INFORMATION TO PROPOSERS

for

(C3) RFP No. E19-068

MENDENHALL VALLEY WASTE WATER TREATMENT PLANT SBR BUILDING ROOF REPLACEMENT

ISSUED BY:

City and Borough of Juneau
ENGINEERING DEPARTMENT
155 South Seward Street
Juneau, Alaska 99801

Date Issued: September 24, 2018

The following information is posted online. Please refer to the CBJ Engineering Contracts Division webpage at: http://www.juneau.org/engineering_ftp/contracts/Contracts.php. This is ***not*** an addendum.

- Attachment 1 – Condition Assessment Report

North Wind Architects, LLC 126 Seward St, Juneau AK 99801 P: 907-586-6150 F: 907-586-6181

Condition Assessment Report

Project:	**MR E13-156 Mendenhall Valley Waste Water Treatment Plant** **Roof Condition Assessment**
Project Manager:	Theresa Mores Araki, PM Engineering Department City and Borough of Juneau
Date:	06/26/15 07/23/15 10/02/15
Weather:	Rain, ~55ºF Overcast, 60ºF
Location of Inspection:	Grid A X 6-8.5 (blind gable and rakes over entry) Grid F X 1-3.75 (cricket and valley at Influent Pump Station wing) Grid F X 7-9 (blind gable and valleys over break room) Grid B, 8.5 (plumbing vent penetration)

Background:
The Mendenhall Valley Waste Water Treatment Plant roof appears to be the original roof installed in 1985. It has a ~2.625":12" wood framed roof structure and a ~22 gage clip-lock style, standing seam metal roof with limited valleys, rake walls and penetrations. The roof area is approximately 28,200 sf based on framing plan.

Comments:
NorthWind Architects (NWA) visited the project site on two occasions. On the first NWA observed each interior area where leaks had presented and been identified, then observed each roof area associate with individual leaks from the exterior using a man-lift. On the second visit, NWA conducted destructive investigation of the roof and adjacent wall assembly in the areas identified at the top of the location list above, and visual investigation of the remaining areas. Areas subject to destructive investigation were restored to their initial condition. Access was via man-lift. The areas investigated are indicated in Appendix A.

The existing conditions assumptions in this report are based on what was revealed through destructive investigation which occurred where noted above. We assume these conditions are representative of the overall condition of the roof assembly.

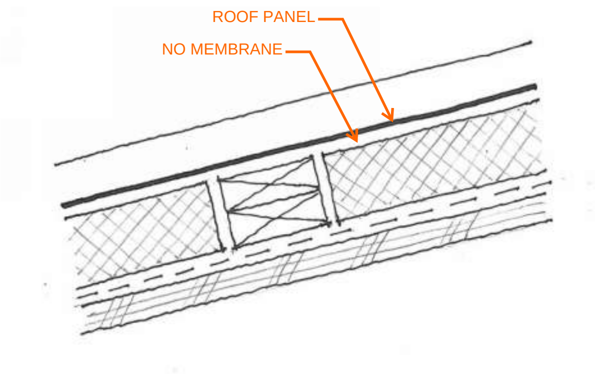
Based on our key findings, we must assume that though leaks have been identified in limited areas, infiltration is occurring in many additional locations over the entire roof. This report will identify three courses of corrective action, the efficacy of each varying from short to long term. Long term corrective action will address all infiltration. Short term corrective action will address infiltration where it is most concentrated and presenting in the form of interior leakage at valleys and rake wall valleys.

Note that details included here are diagrammatic, exclude structure for clarity and are not drawn to scale.

Existing Conditions

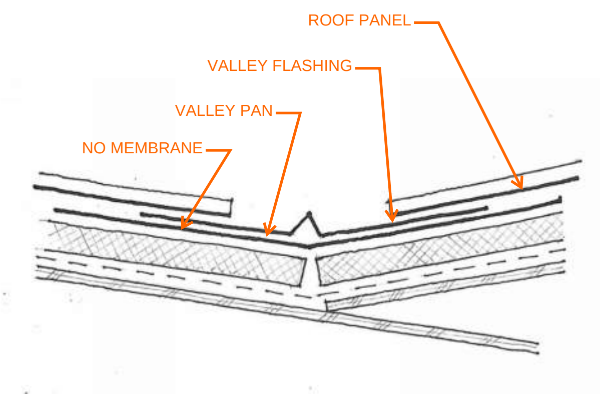
Roof Assembly

The existing roof assembly consists of 22g clip lock style standing seam metal roof panels on clips on ~ 4x or double 2x horizontal furring on an ~4mil plastic, paper backed air/vapor retarder sheet on ~1" plywood sheathing. Insulation is 3" foil faced polyisocyanurate foam insulation. The foil facing is oriented up, and the insulation is tight-fit between furring members. There is no underlying weather/air barrier membrane.



Valley at Grid F

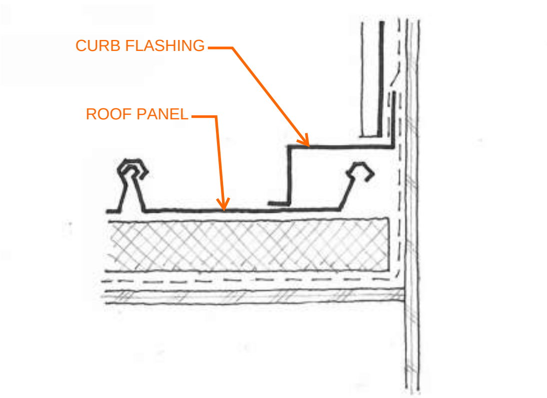
The existing valley at grid F consists of an ~ 22g W profile valley flashing overlaid on a galvanized sheet steel valley pan. The galvanized pan extends 24" in each direction from the centerline of the valley, and appears to turn up where it intersects the rake wall near the collector head.



North Wind Architects, LLC 126 Seward St, Juneau AK 99801 P: 907-586-6150 F: 907-586-6181

Rake Wall Valley– Grids 7 and 8

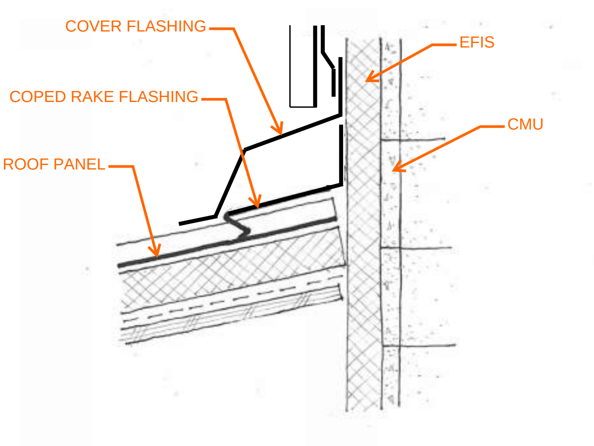
The existing rake wall valley assembly on grids 7 and 8 at the entry gable consists of a continuation of the ~22g clip-lock roof panel system under and lapped by rake-wall curb flashing under which it turns up into its rib. The curb flashing in turn is lapped by the vertical roof panels cladding the rake wall.



Rake Wall Assembly – Grid F

The existing rake wall assembly on grid F at the tea cup wing consists of ~ 26g gasketed, vertically oriented interlocking, blind fastened metal wall panels on ~18g horizontal, galvanized hat channel, pinned through an ~2.5" Exterior Insulating and Finish System (EIFS) composed of Expanded Polystyrene (EPS) foam insulation with a troweled cement/acrylic finish directly applied to the Concrete Masonry Unit (CMU) wall structure.

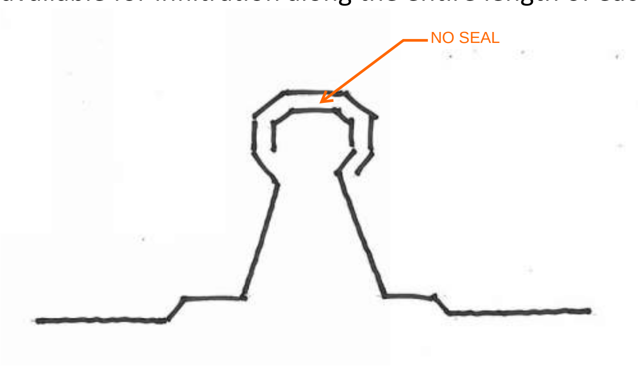
Adjacent roof panels terminate as shown below with coped rake flashing which laps under cover flashing and in turn metal siding panels. The coped rake flashing is not well sealed to the roof panel.



Rake Wall Assembly – Grids 7 and 8
The existing rake wall assembly on grids 7 and 8 at the entry gable consists of the ~22g clip-lock roof panel system, vertically oriented on ~4mil plastic, paper backed air/vapor retarder sheet on plywood wall sheathing of stud framing.

Deficiencies

Roof Assembly – Panel Joints
A detail of the typical clip-lock assembly is shown here. At panel joints, the ribs interlock, but by design are not seamed, relying simply on their profile geometry to hold adjacent panels together. Joints therefore are relatively loose and can be pulled apart by hand. Other clip-lock systems incorporate a continuous gasket or bead of sealant to help ensure that the joint is watertight for its length in case it becomes inundated with water backed up by an ice dam or driven by high wind. The system employed on the MVWWTP does not include this seal. Because joints are loose, open paths are available for infiltration along the entire length of each joint over the entire roof.



Roof Assembly – Penetrations

Snow guards, flashings and other accessories are typically fastened with gasketed screws penetrating the metal roof panels. Gaskets are aged and brittle, the fasteners themselves are rusted and in cases worn along with the surrounding steel by years of thermal expansion/contraction cycles where no compensation for this movement was designed for. It is likely that most penetrations are no longer water-tight.

Roof Assembly - Air/Water Barrier

Modern metal roof systems, especially for low-slope applications, incorporate a weather barrier membrane directly below the metal panel system. It is assumed that the metal panels will work more as rain-screen assembly preventing bulk moisture from entering, but allowing some infiltration which will be prevented from entering the structure by the membrane barrier. The MVWWTP roof system has no membrane barrier. The photo below shows the top face of the roof insulation where the insulation abuts a typical horizontal PT wood furring strip. While the foil face of the insulation may act as a barrier where it occurs, joints like the one shown here between insulation and furring and joints between insulation panels are open. Any infiltration through the metal roof panels will run down through these joints and collect on the paper-backed air/vapor retarder sheet, which we assume is also not continuous and suffers many penetrations, and wet and even saturate the roof insulation. Moisture is visible on the air/vapor retarder sheet at the bottom of this core-out.

Valleys
The opportunities for moisture infiltration increase significantly at valleys, particularly where they terminate at the roof edge where the chances that water may pond are increased. Ponding is much more likely to occur on a low-slope roof and is due to ice and/or debris damming, or due to the volume of water in the valley exceeding the flow capacity of scuppers during heavy rain.

Moisture can also infiltrate at valleys when there is force on it – from wind, gravity, and/or negative pressure.

Infiltration occurs when the valley is improperly detailed or installed such that it is not water tight.

Typical Valley
A number of deficient details were identified at typical valleys. Primary among them is the seal between roof panels and valley flashing. When water ponds or is driven by wind or gravity against this joint, this seal is the only thing preventing water from entering the system between valley flashing and the roof panels. Typically, two parallel, continuous beads of sealant are required uphill, or “dry” side of any fasteners on the low edge of the roof panels where they lap valley flashing. Here, there appears to be a single bead along the bottom edge of the roof panels themselves, exposed to UV and failing. Rib openings should also be sealed. Seals here are poorly applied, missing or failed.

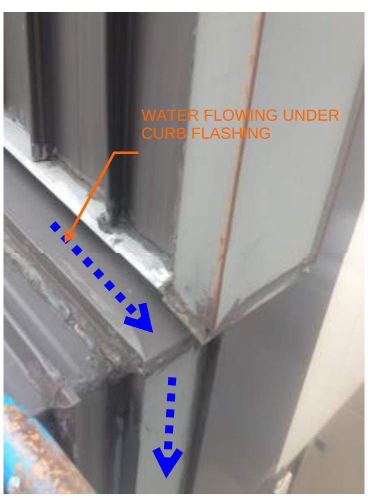
Once water infiltrates valley flashing, it encounters the valley pan. Seen pictured below, the pan extends 24” each way from the valley centerline. Beyond that, there is no protection – water runs directly through joints in poly-iso insulation. The pan is also through fastened with gasketed fasteners whose gaskets are failing and for which no allowance for thermal movement has been made. Whenever possible, continuous metal roof components should be anchored with clips to allow the normal thermal expansion and contraction which occurs with changes in temperature.

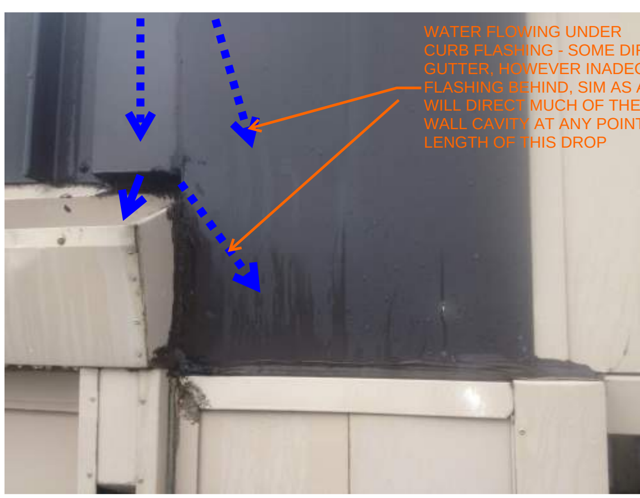
The valley termination is likely the primary point of infiltration, which is consistent with leak patterns in the interior. In the photo below, the valley pan is shown terminating flush with the exterior wall, behind the downspout conductor box. Based on evidence above, we assume there is significant water flow between the valley flashing and the valley pan. This water will tend to flow directly into the roof and wall cavity below at this and at similar locations.

Rake Wall Valley

A number of deficient details were also identified at the rake wall valleys. Primary among them is the roof panel to curb flashing detail. In the photo below one can see the roof area which feeds a single rake wall valley. In modest to heavy rain events, particularly if any damming occurs at the valley termination, this valley will be full. The water tightness of the valley assembly should be reliant on the return leg or rib of the roof panel under the curb flashing which should be roughly where shown in the photo to the right. The liberal application of sealant at the outer joint, however, may indicate that the return leg is inadequate or absent.

Whether the return leg is adequate/absent or not, water that makes it under the curb flashing must also be managed at rake wall valley terminations. At these conditions, the roof panel itself is acting as the pan flashing. This pan flashing presumably terminates flush with the exterior wall assembly, similar to typical valley terminations, which puts it behind the fascia metal, therefore behind the gutter. It is doubtful that there is adequate moisture protection inboard of this termination – water therefore is likely free to flow into the wall cavity.



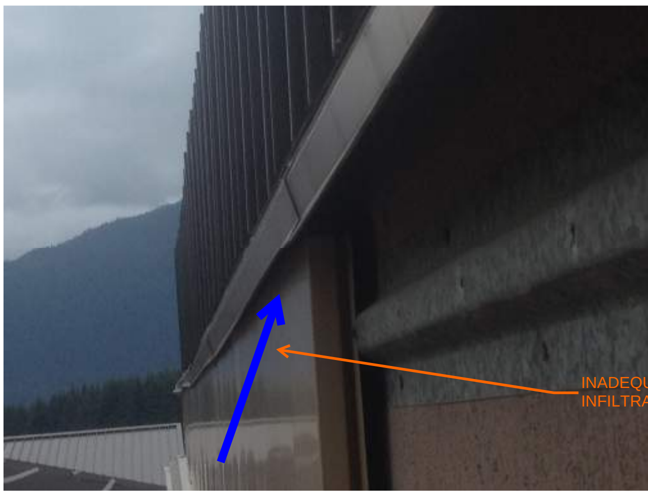


Rake Walls

Rake walls are also contributing to infiltration. Where the roof panels fold down at the eave, the knee joint is multi-faceted, w/ open joints and missing fasteners. At the base of the walls, we find coped rake flashing at grid F and curb flashing at grids 7 and 8 which do not provide an adequate seal, particularly where valley water ponds against rake walls. At grid 7 and 8 rake walls, base of wall flashing just above curb flashing is back-sloped and holds water, causing corrosion. The base condition of rake walls in general is deficient, but there are other problems unique to the grid F rake wall.

Grid F Rake Wall and Eave

At the roof to wall cladding joint, material lap is inadequate allowing infiltration, especially wind-blown. At the wall base towards the west end (and down the west facing rake on grid 2.5), the flashing detail includes a substantial overhang without adequate counter flashing and/or closure at its underside. This detail creates a wind catch, focusing windblown precipitation into the wall assembly. And as described above, this wall (and likely all others at Influent Pump Sation wing walls) have exterior insulation, and no apparent vapor barrier or weather barrier. The exterior insulation is saturated, likely from a combination of infiltration, and condensation in the absence of a vapor barrier. Either way, moisture present inside this rake wall assembly contributes to moisture infiltration into the building.



Grids 7 and 8 Rake walls

At grids seven and eight, the rake walls are clad exactly as the roof is, with the same lack of joint seals and the same penetrations. This is a framed wall assembly and appears to be dry beneath the vertical roof panel cladding. We assume there is a vapor barrier on the warm side of the insulation in this assembly. It is unclear what the nature and extend of any rake flashing is as its concealed by the curb flashing, but as discussed above, the system may relay on the rib of the roof panel which is lapped by the curb flashing. Infiltration occurring at the wall base in this case is more a product of improper rake valley flashing and not from significant infiltration into the rake wall above.

Other Concerns

There are a number of unique details that may be contributing to infiltration. Plumbing vents and other penetrations are improperly flashed, or not flashed at all. Secondary systems such as the heat trace system on grid A is mechanically fastened directly through the roof panels, creating additional, impossible to protect penetrations. Existing flashings have been damaged and are no longer performing. And finally, though to our knowledge not presenting leaks, head flashings at wall penetrations occurring on the second floor appear to be back-sloped, and do not appear to allow for a means to shed water outside the adjacent metal cladding where, particularly with a back-slope condition, water will tend to travel.

Recommendations

The primary deficiencies in the existing system are an open joint metal roof assembly, complete lack of an underlying weather barrier, sub flashings which direct water into wall cavities, and high ponding potential at the valleys. Any corrective strategy must address these issues.

There are three approaches to correcting the deficiencies identified above based on our assumption that the Owner intends to retain a metal roof system. Each will require that roofing, insulation and the weather/vapor retarded be removed to expose underlying structure. Each will require that the underlying structure be inspected for rot or other damage caused by moisture and repaired where necessary. Each will require that the rake wall cladding be disassembled and reconstructed to allow the installation of new flashings. The difference between each approach is the extent of the removal and the extent to which existing materials are reused.

A fourth strategy utilizing membrane roofing should be considered. Of the four strategies it offers the highest value, correcting the primary deficiencies more efficiently than the metal roof options for a lower unit cost.

Rough order of magnitude costs were developed by Estimations Inc. for all four approaches, and are cited with each approach below.

Complete Correction – Metal option $32/SF x 28,200SF = $902,400 (Recommended)

As noted above, the un-sealed clip-lock style roof panel does not provide a water-tight condition, and there is no weather barrier directly beneath the roof panels as one would find in a modern assembly. The roof therefore, even if in perfect condition, will leak. A full replacement is the only way to assure a durable, long-term water-tight solution. A new roof system may reuse existing poly-iso insulation, but would otherwise be assembled as follows:

(E) structure – repaired as necessary
Vapor barrier
(E) insulation
.5” - .625” plywood underlayment
Min 35mil polyethylene backed bituminous weather barrier
Mechanically seamed metal roof panel system with all new flashings

Complete Correction - Membrane Option $26/SF x 28,200SF = $733,200 (Recommended)

If a complete re-roof is considered, EPDM and PVC membrane systems should be considered. EPDM offers much higher slip resistance which may make it more suitable for this application. Structural upgrade may still be required necessitating selective demolition, but the overall cost should be lower per unit than those costs stated above for a metal roof system. This assembly is as follows:

(E) structure – repaired as necessary
Vapor barrier
(E) insulation
.625” coverboard
EPDM membrane
(N) flashings (where required – use of membrane will limit need for flashing)

Partial Correction $35/SF x 28,200SF = $987,000 (Not recommended)

In general, salvage and reuse costs more ultimately, than replacement with new. However, a salvage/reuse strategy may be to carefully remove the existing roof panels, which as noted above are in relatively serviceable condition. All work associated with complete correction above would be executed up to and including installation of a new, continuous weather barrier. Salvaged roof panels would be reused, however a continuous sealant bead or strip would be introduced along the length of each rib interior at panel joints to provide a positive seal to the greatest extent possible. All flashings would be new. This assembly is as follows:

(E) structure – repaired as necessary
Vapor barrier
(E) insulation
.5” - .625” plywood underlayment
Min 35mil polyethylene backed bituminous weather barrier
(E) roof panels with new seal at panel joints and all new flashings

Spot Correction $37/SF x 4369SF = $161,653 (Not recommended)

Spot correction is the least expensive (though highest unit cost) option, but will provide the least assurance of infiltration mitigation, and should not be considered a long-term solution. As noted above, the greatest vulnerability in the system is at valleys, particularly at their low ends. Work could be limited to valley areas and adjacent rake walls only, in areas specifically identified as leaking. In this case, roof panels and existing poly-iso insulation would be removed and salvaged in specific areas as identified in Appendix B. Existing structure would be inspected and repaired as necessary. The existing vapor retarder would be left in place to the extent possible. Existing poly-iso insulation would be reinstalled. A loose-laid self-healing weather barrier would be installed then the salvaged roof panels would be

reinstalled with new sealant or sealant stripping at panel rib joints. All flashings would be new. This is a short term solution with no backing warranty.
(E) structure – repaired as necessary
(E) vapor barrier
(E) insulation
Min 35mil polyethylene backed bituminous weather barrier, loose-laid
(E) roof panels with new seal at panel joints and all new flashings

Additional Corrections
Corrections for all conditions noted under Other Concerns should be considered with all three proposed approaches. In comparison to the cost of the more significant corrections, the cost to execute these will be minimal. In addition, regardless of the approach chosen, it is critical that the potential for ponding be completely eliminated. This can be achieved by the installation of heat trace along the length of and at the termination of all valleys to prevent ice/snow damming, and with regular maintenance to control debris damming.

If complete or partial correction is considered, there is an opportunity to improve the roof vapor retarder performance. We do not necessarily believe that deficiencies of the roof vapor retarder are contributing significantly to leaking; however, condensation is likely a problem which may eventually compromise structural elements. The building's interior environment, likely often warmer and more humid than the exterior environment, will promote moisture vapor transmission through the roof assembly. This moisture vapor, once in the cooler zone above the existing vapor retarder, will tend to condense, wetting insulation and structure.

Likewise, if complete or partial correction is considered, there is an opportunity to improve roof insulation. The existing poly-isocyanurate foam insulation is 3" thick, at least in the areas investigated. This offers an overall R-value of approximately 16.5 aged and likely wetted. This low value does not afford much thermal protection, though a higher value may not be useful for a facility of this nature.

Cost
The budget determined for any approach should include allowances for structural repairs and installation of permanent fall protection anchors, and should include a contingency sum for unforeseen conditions. Project budgets must also include a 1.3% multiplier for incidental costs. Rough Order of Magnitude (ROM) costs for these are as follows:

Structural repairs	~10% project cost for Complete Correction approaches
	~25% project cost for Spot Correction approach
Fall protection	$75,000 for any approach
Contingency	~10% project cost for any approach (Inclusive of Additional Corrections)
Incidental costs	~3% project cost for any approach

Using the Complete Correction Membrane Option as a model, ROM project costs would be as follows:

Base cost	$733,200
Structural repairs	$ 73,320
Fall protection	$ 75,000
Contingency	$ 73,320
Incidental Costs	$ 21,996
TOTAL	**$976,836**

END OF REPORT