



## COMMUNITY DEVELOPMENT

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

# Staff Report

## Floodplain Development Review

FP-09-23

December 6, 2023

### Summary

This staff report evaluates a Floodplain Development Review application to construct repairs to the existing spillway crossing Cox Creek along Salem Avenue. The proposed improvements are located in the flood fringe and floodway of the Special Flood Hazard Area (SFHA). The project site is an existing spillway under the Salem Avenue bridge crossing Cox Creek. A vicinity map is included as Attachment A.

The applicant proposes improvements to repair existing and prevent further scour within the existing spillway which is located within the stream channel of Cox Creek.

Based on the effective FEMA Flood Insurance Rate Map 41043C0214H (dated December 8, 2016), the proposed project is located within FEMA Zone AE SFHA, for Cox Creek. A regulatory floodway has been defined for the area and the proposed improvements are located within the floodplain and regulatory floodway (Attachment F). Floodwaters are conveyed from the upstream to the downstream side of Salem Avenue via a bridge over Cox Creek and a dam (Waverly Dam) located directly under the Salem Avenue bridge.

To meet City of Albany Development Code (ADC) requirements, an encroachment analysis is required to ensure the proposed repair and improvements does not reduce the flood carrying capacity of existing watercourses and causes no-rise to base flood or floodway water surface elevations.

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). This 'no-rise' analysis was reviewed by Ryan Beathe PE, CFM, City of Albany, 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), *Site Improvement Standards* (ADC 6.110), *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. All elevations in this report are referenced from the National Geodetic Vertical Datum of 1988 (NGVD '88).

### Application Information

Proposal:	Floodplain Development Review to repair and improve an existing spillway within Cox Creek channel, 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; Salem Avenue
Map/Tax Lot:	Linn County Assessor's Map No. 11S-03W-04BC Tax Lot 3800

Zoning:	Residential Single Dwelling (RS-6.5) with Floodplain (/FP), Riparian Corridor Overlay (/RC), and Hillside Overlay (/HD)
Existing Land Use:	Right-of-way bridge; multi-use bridge; pedestrian bridge; park
Neighborhood:	Willamette Neighborhood
Surrounding Zoning:	North: Light Industrial (LI) and Residential Medium Density (RM) South: Residential Single Dwelling (RS-6.5) East: RM and RS-6.5 West: LI and RS-6.5
Surrounding Uses:	North: Industrial Building and Cemetery South: Waverly Lake Park East: Cemetery, Waverly Lake Park, Residential West: Waverly Lake Park, Industrial Offices and 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 November 13, 2023. At the time the comment period ended on November 27, 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 The proposal is repair and improvement of an existing spillway that controls outflow from Waverly Lake, located within Cox Creek in Albany Oregon. The existing spillway is experiencing scours and requires repairs and improvements to protect against future scour damage. The existing spillway is located under the Salem Avenue bridge over Cox Creek. A vicinity map is included as Attachment A.
- 1.2 No habitable structures or fences are proposed within the floodway. The proposed expansion and repair of the existing spillway is a public transportation municipal use, which is allowed in the floodway per ADC 6.100(3).
- 1.3 Based on the effective FEMA Flood Insurance Rate Map 41043C0214H (dated December 8, 2016), the proposed project is located within FEMA Zone AE of the Special Flood Hazard Area (SFHA) and within the regulatory floodway. According to the FIS, the one-percent annual chance floodplain for Cox Creek is generally limited to a narrow corridor along the channel in the vicinity of the project site. FEMA and City regulations require that proposed changes within a regulatory floodway cause ‘no-rise’ to floodplain or floodway elevations. If the proposed changes cause a rise, submittal of a Conditional Letter of Map Revision (CLOMR) prior to the beginning of construction is required, followed by a Letter of Map Revision (LOMR) after the project is complete.

A site map (Attachment B) of the proposed development complete with elevations (North American Vertical Datum of 1988) has been submitted with the land use application.

- 1.4 To meet these requirements, the applicant has provided a HEC-RAS No-Rise Analysis. This report was produced by WEST Consultants C/O Ken Puhn, dated February 3, 2023, and included as Attachment D. The report concludes that *“The proposed spillway repairs will not cause a rise to base flood or floodway elevations. A FEMA Engineering No-Rise certificate is provided (Figure 10 in Attachment D).”*
- 1.5 The City of Albany requested a review of this ‘no-rise’ analysis by Ryan Beathe, PE, CFM, of Public Works, City of Albany. Ryan Beathe states in a memorandum dated November 2, 2023 (Attachment E): *“The no-rise analysis provided in the report from WEST Consultants includes a detailed summary of the regulatory background the history of site and pertinent development, a summary of existing site conditions in the immediate area as it pertains to the channel hydraulics, and a summary of the hydrology. The report assessed the current hydraulic “deficiencies” and provided a thorough analysis that supports the recommendations for design of repair and scour counter-measures improvements. As is required for a no-rise analysis, the report provides a detailed hydraulic analysis that compares the backwater conditions from the pre-project (existing) conditions to the modeled backwater conditions resulting from any changes from construction of the proposed improvements (as detailed in the project plans and represented in the HEC-RAS model). Tables are included in the report that provide the comparison of existing and proposed water surface elevations for the base flood under both encroached and non-encroached conditions. Water surface elevations show that a no-rise is achieved under both conditions.”*

## 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

- 1.1 The proposal is to repair and improve an existing spillway located within the channel of Cox Creek, which is considered alteration of a watercourse per ADC 6.101.
- 1.2 The applicant's engineer, WEST Consultants, Inc, provided an Encroachment HEC-RAS No-Rise Analysis (Attachment D), which concludes the change in water surface elevation is less than one foot for every station along Cox Creek. The report shows the proposed spillway repairs and improvements will not diminish the flood-carrying capacity of Cox Creek.
- 1.3 The City requested a review of this hydraulic analysis from Ryan Beathe, PE, CFM, at the City of Albany, who found the application material adequately addresses the floodplain development criteria (Attachment E).

### 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

- 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

- 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

- 4.1 The existing spillway is dedicated and owned by the City of Albany. Future inspections and maintenance of the improved spillway will be conducted by the city. Based on these factors, the flood-carrying capacity of the Cox Creek watercourse will be maintained and will not be diminished.

### 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.

### Site Improvements in the Floodplain (ADC 6.110)

**Site improvements, land divisions, and manufactured home parks in the Special Flood Hazard Area (100-year floodplain) shall be reviewed by the Planning Division as a part of the land use review process. An application to develop property that has floodplain on it, but where no development is proposed in that floodplain will be processed as otherwise required in this Code. In the case of a land**

division, “no actual development” means the floodplain area has been excluded from the land division. This can be done by setting the property aside for some other purpose than later development (for example, as a public drainage right-of-way). In addition to the general review criteria for site improvements, land divisions and manufactured home parks, applications that propose actual development within the Special Flood Hazard Area shall also be subject to the following standards:

### Criterion 1

**All proposed new development and land divisions shall be consistent with the need to minimize flood damage and ensure that building sites will be reasonably safe from flooding.**

#### Findings of Fact

- 1.1 The applicant proposes the repair and improvement of an existing spillway located within the Cox Creek channel. No new buildings are proposed with this Floodplain Development Review.
- 1.2 The applicant submitted a hydraulic study complete with an engineered certified “No-Rise Analysis” for the proposed repair and improvements. The submitted hydraulic study indicated the proposed improvements will not create a rise in the floodway or base flood elevation (Attachment D), consistent with the requirements of ADC 6.100 “*Floodway Restrictions.*” The findings under ADC 6.100 are included here by reference.
- 1.3 The criteria for “Grading, Fill, Excavation, and Paving” in the floodplain are also addressed later in this report. Those findings under ADC 6.111 are included here by reference.

#### Conclusion

- 1.1 Based on the factors above, the proposed spillway repairs and improvements will not impact the ability to ensure nearby building sites will be reasonably safe from flooding.
- 1.2 This criterion is satisfied.

### Criterion 2

**All new development and land division proposals shall have utilities and facilities such as sewer, gas, electrical, and water systems located and constructed to minimize flood damage.**

#### Findings of Fact

- 2.1 The applicant proposes to repair and improve the existing spillway within the channel of Cox Creek at the Salem Avenue Bridge. There are no proposed alterations to the existing utilities located in the Salem Avenue right-of-way.
- 2.2 Sanitary Sewer: City utility maps show an 8-inch public sanitary sewer main in Salem Avenue, but not near the existing bridge.
- 2.3 Water: City utility maps show a 20-inch public water main within the Salem Avenue right-of-way.
- 2.4 Stormwater Drainage: City utility maps show a 10-inch and 12-inch storm drainage main in Salem Avenue. The storm drainage mains convey stormwater from Salem Avenue and adjacent development then discharges to Waverly Lake prior to Salem Avenue bridge.

#### Conclusions

- 2.1 Based on the factors above, the proposed development will have utilities and facilities located and constructed to minimize flood damage.
- 2.2 This criterion is satisfied.

### Criterion 3

**On-site waste disposal systems shall be located and constructed to avoid functional impairment, or contamination from them, during flooding.**

#### Finding of Fact and Conclusion

- 3.1 No new on-site waste disposal systems are proposed for this development.
- 3.2 This criterion is not applicable.

### Criterion 4

**All development proposals shall have adequate drainage provided to reduce exposure to flood damage.**

#### Findings of Fact and Conclusion

- 4.1 The proposed development is located within Cox Creek channel and does not change any existing drainage. The proposed repair and improvements to the existing spillway will not create additional drainage to the site.
- 4.2 Adequate drainage exists to reduce exposure to flood damage.
- 4.3 This criterion is satisfied.

### Criterion 5

**Any lot created for development purposes must have adequate area created outside of the floodway to maintain a buildable site area meeting the minimum requirements of this Article.**

#### Finding of Fact and Conclusion

- 5.1 No new lots are being created with this land use application.
- 5.2 This criterion does not apply.

### Criterion 6

**Any new public or private street providing access to a residential development shall have a roadway crown elevation not lower than one foot below the 100-year flood elevation.**

#### Finding of Fact and Conclusion

- 6.1 No new streets are part of this Floodplain Development Review.
- 6.2 This criterion does not apply.

### Criterion 7

**All development proposals shall show the location of the 100-year flood contour line followed by the date the flood elevation was established. When elevation data is not available, either through the Flood Insurance Study or from another authoritative source, and the development is four or more acres or results in four or more lots or structures, the elevation shall be determined and certified by a registered engineer. In addition, a statement located on or attached to the recorded map or plat shall read as follows: "Development of property within the Special Flood Hazard Area as most currently established by the Federal Emergency Management Agency or City of Albany may be restricted and subject to special regulations by the City."**

#### Findings of Fact and Conclusion

- 7.1 Based on the effective FEMA Flood Insurance Rate Map 41043C0214H (dated December 8, 2016), the proposed project is located within FEMA Zone AE of the Special Flood Hazard Area (SFHA). According to the FIS, the one-percent annual chance of flood for Cox Creek is generally limited to a narrow corridor along the channel in the vicinity of the project site. FEMA and City regulations require that proposed changes within a regulatory floodway causes 'no-rise' to floodplain or floodway elevations. If the proposed changes cause a rise, submittal of a Conditional Letter of Map Revision

(CLOMR) prior to the beginning of construction is required, followed by a Letter of Map Revision (LOMR) after the project is complete.

- 7.2 The proposed project is not a development that is four or more acres or results in four or more lots or structures, which requires development of a BFE. However, a hydraulic model was developed by the applicant's engineer (WEST Consultants) and used to develop a "No-Rise Analysis" for the floodway and floodplain for the portion of Cox Creek that borders the proposed development, which includes the proposed repair and improvements. In the submitted report, the applicant has shown the proposed repairs and improvements will not cause a rise in the floodway or base flood elevation (Attachment D), consistent with the requirements of ADC 6.100.
- 7.3 This 'no-rise' analysis provided by the applicant was reviewed by Ryan Beathe, PE, CFM, of Public Works Department, City of Albany, who found the application material adequately addressed the Floodway Restrictions review criteria under ADC 6.100 (Attachment E).
- 7.4 This Floodplain Development Review does not involve a land division, replat, or property line adjustment; therefore, a statement on a recorded map or plat is not required or applicable for this application.
- 7.5 Based on the factors above, this criterion is satisfied.

## Criterion 8

**In addition to the general review criteria applicable to manufactured home parks in Article 10, applications that propose actual development within a Special Flood Hazard Area shall include an evacuation plan indicating alternate vehicular access and escape routes.**

## Finding of Fact and Conclusion

- 8.1 The project does not involve a manufactured home park.
- 8.2 This criterion does not apply.

## Site Improvements in the Floodplain Conclusion

As proposed, the application for site improvements in the floodplain satisfies the applicable review criteria for ADC 6.110.

## 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.**

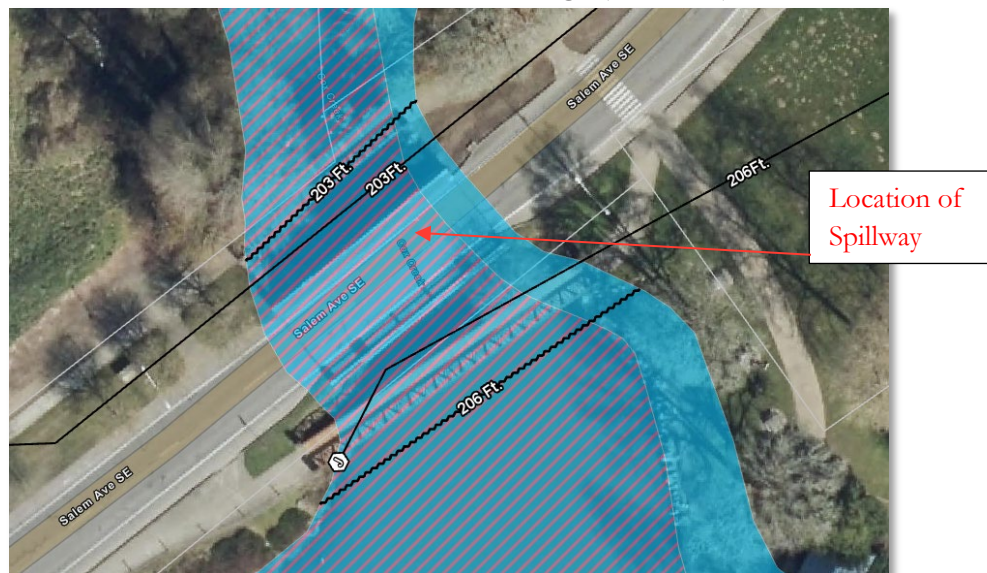
## Finding of Fact and Conclusion

- 1.1 The location of the proposed spillway repair and improvement project is described in detail under Findings 1.1 under ADC 6.100 (above); those findings are included here by reference.
- 1.2 Based on the effective FEMA Flood Insurance Rate Map 41043C0214H (dated December 8, 2016), the proposed project is located within FEMA Zone AE of the Special Flood Hazard Area (SFHA). According to the FIS, the one-percent annual chance floodplain for Cox Creek is generally limited to a narrow corridor along the channel in the vicinity of the project site. FEMA and City regulations

require that proposed changes within a regulatory floodway causes ‘no-rise’ to floodplain or floodway elevations. If the proposed changes cause a rise, submittal of a Conditional Letter of Map Revision (CLOMR) prior to the beginning of construction is required, followed by a Letter of Map Revision (LOMR) after the project is complete.

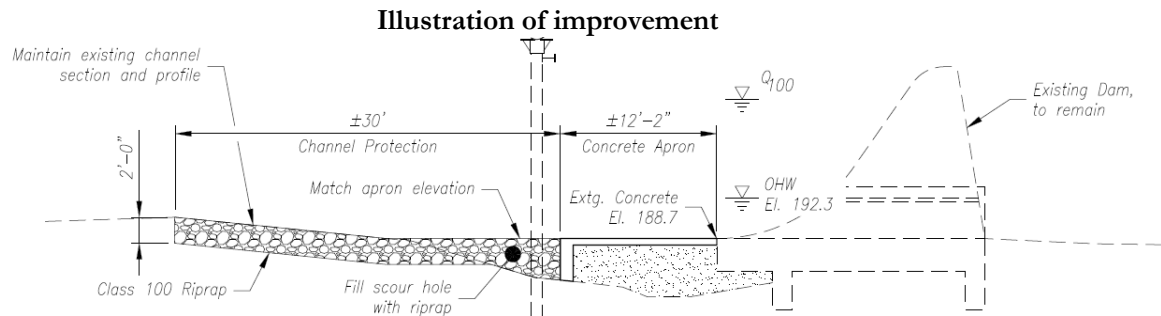
- 1.3 Criterion 6.111 allows grading in a floodway if the applicant has supplied evidence prepared by a professional engineer that demonstrates the proposal will not result in any increase in flood levels during the occurrence of the 100-year flood.
- 1.4 The applicant provided an Encroachment HEC-RAS No-Rise Analysis. This report was produced by WEST Consultants, dated February 3, 2023, and included as Attachment D. The report concludes that *“The proposed spillway repairs will not cause a rise to base flood or floodway elevations. A FEMA Engineering No-Rise certificate is provided (Figure 10 in Attachment D).”*
- 1.5 The City of Albany requested a review of this ‘no-rise’ analysis by Ryan Beathe, PE, CFM, of Public Works Department, City of Albany. Ryan Beathe states in a memorandum dated November 2, 2023 (Attachment E): *“The no-rise analysis provided in the report from WEST Consultants includes a detailed summary of the regulatory background the history of site and pertinent development, a summary of existing site conditions in the immediate area as it pertains to the channel hydraulics, and a summary of the hydrology. The report assessed the current hydraulic “deficiencies” and provided a thorough analysis that supports the recommendations for design of repair and scour counter-measures improvements. As is required for a no-rise analysis, the report provides a detailed hydraulic analysis that compares the backwater conditions from the pre-project (existing) conditions to the modeled backwater conditions resulting from any changes from construction of the proposed improvements (as detailed in the project plans and represented in the HEC-RAS model). Tables are included in the report that provide the comparison of existing and proposed water surface elevations for the base flood under both encroached and nonencroached conditions. Water surface elevations show that a no-rise is achieved under both conditions.”*
- 1.6 As shown on Attachment F, the Base Flood Elevation (BFE) at the site location changes from 206 on the south side of the Salem Avenue bridge to 203 feet at the north side of the same bridge. The image below illustrates the BFE at the location of the bridge.

**Base Flood Elevation at the Bridge (199.5 feet)**





- 1.7 As shown on the Preliminary Plans (Attachment B), the proposed repair and improvements are located within the channel of Cox Creek. The proposed improvements are to match the existing grade of the channel bed and not increase the BFE for either the floodplain or the floodway.



- 1.8 The existing spillway is dedicated and owned by the City of Albany. Future inspections and maintenance of the repaired and improved spillway will be conducted by the city. Based on these factors, the flood-carrying capacity of Cox Creek will be maintained.
- 1.9 At the conclusion of grading and filling the project area, documentation is necessary to verify implementation is consistent with the preliminary plans as proposed.
- 1.10 As proposed and conditioned, the development will maintain adequate flood-carrying capacity of existing watercourses. This review criterion can be met with the following condition of approval.

### Condition of Approval

- Condition 1 At the conclusion of the proposed project, the following documentation shall be submitted to the Community Development Department:
- As-built drawings with elevations provided; and
  - 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 a 12-inch public storm drainage main along the north side of Salem Avenue, east of Cox Creek, and a 10-inch storm drainage on the south side of Salem Avenue. The proposed repairs and improvements will not extend the storm across the existing Salem Avenue bridge.
- 2.2 Cox Creek is the main drainage feature in this area. The proposed development will not increase or create any stormwater runoff.
- 2.3 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 No public utilities will be adversely impacted by the proposed fill, grading, excavation, or paving.

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 AE of the Special Flood Hazard Area (SFHA). According to the FIS, the one-percent annual chance floodplain for Cox Creek is generally limited to a narrow corridor along the channel in the vicinity of the project site.
- 4.2 This criterion allows grading, fill, excavation, and paving if it can be demonstrated that the water surface elevation of the base flood will not increase by more than one foot.
- 4.3 To meet these requirements, the applicant has provided a HEC-RAS No-Rise Analysis. This report was produced by WEST Consultants C/O Ken Puhn, dated February 3, 2023, and included as Attachment D. The report concludes that *“The proposed spillway repairs will not cause a rise to base flood or floodway elevations. A FEMA Engineering No-Rise certificate is provided (Figure 10 in Attachment D).”*
- 4.4 Detailed findings are provided under ADC 6.111(1) that show the proposed spillway repair and improvements will not cause a change in water surface elevation. The findings under ADC 6.111(1) are included here by reference.
- 4.5 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.
- 4.6 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 The proposed development is located within the channel of Cox Creek. The proposed improvements and repairs will not create any runoff.

- 6.2 Erosion of ground is prevented by paving covered areas and hydroseeding remaining areas. In addition, an Erosion Prevention and Sediment Control (EPSC) permit is required, prior to site development.
- 6.3 This criterion is satisfied.

## 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 proposal is for public construction of spillway repairs and improvements. The existing spillway has scour damage and is in need of repair. The applicant proposes to repair the existing scour damage and improve the spillway's apron to prevent further scour damage. As shown on the location map (Attachment A), this project passes through the Riparian Corridor Natural Resources Overlay.
- 3.2 The proposed spillway repairs and improvements are to maintain and repair the existing infrastructure. 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

- Condition 2 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

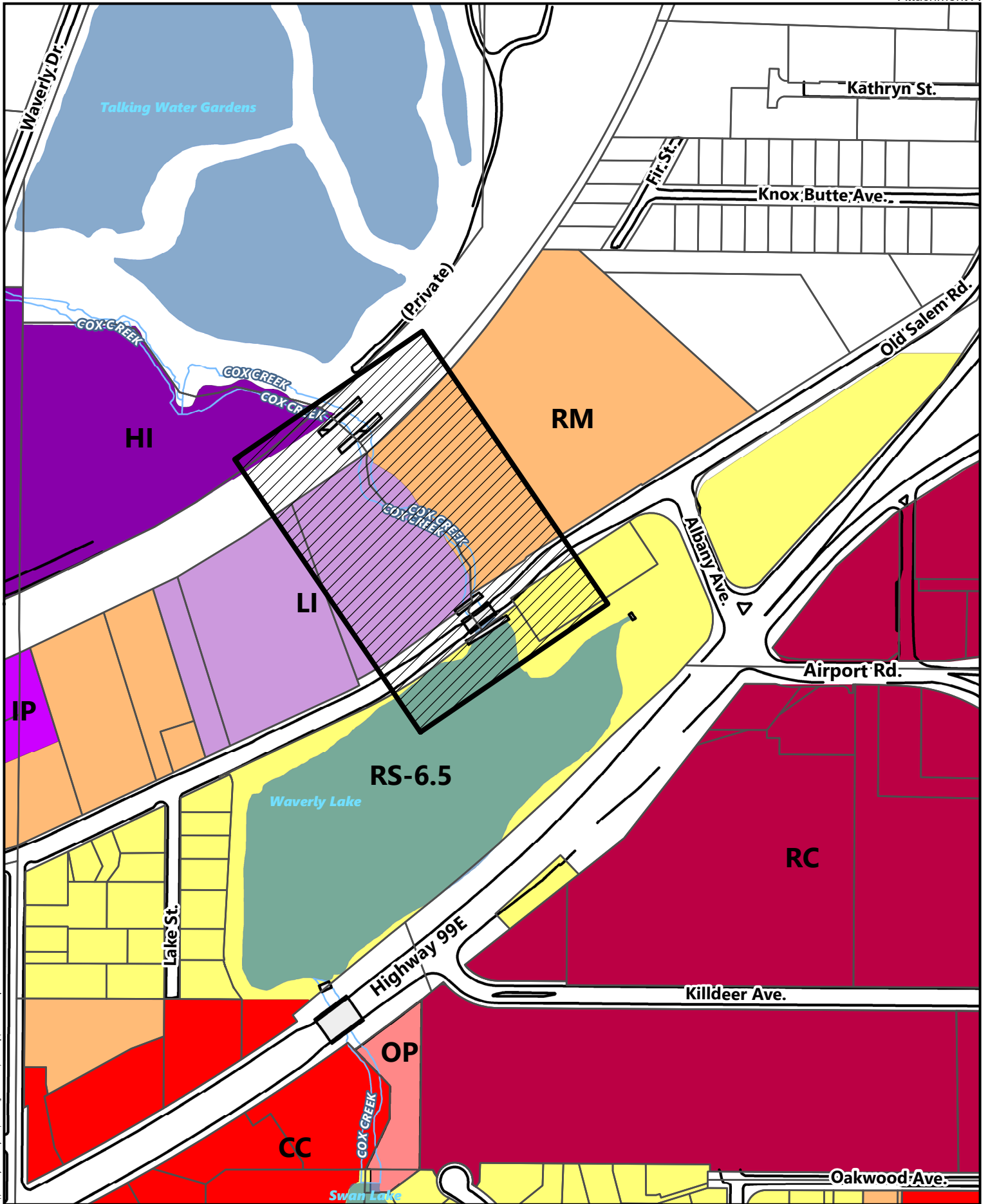
As proposed and conditioned, the application for Floodplain Development Review to repair and improve the existing spillway within Cox Creek channel which is located within a Special Flood Hazard Area satisfies all applicable review criteria as outlined in this report.

## Conditions of Approval

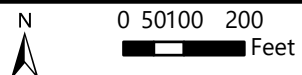
- Condition 1 At the conclusion of the proposed project, the following documentation shall be submitted to the Community Development Department:
- a) As-built drawings with elevations provided; and
  - b) Letter from the Engineer of Record who is licensed in the state of Oregon, stating the fill was placed in accordance with the signed plans.
- Condition 2 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 Cox Creek Spillway Plans
- C. Applicant's Findings of Fact
- D. Waverly Hydraulics Report (dated February 3, 2023)
- E. Floodplain Review by Ryan Beath, City of Albany (dated November 2, 2023)



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Date: 10/19/2023 Map Source: City of Albany

# Cox Creek Bridge and Spillway

## Location Map

# Salem Avenue (Waverly Lake) Bridge Repairs

City of Albany

## GENERAL NOTES

Provide materials and perform work according to the 2021 Oregon Standard Specifications for Construction.

Repair is designed in accordance with the 9th Edition of the AASHTO LRFD Bridge Design Specifications.

Seismic design is not considered in this project.

Provide reinforcing steel according to ASTM Specification A706 Grade 60, or AASHTO M31 (ASTM A615) Grade 60. Provide field bent and welded reinforcing according to ASTM Specification A706. Use the following splice lengths (unless shown otherwise).

Reinforcing Splice Lengths (Class B) Grade 60 $f'_c=4.0$ ksi										
Bar Size	#3	#4	#5	#6	#7	#8	#9	#10	#11	#14 & #18
Uncoated	1'-0"	1'-4"	1'-8"	2'-0"	2'-6"	3'-3"	4'-1"	5'-2"	6'-4"	Not Permitted

Splice reinforcing steel at alternate bars staggered at least one splice length or as far as possible unless shown otherwise.

Place bars 2" clear of the nearest face of concrete unless noted otherwise.

All reinforcement spacing is maximum unless noted otherwise.

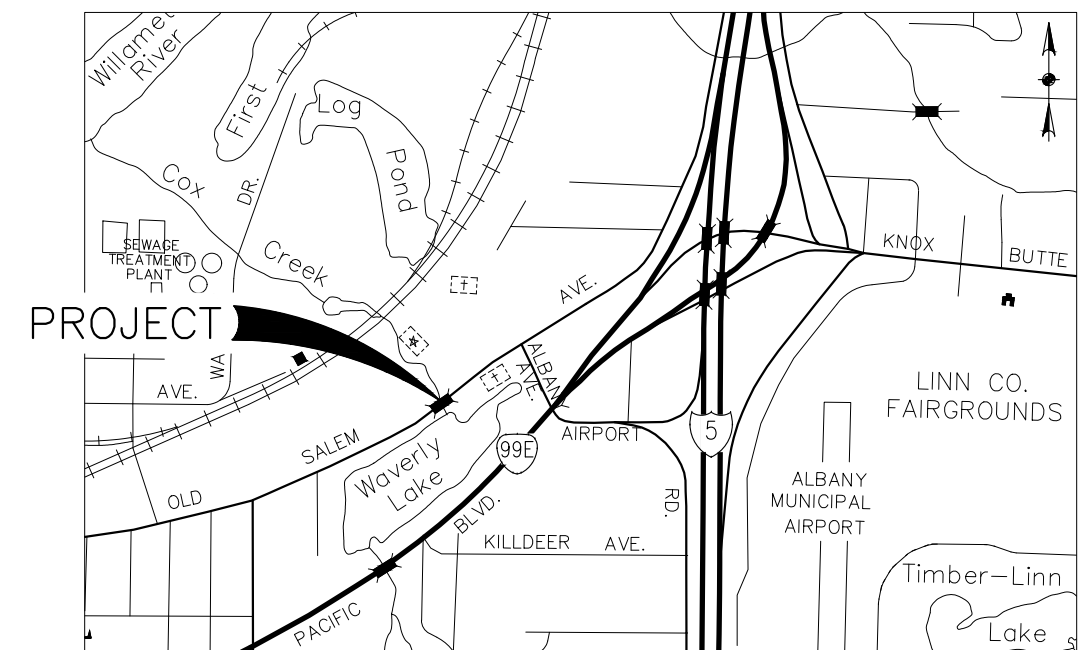
Provide Class 4000-1 1/2, 1, or 3/4" concrete for apron.

Provide Commercial Grade Concrete for fill beneath apron.

Protect all utilities in place. Contractor shall call 811 for utility locates prior to starting work.

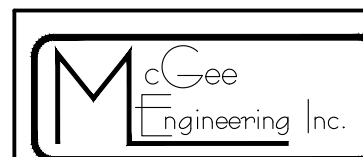
## SHEET LIST

Sheet Number	Title
1	Title Sheet & General Notes
2	Site Plan
3	Temporary Access and Water Mgmt.
4	Concrete Apron Details
5	Channel Protection Details - 1
6	Channel Protection Details - 2



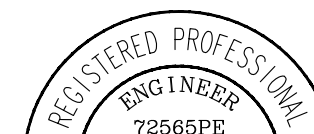
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No Scale

Rev	Description	By	Date



P.O. Box 1067  
Corvallis, OR 97339  
Phone: (541) 757-1270  
Fax: (541) 758-6585

Measures one inch on original drawing.  
Adjust scales accordingly.



Renewal: 12/31/2023

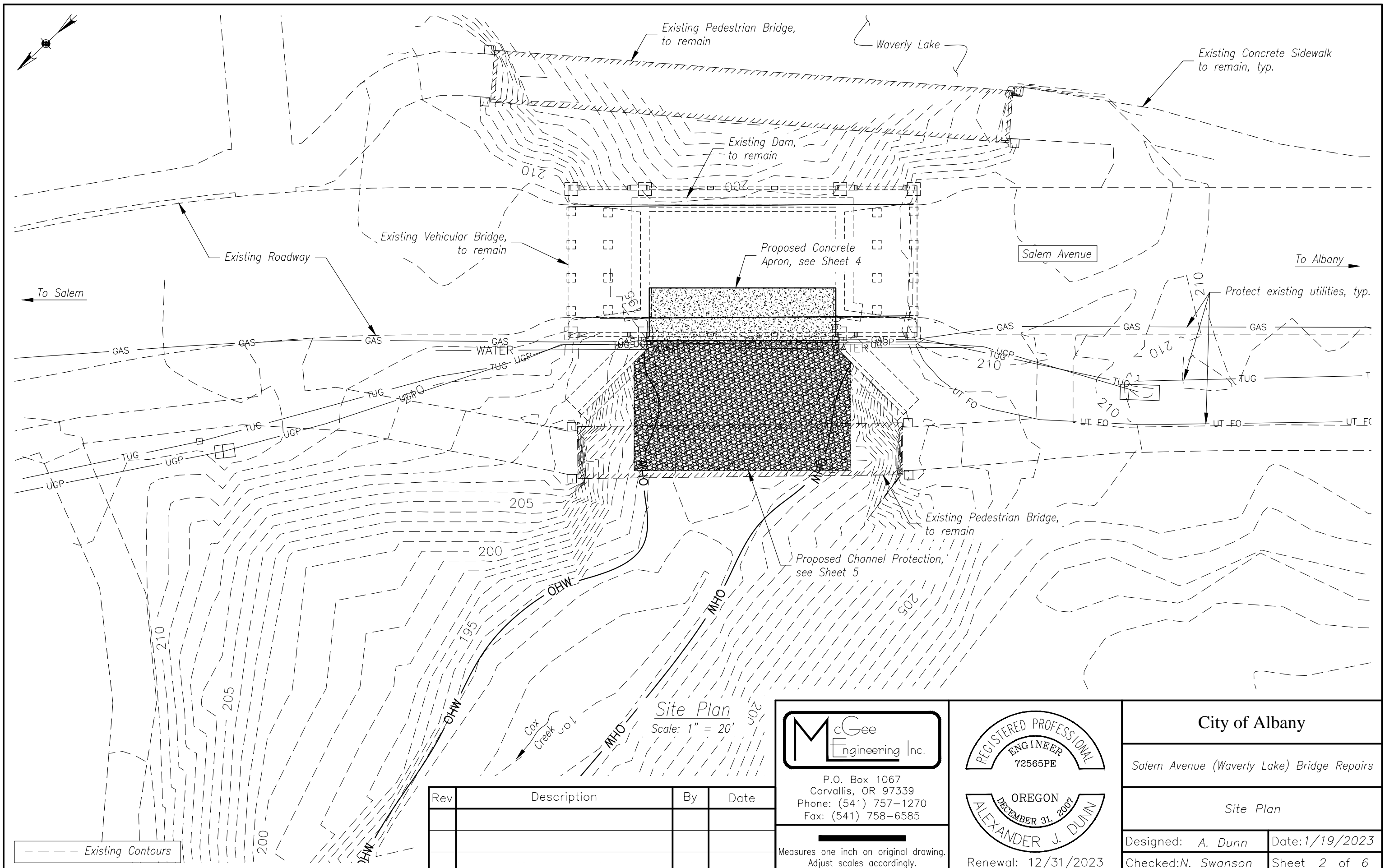
City of Albany

Salem Avenue (Waverly Lake) Bridge Repairs

Title Sheet & General Notes

Designed: A. Dunn Date: 1/19/2023

Checked: N. Swanson Sheet 1 of 6



Site Plan  
Scale: 1" = 20'

Rev	Description	By	Date

**McGee Engineering Inc.**  
 P.O. Box 1067  
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 Phone: (541) 757-1270  
 Fax: (541) 758-6585

Measures one inch on original drawing.  
 Adjust scales accordingly.

REGISTERED PROFESSIONAL  
 ENGINEER  
 72565PE

OREGON  
 DECEMBER 31, 2023  
 ALEXANDER J. DUNN

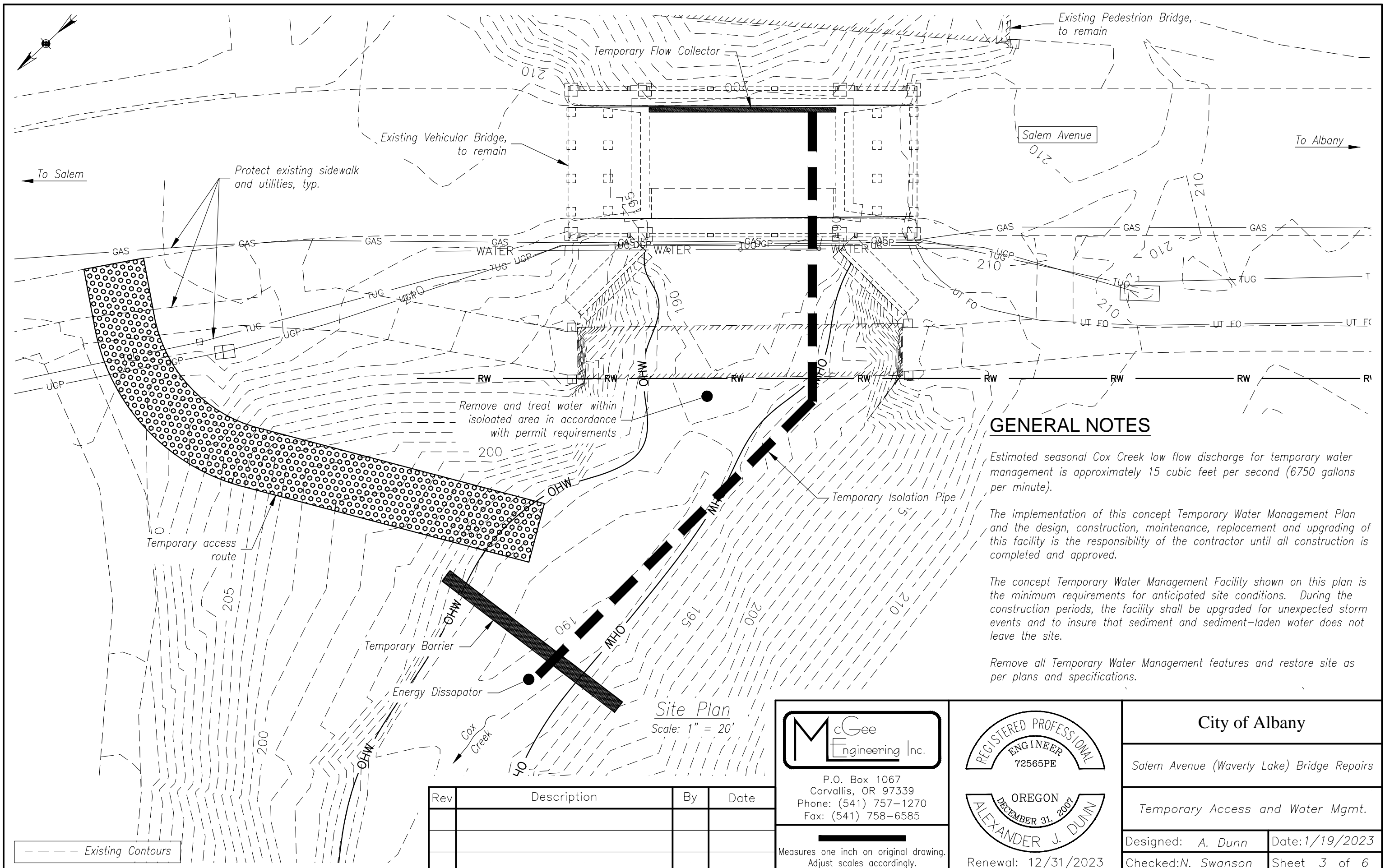
Renewal: 12/31/2023

**City of Albany**

Salem Avenue (Waverly Lake) Bridge Repairs

Site Plan

Designed: A. Dunn      Date: 1/19/2023  
 Checked: N. Swanson      Sheet 2 of 6



### GENERAL NOTES

- Estimated seasonal Cox Creek low flow discharge for temporary water management is approximately 15 cubic feet per second (6750 gallons per minute).
- The implementation of this concept Temporary Water Management Plan and the design, construction, maintenance, replacement and upgrading of this facility is the responsibility of the contractor until all construction is completed and approved.
- The concept Temporary Water Management Facility shown on this plan is the minimum requirements for anticipated site conditions. During the construction periods, the facility shall be upgraded for unexpected storm events and to insure that sediment and sediment-laden water does not leave the site.
- Remove all Temporary Water Management features and restore site as per plans and specifications.

**McGee Engineering Inc.**  
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 Fax: (541) 758-6585

REGISTERED PROFESSIONAL  
 ENGINEER  
 72565PE

OREGON  
 DECEMBER 31, 2007  
 ALEXANDER J. DUNN

Renewal: 12/31/2023

**City of Albany**

Salem Avenue (Waverly Lake) Bridge Repairs

Temporary Access and Water Mgmt.

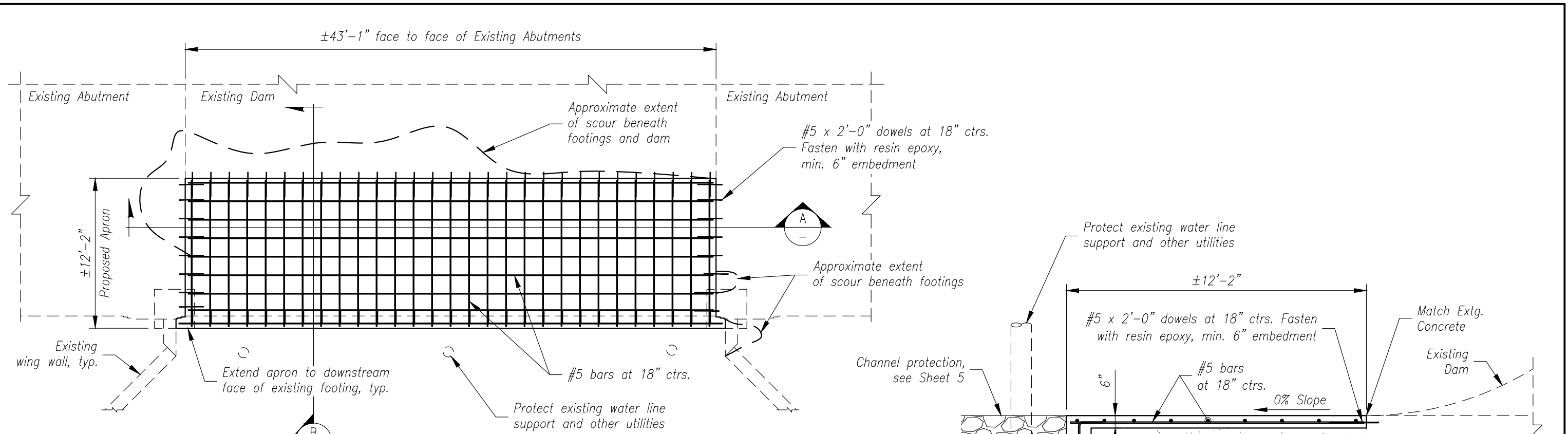
Designed: A. Dunn      Date: 1/19/2023

Checked: N. Swanson      Sheet 3 of 6

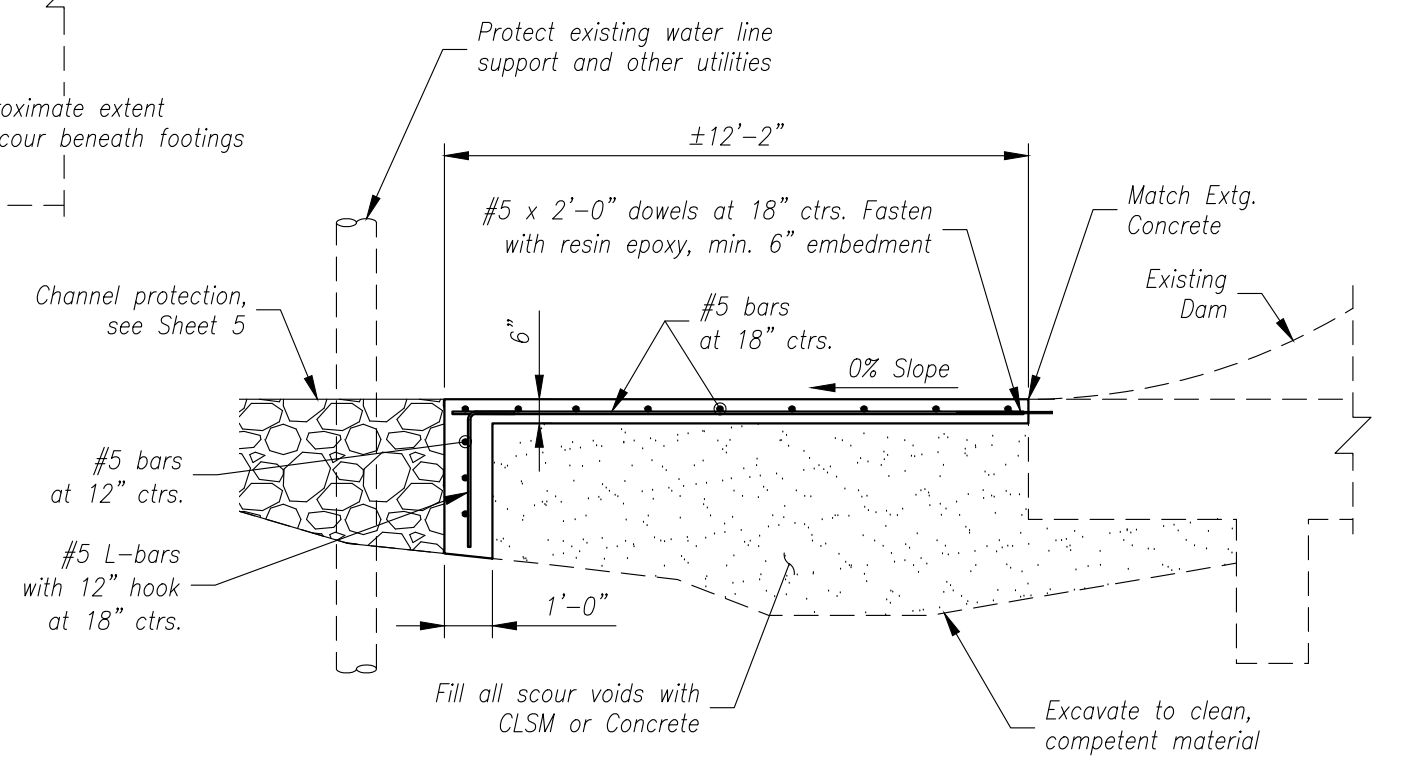
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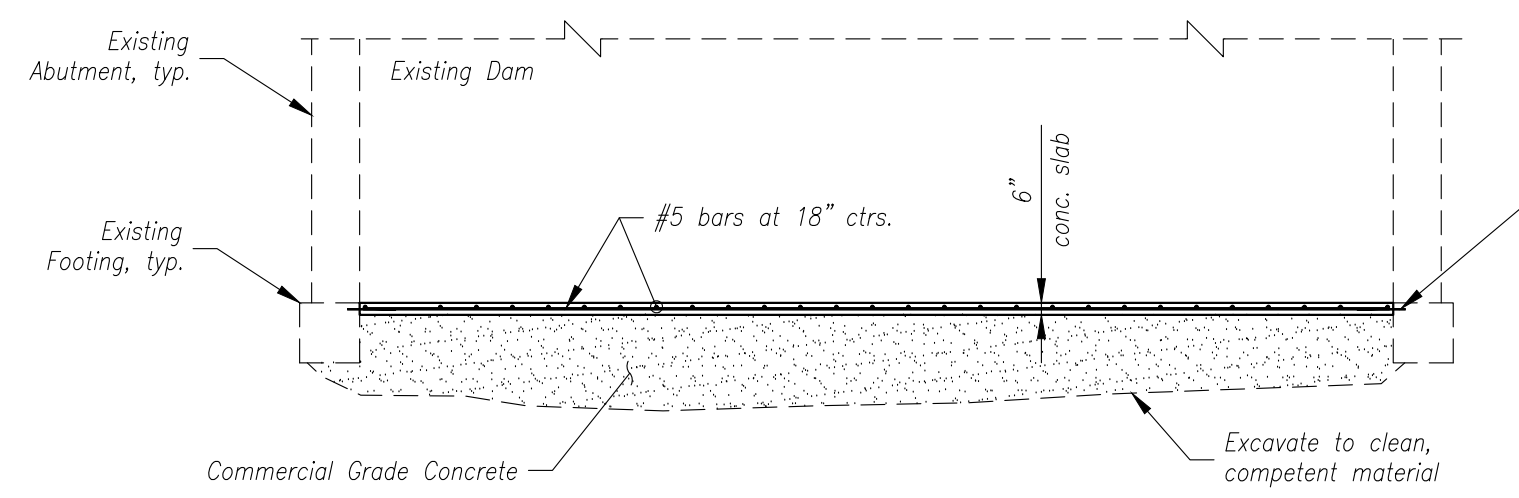




**Plan**  
Scale: 1/8" = 1'-0"



**Section**  
Scale: 1/4" = 1'-0"



**Section**  
Scale: 1/8" = 1'-0"

Rev	Description	By	Date

**McGee Engineering Inc.**  
P.O. Box 1067  
Corvallis, OR 97339  
Phone: (541) 757-1270  
Fax: (541) 758-6585

Measures one inch on original drawing. Adjust scales accordingly.

REGISTERED PROFESSIONAL ENGINEER  
72565PE

OREGON  
DECEMBER 31, 2007  
ALEXANDER J. DUNN

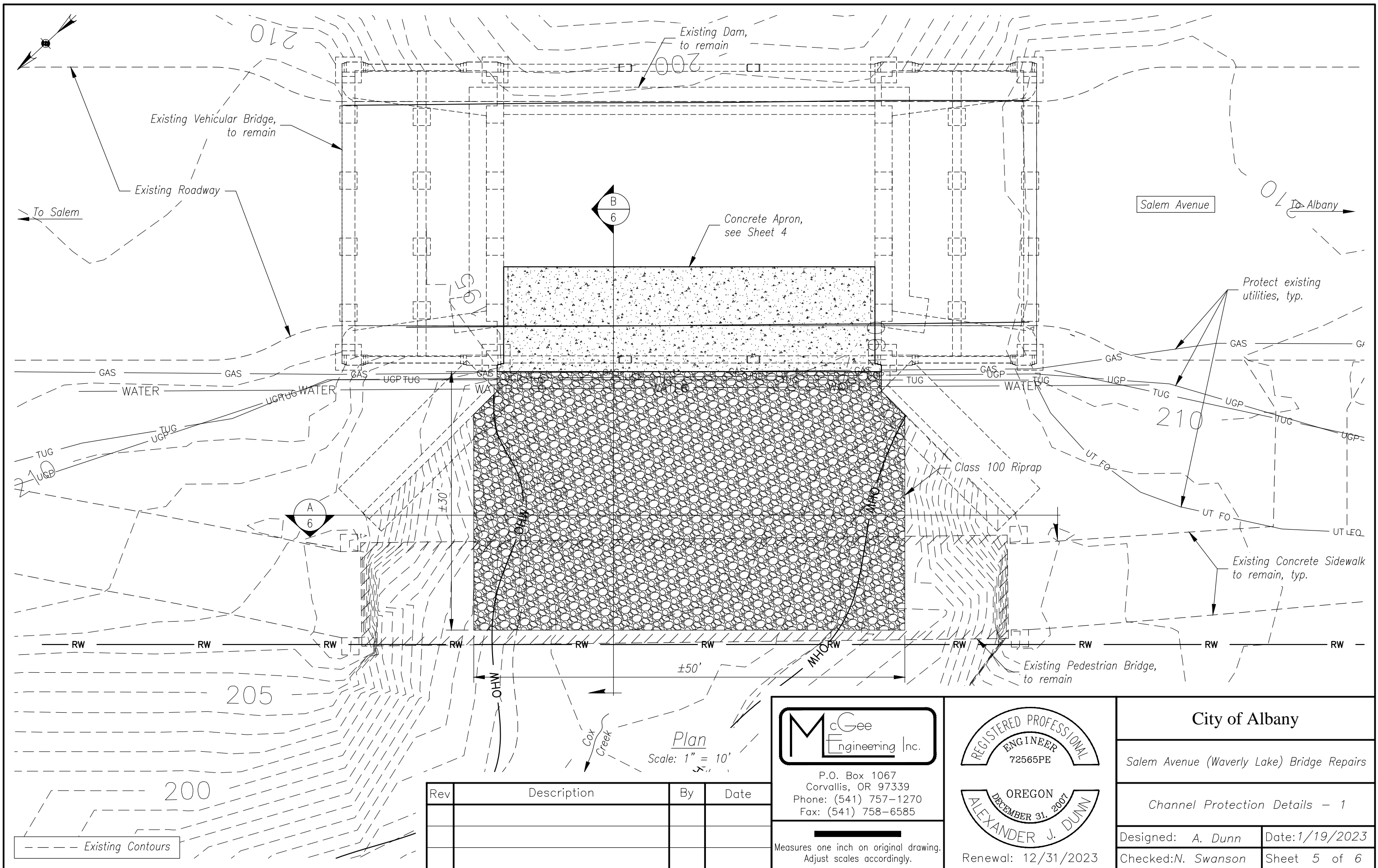
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**City of Albany**

Salem Avenue (Waverly Lake) Bridge Repairs

Concrete Apron Details

Designed: A. Dunn Date: 1/19/2023  
Checked: N. Swanson Sheet 4 of 6



Plan  
Scale: 1" = 10'

Rev	Description	By	Date

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 Adjust scales accordingly.

REGISTERED PROFESSIONAL  
 ENGINEER  
 72565PE

OREGON  
 DECEMBER 31, 2007  
 ALEXANDER J. DUNN

Renewal: 12/31/2023

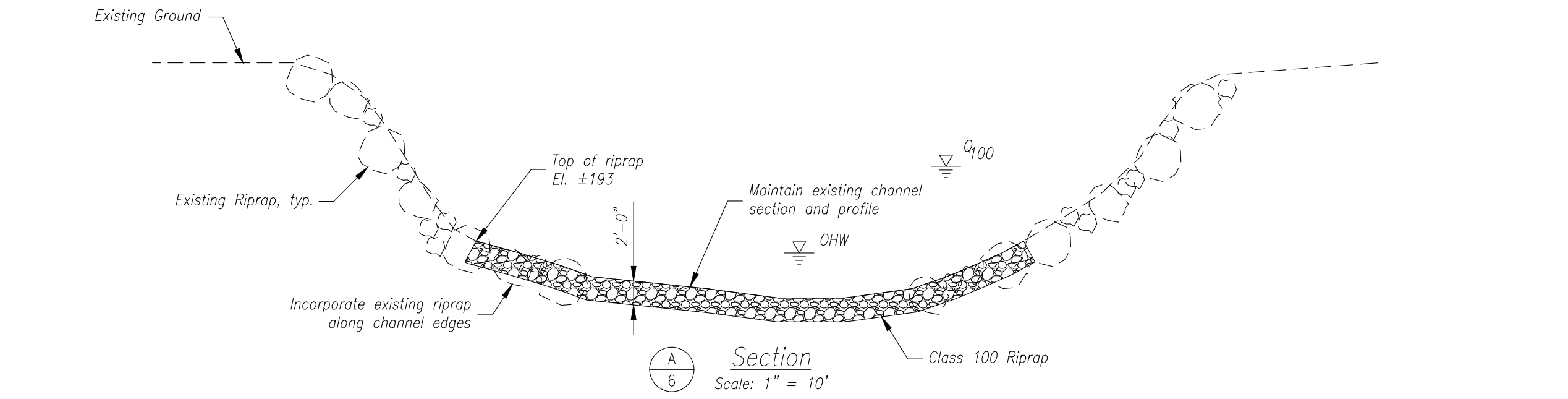
**City of Albany**

Salem Avenue (Waverly Lake) Bridge Repairs

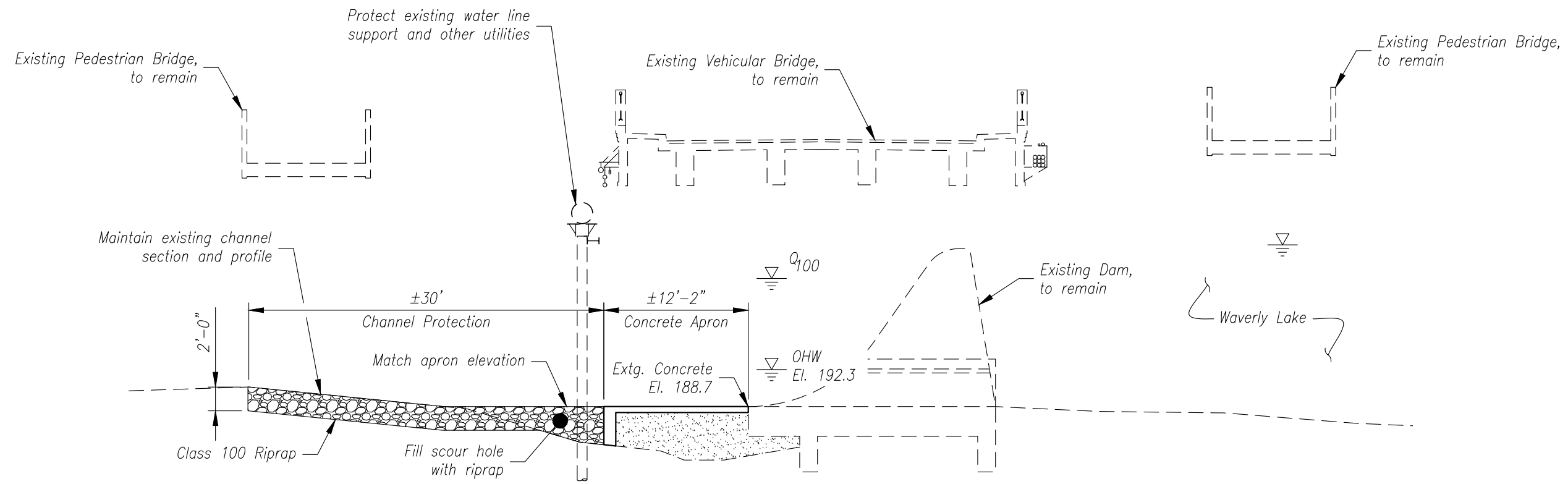
Channel Protection Details - 1

Designed: A. Dunn      Date: 1/19/2023  
 Checked: N. Swanson      Sheet 5 of 6

--- Existing Contours



**A**  
6 Section  
Scale: 1" = 10'



**B**  
6 Section  
Scale: 1" = 10'

*Class 100 Riprap*

% by weight	Size of Rock	
	lb.	appx. dia. (in)
20	100-60	13-11
30	60-25	11-8
40	25-2	8-4
10	2-0	4-0

Rev	Description	By	Date

**McGee Engineering Inc.**  
 P.O. Box 1067  
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 ENGINEER  
 72565PE

OREGON  
 DECEMBER 31, 2023  
 ALEXANDER J. DUNN

Renewal: 12/31/2023

**City of Albany**

Salem Avenue (Waverly Lake) Bridge Repairs

Channel Protection Details - 2

Designed: A. Dunn Date: 1/19/2023  
 Checked: N. Swanson Sheet 6 of 6

6.110 Site Improvement, Land Division and Manufactured Home Park Standards. Site improvements, land divisions, and manufactured home parks in the Special Flood Hazard Area (100-year floodplain)

(1) All proposed new development and land divisions shall be consistent with the need to minimize flood damage and ensure that building sites will be reasonably safe from flooding.

**Fact: This work's purpose is to protect the spillway and bridge from any further damage from flooding. The permanent extension of the spillway is within the existing bottom of the creek and does not increase the chance of flooding.**

(2) All new development and land division proposals shall have utilities and facilities such as sewer, gas, electrical, and water systems located and constructed to minimize flood damage.

**Fact: No utilities are being constructed or relocated with this project.**

(3) On-site waste disposal systems shall be located and constructed to avoid functional impairment, or contamination from them, during flooding.

**Fact: No on site waste disposal systems are being constructed.**

(4) All development proposals shall have adequate drainage provided to reduce exposure to flood damage.

**Fact: This construction is occurring within the creek bed and does not change any existing drainage.**

(5) Any lot created for development purposes must have adequate area created outside of the floodway to maintain a buildable site area meeting the minimum requirements of this Article.

**Fact: No new lots are being created for this project**

(6) Any new public or private street providing access to a residential development shall have a roadway crown elevation not lower than one foot below the 100-year flood elevation.

**Fact: No new access is being constructed for this project.**

(7) All development proposals shall show the location of the 100-year flood contour line followed by the date the flood elevation was established. When elevation data is not available, either through the Flood Insurance Study or from another authoritative source, and the development is four or more acres or results in four or more lots or structures, the elevation shall be determined and certified by a registered engineer. In addition, a statement located on or attached to the recorded map or plat shall read as Albany Development Code, Article 6 6 - 14 December 28, 2022 follows: "Development of property within the Special Flood Hazard Area as most currently established by the Federal Emergency Management Agency or City of Albany may be restricted and subject to special regulations by the City." [Ord. 5338, 1/28/98]

**Fact: The developed area is 524 square feet.**

(8) In addition to the general review criteria applicable to manufactured home parks in Article 10, applications that propose actual development within a Special Flood Hazard Area shall include an evacuation plan indicating alternate vehicular access and escape routes.

**Fact: This is not a manufactured home park being developed.**

6.111 Grading, Fill, Excavation, and Paving. 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:

[Ord. 5746, 9/29/10; Ord. 5929, 7/26/19]

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

**Fact: The new concrete is being constructed at the elevation of the existing creek bed bottom. The flood carrying capacity should not change.**

(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 as otherwise approved by the City Engineer.

**Fact: no new storm water runoff will be generated from this project since it is under water at all times.**

(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.

**Fact: There are now existing utilities under the proposed area.**

(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.

**Fact: There is no increase to the water surface elevation from the proposed development.**

(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).

**Fact: The watercourse is not being relocated or altered with this project. The work is being completed within the existing creek bed.**

(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.

**Fact: there is no drainage being created, directed, or mitigated by this development.**

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

**Fact: There are no building pads being constructed with this development.**

**Hydraulic Analysis**  
**for**  
**Waverly Lake (Cox Creek Dam) Spillway Repair**

**Albany, Oregon**

Prepared for:

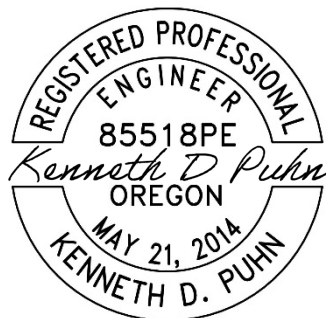
**McGee Engineering**  
804D NW Buchanan Ave  
Corvallis, OR 97330

Prepared by:



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Salem, OR 97302  
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February 3, 2023



EXPIRES: 12/31/2024

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## Introduction

The spillway structure that controls outflow from Waverly Lake, located on Cox Creek in Albany, Oregon, is experiencing scour and requires repairs and improvements to protect against future scour damage. A hydraulic analysis was conducted to help inform design of the spillway repairs and retrofit, and to ensure that the proposed work meets Federal Emergency Management Agency (FEMA) requirements and City of Albany floodplain development code. According to the effective FEMA Flood Insurance Study (FIS) for Linn County Oregon (FEMA, 2019), the spillway is located within a FEMA Zone AE Special Flood Hazard Area (SFHA) and within the regulatory floodway. According to the FIS, the 1% annual chance floodplain for Cox Creek is generally limited to a narrow corridor along the channel in the vicinity of the project site. FEMA and City regulations require that proposed changes within a regulatory floodway cause 'no-rise' to floodplain or floodway elevations. If the proposed changes cause a rise, submittal of a Conditional Letter of Map Revision (CLOMR) prior to the beginning of construction is required, followed by a Letter of Map Revision (LOMR) after the project is complete. A site map is provided as **Figure 1** (figures referenced in the text are found in **Appendix A**). All elevations in this memorandum are referenced to the North American Vertical Datum of 1988 (NAVD 88).

This hydraulic study was completed in accordance with standard engineering practice for a hydraulic analysis which produces water surface elevations for the modeled flood events. This report summarizes the analysis methodology and results.

## Background

The Waverly Lake spillway is located approximately 3,200 ft upstream of the confluence of Cox Creek with the Willamette River. The FEMA regulatory floodplain elevations at the site are based on backwater from the Willamette River; however, due to the large difference in watershed areas, peak flows on Cox Creek would likely occur prior to peak flows on the Willamette River. Therefore, this analysis does not consider backwater from the Willamette River.

The ogee style spillway, which impounds Waverly Lake, was constructed as part of the bridge that carries SE Salem Avenue over Cox Creek immediately downstream of Waverly Lake. The top of the spillway forms the bottom of the 41.6 ft wide by 5.25 ft tall rectangular opening at the upstream side



of the bridge, located between the bridge abutments. The low chord of the bridge forms the top of the opening. The spillway is approximately 13.25 feet tall from crest to toe, and the toe of the spillway is located under the bridge, about two thirds of the distance between the upstream and downstream sides of the bridge. Two pedestrian bridges are located near the SE Salem Avenue Bridge: one immediately upstream and one immediately downstream.

The available construction plans for the bridge and spillway are dated 1940 (**Figure 2**) and the ODOT inspection report indicates that the structure was constructed in 1940 (**Figure 3**). According to the construction plans, a horizontal “shale paving slab” apron extends approximately 14.5 feet downstream from the base of the spillway, to a point approximately 3 ft beyond the downstream face of the bridge. However, information from the ODOT inspection report together with survey conducted in 2022 for this project shows that the horizontal apron is not present. It is noted that the ‘apron’ referenced in the ODOT report appears to be the actual spillway structure and not the horizontal apron shown in the construction plans. It is unknown if the horizontal apron was ever constructed, or less likely, if it was removed post construction. Field observations indicate that some of the channel downstream of where the apron should be located, is protected with riprap. The construction plans do not include any details of the riprap channel bed protection noted during the site visit (further discussed below); therefore, details of the extent, gradation, and thickness of the existing riprap protection are unknown.

Based on the ODOT underwater inspection report dated 5/13/2016, scouring of the channel bed at the downstream end of the spillway has occurred. The report indicates that the downstream end of the spillway (which has no apron or cutoff wall) has been undermined by scour to a maximum depth of 1.7 ft for a horizontal distance of up to 4.2 ft upstream from the end of the spillway. A shallow scour hole is also noted downstream of the spillway toe, extending a maximum distance of approximately 4 ft from the spillway, with a maximum depth of 1.2 ft. Undermining of the right abutment is also noted. Given the age of the structure and lack of a vertical cutoff wall that would otherwise protect the base material under the spillway structure, the amount of observed scour is not unexpected. Thus, the resulting loss of base material has created a void that requires repair and protection from future scour.

## Site Visit and Survey

A site visit was conducted by Ken Puhn, PE, on March 4, 2022. The purpose of the site visit was to document site conditions and become familiar with the hydraulic characteristics of the site for use in development of the hydraulic model. A photographic log of the site visit is included in **Appendix B**.

Due to turbid water at the time of the initial site visit, existing bed material could not be documented. Accordingly, subsequent site visits were conducted in June and July 2022 during times when the water was clear enough to observe the channel bed and understand the approximate size and extent of existing bed protection downstream of the spillway. During one of the subsequent site visits, riprap was observed to generally cover the channel bottom from a point about mid-way between the Salem Street Bridge and the pedestrian bridge to a point just downstream of the pedestrian bridge, a distance of about 30 feet. The observed riprap varied in size from gravel size material to boulder size material up to 12-18 inches in diameter. Due to deeper water conditions between the toe of the spillway and the point midway between the upstream side of the pedestrian bridge and the Salem Street Bridge, no direct observation of the channel bed could be made in this portion of the channel.

The banks between the Salem Street Bridge and the downstream pedestrian bridge are protected by large boulder size riprap; however, the slopes are very steep (approximately 0.5H:1V on the left bank) and some of the material has fallen into the channel. The maximum slope recommended for loose riprap protection is 1.5H:1V, which is significantly less than exists at the site. Boulder size material on the banks extends downstream of the pedestrian bridge for a few feet, to where the banks have a flatter slope.

Survey for the project was conducted by Northstar Surveying and was provided to WEST in May 2022. The survey included data for the spillway structure and thirteen bank to bank cross sections located both upstream and downstream of the spillway.

## Hydrology

Peak flows are based on the values used for the effective FEMA FIS. The published peak flows are provided in **Table 1**.

**Table 1. Summary of Discharges for Cox Creek near Albany, OR**

Peak Event	Discharge (cfs)
2-yr	170
5-yr	550
10-yr	900
50-yr	1,220
100-yr	1,360
500-yr	1,690

Peak discharge-frequency estimates from the FIS for Cox Creek in the City of Albany were based on statistical analysis of a USGS crest gage (No. 14174100) using data from 1953 to 1968. The data were analyzed in accordance with criteria outlined in Bulletin No. 17B (FEMA 2019). Operation of the gage ended in 1968; therefore, no additional data were available which could be used to update the original statistical analysis. Lower recurrence interval flows (less than the 10-yr event) used in this analysis were obtained by extrapolation of the existing FEMA flows using a log-frequency plot.

## Hydraulics

### Existing Conditions Model

The hydraulic analysis was conducted using the U.S. Army Corps of Engineers' (USACE) software HEC-RAS (Hydraulic Engineering Center – River Analysis System) version 6.2 (USACE 2022). A HEC-RAS steady state, mixed flow, 1-dimensional hydraulic model was developed for Cox Creek beginning just upstream of SE Salem Ave and ending downstream of a set of two railroad tracks, for a total distance of approximately 800 feet. Model extents and cross section locations are provided as **Figure 4**.

The existing conditions model includes the SE Salem Ave bridge with utility and pedestrian crossings and the two railroad crossings located downstream of the project site. The modeled cross sections were developed based on the channel survey collected by Northstar Surveying in March 2022. Manning's n-values were estimated based on observations made at the site, reference texts, and engineering judgment. The downstream boundary condition is based on the 100-yr elevation (without influence of the Willamette River) in the effective FEMA floodway data table at cross section F.

The results of the existing conditions hydraulic model are provided in Table 3. The extent of the modeled 100-yr floodplain (without backwater from Willamette River) is shown in **Figure 5**.

### Proposed Conditions Model

A proposed conditions model was developed by modifying the existing conditions model to include a proposed spillway apron designed by McGee Engineering (McGee). The proposed spillway apron will extend to the downstream face of the bridge, 12.2 ft downstream from the toe of the spillway, at elevation 188.7 ft. To protect the channel against scour, riprap channel protection will be placed in the channel bed for an additional distance of approximately 30.0 ft downstream of the proposed apron, such that the total length of channel protection extends for a distance of approximately 42.2 ft from the spillway toe. Construction plans from McGee are provided in **Appendix C**.

Under existing and proposed conditions, and for all modeled events (2-yr – 500-yr) the hydraulic model indicates that the spillway has a high tailwater condition and subcritical flow immediately downstream of the culvert (**Figure 6**). During the site visits, which were conducted during relatively low flow periods, the hydraulic jump was observed to be located at the base of the spillway (**Figure 7**). The high tailwater conditions occur as a result of the adverse channel thalweg slope downstream of the project site and also from backwater associated with the two downstream railroad structures.

Although the hydraulic model was run for mixed flow conditions (sub- and super-critical flow) the model may not fully represent the momentum forces present at the base of the spillway and channel immediately downstream. Therefore, additional analysis was conducted to estimate the potential length of a hydraulic jump that would occur during flood conditions. Using hydraulic jump length relationship developed by the U.S Bureau of Reclamation and described in Chow's Open-Channel Hydraulics (Chow, 1959), the potential hydraulic jump length was calculated as a function of sequent depths (the paired depths upstream and downstream of a hydraulic jump).

Using Figure 15-4 from Chow (**Figure 8**), the length ( $L$ ) of the hydraulic jump is calculated as a function of Froude number ( $F_1$ ) in the supercritical flow zone just upstream of the hydraulic jump, and the depth of water ( $Y_2$ ) in the subcritical flow zone, just downstream of the hydraulic jump. Since larger values of  $Y_2$  will result in larger values of  $L$ , the potential hydraulic jump length was conservatively based on the 500-yr event. Using an assumed  $F_1$  value of 1.1 due to the short length and drop of the spillway, and a  $Y_2$  value of 11.3 ft from RS 815, the calculated potential jump length is 39 ft. Given the high tailwater conditions in the model, backwater contributions from the two downstream railroad bridges, combined with the relatively short length of the existing downstream scour hole, the calculated jump

length is likely conservatively long. However, the sizes of any previously repaired scour holes are unknown, and scour may have been worse historically.

## Scour Protection

To protect the spillway and downstream channel from scour, channel protection should be used within the zone of the potential hydraulic jump. Construction of a horizontal apron based on the proposed design by McGee, combined with adequately sized downstream riprap protection of the channel bed is considered sufficient to protect the channel against future damage. Since the proposed apron will extend to the downstream end of the bridge (approximately 12.2 ft downstream from the toe of the spillway), the remaining 26.8 ft of the total 39 ft required protection zone length requires riprap protection of the channel bed.

Riprap channel protection was sized using the Riprap Design System (RDS) software (WEST) as well as ODOT criteria and recommendations from the Federal Highway Administration Hydraulic Engineering Circular 14 (HEC-14) (FHWA). Riprap size was calculated in RDS using three methods; ASCE, USGS, and HEC-11. The ASCE and HEC-11 methods allow riprap to be sized for the channel bed. The USGS method is based on an envelope curve and typically provides the most conservative results of riprap sizing methods. Riprap sizing was calculated for all cross sections where riprap would be placed, and the values provided below are based on the most conservative results. The riprap size was estimated for the 100-yr event and checked for the 500-yr event.

For the ASCE method, the  $D_{50}$  was calculated to be 0.13 ft using the highest average channel velocity for cross sections 803 to 767 (4.5 ft/s), and a unit weight for stone of 165 lbs/ cu ft.

For the HEC-11 method, the  $D_{50}$  was calculated to be 0.08 ft using an average channel velocity of 4.5 ft/s, unit weight for stone of 165 lbs/cu ft, an average channel depth of 6.5 ft, and a safety factor of 2.

For the USGS method, the  $D_{50}$  was calculated to be 0.39 ft using an average channel velocity of 4.5 ft/s. All three methods would correspond to ODOT class 50 riprap. Given the potentially turbulent conditions and since the riprap is protecting a spillway that controls an upstream lake, it is recommended that Class 100 riprap be used to protect the channel bottom. Class 100 riprap requires a blanket thickness of 1.5 ft. Since the riprap will be protecting the downstream side of a structure, an additional check of the potential riprap blanket thickness was conducted using methods from HEC-14.

HEC-14 provides riprap blanket thickness recommendations for dissipator pool protection downstream of a structure. The guidance recommends a thickness of  $2D_{50}$  or  $1.5 D_{max}$ , potentially increased to  $3D_{50}$  or  $2D_{max}$  at the fore slope (if a dissipater pool were constructed). Class 100 riprap has a  $D_{50}$  of 0.66 ft and a  $D_{100}$  of 1.05 ft. The fore slope guidance results in a recommended thickness of approximately 2 ft [ $3D_{50} = 2$  ft, and  $2D_{100} = 2.1$  ft], which is greater than the ODOT minimum thickness of 1.5 ft. Therefore, it is recommended that the downstream riprap blanket have a minimum thickness of 2 ft (**Figure 9**). Riprap gradation requirements for ODOT Class 100 riprap are shown in **Table 2**.

**Table 2. Class 100 Riprap Gradation**

Percent by Weight	Class 100 Stone Weight (lb)
<b>20</b>	100 - 60
<b>30</b>	60 - 25
<b>40</b>	25 - 2
<b>10 - 0</b>	2 - 0

Use of a riprap geotextile filter fabric at the interface between the riprap and native bed material is not required for Class 100 riprap. However, if after the existing material are excavated, it is determined that the channel bed material at the interface is comprised of fine-grained, cohesionless soil such as sand, a geotextile filter or a gravel filter layer is recommended. It is further recommended that a vertical cutoff wall be incorporated into the downstream end of the concrete apron. The cutoff wall should extend to the depth of the proposed riprap blanket. If the environmental permitting should require that native rounded bed material be placed on top of the riprap protection, the riprap should be inset further into the channel bed and topped with the rounded material. In this case, the vertical cutoff wall should be extended to the bottom of the riprap blanket.

It should be noted that the turbulence associated with a hydraulic jump that could occur has the potential to cause erosion of the channel banks in addition to the channel bed. The banks between the Salem Street Bridge and the downstream pedestrian bridge are currently protected by large boulders within the calculated jump zone. The current City repair project scope is limited to addressing the lack of a spillway apron and existing scour in the channel bed; however, consideration should be given to repairing the over steepened riprap slopes that will likely continue to lose material over time. Due to the steep bank slopes in this area, bank protection may require use of interlocking concrete blocks,

concrete walls, stacked rock, or other protection methods that can be used in areas with slopes exceeding 1.5H:1V (the maximum recommended slope for loose riprap).

## FEMA Floodplain Impact Results

To ensure the proposed spillway repairs meet FEMA and City of Albany no-rise requirements for development in the regulatory floodway, a comparison was made of existing conditions and proposed conditions water surface elevations for base flood and floodway conditions. For encroached (floodway) conditions, encroachment stations from the effective FIS were used in locations where survey and FEMA cross sections coincided or where in close proximity to one another. Encroachment stations for the remaining cross sections we determined by measurements of the floodway widths from the FIS floodway boundaries in ArcGIS. A comparison of existing and proposed water surface elevations for the base flood (non-encroached non-regulatory) condition is provided in **Table 2**. A comparison of existing and proposed water surface elevations for the floodway (encroached) condition is provided in **Table 3**. As seen in **Table 2** and **Table 3**, the proposed spillway repairs will not cause a rise to base flood or floodway elevations. A FEMA Engineering No-Rise certificate is provided in **Figure 10**.

**Table 3. Comparison of existing and proposed water surface elevations for base flood (non-encroached) conditions**

Approx. FEMA Lettered Cross Section	RAS Cross Section	Existing Conditions WSE (ft)	Proposed Conditions WSE (ft)	Rise (ft)
J	850	206.80	206.80	0.00
	820	SE Salem Ave Bridge		
	816.5	199.60	199.60	0.00
	815	199.63	199.63	0.00
	806	199.63	199.63	0.00
	803	199.64	199.64	0.00
	797	Utility Crossing		
I	792	199.52	199.52	0.00
	780	Pedestrian Crossing		
	767	199.37	199.37	0.00
	666	199.18	199.18	0.00
	585	198.96	198.96	0.00
	524	198.90	198.90	0.00
	367	198.90	198.90	0.00
	286	198.84	198.84	0.00
H	209	198.65	198.65	0.00
	205	Railroad Crossing		
	175	198.01	198.01	0.00
G	137	198.03	198.03	0.00
	120	Railroad Crossing		
	103	197.41	197.41	0.00
F	56	197.30	197.30	0.00



**Table 4. Comparison of existing and proposed water surface elevations for floodway (encroached) conditions**

Approx. FEMA Lettered Cross Section	RAS Cross Section	Existing Conditions WSE (ft)	Proposed Conditions WSE (ft)	Rise (ft)
J	850	206.79	206.79	0.00
	820	SE Salem Ave Bridge		
	816.5	199.69	199.69	0.00
	815	199.72	199.72	0.00
	806	199.72	199.72	0.00
	803	199.73	199.73	0.00
	797	Utility Crossing		
I	792	199.62	199.61	-0.01
	780	Pedestrian Crossing		
	767	199.47	199.47	0.00
	666	199.30	199.30	0.00
	585	199.08	199.08	0.00
	524	199.03	199.03	0.00
	367	198.98	198.98	0.00
	286	198.95	198.95	0.00
H	209	198.78	198.78	0.00
	205	Railroad Crossing		
	175	198.14	198.14	0.00
G	137	198.16	198.16	0.00
	120	Railroad Crossing		
	103	197.56	197.56	0.00
F	56	197.40	197.40	0.00

## Summary

A hydraulic analysis was conducted for proposed Waverly Lake spillway repairs on Cox Creek to address scour and undermining that has occurred to the spillway structure. The proposed repair will include installation of a concrete apron between the existing bridge abutments, extending from the toe of the spillway to the downstream end of the bridge, a distance of approximately 12.2 ft. A vertical cutoff wall will be constructed at the downstream end of the spillway, to protect against future undermining of the apron, should scour occur. Due to the potential for turbulence associated with a potential hydraulic jump that could occur downstream of the spillway during high flow conditions, channel bed protection should be placed between the end of the proposed spillway apron and the downstream face of the pedestrian bridge, a distance of approximately 28.5 ft from the downstream end of the proposed apron.

It is recommended that Class 100 riprap be used to protect the channel bottom downstream of the apron. The riprap blanket should have a minimum thickness of 2ft. Use of a riprap geotextile filter fabric at the interface between the riprap and native bed material is not required for Class 100 riprap. However, if after the existing material are excavated, it is determined that the channel bed material at the interface is comprised of fine-grained, cohesionless soil such as sand, a geotextile filter or a gravel filter layer is recommended. It is further recommended that a vertical cutoff wall be incorporated into the downstream end of the concrete apron. The cutoff wall should extend to the depth of the proposed riprap blanket. If the environmental permitting should require that native rounded bed material be placed on top of the riprap protection, the riprap should be inset further into the channel bed and topped with the rounded material. In this case, the vertical cutoff wall should be extended to the bottom of the riprap blanket.

It should be noted that the turbulence associated with a hydraulic jump that could occur has the potential to cause erosion of the channel banks in addition to the channel bed. The banks between the Salem Street Bridge and the downstream pedestrian bridge are currently protected by large boulders within the calculated jump zone. The current City repair project scope is limited to addressing the lack of a spillway apron and existing scour in the channel bed; however, consideration should be given to repairing the over steepened riprap slopes that will likely continue to lose material over time. Due to the steep bank slopes in this area, bank protection may require use of interlocking concrete blocks, concrete walls, stacked rock, or other protection methods that can be used in areas with slopes exceeding 1.5H:1V (the maximum recommended slope for loose riprap).

## References

Federal Highway Administration (FHWA), Evaluating Scour at Bridges, FHWA-HIF-12-003, Hydraulic Engineering Circular No. 18, third Edition, Washington, D.C., July 2006.

Federal Highway Administration (FHWA), Hydraulic Design of Energy Dissipators for Culverts and Channels, FHWA-NHI-06-086, Hydraulic Engineering Circular No. 14, Fifth Edition, Washington, D.C., April 2012.

U.S. Army Corps of Engineers, Hydrologic Engineering Center; HEC-RAS, River Analysis System, Software Version 6.2; March 2022

U.S. Department of Homeland Security, Federal Emergency Management Agency; Flood Insurance Study for Linn County, OR and Incorporated Areas, 41043CV001B; Revised December 8, 2016; Reprinted with correction July 31, 2019

Oregon Department of Transportation (ODOT) Highway Division, Hydraulics Manual, ODOT, Salem, Oregon, April 2014.

Chow, Ven Te. Open-Channel Hydraulics, 1959.

## Appendix A - Figures

Figure 1. Study Area with Effective SFHA Mapping

Figure 2. Construction Plan

Figure 3. ODOT Inspection Report

Figure 4. HEC-RAS Cross Section locations

Figure 5. 100-yr Floodplain Map

Figure 6. Existing conditions flood profiles

Figure 7. Spillway under low flow conditions (showing backwater conditions).

Figure 8. Chow Figure 15.4

Figure 9. Recommended channel protection

Figure 10. No-rise Certificate

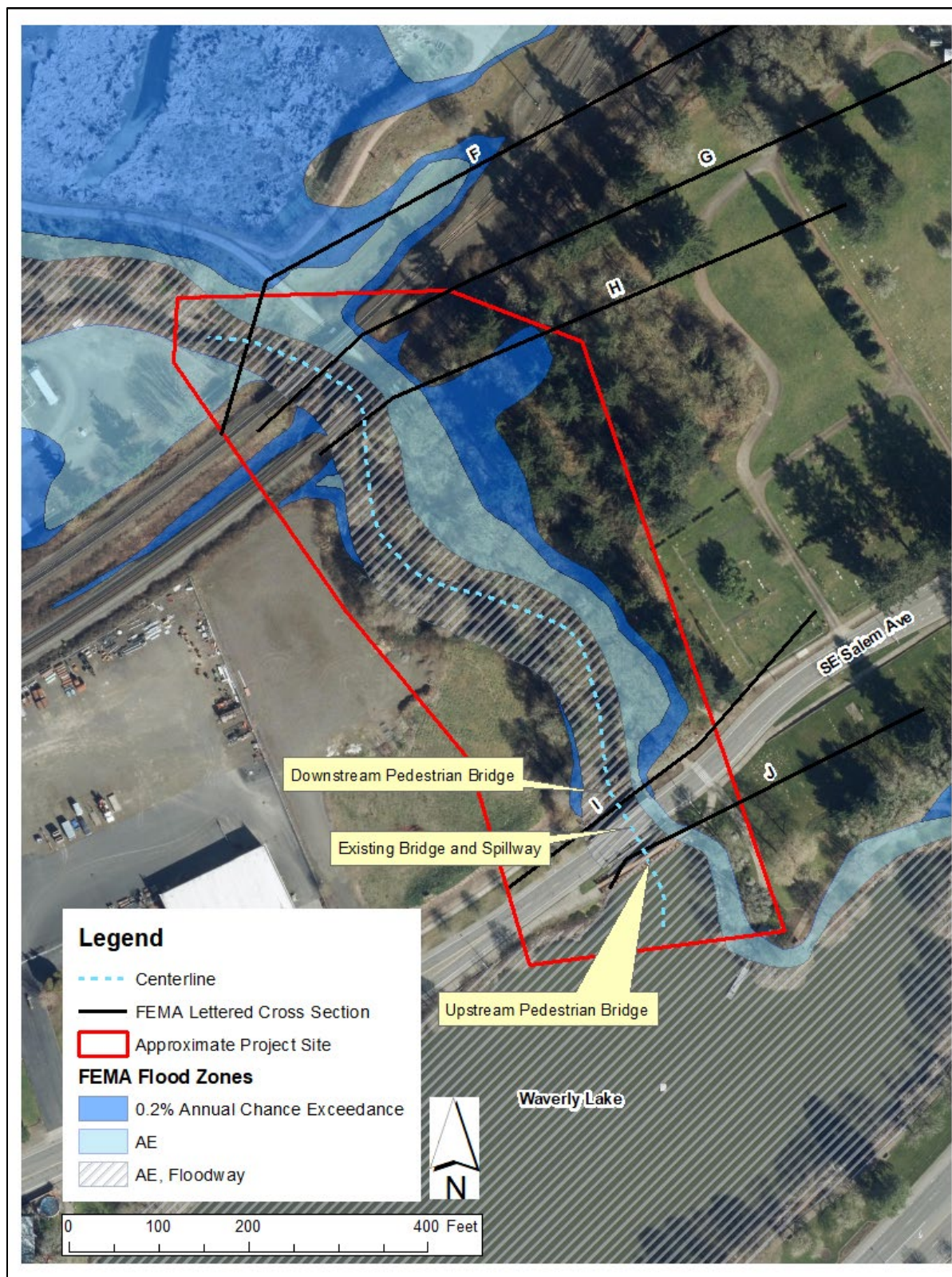


Figure 1. Study Area with Effective SFHA Mapping

WEST Consultants, Inc.

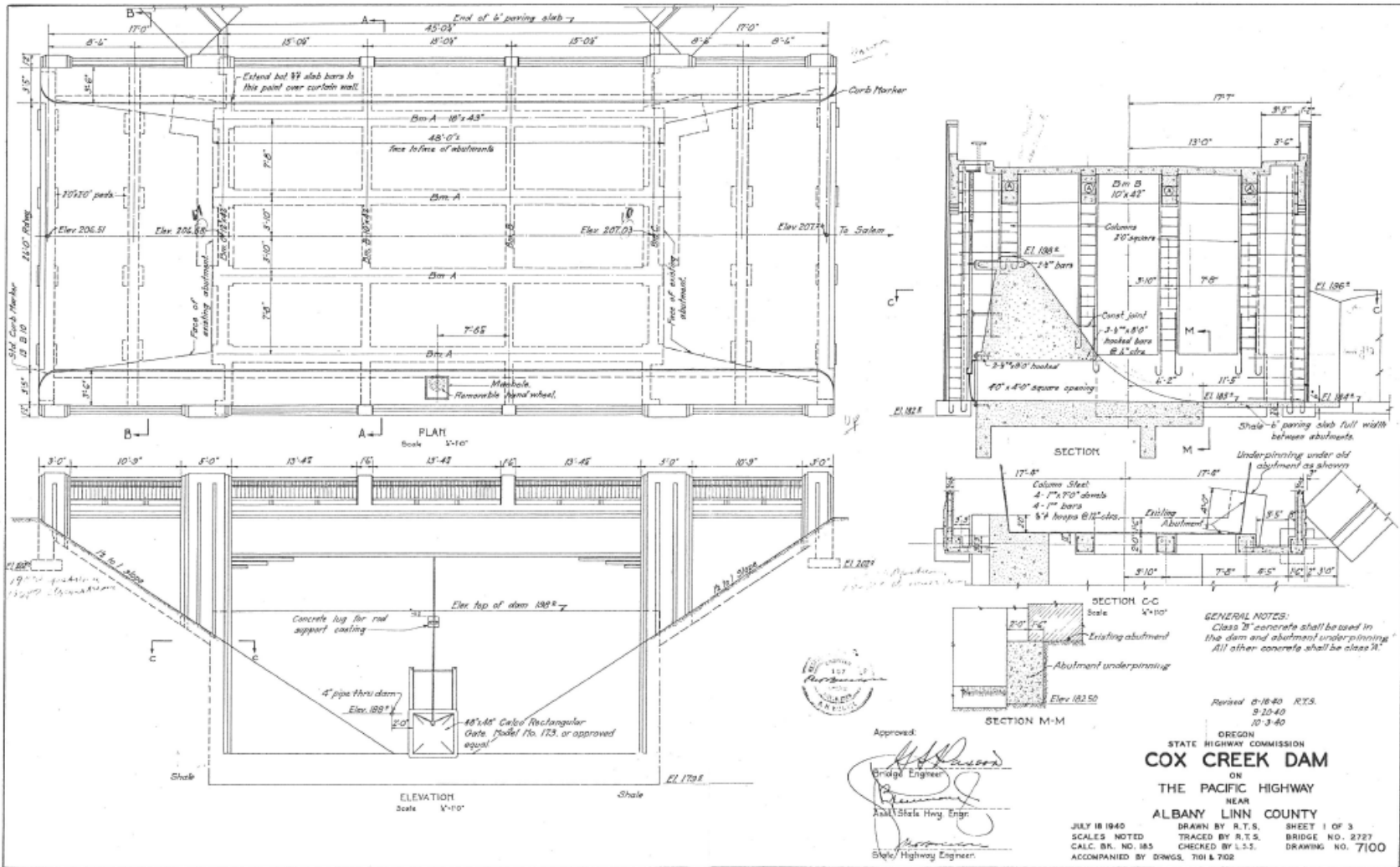


Figure 2. Construction Plan

WEST Consultants, Inc.

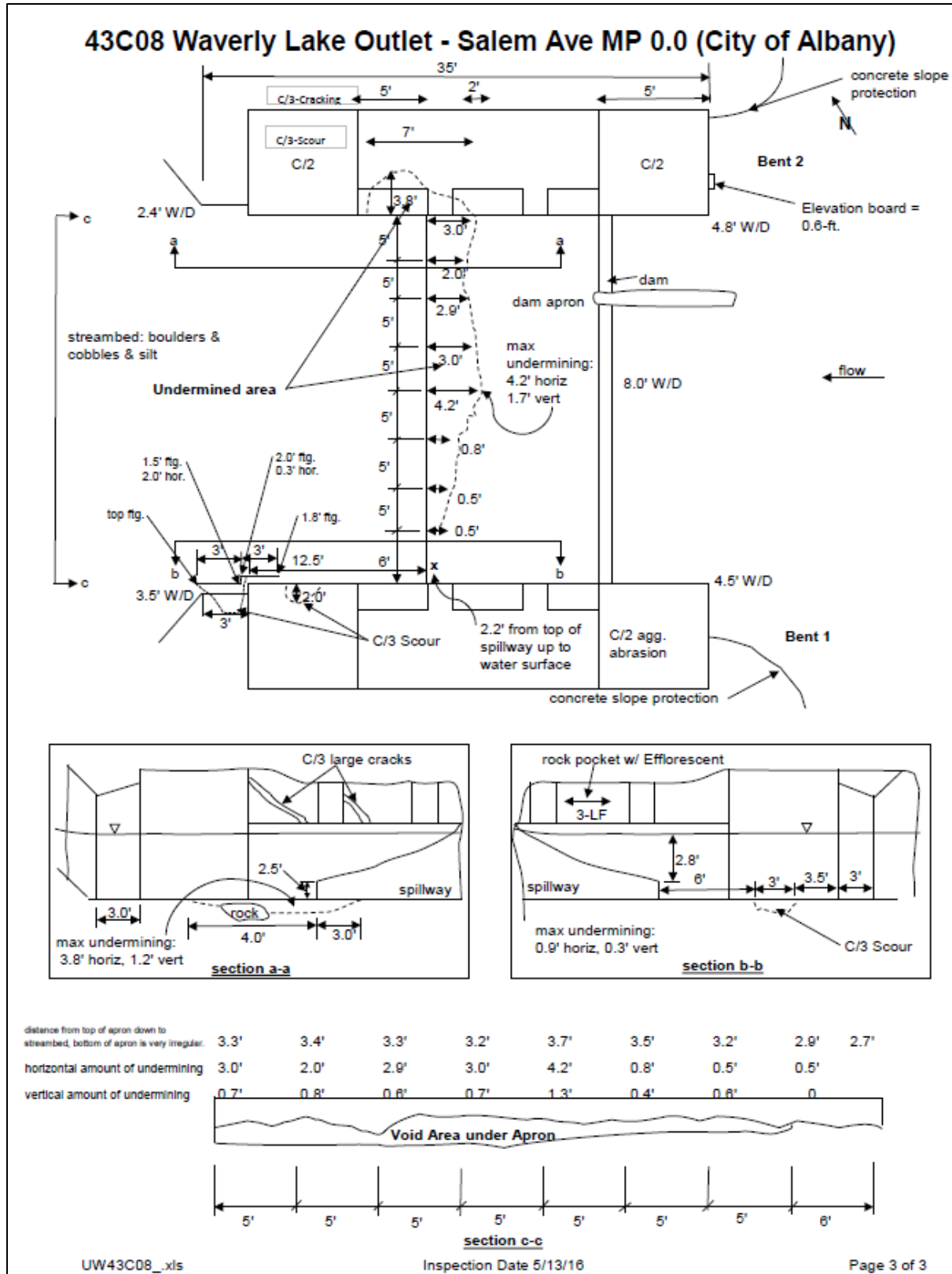


Figure 3. ODOT Inspection Report

WEST Consultants, Inc.

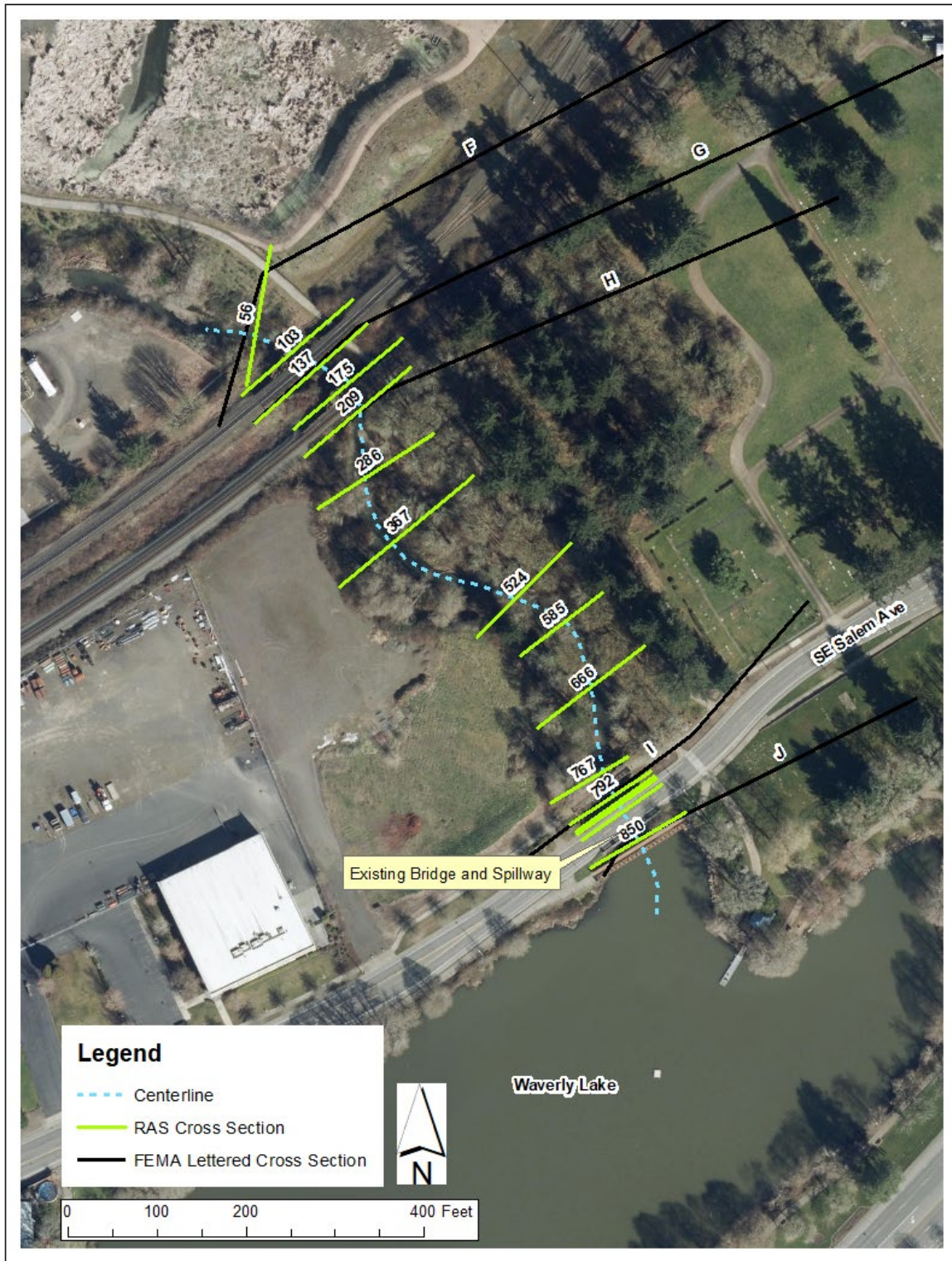


Figure 4. HEC-RAS Cross Section locations



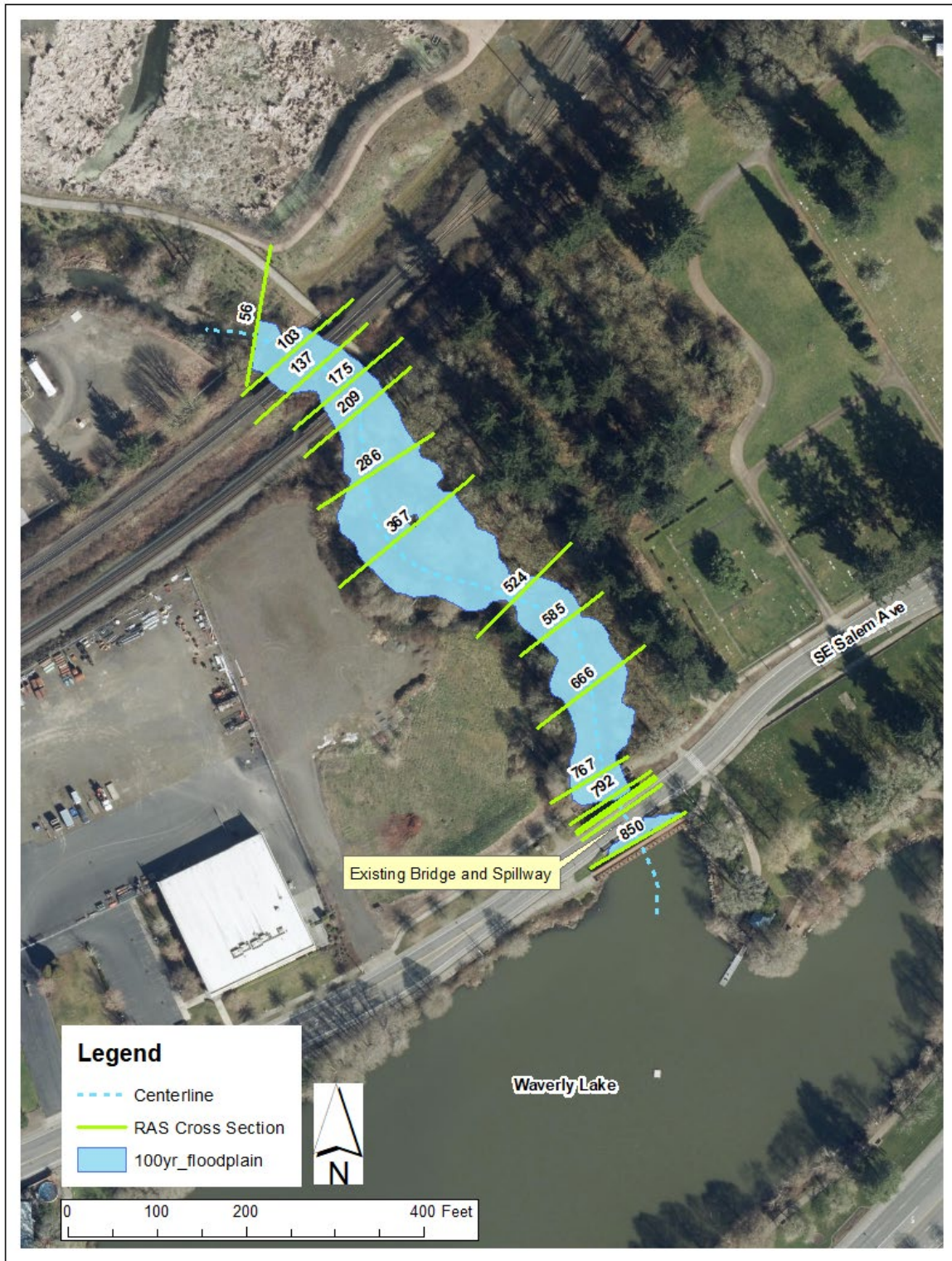


Figure 5. Modeled 100-yr Floodplain Map (Not Effected by Backwater from Willamette River)

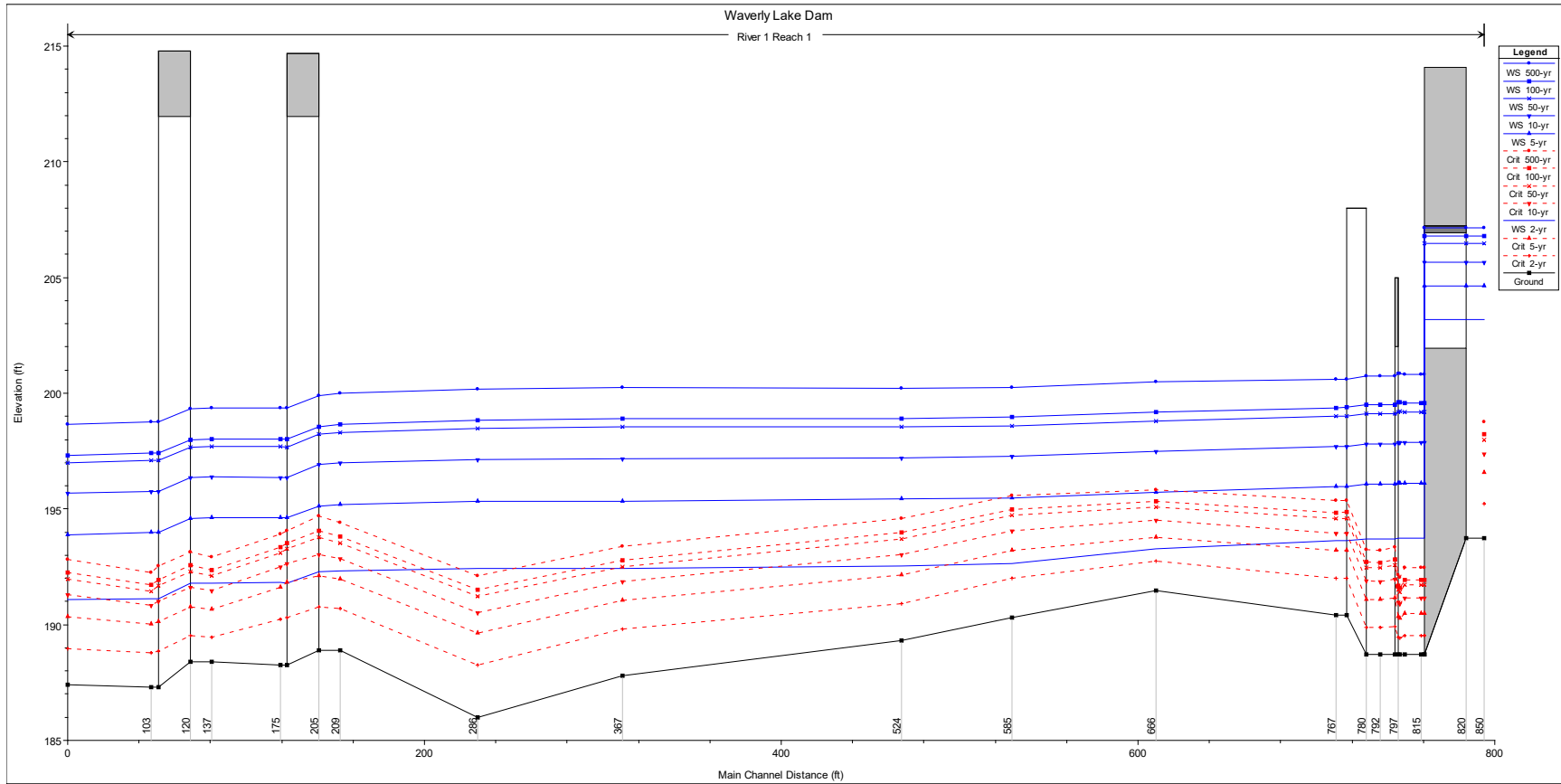


Figure 6. Existing conditions flood profiles



**Figure 7. Spillway under low flow conditions (showing backwater conditions).**

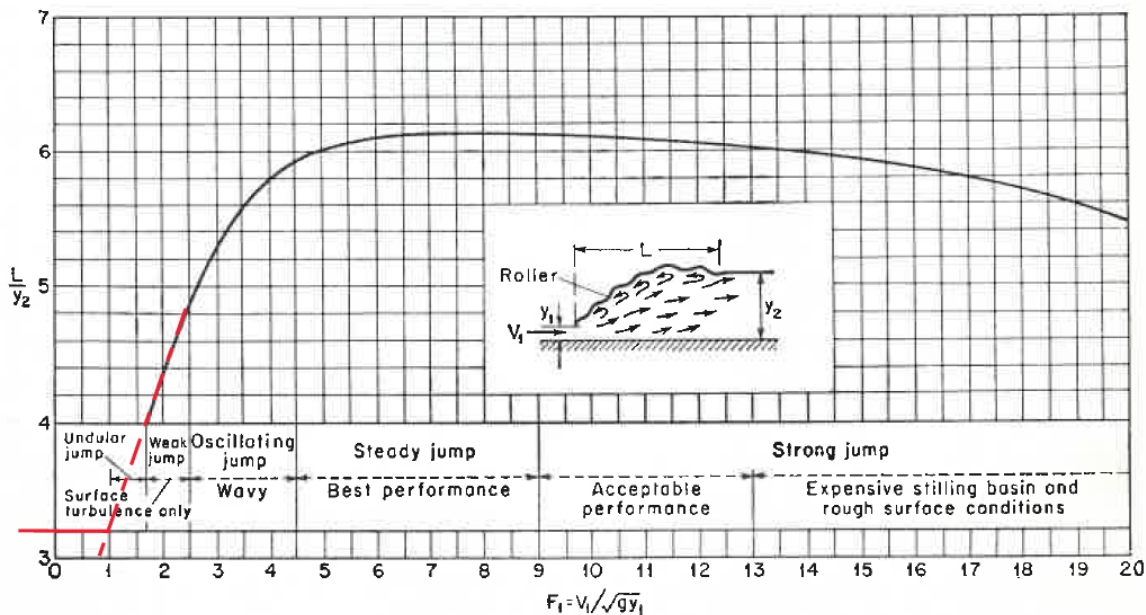


FIG. 15-4. Length in terms of sequent depth  $y_2$  of jumps in horizontal channels. (Based on data and recommendations of U.S. Bureau of Reclamation [34].)

Figure 8. Chow Figure 15.4

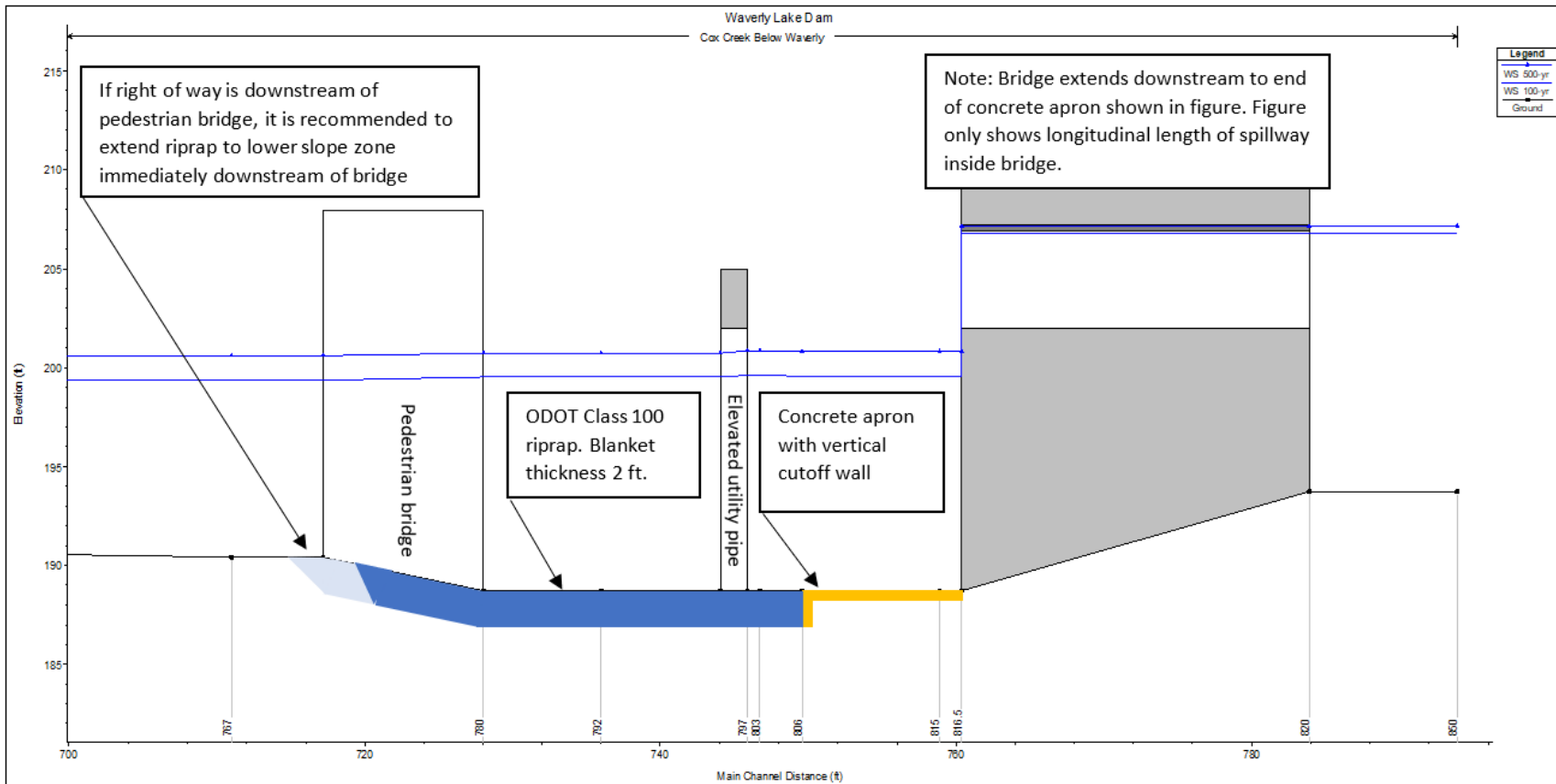


Figure 9. Recommended channel protection

**Engineering “No-Rise” Certification**

This is to certify that I am a duly qualified engineer licensed to practice in the State of Oregon.

It is to further certify that the technical memo supports the fact that the proposed spillway repairs for the Waverly Lake Spillway in Albany, OR will not will not cause an increase in the base flood or floodway elevations for Cox Creek of greater than 0.00 ft.

2/3/2023

\_\_\_\_\_  
(Date)



\_\_\_\_\_  
(Signature)

Senior Project manager

\_\_\_\_\_  
(Title)

Figure 10. No-rise Certificate



EXPIRES: 12/31/2024

## Appendix B - Photos



Photo 1:  
Looking right to left (west) along downstream pedestrian bridge



Photo 2:  
Looking towards left bank between spillway bridge and downstream pedestrian bridge



Photo 3:  
Looking towards right bank between spillway bridge and downstream pedestrian bridge



Photo 4:  
Looking downstream from pedestrian bridge





Photo 5:  
Downstream face of spillway bridge



Photo 6:  
Looking upstream to spillway



Photo 7:  
Left abutment of downstream pedestrian bridge



Photo 8:  
Right abutment of downstream pedestrian bridge



Photo 9:  
Upstream face of spillway



Photo 10:  
Upstream face of RR trestle bridge

## Appendix C – Construction Plans

# Salem Avenue (Waverly Lake) Bridge Repairs

City of Albany

## GENERAL NOTES

Provide materials and perform work according to the 2021 Oregon Standard Specifications for Construction.

Repair is designed in accordance with the 9th Edition of the AASHTO LRFD Bridge Design Specifications.

Seismic design is not considered in this project.

Provide reinforcing steel according to ASTM Specification A706 Grade 60, or AASHTO M31 (ASTM A615) Grade 60. Provide field bent and welded reinforcing according to ASTM Specification A706. Use the following splice lengths (unless shown otherwise).

Reinforcing Splice Lengths (Class B) Grade 60 $f'c=4.0$ ksi										
Bar Size	#3	#4	#5	#6	#7	#8	#9	#10	#11	#14 & #18
Uncoated	1'-0"	1'-4"	1'-8"	2'-0"	2'-6"	3'-3"	4'-1"	5'-2"	6'-4"	Not Permitted

Splice reinforcing steel at alternate bars staggered at least one splice length or as far as possible unless shown otherwise.

Place bars 2" clear of the nearest face of concrete unless noted otherwise.

All reinforcement spacing is maximum unless noted otherwise.

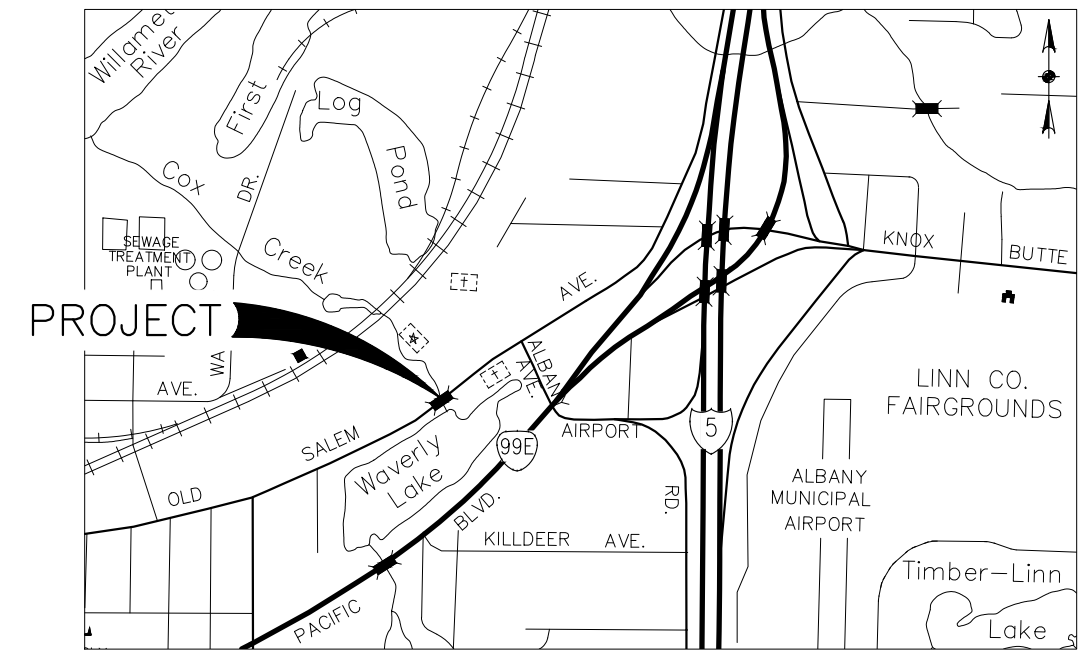
Provide Class 4000-1 1/2, 1, or 3/4" concrete for apron.

Provide Commercial Grade Concrete for fill beneath apron.

Protect all utilities in place. Contractor shall call 811 for utility locates prior to starting work.

## SHEET LIST

Sheet Number	Title
1	Title Sheet & General Notes
2	Site Plan
3	Temporary Access and Water Mgmt.
4	Concrete Apron Details
5	Channel Protection Details - 1
6	Channel Protection Details - 2

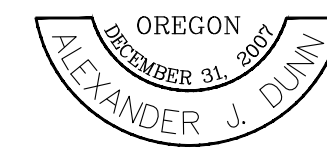
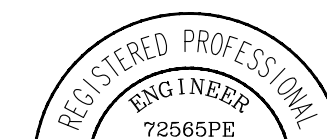


Vicinity Map  
No Scale

Rev	Description	By	Date

**McGee Engineering Inc.**  
 P.O. Box 1067  
 Corvallis, OR 97339  
 Phone: (541) 757-1270  
 Fax: (541) 758-6585

Measures one inch on original drawing.  
Adjust scales accordingly.



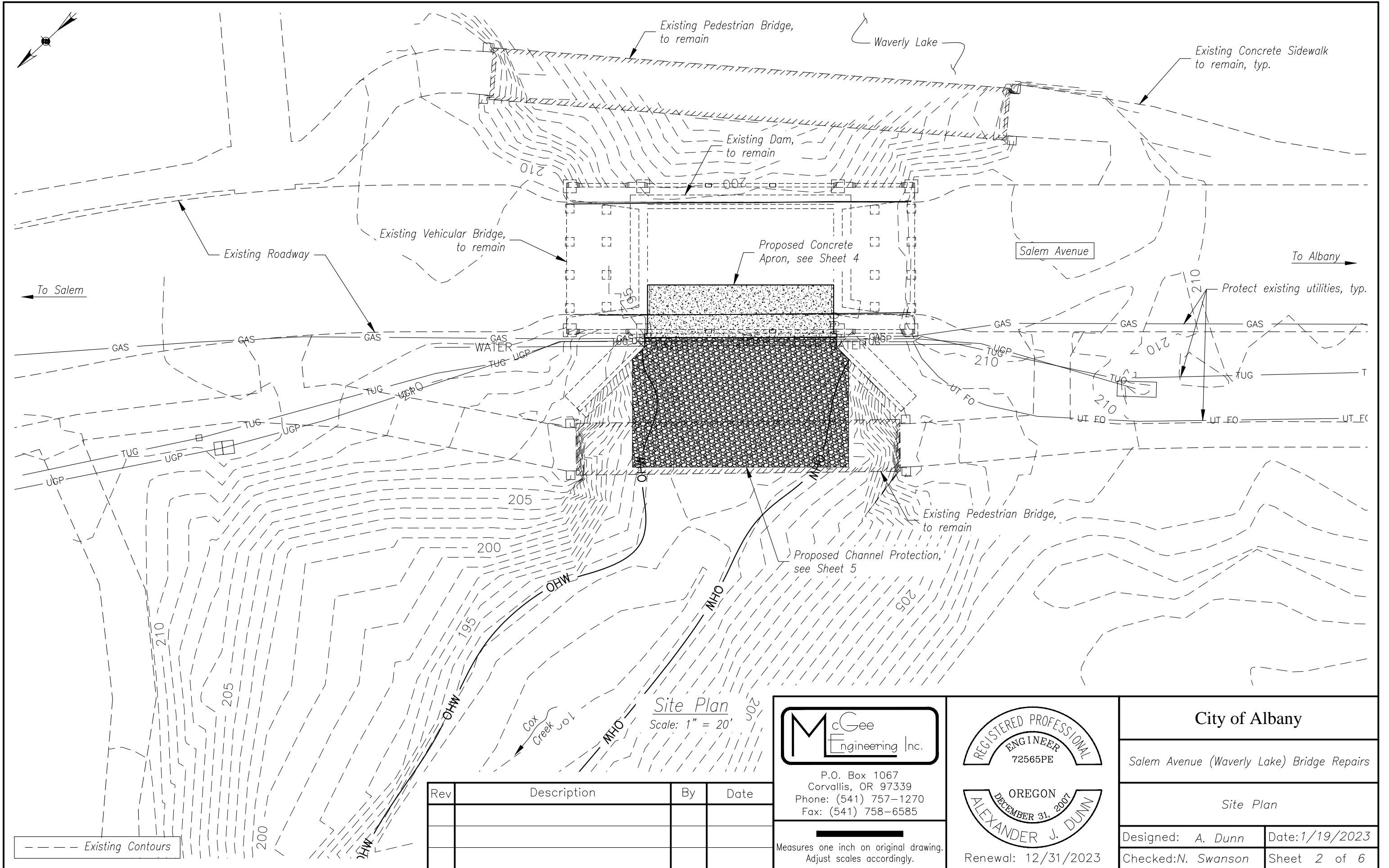
Renewal: 12/31/2023

**City of Albany**

Salem Avenue (Waverly Lake) Bridge Repairs

Title Sheet & General Notes

Designed: A. Dunn	Date: 1/19/2023
Checked: N. Swanson	Sheet 1 of 6



Site Plan  
Scale: 1" = 20'

Rev	Description	By	Date

**McGee Engineering Inc.**  
 P.O. Box 1067  
 Corvallis, OR 97339  
 Phone: (541) 757-1270  
 Fax: (541) 758-6585

REGISTERED PROFESSIONAL  
 ENGINEER  
 72565PE

OREGON  
 DECEMBER 31, 2023  
 ALEXANDER J. DUNN

Renewal: 12/31/2023

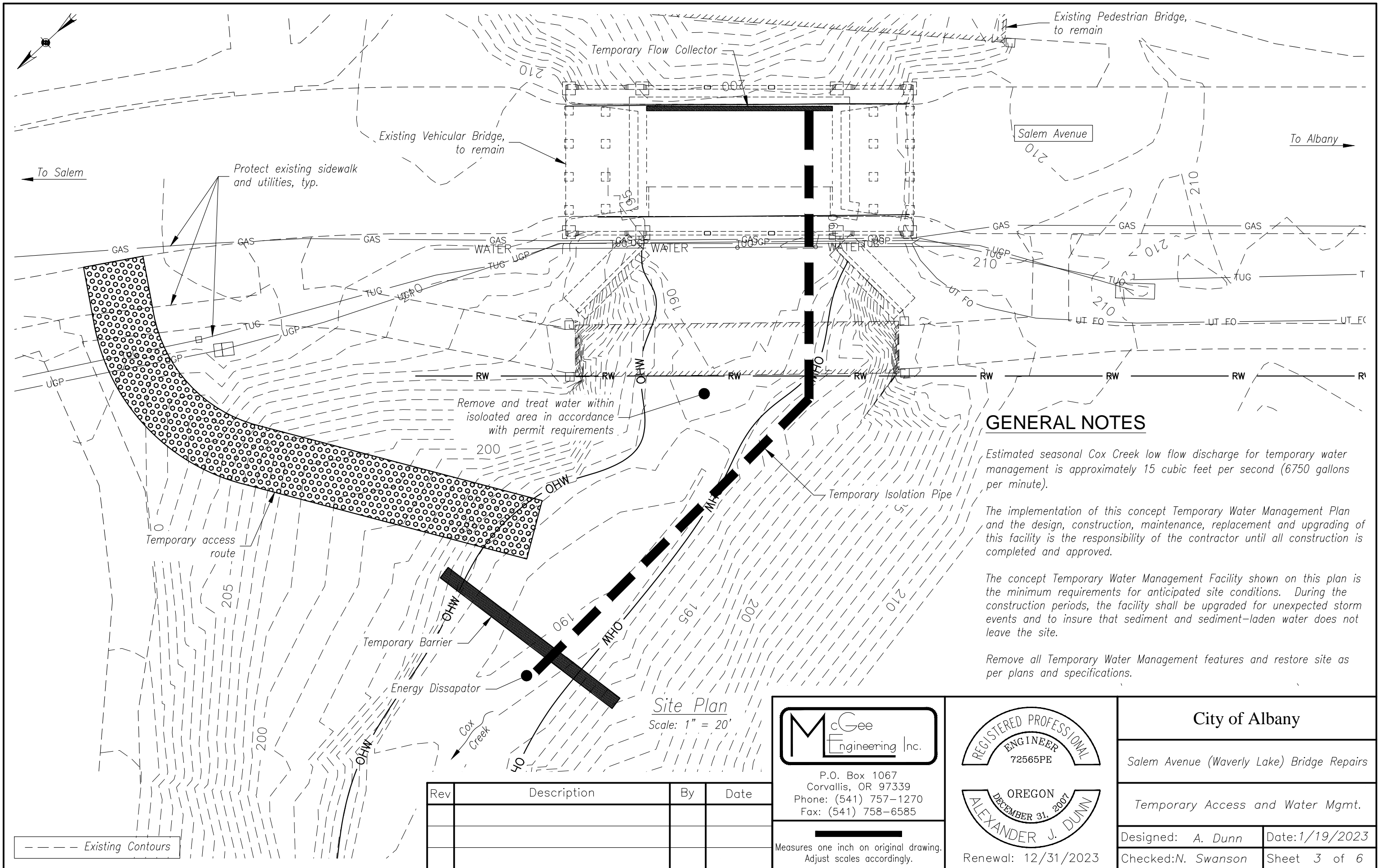
**City of Albany**

Salem Avenue (Waverly Lake) Bridge Repairs

Site Plan

Designed: A. Dunn      Date: 1/19/2023  
 Checked: N. Swanson      Sheet 2 of 6

Measures one inch on original drawing.  
 Adjust scales accordingly.



**GENERAL NOTES**

Estimated seasonal Cox Creek low flow discharge for temporary water management is approximately 15 cubic feet per second (6750 gallons per minute).

The implementation of this concept Temporary Water Management Plan and the design, construction, maintenance, replacement and upgrading of this facility is the responsibility of the contractor until all construction is completed and approved.

The concept Temporary Water Management Facility shown on this plan is the minimum requirements for anticipated site conditions. During the construction periods, the facility shall be upgraded for unexpected storm events and to insure that sediment and sediment-laden water does not leave the site.

Remove all Temporary Water Management features and restore site as per plans and specifications.

Site Plan  
Scale: 1" = 20'

Rev	Description	By	Date

**McGee Engineering Inc.**  
 P.O. Box 1067  
 Corvallis, OR 97339  
 Phone: (541) 757-1270  
 Fax: (541) 758-6585

REGISTERED PROFESSIONAL  
 ENGINEER  
 72565PE

OREGON  
 DECEMBER 31, 2007  
 ALEXANDER J. DUNN

Renewal: 12/31/2023

**City of Albany**

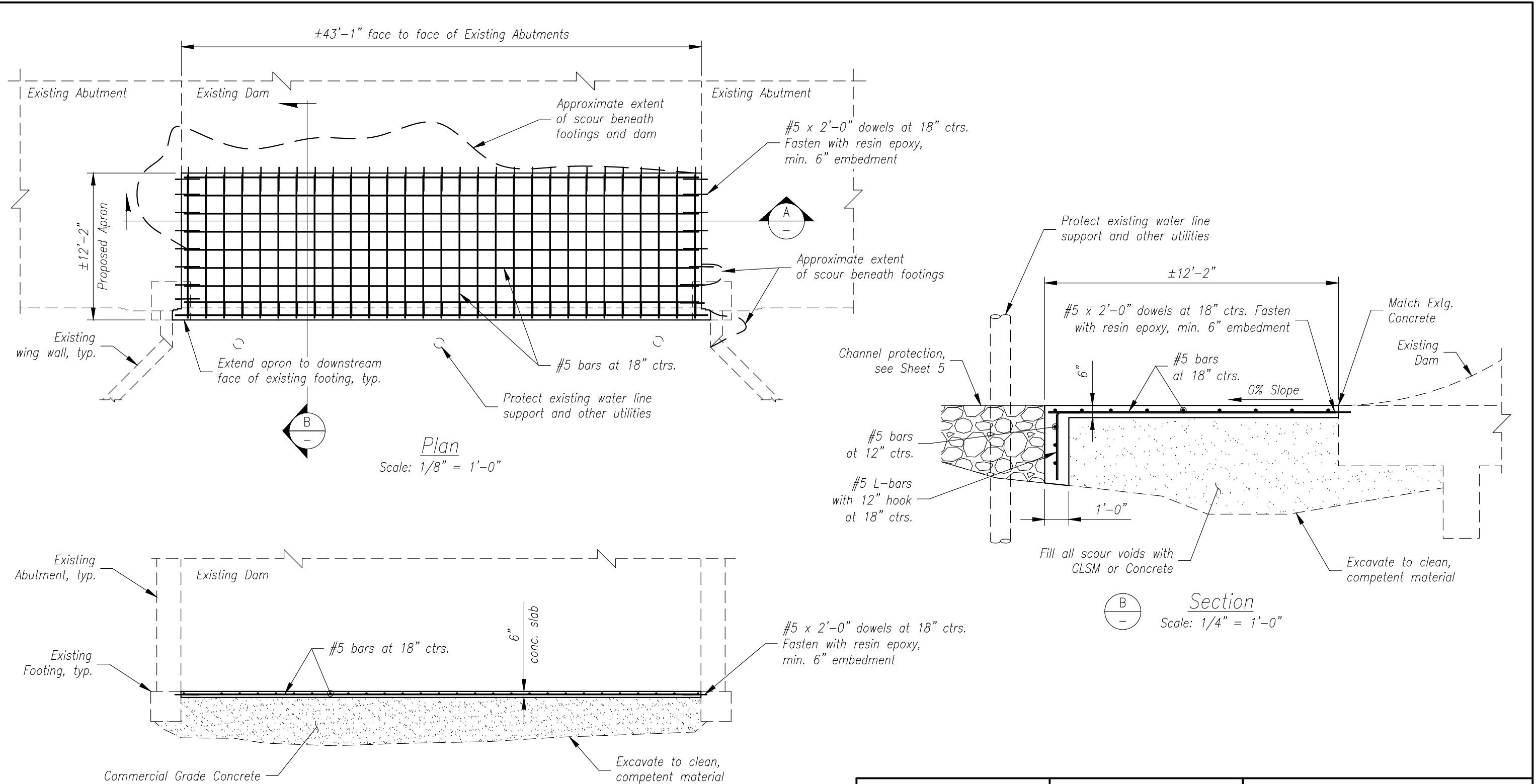
Salem Avenue (Waverly Lake) Bridge Repairs

Temporary Access and Water Mgmt.

Designed: A. Dunn      Date: 1/19/2023  
 Checked: N. Swanson      Sheet 3 of 6

--- Existing Contours

Measures one inch on original drawing.  
 Adjust scales accordingly.



**Plan**  
Scale: 1/8" = 1'-0"

**Section**  
Scale: 1/4" = 1'-0"

**Section**  
Scale: 1/8" = 1'-0"

Rev	Description	By	Date

**McGee Engineering Inc.**  
 P.O. Box 1067  
 Corvallis, OR 97339  
 Phone: (541) 757-1270  
 Fax: (541) 758-6585

Measures one inch on original drawing.  
 Adjust scales accordingly.

**REGISTERED PROFESSIONAL ENGINEER**  
 72565PE

**OREGON**  
 DECEMBER 31, 2007  
 ALEXANDER J. DUNN

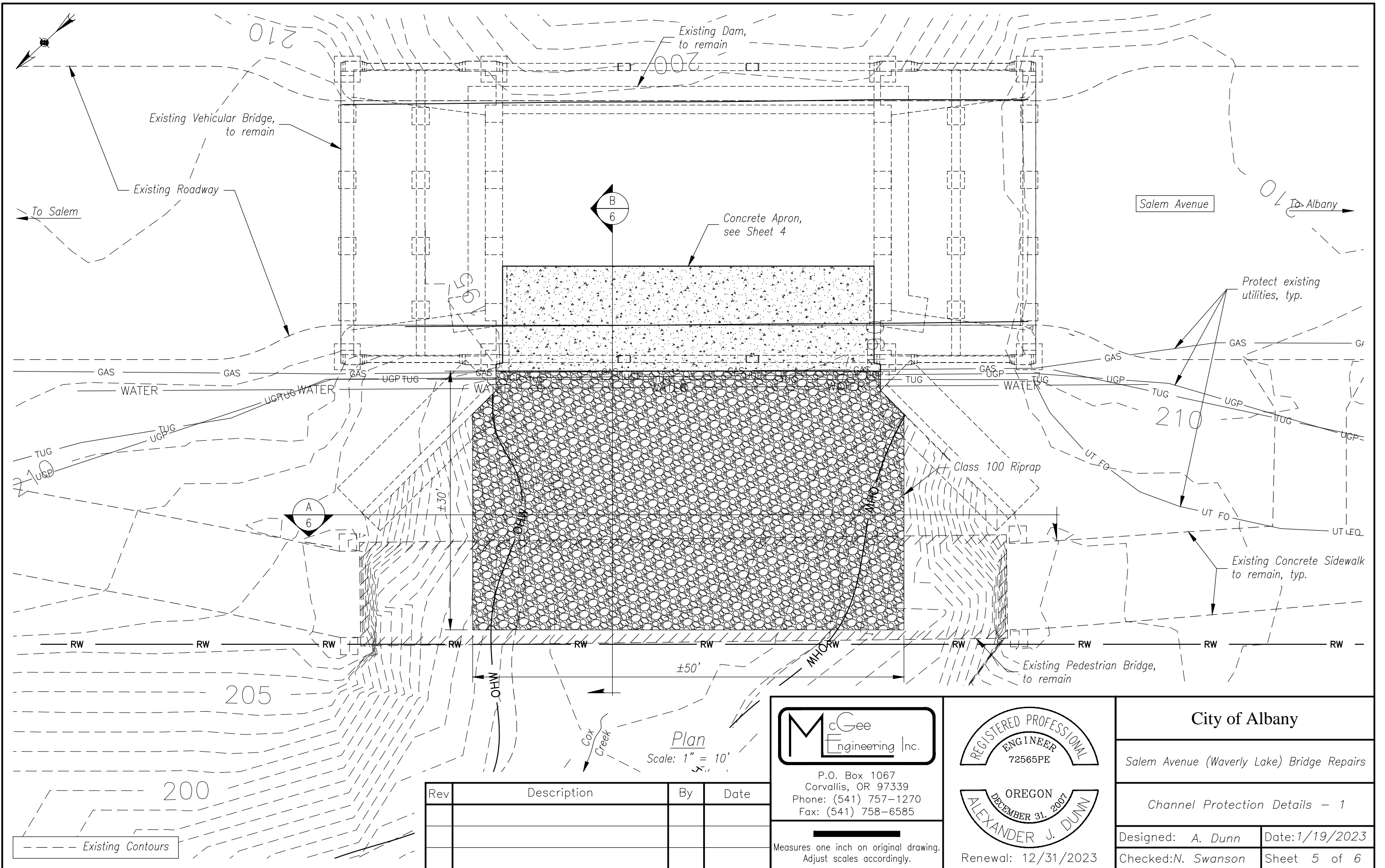
Renewal: 12/31/2023

**City of Albany**

Salem Avenue (Waverly Lake) Bridge Repairs

Concrete Apron Details

Designed: A. Dunn      Date: 1/19/2023  
 Checked: N. Swanson      Sheet 4 of 6



Plan  
Scale: 1" = 10'

Rev	Description	By	Date

**McGee Engineering Inc.**  
 P.O. Box 1067  
 Corvallis, OR 97339  
 Phone: (541) 757-1270  
 Fax: (541) 758-6585

Measures one inch on original drawing.  
 Adjust scales accordingly.

REGISTERED PROFESSIONAL  
 ENGINEER  
 72565PE

OREGON  
 DECEMBER 31, 2007  
 ALEXANDER J. DUNN

Renewal: 12/31/2023

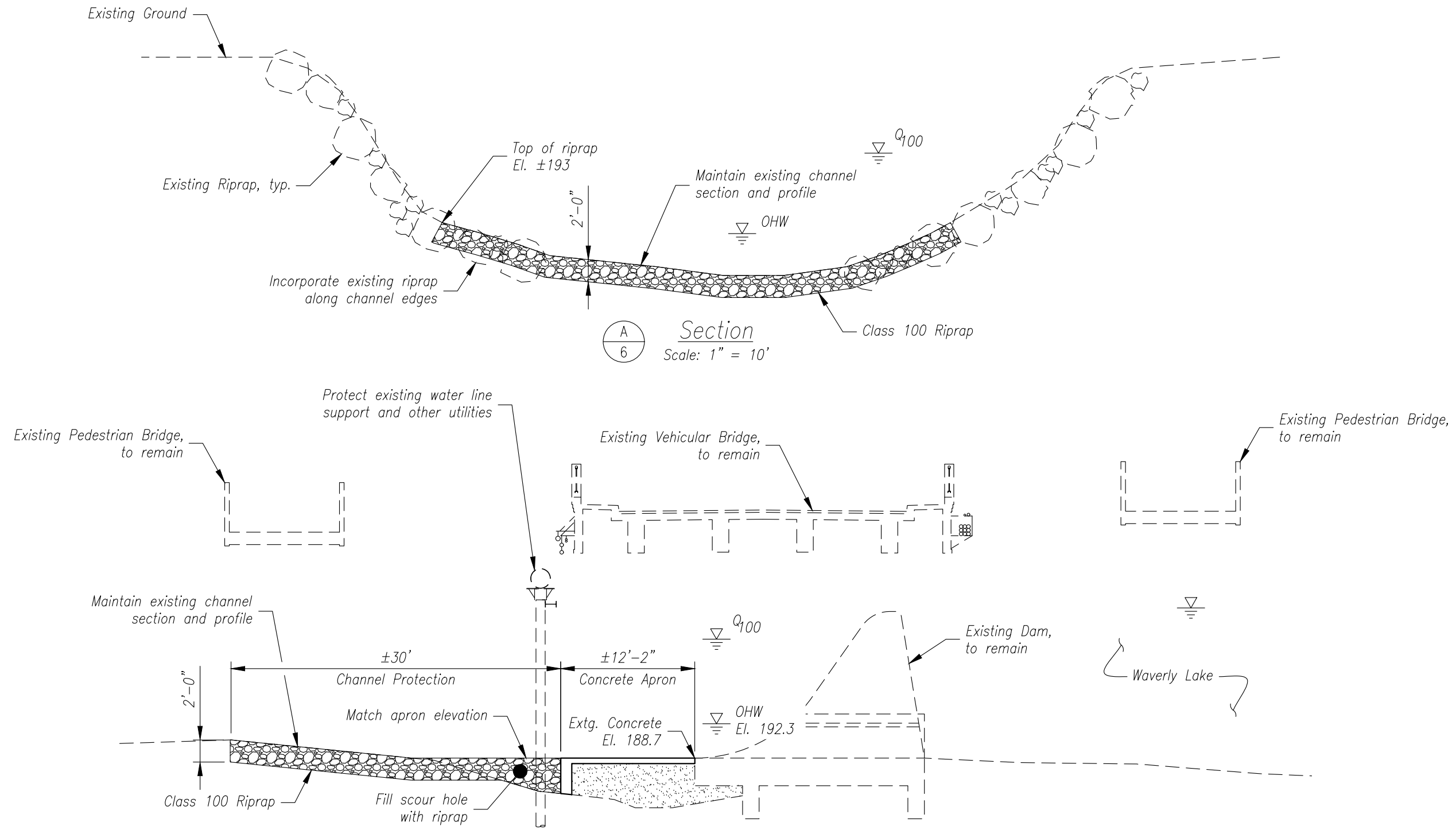
**City of Albany**

Salem Avenue (Waverly Lake) Bridge Repairs

Channel Protection Details - 1

Designed: A. Dunn      Date: 1/19/2023  
 Checked: N. Swanson      Sheet 5 of 6





**A**  
6  
*Section*  
Scale: 1" = 10'

**B**  
6  
*Section*  
Scale: 1" = 10'

*Class 100 Riprap*

% by weight	Size of Rock	
	lb.	appx. dia. (in)
20	100-60	13-11
30	60-25	11-8
40	25-2	8-4
10	2-0	4-0

Rev	Description	By	Date

**McGee Engineering Inc.**  
 P.O. Box 1067  
 Corvallis, OR 97339  
 Phone: (541) 757-1270  
 Fax: (541) 758-6585

Measures one inch on original drawing.  
 Adjust scales accordingly.

REGISTERED PROFESSIONAL  
 ENGINEER  
 72565PE

OREGON  
 DECEMBER 31, 2023  
 ALEXANDER J. DUNN

Renewal: 12/31/2023

**City of Albany**

Salem Avenue (Waverly Lake) Bridge Repairs

Channel Protection Details - 2

Designed: A. Dunn      Date: 1/19/2023  
 Checked: N. Swanson      Sheet 6 of 6



# MEMO

TO: Jennifer Cepello, CFM, Planner III

FROM: Ryan Beathe, P.E., CWRE, CFM, Civil Engineer III

DATE: November 2, 2023

**SUBJECT:** Review and Summary of Findings - City of Albany Floodplain Development Permit Application FP-09-23 - Waverly Lake (Cox Creek Dam) Spillway Repair

## Introduction and Background

This memo summarizes the review of the subject project's compliance with Federal Emergency Management Agency (FEMA) floodplain development regulations. The City regulates development activities within the 100-year floodplain through the implementation of the City's Development Code. The project is located within a FEMA Zone AE Special Flood Hazard Area (SFHA) and within the regulatory floodway. FEMA and City regulations require that proposed changes within a regulatory floodway cause 'no-rise' to floodplain or floodway elevations.

The project proposes construction of scour repair and improvements to protect against future scour damage at the spillway structure that controls outflow from Waverly Lake. A hydraulic study, *Hydraulic Analysis for Waverly Lake (Cox Creek Dam) Spillway Repair* (February 3, 2023), was completed by WEST Consultants, Inc. to inform an appropriate design and assure the design could meet with "no-rise" requirements. The design of the repairs is represented in the construction drawings plan set, *Salem Avenue (Waverly Lake) Bridge Repairs* (January 19, 2023), completed by McGee Engineering, Inc. The findings of this memo are based on the review of these documents only as they pertain to the hydraulics analysis, floodplain compliance, and the appropriate representation of recommendations from the hydraulic report into the design of the scour repair and countermeasures. Additional background for this review was obtained in the current Flood Insurance Rate Map (FIRM) Map for Linn County No4104320214H (eff. date 12/8/2016) and the associated Flood Insurance Study (FIS). This review does not serve as a technical review of the construction plans or specifications (e.g. concrete specs of apron, rebar size and spacing, etc), a task previously completed by the City's Engineering Project Manager.

The no-rise analysis provided in the report from WEST Consultants includes a detailed summary of the regulatory background, the history of site and pertinent development, a summary of existing site conditions in the immediate area as it pertains to the channel hydraulics, and a summary of the hydrology. The report assessed the current hydraulic "deficiencies" and provided a thorough analysis that supports the recommendations for design of repair and scour countermeasure improvements. As is required for a no-rise analysis, the report provides a detailed hydraulic analysis that compares the backwater conditions from the pre-project (existing) conditions to the modeled backwater conditions resulting from any changes from construction of the proposed improvements (as detailed in the project plans and represented in the HEC-RAS model). Tables are included in the report that provide the comparison of existing and proposed water surface elevations for the base flood

November 2, 2023

Page 2 of 2

under both encroached and non-encroached conditions. Water surface elevations under both conditions show that a no-rise is achieved under both conditions.

### **Summary of Findings**

Based on the hydraulics report and the associated construction drawings for the Salem Avenue (Waverly Lake) Bridge Repair Project, **this review concludes that the improvements will result in no-rise to the 1% annual-chance flood.** The hydraulic report also includes a 'no-rise' certification stamped by a registered professional engineer. All information referenced in this memo are on file under the subject application with the City of Albany Community Development Department.

RMB/CD FILE FP 09-23

