Juneau Douglas Wastewater Treatment Plant
Structural Evaluation and Safety Upgrades

Prepared for:

City and Borough of Juneau, Alaska

155 South Seward Street
Juneau, AK 99801

Prepared by:

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February 28, 2014
R&M Project No. 131434

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Juneau Douglas Wastewater Treatment Plant

JUNEAU-DOUGLAS WASTEWATER TREATMENT PLANT

INTRODUCTION

Inspections were carried out from February 24-26, 2014. The scope of this report covers the deterioration of the steel framing supporting the access catwalks. This report contains a condition assessment of the affected structural framing with the recommendations for repair and renovation. This report addresses the inspection of the safety and access structures at three buildings which are part of the Juneau Douglas Waste Water Treatment Plant (JDWWTP); Aerator Buildings No. 1 and No. 2 and the Digester Building. As-built information for these building was obtained from design plans dated January 1973, by Clair A. Hill and Associates (CH2M Hill).

DESCRIPTION

The Aeration Buildings are both 142-feet long by 82-feet wide, consisting of approximately 14-feet deep tanks with a steel-framed roof covering. At the mid-line of the basin, there are two floating, mechanical aerator devices tethered to steel columns which support the roof. In order to service the electrical motors and mechanical components of the EIMCO aerators, there are access catwalks, approximately 36-feet long by 2-foot 6-inches wide, consisting of aluminum bar gratings on aluminum beams. The beams are CS8x4.15, standard aluminum channels, spanning between steel tube frames at, typically, 10-foot on center. The welded, steel tube frames are of TS5x2x3/16 section and are connected by tension bolts to the roof beams. There are double steel angle brackets on each steel frame which connect the frame to the aluminum catwalk beams. The aluminum beams also rest on the bottom member of the steel U-frames. There is contact between steel and aluminum at the bolted, angle bracket connection, and where the flange and web of the aluminum beam rest against the steel frame. On the aluminum catwalk there are aluminum guard rails with posts at about 8-foot centers and horizontal rails, with clips where the railing passes through each steel frame. There are no protective coatings on the aluminum members, but the steel members are painted. All bolts connecting aluminum to aluminum or aluminum to steel appear to be stainless steel. There appears to be no isolation layer between steel and aluminum surfaces that are in contact.

The Digester Building is 82-feet by 82-feet with a 16-foot deep digester basin. The access catwalk is similar to those in the aeration basins with the same aluminum grating, beam and handrail supported by steel frames. The catwalk is approximately 36-feet long by 2-foot, 6-inches wide.

INSPECTIONS

Inspection of the Aeration Building No. 2 was carried out on February 24, 2014. Inspection of the Aeration Building No. 1 and the Digester building was carried out on February 26, 2014. Present during the inspection on February 24th were Paul Beck of CBJ Engineering, Chris Poulsen and Adrian Slater, P.E. of R&M Engineering, Inc. Present during the inspection on February 26th were Paul Beck of CBJ Engineering and Chris Poulsen of R&M Engineering, Inc.

1. Aeration Building No. 1

At the time of our inspection, the aeration units were turned off, but the tanks were full. Prior to inspection, the catwalks and framing had been pressure washed as far as practical from above. However, some surfaces were still covered with obscuring soil. The atmosphere inside the building is generally wet. There is continuous evaporation from the surface of the water which condenses against the colder roof framing and the steel and aluminum framing which make up the aerator platform and catwalks. There is even some mossy and algae growth on structural steel framing surfaces. Ventilation within the buildings is severely limited with only small openings around the perimeter near the surface of the water.

The inspection of the access catwalks was based upon visual examination of a sampling of limited areas, manually scraped clean, with some limited probing of potential weak points. No destructive testing of steel or aluminum members was carried out. The condition noted below appears to be typical of other areas, but due to the difficulty in seeing these surfaces without extensive manual scraping and cleaning, there may be hidden areas of more significant damage which was not noted during this inspection. The condition of the catwalk and platforms described is similar for both locations within this aeration basin building.

a.) Steel Support Frames

The steel support frames at approximately 10-foot spacing consist of vertical tube steel, TS5x2x3/16 inch sections with the same size tube welded between the bottom, narrow faces of the verticals to form a U-shaped frame. The vertical members are 8-foot 6-inches long, per the plans, with a bolted connection to the bottom flange of the steel, roof purlins. The roof purlins are noted on the plans as W10x21 and they span 20 feet between the roof girders. The bolted connection consists of two (2) 5/8-inch diameter bolts in direct tension at each tube, a total of four (4) bolts for each frame. None of these bolts were removed for inspection. Since these bolts are in direct tension, a failure would be sudden and would result in total collapse of a section of catwalk. Typical use of the catwalk is for personnel access only, but the most significant loading event is at the removal of the motor or mechanical equipment from the aerator via the catwalk. Given the age of the structure, the consequence of failure and the relative ease of replacement of the bolts, we recommend replacing all tension bolts with new hot-dip galvanized steel bolts.

The steel framing has a painted finish and evidence of some layers of over-painting in the past. In some places, the original paint is still intact. In others, the over-painting has bonded and has provided a good seal of the underlying surface. However, there are large areas where paint is flaking and peeling and others where there is rust staining of the steel surface. In this building, all areas which were tested by probing, scraping and visual examination appear to be structurally sound. At present, the corrosion is limited to the surface and there is no evidence of scaling or flaking rust. After performing basic calculations for the steel frame it appears to have a more than adequate safety factor, considering the design loads applied.

2. Aeration Building No. 2

This building and the equipment within are similar to that described in Aeration Building No. 1. At the time of our inspection, the aeration units were turned off and the tanks were empty. Prior to inspection, the catwalks and framing had been pressure washed as far as practical from above. However, some surfaces were still covered with obscuring soil. The conditions noted were similar to those encountered in Aeration Building No. 1.

The rust noted is generally superficial and has not progressed to deep pitting, flaking or scaling rust. There is evidence of several layers of paint in different locations. Paint is well bonded in some sections, though flaking and peeling in others, and in general the condition of the steel appears to be good. Similar to Aeration Building No. 1, we recommend replacing the tension bolts securing the catwalk frames to the roof purlins with new hot-dip galvanized steel bolts.

3. Digester Building

The aeration device in this building was not operating at the time of this inspection. Prior to inspection, the catwalk and framing had been pressure washed as far as practical from above. However, some surfaces were still covered with obscuring soil. This building appears to have an atmosphere even wetter than the two aeration buildings with notable areas of dripping moss on structural roof surfaces and generally dripping surfaces on all the steel work and aluminum of the catwalks. There is no mechanical ventilation in this building.

The steel frames in this building have more severe corrosion than the Aerator Buildings. Rust, particularly at the corners, has penetrated below the surface of the steel, resulting in some flaking rust and pitting of the surface. There are small holes drilled through the 3/16-inch thickness tubes in two locations where pitting was evident. These holes were inspected and appear to be in similar condition to that of the inspection from 2010 with adequate thickness of steel to safely carry all the loads from the access catwalks (see photographs in Appendix A). However, given the advanced state of rust damage in some areas, the steel section will continue to be reduced as rusting continues.

DISCUSSION

The purpose of this inspection was to determine if a 10 year life for the steel framing to the catwalks was achievable under current conditions. The capacities of the steel framing members are significantly higher than the design loads applied. Due to this and the advancement in deterioration noticed from 2010 to 2014, the steel framing should be adequate for another 10 years. However, due to limited access it was not possible to examine every steel member completely, particularly the horizontal members underneath the catwalks. Annual cleaning and inspection of the steel framing is recommended. In addition, we recommend replacing all existing 5/8-inch tension bolts connecting the steel catwalk frames to the roof purlins, in both Aeration Buildings and the Digester Building, with hot-dip galvanized steel bolts.

RECOMMENDATIONS

1. The steel U-frames have sufficient structural strength in their current condition to give a useable life of at least 10 years.

2. The safety upgrades of the catwalk should thus be limited to replacement of the aluminum grating, catwalk beams and guardrails.

3. The tension bolts connecting the steel U-frames to the roof purlins should be replaced with new 5/8-inch hot-dip galvanized steel bolts.

R&M Engineering, Inc.

M. Christopher Poulsen, E.I.T.
Civil Engineer

Adrian D. Slater, P.E.
Senior Civil Engineer

APPENDIX A
PHOTOGRAPHS

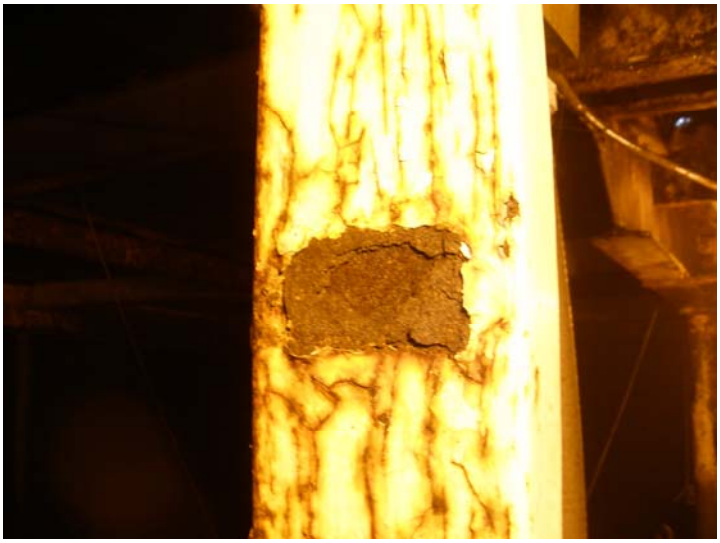

Figure 1: Vertical HSS5x2x3/16 in Digester Building, 2010. Compare with Figure 2.

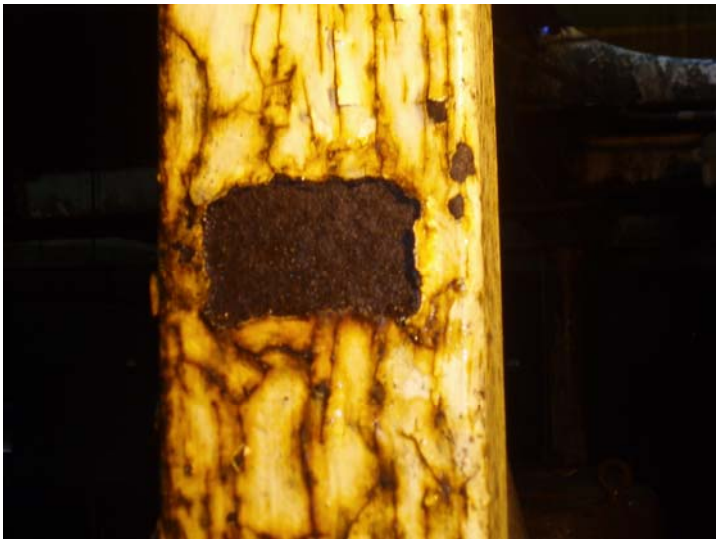

Figure 2: Vertical HSS5x2x3/16 in Digester Building, 2014. Compare with Figure 1.

Figure 3: Vertical HSS5x2x3/16 in Digester Building, 2010. Compare with Figure 4.

Figure 4: Vertical HSS5x2x3/16 in Digester Building, 2014. Compare with Figure 3.

Figure 5: Vertical HSS5x2x3/16 in Digester Building, 2010. Compare with Figure 6.

Figure 6: Vertical HSS5x2x3/16 in Digester Building, 2014. Compare with Figure 5.

Figure 7: Vertical HSS5x2x3/16 in Digester Building, 2014. Steel tested and inspected.

Figure 8: Steel Angle Bracket Connecting Vertical HSS5x2x3/16 to Aluminum Channel in Aeration Building No. 1, 2014. Steel tested and inspected.

APPENDIX B
PLANS

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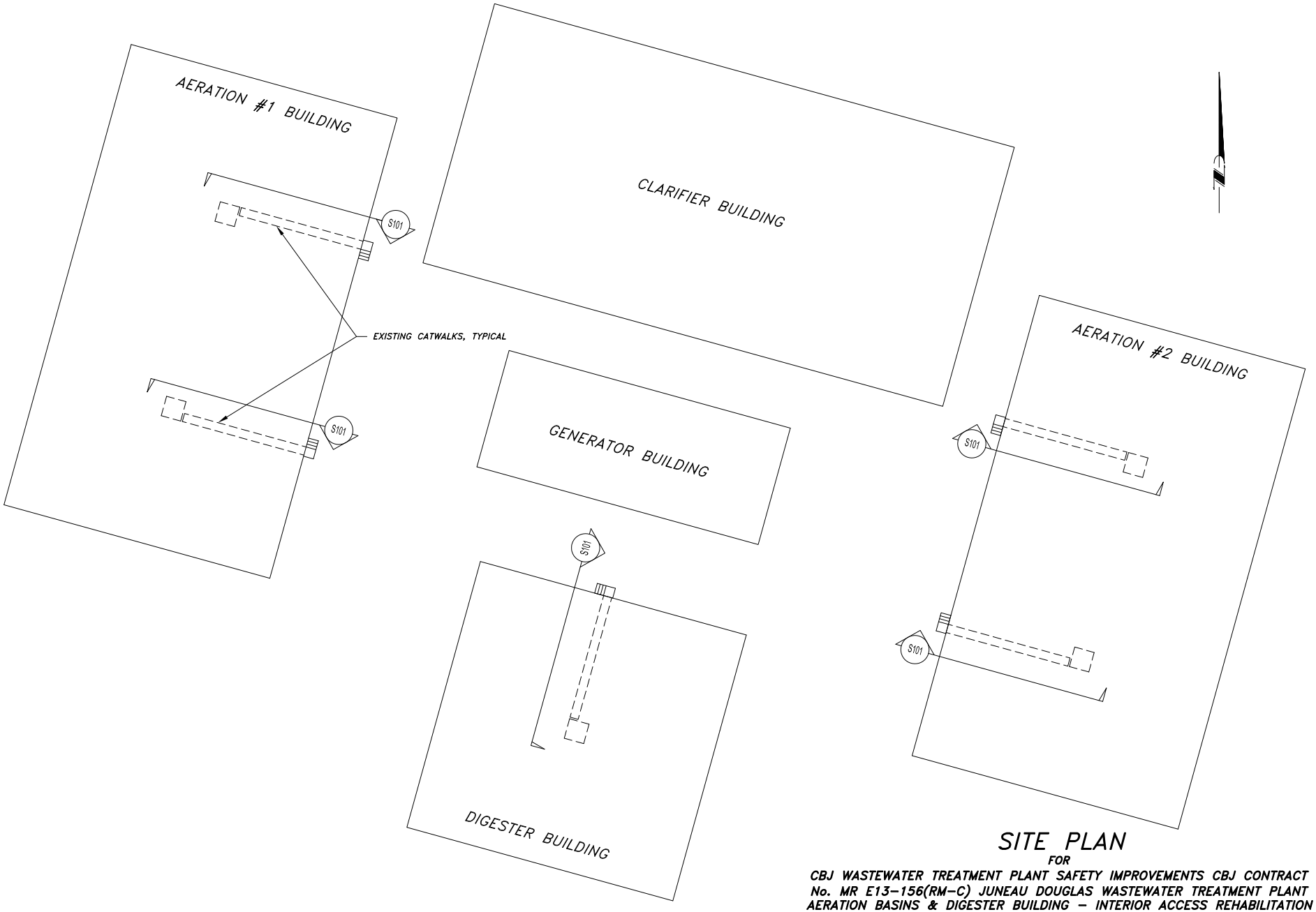

GRAPHIC SCALE

0' 10' 20' 30' 50'

SITE PLAN

FOR

CBJ WASTEWATER TREATMENT PLANT SAFETY IMPROVEMENTS CBJ CONTRACT No. MR E13-156(RM-C) JUNEAU DOUGLAS WASTEWATER TREATMENT PLANT AERATION BASINS & DIGESTER BUILDING - INTERIOR ACCESS REHABILITATION

CLIENT:
CITY AND BOROUGH OF JUNEAU
155 SOUTH SEWARD STREET
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ENGINEER:
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SHEET S100

DATE: FEBRUARY 28, 2014

R&M PROJ. NO. 131434

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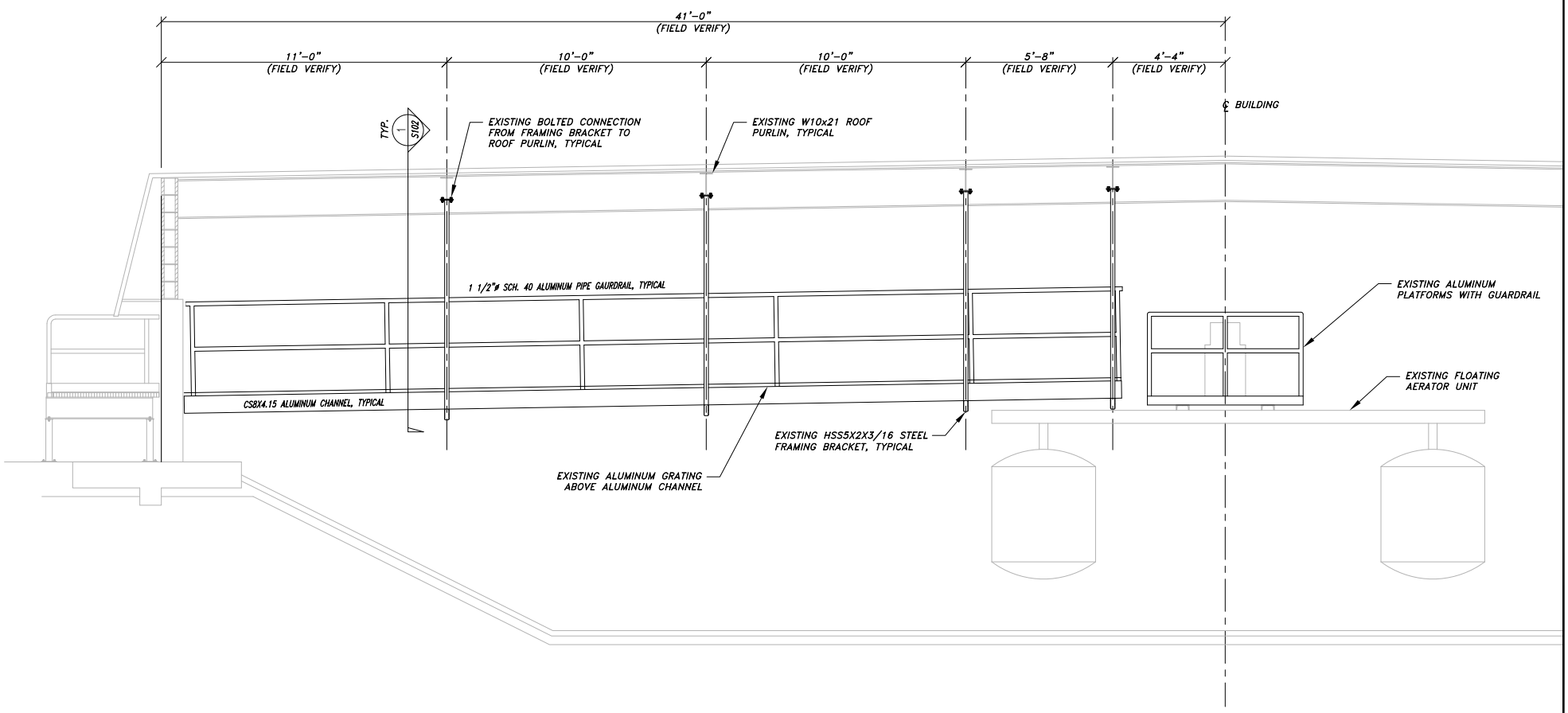

CATWALK ELEVATION

FOR

CBJ WASTEWATER TREATMENT PLANT SAFETY IMPROVEMENTS CBJ CONTRACT No. MR E13-156(RM-C) JUNEAU DOUGLAS WASTEWATER TREATMENT PLANT AERATION BASINS & DIGESTER BUILDING - INTERIOR ACCESS REHABILITATION

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DATE: FEBRUARY 28, 2014

R&M PROJ. NO. 131434

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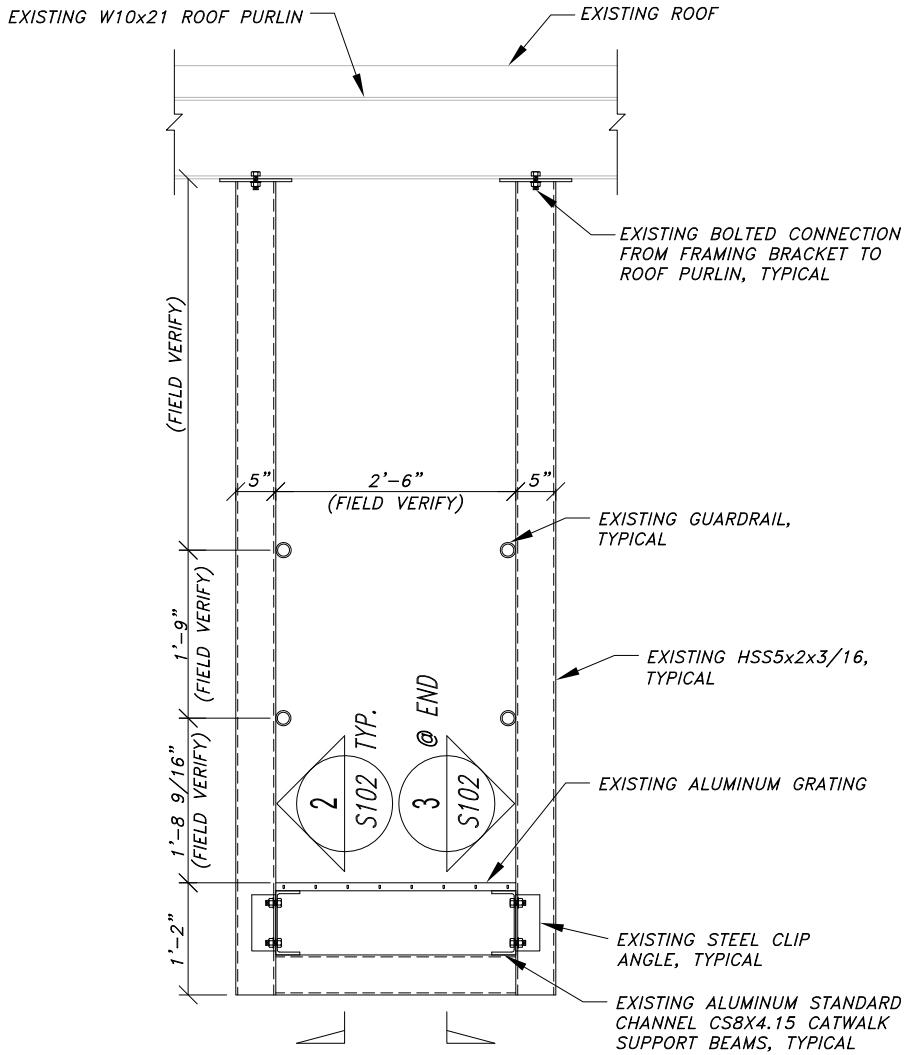
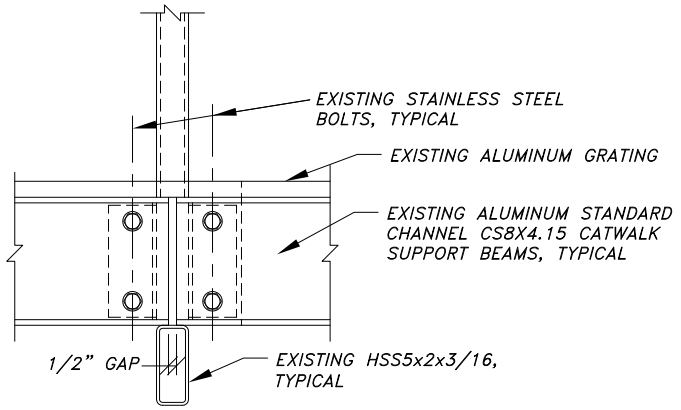


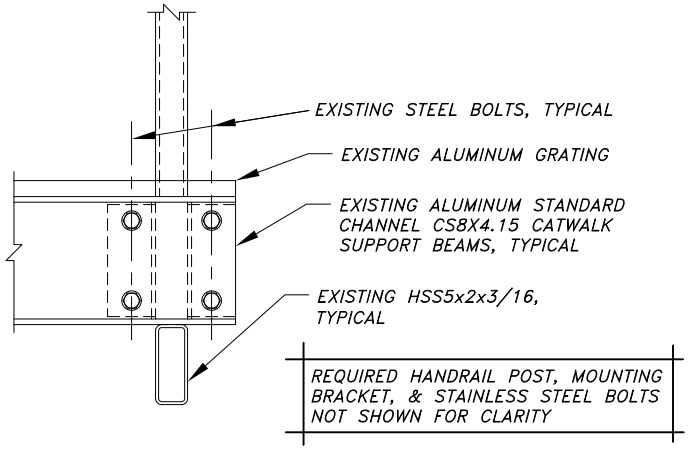
1 CATWALK & SUPPORT FRAMES

SCALE: 1/2"=1'-0"



2 TYP. CATWALK BEAM CONNECTION DETAIL

SCALE: 1"=1'-0"



3 CATWALK BEAM END CONNECTION DETAIL

SCALE: 1"=1'-0"

CATWALK DETAILS

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