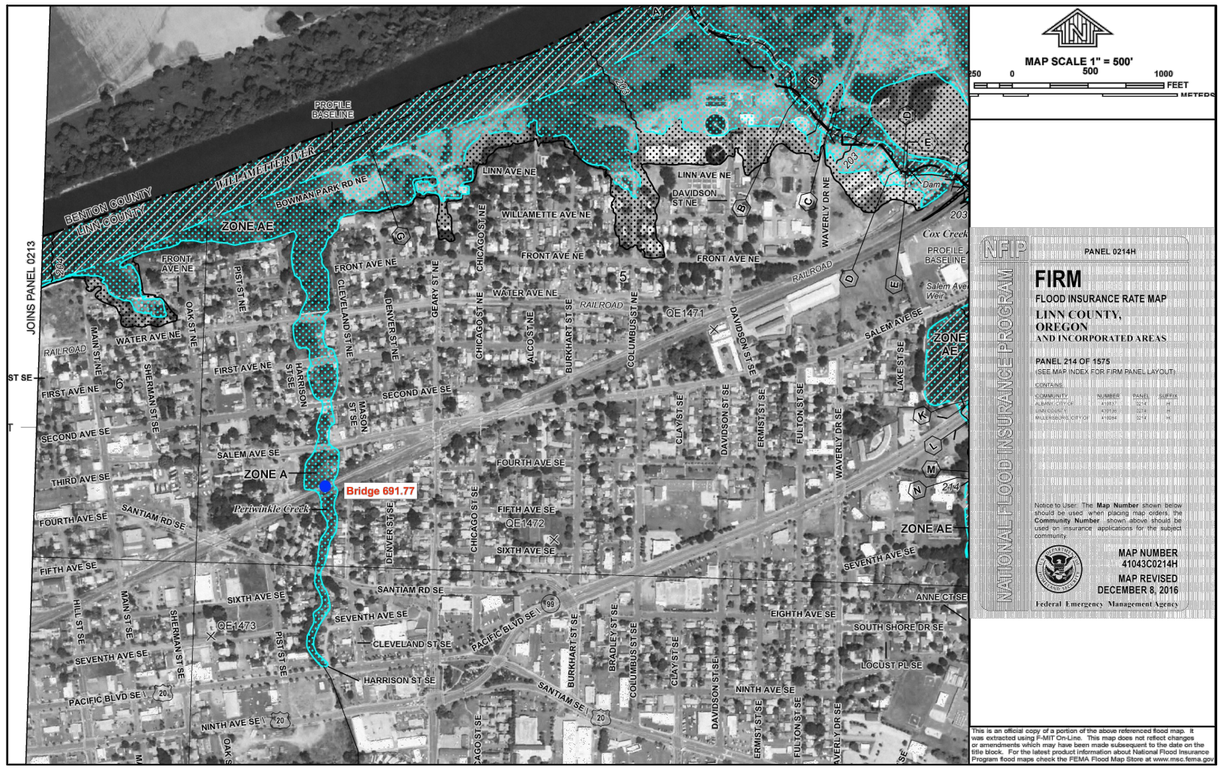

LOCATION PLAN
50 0 100 200

## LEGEND

- CENTERLINE RAILROAD TRACK
- UPRR RIGHT–OF–WAY
- FLOWLINE
- EDGE OF ROAD
- FENCE LINE
- TEMPORARY BENCHMARK
- UTILITY POLE
- FIBER OPTIC
- SIGNAL




LOCATION MAP
1000 0 2000 4000
SOURCE: USGS 7.5–MINUTE QUADRANGLE MAP, ALBANY, OR (2017)




FLOODPLAIN MAP




GENERAL NOTES

1. ELEVATION DATUM ESTABLISHED AT BASE OF RAIL AT UPRR BRIDGE 691.77 SOUTH ABUTMENT. TO CONVERT TO NAVD '88 ELEVATION DATUM, ADD 118.59'.
2. BRIDGE 691.77 SPANS PERIWINKLE CREEK WITH A DRAINAGE AREA OF 6.27 SQUARE MILES.
3. TEMPORARY STAGING AREAS TO BE PLACED WITHIN UPRR RIGHT–OF–WAY, OUTSIDE OF THE FLOODPLAIN.
4. THE TOTAL LOT AREA WITHIN THE FLOODPLAIN IS APPROXIMATELY 0.38 ACRES.
5. LOT AREA IMPACTED WITHIN THE FLOODPLAIN IS TO BE LESS THAN 0.10 ACRES.

| REV. NO. | DATE | REMARKS |
|---|---|---|
| | | |

COLDWATER
ENGINEERING
21 NORTH LAST CHANCE GULCH, SUITE 201
HELENA, MONTANA 59601

DESIGNED BY: T. ASKIN
DRAWN BY: A. EGAN
CHECKED BY: T. ASKIN
CROSS CHK'D BY: T. COWAN
APPROVED BY: T. COWAN
DATE: JANUARY 2019

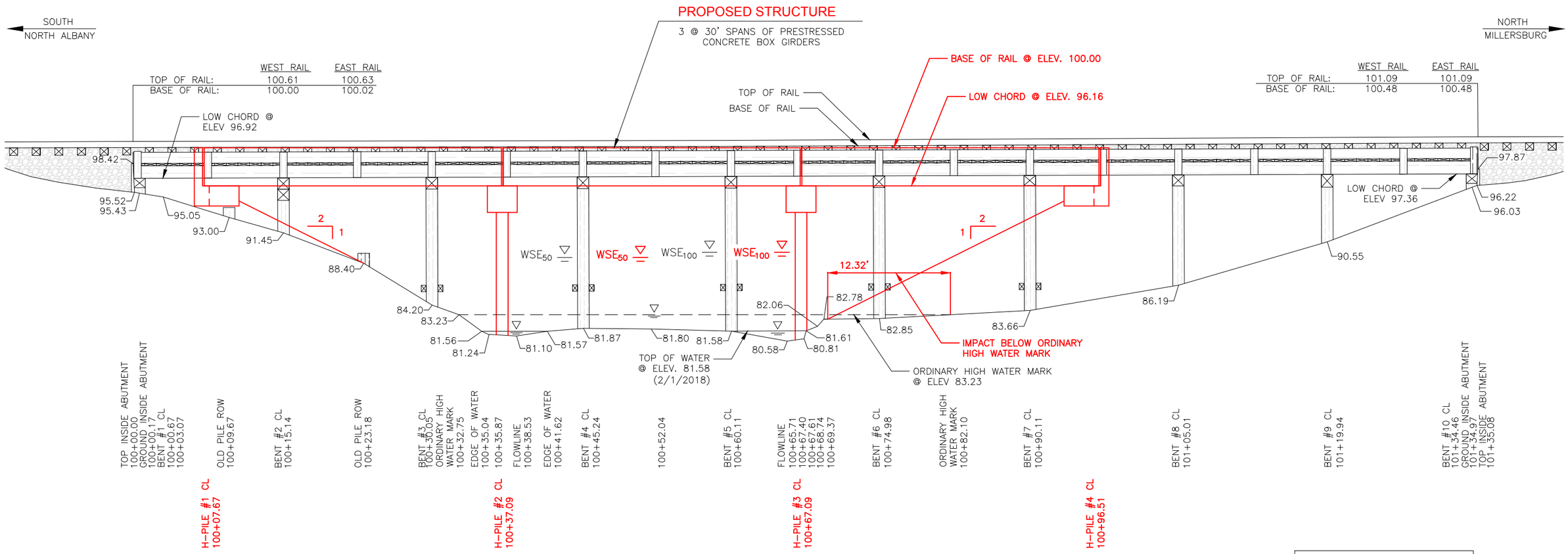
SHEET NO. 1

PROJECT NO. 2018010

FILE NAME: FP Permit (Bridge 691.77).dwg

# BRIDGE REPLACEMENT LOCATION SURVEY

BRIDGE 691.77, BROOKLYN SUBDIVISION
9 - SPAN, 135' LONG, TIMBER STRINGER TRESTLE - BALLAST DECK

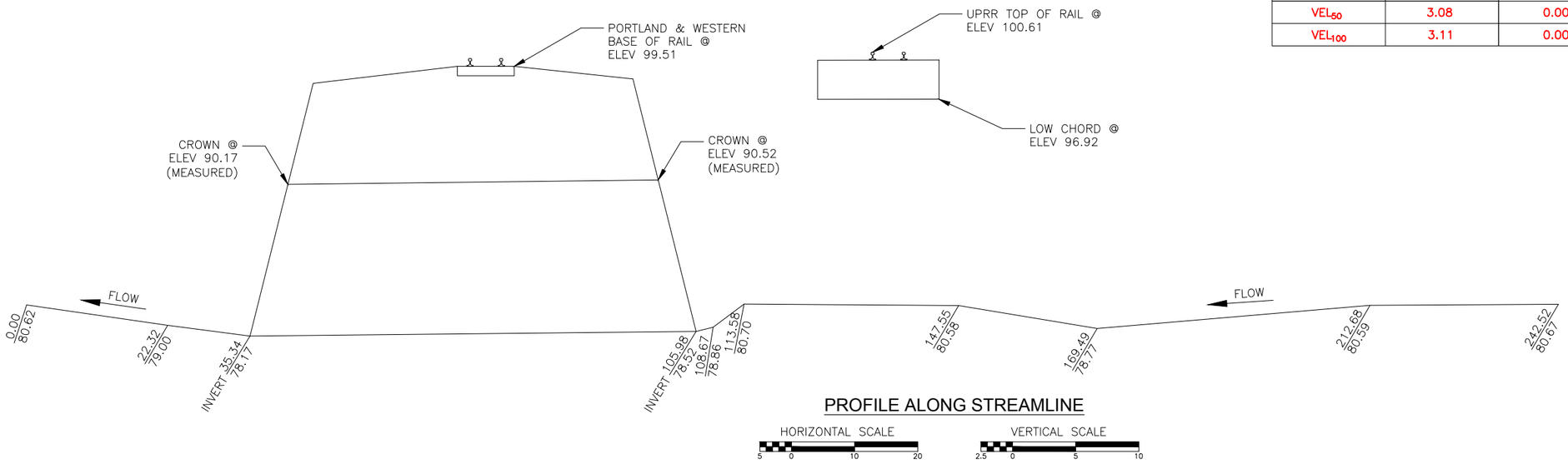



## BRIDGE ELEVATION VIEW

(VIEW LOOKING RR WEST – DOWNSTREAM)

2.5 0 5 10

NOTE: FIRST FLOOR ELEVATION OF ADJACENT RESIDENCE: 97.37




## PROFILE ALONG STREAMLINE

HORIZONTAL SCALE 5 0 10 20

VERTICAL SCALE 2.5 0 5 10

| FLOW VELOCITIES AT DOWNSTREAM BRIDGE FACE (ft/sec) | | |
|---|---|---|
| $VEL_{50}$ | 3.08 | Δ EXISTING CONDITIONS: |
| $VEL_{100}$ | 3.11 | |
| **$VEL_{50}$** | **3.08** | 0.00 |
| **$VEL_{100}$** | **3.11** | 0.00 |

| WATER SURFACE ELEVATIONS AT UPSTREAM BRIDGE FACE (ft) | | |
|---|---|---|
| OHWM | 83.23 | |
| $WSE_{50}$ | 88.98 | Δ EXISTING CONDITIONS: |
| $WSE_{100}$ | 89.50 | |
| **$WSE_{50}$** | **88.98** | 0.00 |
| **$WSE_{100}$** | **89.50** | 0.00 |

| REV. NO. | DATE | REMARKS |
|---|---|---|
| | | |

COLDWATER ENGINEERING
21 NORTH LAST CHANCE GULCH, SUITE 201
HELENA, MONTANA 59601

DESIGNED BY: T. ASKIN
DRAWN BY: A. EGAN
CHECKED BY: T. ASKIN
CROSS CHK'D BY: T. COWAN
APPROVED BY: T. COWAN
DATE: JANUARY 2019

SHEET NO. 2

PROJECT NO. 2018010

FILE NAME: FP Permit (Bridge 691.77).dwg

# BRIDGE REPLACEMENT LOCATION SURVEY

BRIDGE 691.77, BROOKLYN SUBDIVISION
9 - SPAN, 135' LONG, TIMBER STRINGER TRESTLE - BALLAST DECK

## NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Oregon State Plane North Zone (FIPS zone 3601). The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

**Base map** information shown on this **FIRM** was derived from multiple sources. Base map files were provided in digital format by the State of Oregon and the U.S. Fish and Wildlife Service. This information was compiled from Oregon Water Resources Department (2008), ORWA Bureau of Land Management (2000), U.S. Fish and Wildlife Service (2008), Oregon Parks and Recreation Department (2008), National Geodetic Survey (2007), the City of Albany (2006, the U.S. Census Bureau (2007), and the Linn County GIS Department (2005) at a scale of 1:24,000.

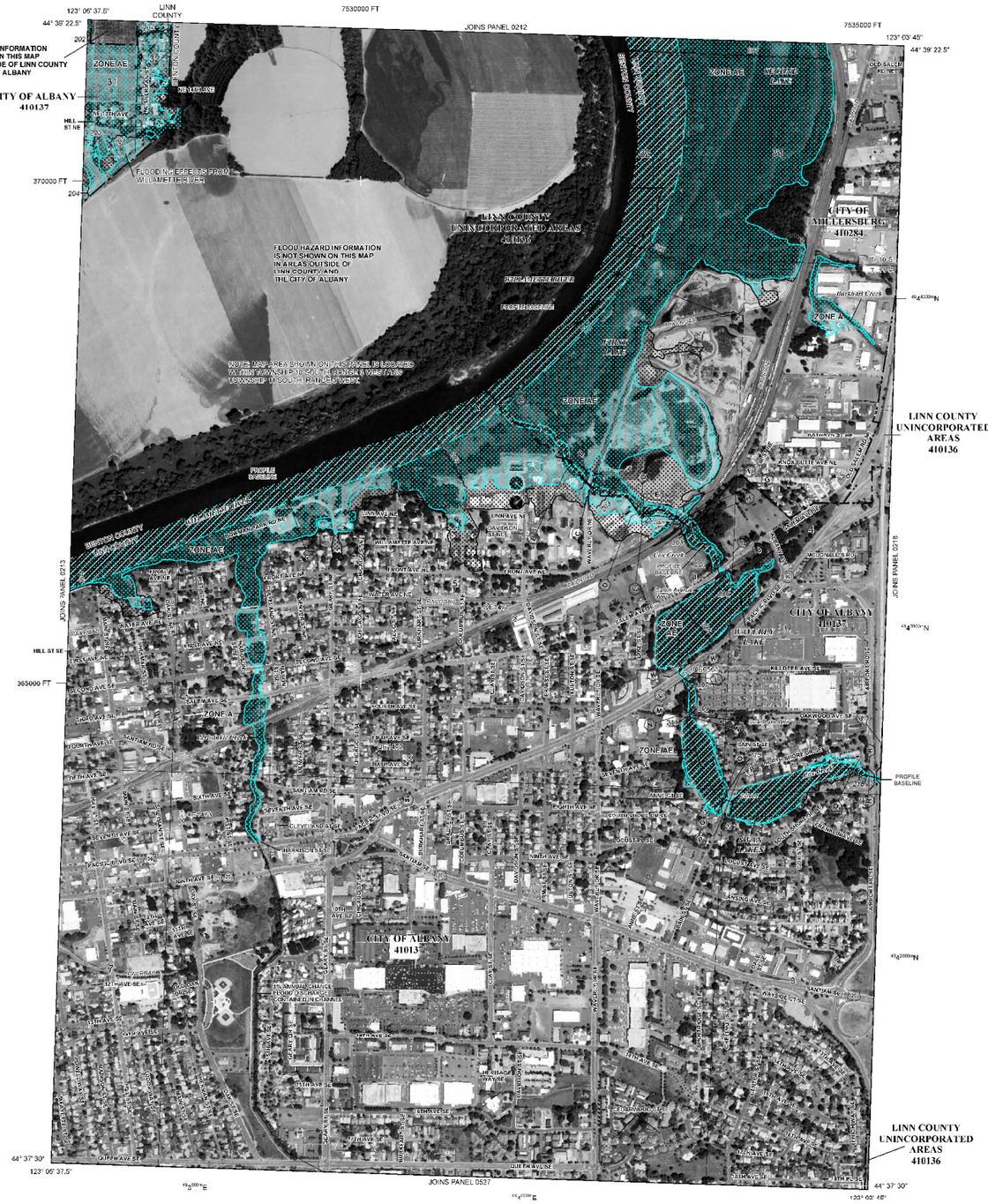
The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.




## LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

| | |
|---|---|
| ZONE A | No Base Flood Elevations determined. |
| ZONE AE | Base Flood Elevations determined. |
| ZONE AH | Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined. |
| ZONE AO | Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined. |
| ZONE AR | Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood. |
| ZONE A99 | Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined. |
| ZONE V | Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined. |
| ZONE VE | Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined. |

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

| | |
|---|---|
| ZONE X | Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood |

OTHER AREAS

| | |
|---|---|
| ZONE X | Areas determined to be outside the 0.2% annual chance floodplain. |
| ZONE D | Areas in which flood hazards are undetermined, but possible. |

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% Annual Chance Floodplain Boundary
- 0.2% Annual Chance Floodplain Boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
- 513 Base Flood Elevation line and value; elevation in feet*
- (EL 987) Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

- A–A Cross section line
- 23–23 Transect line
- Culvert
- Bridge
- 45° 02' 08", 93° 02' 12" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
- 3180000 FT 5000-foot ticks: Oregon State Plane North Zone (FIPS Zone 3601), Lambert Conformal Conic projection
- 1000-meter Universal Transverse Mercator grid values, zone 10
- DS510 Bench mark (see explanation in Notes to Users section of this FIRM panel)
- River Station

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
September 28, 2010

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
December 8, 2016 - to reflect updated topographic information and to change Base Flood Elevations.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
125 0 150 300 METERS

NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0214H

# FIRM

## FLOOD INSURANCE RATE MAP

## LINN COUNTY, OREGON AND INCORPORATED AREAS

**PANEL 214 OF 1575**
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| ALBANY, CITY OF | 410137 | 0214 | H |
| LINN COUNTY | 410136 | 0214 | I |
| MILLERSBURG, CITY OF | 410284 | 0214 | H |

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

**MAP NUMBER**
**41043C0214H**
**MAP REVISED**
**DECEMBER 8, 2016**

Federal Emergency Management Agency