Appendix K – Structural Analysis

Marsh Lake Aquatic Ecosystem Restoration Project
Structural Feasibility Study

1 General

This study outlines five proposed structures for the Marsh Lake Aquatic Ecosystem Restoration Project. Concrete, excavation, sheet pile, and aluminum stoplog quantities are tabulated at the end of the report.

General Assumptions:

1. All concrete walls are assumed to be founded on 2' thick footings and extend 3' below grade. Bottom of footing elevation will be at 5' below grade.

2 Structural Features

2.1 Culverts beneath Louisburg Grade Road

Description:

Seven existing 60" diameter RCP culverts cross below Louisburg Grade Road connecting the upper and lower pools of Marsh Lake. As a result of Marsh Lake drawdown requirements, water level control will be required in 6" increments on all of these culverts, and therefore, headwalls with stop log tracks will be provided.

Assumptions:

1. Southern three existing RCP's replaced with a single 3 cell RCP box culvert (see Figure 1)
2. Northern four existing RCP's replaced with two 2 cell RCP box culvert (see Figure 1)

Questions and Uncertainties:

1. Is dewatering required?

2.2 Existing Spillway South East of Marsh Lake

Description:

The existing spillway requires removal of concrete to establish a new elevation of 935.5' down from 937.6' as shown in Figure 2.

Assumptions:

1. Removal of approximately 3' Deep x 10' Wide x 30' Length of existing concrete,
2. Dowel into existing concrete, and add 1' of new concrete (see quantities)

Questions and Uncertainties:

1. Is dewatering required?
2. Is there concrete repair required aside from the notch?

2.3 Drawdown Structure SW of Marsh Lake

Description:

A drawdown structure (see Figure 3) is required which would provide a top of water elevation between 935' and 940'.

Assumptions:

1. Stop logs will be used to achieve the elevation desired by the local sponsor
2. Soil conditions permit the use of a bearing foundation (no load bearing piles required)

3. Sheet piling extending six feet below the bottom of the footing at the head water to prevent seepage and scour
4. A concrete apron will be used down stream from the structure with sheet piling below to prevent erosion
5. Abutments will be assumed on either side of the drawdown structure to retain existing dam elevations on both sides
6. A 16’ wide concrete walkway will be assumed to span the entire 116’-6” length of the drawdown structure

Questions and Uncertainties:

1. Will walkway surface at (bottom @ 948.6’) cause a hydraulic concern during flood events?
2. Is dewatering required for construction?

2.4 Two Lane Bridge over Pomme Du Terre River

Description:

A vehicular bridge is required to cross the Pomme De Terre River. Two alternatives may be considered:

1. 5 span bridge with 46” deep precast concrete girders (plus an 8” deck)
2. 3 span bridge with 88” deep precast concrete girders (plus an 8” deck)

Assumptions:

1. 450’ Long x 32’ Wide, 2 vehicular lanes
2. The bridge will be supported on vertical concrete abutments
3. Unit cost of bridge: $150/sf

Questions and Uncertainties:

1. Deviations beyond assumptions may add to unit cost
2. Will additional concrete and/or riprap be required for hydraulic reasons?
3. Alternative 2 may require a raise in bridge deck height, and thus, sloped approaches

2.5 Pedestrian Bridge over Existing Spillway

Description:

A prefabricated pedestrian bridge crossing the existing spillway

Assumptions:

1. 120’ Long, Poured Concrete Deck, Weathering Steel, Design per AASHTO
2. 6’ Width ($64,000 per Continental Bridge, concrete deck not included)
3. 10’ Width ($85,000 per Continental Bridge, concrete deck not included)

Questions and Uncertainties:

1. Will repair work be required on the existing spillway structure to adequately support pedestrian bridge?

Table 1: Concrete Quantities

	Item	Quantity (yd^3)
2.1:	Culverts:	**322**
2.2:	Existing Spillway:	**10**
2.3a:	Drawdown (footing):	**685**
2.3b:	Drawdown (walls):	**333**
2.3c:	Drawdown (slab):	**70**
2.4:	2 Lane Bridge:	**90**
2.5:	Pedestrian Bridge:	*NA*
	Total:	**1,510**

Table 2: Excavation Quantities

	Item	Quantity (yd^3)
2.1:	Culverts:	**2,162**
2.2:	Existing Spillway:	*NA*
2.3:	Drawdown Structure:	**1,947**
2.4:	2 Lane Bridge:	*NA*
2.5:	Pedestrian Bridge:	*NA*
	Total:	**4,109**

Table 3: Sheetpiling

	Item	Area (ft^2)
2.1:	Culverts:	*NA*
2.2:	Existing Spillway:	*NA*
2.3:	Drawdown Structure:	**1,260**
2.4:	2 Lane Bridge:	*NA*
2.5:	Pedestrian Bridge:	*NA*
	Total:	**1,260**

Table 4: Aluminum Stop Logs

	Item	Weight (lb)
2.1:	Culverts:	**1,676**
2.2:	Existing Spillway:	*NA*
2.3:	Drawdown Structure:	**6,267**
2.4:	2 Lane Bridge:	*NA*
2.5:	Pedestrian Bridge:	*NA*

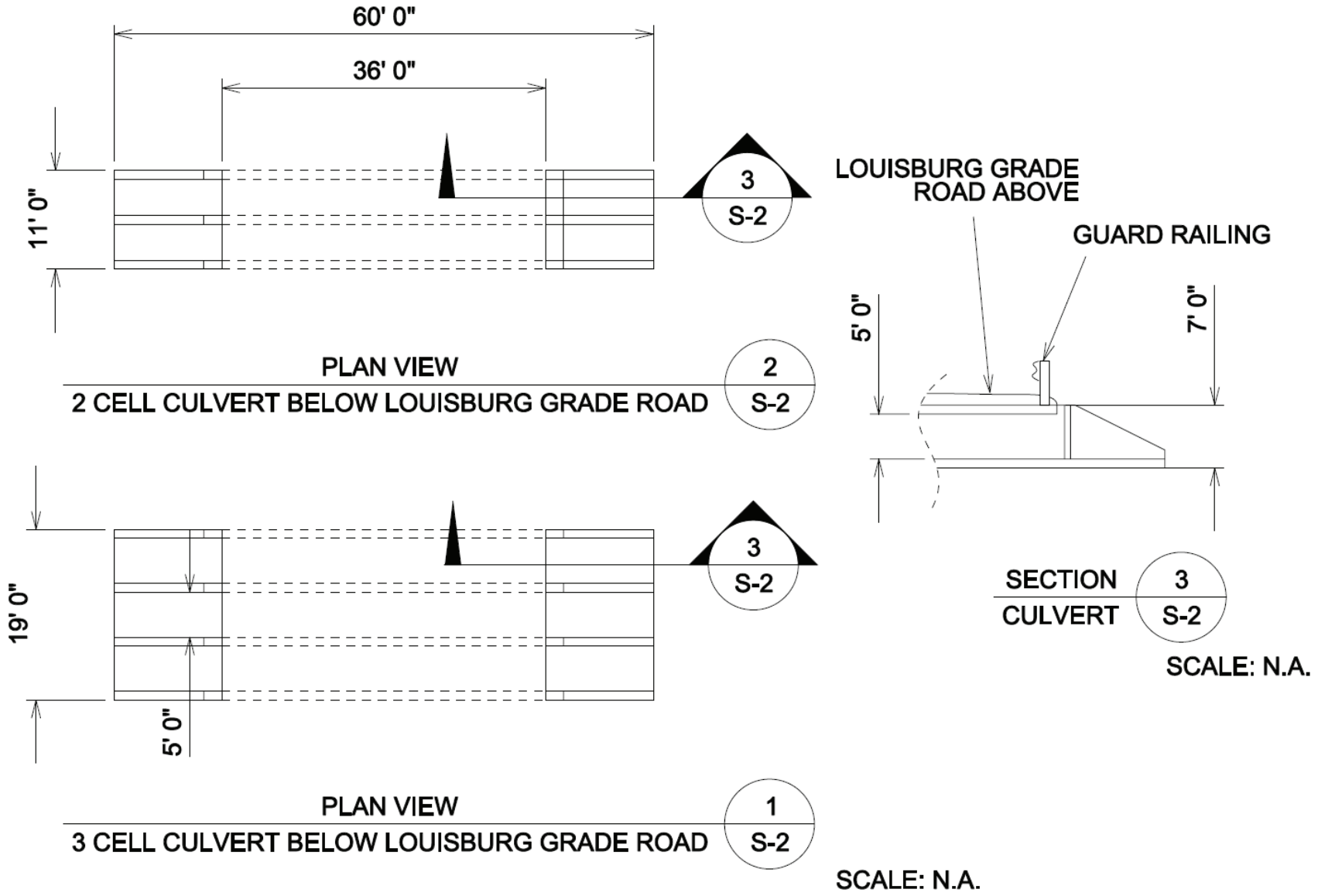

Figure 1: Culverts below Louisburg Grade Road

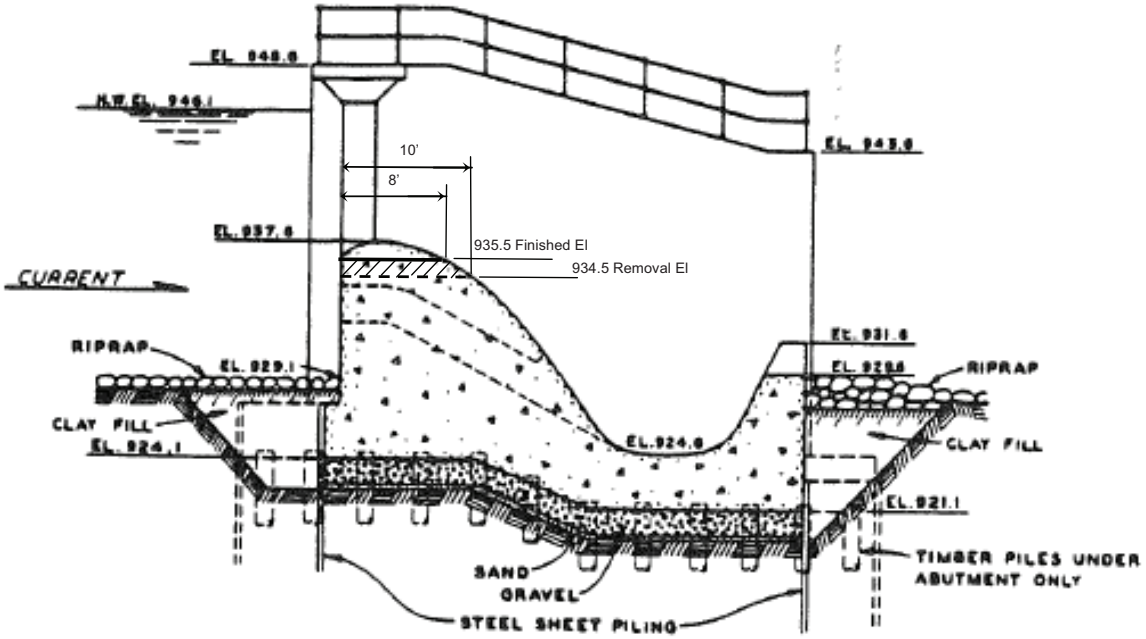

Figure 2: Concrete removal on existing spillway

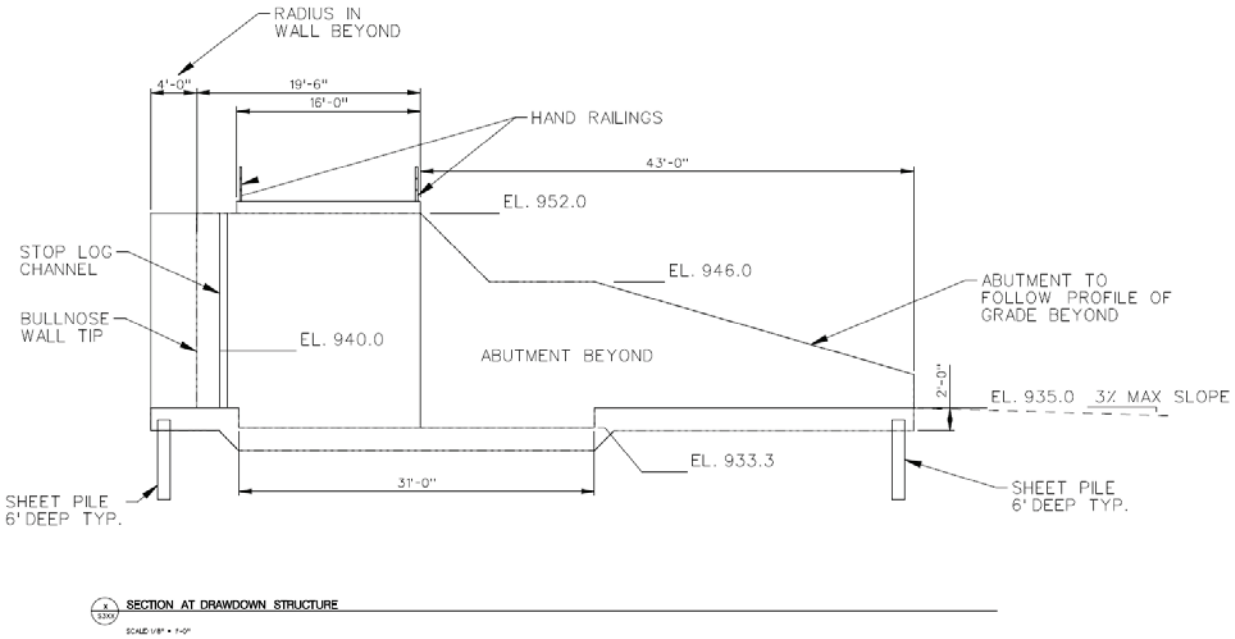

Figure 3: Drawdown Section Cut

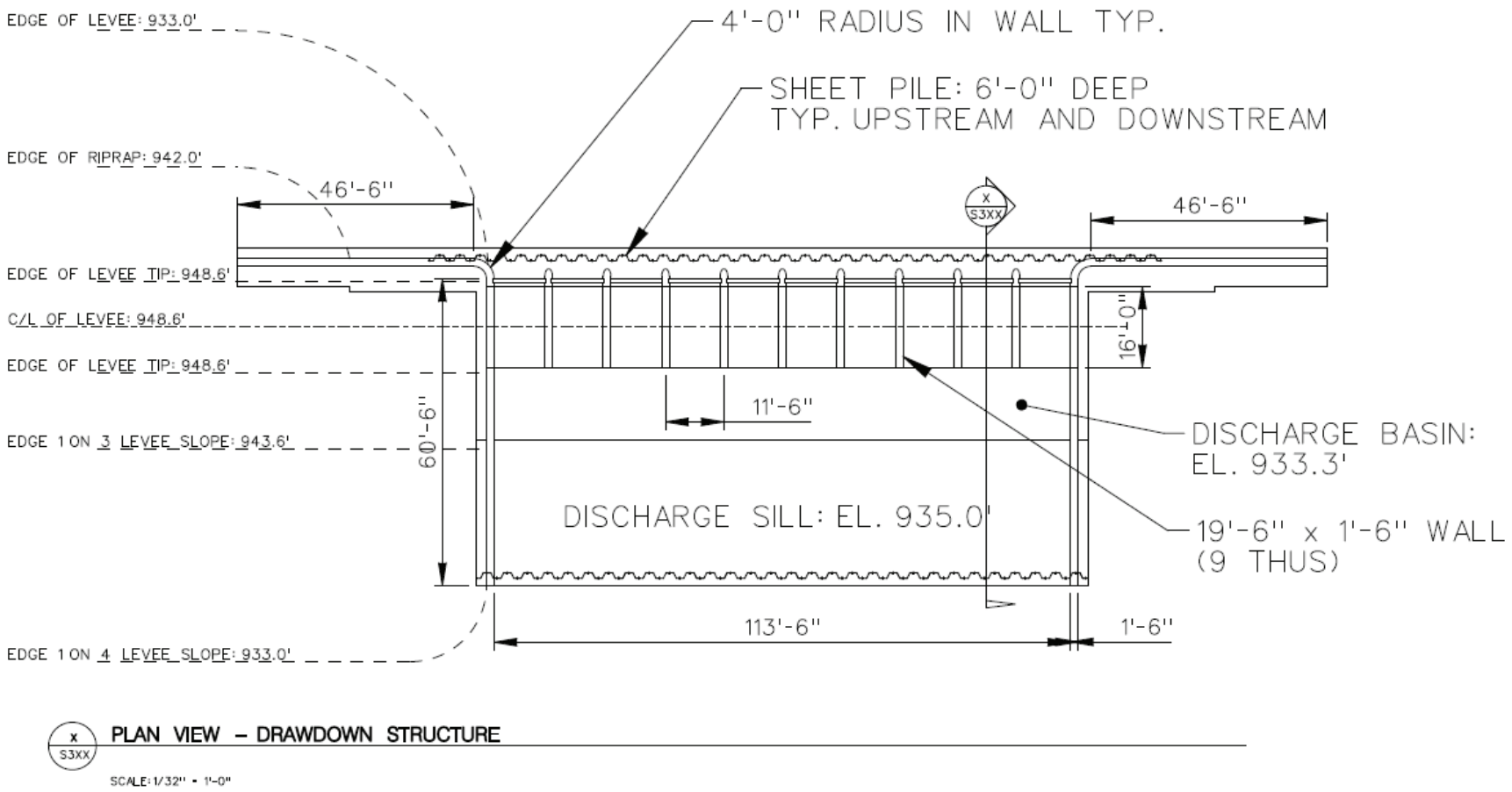

Figure 4: Drawdown Structure Plan View

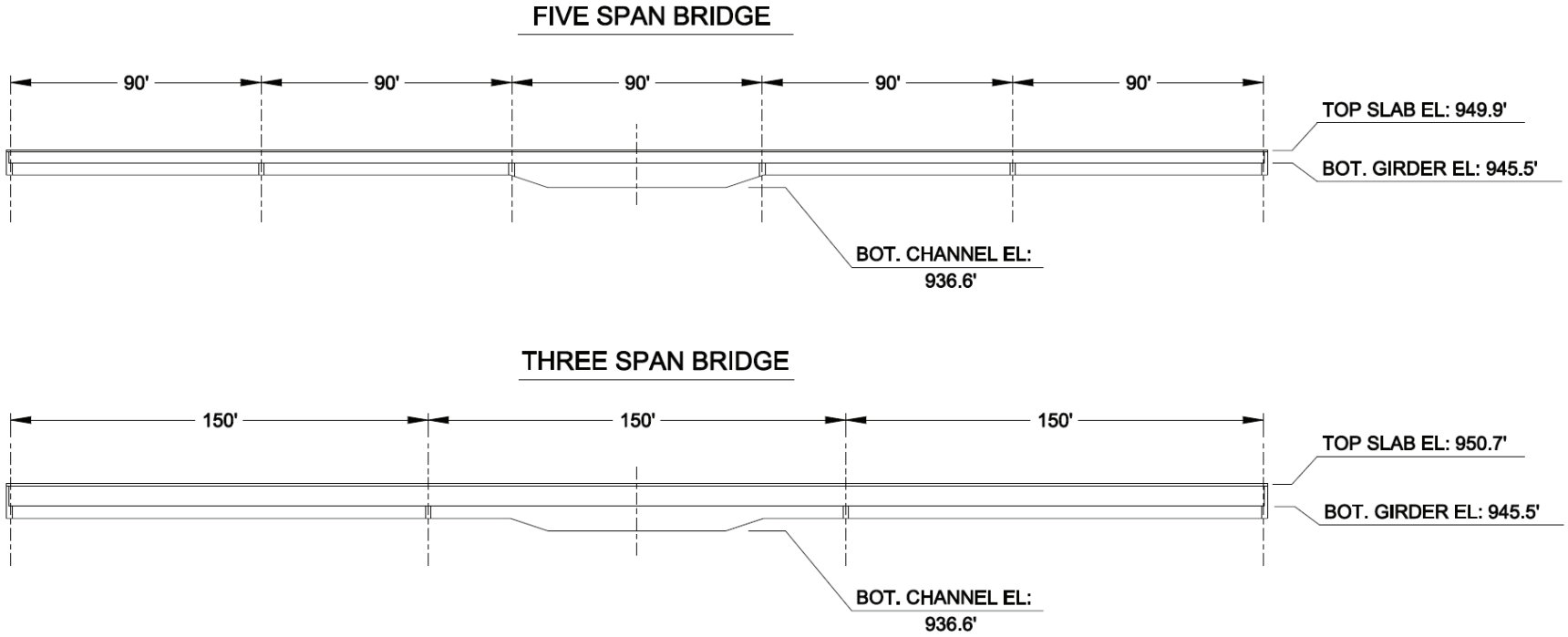

Figure 4: Bridge over Pomme De Terre River (2 alternatives)