APPENDIX C

MEMORANDUM

TO:	**Jason Canady**	**DATE: 7/15/2011**	
FROM:	**Todd Petrik, P.E., MWH**	**CC:**	**Chris Uber, P.E., MSA**
REVIEWED BY:	**Pete Kreft, P.E., MWH**		**Brian Ginter, P. E., MSA**
	Corie Peterson, P.E., MWH		

SUBJECT: Grants Pass WTP – Inspection of the Clearwell (Inspection Date 5/24/2011)

Background

On May 24, 2011, MWH conducted a follow-up inspection of the clearwell concrete roof and beams in the original 1930's constructed part of the building. A photo log of this visit is attached as Appendix A. The follow-up was conducted to determine a more-defined extent of the concrete deterioration that was first discovered during the March 2, 2011 inspection. As a reference, the March 2, 2011 report and photo log are attached as Appendix B. It should be noted that the March 2, 2011 inspection was focused on the area of the clearwell that was leaking in groundwater, but some other areas of concern were observed then as well. The leak area and general recommendations from the March 2, 2011 inspection are summarized below:

Clearwell Water Intrusion Repair Recommendations

- MWH recommends that the backfill on the exterior of the wall adjacent to the joint between the 1930 and 1950 construction be removed for further inspection of this joint from outside the building.
- Once the cause of the water intrusion is known for sure, then repairs to the leak should proceed as quickly as possible.
- There is more than one way to repair this leak. These are, but are not limited to:
  - An exterior rubber strip sealed on both sides of the crack and covering over the crack to prevent the migration of the groundwater into the building.
  - Injection grouting into the crack
- One thing that should be considered by the City is to chip away the exterior wall concrete down to the 10 ga galv. iron waterstop and remove it altogether. This will help to eliminate any future rusting of this waterstop and help to prevent the rusting of the waterstop and spalling of concrete.

Clearwell General Inspection Repair Recommendations

<u>Ladder Rungs in Each of the Three Clearwell Manhole Access</u>

- None of the ladder rungs are in a state of immediate collapse. Yet, they should be replaced in the near future. It is important to mitigate any further rusting of the ladder rungs back into the concrete wall. New rungs should be installed with a "drill and epoxy" system. The rungs should be either stainless steel or FRP.

Various Concrete Beams in the Roof of the Octagon Clearwell

- None of the beams have deteriorated to a point where the beams are failing. Yet, they should be repaired in the near future. It is important to mitigate any further rusting of the reinforcement. Once the rusting starts, it will travel over time down the length of the entire bar. They are many different options for the repair of these types of deterioration in concrete. These options will be discussed at length with the City Staff at a time closer to put together a repair plan.

The most recent inspection was completed on Tuesday, May 24, 2011 by Todd Petrik and accompanied by the Treatment Plant Superintendent, Jason Canady. A summary of this visit and recommendations that resulted from it are listed below.

Clearwell - General Structural Inspection

Note: All of the photos referenced in the following text below are included in the attached annotated site photo log, attached as Appendix A.

Generally, the concrete floors, walls, columns, beams, and undersides of the top decks are in good condition. However, a more aggressive approach was taken during the most recent inspection to determine how far-reaching the spalling concrete and corroding reinforcement is that was first encountered during the March 3 inspection. For those areas that do have issues, the extent of the deterioration is worse than originally determined. If certain areas are not repaired, damage could continue to spread and threaten the structural stability and integrity of the clearwell. In turn, this could potentially threaten the ability of the Water Treatment Facility to effectively disinfect water and deliver safe drinking water to the citizens of Grants Pass.

Identification of Various Concrete Beams in the Roof of the Octagon Clearwell

There are four interior concrete columns in the clearwell that divide the roof/beams into nine different panels. Running in the North/South direction, there are north, middle and south beams. Running in the East/West direction, there are east, middle and west beams. These beams and the exterior walls of the clearwell define the 9 different panels. Reference the attached sketch presented as **Figure 1**. The summary below makes use of the labeling defined above and shown in **Figure 1**.

Common/Typical General Concrete Repair Methods

One common, and often-used, method for the repair of concrete structural elements is to use a bonded fiberglass reinforced plastic (FRP) system. This practice is governed by ACI 440.2R and is widely used throughout the engineering community. For this report, this process will be referred to as FRP Repair.

Repair Priority

MWH has determined that the repairs presented below fall into two different Priority categories.

Priority 1: Denoted by “P1”, this is the higher of the two levels. These repairs should be made in the next Low-Water demand period. These repairs should be given a higher priority to prevent the conditions from growing worse which could lead to a failure of the structural systems in the clearwell ceiling.

Priority 2: Denoted by “P2”, this is the lower of the two levels. These issues have much less of an impact on the structural system in the clearwell ceiling. Not completing these repairs will result in worsening of the condition, yet it is not urgent that these repairs take place in the next Low-water demand period,

1. **West-South Beam (Photos 0070 to 0074)**

The bottom-west corner of this beam has rock pockets that extend south about 30-inches in length from the interior column. There is no visible reinforcement. It appears that the concrete was never consolidated in this corner during the initial construction.

P2-Repair: Sand blast clean and fill the pockets with a non-shrink epoxy grout.

2. **South-West Beam (Photos 0075 to 0080)**

The bottom-south corner of this beam has rock pockets that extend from the west wall for about half the length of the beam to the east. There is no visible reinforcement. It appears that the concrete was never consolidated in this corner during the initial construction. On the south side of this beam, there is an abandoned steel floor drain. It is rusting and starting to spall the concrete around it.

P2-Rock Pocket Repair: Sand blast clean and fill the pockets with a non-shrink epoxy grout.

P2-Pipe Repair: Cut off the drain pipe and burn it back up into the concrete a minimum of 1-1/2 inches. Grout over the hole with a non-shrink epoxy grout.

3. **West-Middle Beam (Photos 0082 to 0085)**

The bottom-west corner of this beam from the north column to 48-inches south has significant concrete spalling and deteriorated reinforcing bars. The east side of the beam has a short, 12 to 16-inch section of rock pockets in the mid-span of the lower corner. On the east side of this beam, there is an abandoned steel floor drain. It is rusting and starting to spall the concrete around it.

P1-Reinforcement Repair: Chip back the concrete until clean, bright reinforcement is encountered. Remove the rusted reinforcement. Build back up the deteriorated concrete beam with a non-shrink grout and the use of the FRP repair method to bring back the integrity of this beam.

P2-Rock Pocket Repair: Sand blast clean and fill the pockets with a non-shrink epoxy grout.

P2-Pipe Repair: Cut off the drain pipe and burn it back up into the concrete a minimum of 1-1/2 inches. Grout over the hole with a non-shrink epoxy grout.

4. **South-Middle Beam (Photos 0089 to 0096)**

At the west end of this beam and in the center of the beam, there is a hole from unconsolidated concrete that has resulted in exposed reinforcing bars. The two exposed bars are rusting. The rusting of these bars is causing further spalling of the concrete. Along the north side of the beam, there is a rock pocket that extends for about a 5 foot length.

P1-Reinforcement Repair: Chip back the concrete until clean, bright reinforcement is encountered. Remove the rusted reinforcement. Build back up the deteriorated concrete beam with a non-shrink grout and the use of the repair method to bring back the integrity of this beam.

P2-Rock Pocket Repair: Sand blast clean and fill the pockets with a non-shrink epoxy grout.

5. **East-Middle Beam (Photos 0097 to 0103)**

At the bottom west corner of the beam and for the entire length of the beam, the concrete has spalled off and exposed the reinforcing bar(s). Also, along the east side of the beam, there is a short 6 to 8-inch long section of spalled concrete and exposed reinforcement.

P1-Reinforcement Repair: For the entire length of this beam, chip back the concrete until clean, bright reinforcement is encountered. Remove the rusted reinforcement. Build back up the deteriorated concrete beam with a non-shrink grout and the use of the FRP repair method to bring back the integrity of this beam.

6. Middle-East Ceiling Panel (Photos 0104 to 0110)

There is a 54-foot long section of reinforcement that has rusted and spalled the concrete around it. There is a 2-inch deep hole in the bottom of the floor from a deteriorated wood block. Also, there is an abandoned steel floor drain pipe that is rusting and starting to spall the concrete around it.

P1-Reinforcement Repair: Chip back the concrete until clean, bright reinforcement is encountered. Remove the rusted reinforcement. Build back up the deteriorated concrete floor with a non-shrink grout and the use of the FRP repair method to bring back the integrity of this floor.

P1-Hole Repair: Chip back the concrete until clean, bright reinforcement is encountered. Remove the rusted reinforcement. Build back up the deteriorated concrete floor with a non-shrink grout and the use of the RFP repair method to bring back the integrity of this floor.

P2-Pipe Repair: Cut off the drain pipe and burn it back up into the concrete a minimum of 1-1/2 inches. Grout over the hole with a non-shrink epoxy grout.

7. East-South Beam (Photos 0111 to 0116)

Along the west and east sides of the beam, there are various rock pockets. There is no visible rusted reinforcement showing. Near the center column. there is an abandoned pipe stuffed with some type of insulation. The pipe is rusting and spalling the concrete around it.

P2-Rock Pocket Repair: Sand blast clean and fill the pockets with a non-shrink epoxy grout.

P2-Pipe Repair: Cut off the drain pipe and burn it back up into the concrete a minimum of 1-1/2 inches. Grout over the hole with a non-shrink epoxy grout.

8. South-East Beam (Photos 0117 to 0120)

There is no spalling of the concrete or any visible rusting reinforcement on either side or bottom of the beam.

Repair: None required

9. South-East Ceiling Panel (Photos 0121 to 0124)

In the underside of the floor, there is a large circular patch that appears to have the hole filled at two different times. The outer patch is starting to deteriorate and the older concrete is spalling off. There is no visible rusting reinforcement.

P2-Patch Repair: Chip out the old concrete to sound, solid concrete. Sandblast the hole clean. Place new non-shrink grout into the hole. If the hole becomes over 12-inches in diameter, there may be a need to drill and epoxy in small reinforcing bars to hold the new grout into place.

10. Clearwell Access hole in East wall (Photos 125 to 131)

In order to expand the clearwell to the East, a hole was cut in the wall. When the hole was cut, it appears that reinforcing bars were left exposed. These reinforcing bars are now rusting and spalling the concrete around them. While there is no real structural significance to this, it is worth cleaning out the old bars and patching up the edges of the hole.

P1-Repair: Chip the concrete back to expose clean bright reinforcement. Cut off all rusted reinforcement and burn the bars back into the solid concrete a minimum of 1-1/2 inches. Drill in new, short #4 dowels around the edge of the opening. Form a new opening and cast in new non-shrink grout.

11. North-West Beam (Photos 0132 to 0136)

On the north side of the beam and on the west end, the bottom corner has spalled off and rusted reinforcement is visible.

P1-Reinforcement Repair: For the entire length of this beam, chip back the concrete until clean, bright reinforcement is encountered. Remove the rusted reinforcement. Build back up the deteriorated concrete beam with a non-shrink grout and the use of the FRP repair method to bring back the integrity of this beam.

12. North-West Ceiling Panel (Photo 138)

There is a small hole that has spalling concrete around it. There is no visible rusting of reinforcement.

P2-Hole Repair: Chip back the concrete until clean, bright reinforcement is encountered. Remove the rusted reinforcement. Build back up the deteriorated concrete floor with a non-shrink grout and the use of the RFP repair method to bring back the integrity of this floor.

13. West-North Beam (Photos 139 to 141)

There is no spalling of the concrete or any visible rusting reinforcement on either side or bottom of the beam. There are a few small rock pockets along the length of the beam.

P2-Rock Pocket Repair: Sand blast clean and fill the pockets with a non-shrink epoxy grout.

14. North-Middle Beam (Photos 142 to 148)

There is no spalling of the concrete or any visible rusting reinforcement on either side or bottom of the beam. There are a few small rock pockets along the length of the beam. At the west end of the beam, adjacent to the large patch in the ceiling, there is a small hole in the corner where the beam meets the ceiling. There is a 2 to 3-inch long piece of reinforcement that is visible. This reinforcement is not rusting and the concrete is not spalling.

P2-Rock Pocket Repair: Sand blast clean and fill the pockets with a non-shrink epoxy grout.

P2-Small Hole Repair: Sand blast clean and fill the hole with a non-shrink epoxy grout.

15. North-Middle Ceiling Panel (Photos 149 to 153)

Up tight against the north wall of the clearwell, there are two exposed bars that are rusting and starting to spall the concrete. The west bar is exposed for about 6 to 8-inches. The East bar is exposed for

about 14 to 16-inches. And there is an abandoned steel floor drain pipe that is rusting and starting to spall the concrete around it.

P1-Reinforcement Repair: Chip back the concrete until clean, bright reinforcement is encountered. Remove the rusted reinforcement. Build back up the deteriorated concrete floor with a non-shrink grout and the use of the FRP repair method to bring back the integrity of this floor.

P2-Pipe Repair: Cut off the drain pipe and burn it back up into the concrete a minimum of 1-1/2 inches. Grout over the hole with a non-shrink epoxy grout.

16. North-East Beam (Photos 154 to 159)

There is one hole in the middle of the underside of the beam. It is about 2-inches in diameter and about 2-inches deep. There is rusting reinforcement visible in the hole. The rest of the beam is in good conditions.

P2-Hole Repair: Chip back the concrete until clean, bright reinforcement is encountered. Remove the rusted reinforcement. Build back up the deteriorated concrete floor with a non-shrink grout and the use of the FRP repair method to bring back the integrity of this floor.

17. North-East Beam (Photos 0160 to 0165)

On the east end of the beam, along the bottom south corner for 3 feet, the concrete is spalling off and rusted reinforcement is visible. Also, there is a 12- to 14-inch long section of spalling concrete and rusting reinforcement in the center of the beam.

P1-Reinforcement Repair: For the entire length of this beam, chip back the concrete until clean, bright reinforcement is encountered. Remove the rusted reinforcement. Build back up the deteriorated concrete beam with a non-shrink grout and the use of the FRP repair method to bring back the integrity of this beam.

18. North-East Ceiling Panel (Photos 0166 to 0169)

There are three smaller holes in the ceiling, each having a small section of rusting reinforcement visible in the hole. There are also several small rock pockets with no visible reinforcement.

P1-Reinforcement Repair: Chip back the concrete until clean, bright reinforcement is encountered. Remove the rusted reinforcement. Build back up the deteriorated concrete floor with a non-shrink grout and the use of the FRP repair method to bring back the integrity of this floor.

P2-Rock Pocket Repair: Sand blast clean and fill the pockets with a non-shrink epoxy grout.

19. Clearwell East of the 1930 octagon (Photos 0170 to 0194)

There did not appear to be any visible spalling of concrete or exposed and rusting reinforcement.

Repairs: None required.

20. Clearwell west opf the 1930 Octagon (Photos 195 to 198)

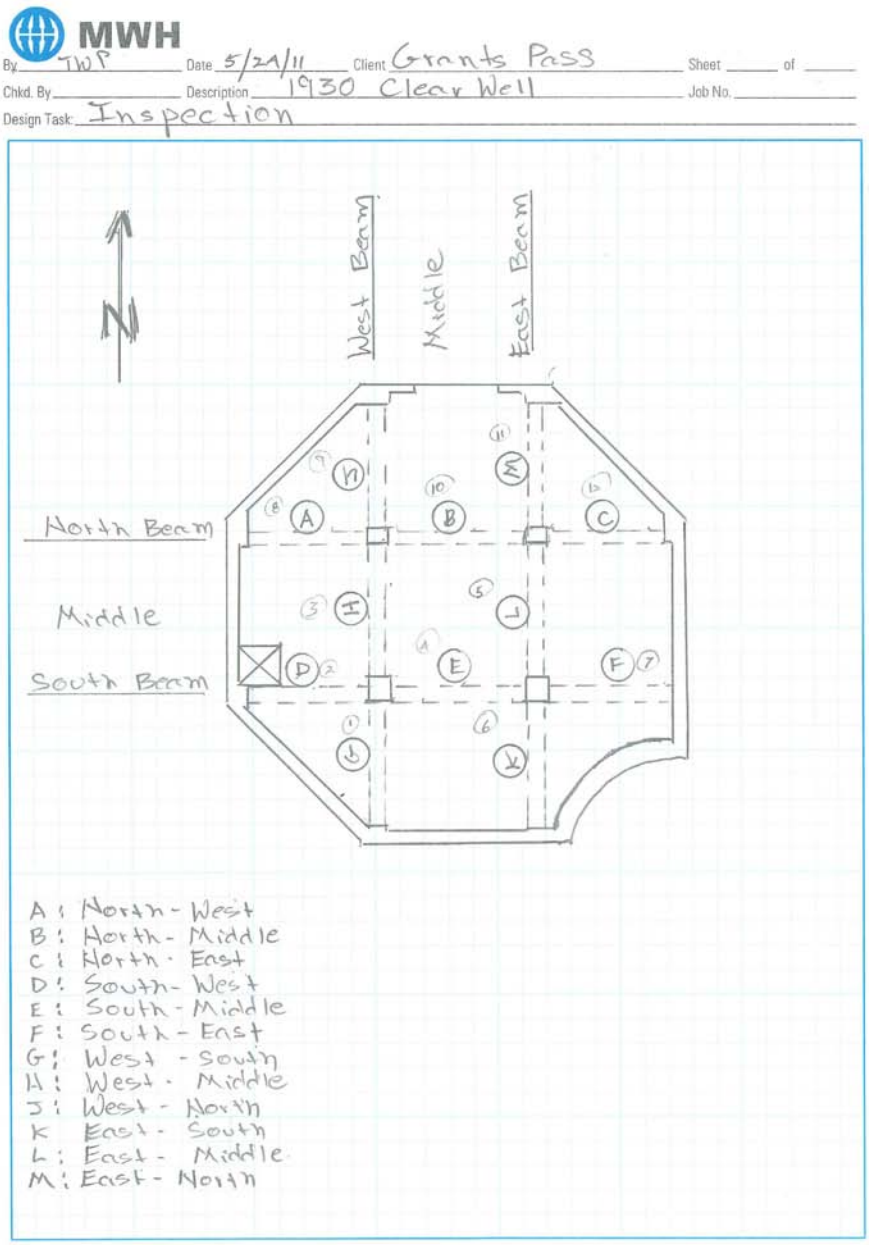
There did not appear to be any visible spalling of concrete or exposed and rusting reinforcement.

Repairs: None required.

Summary

MWH strongly recommends that the P1 level repairs presented in this memo occur during the next low demand period of operation as the repairs will most likely require the clearwell to be taken out of service and dewatered for a period of time. Should the City choose to move forward with repairs, a detailed set of repair plans and specification that can be used for construction should be prepared. In addition, during the next low demand period, the clearwell is slated to be dewatered for construction related to the installation of a new redundant filter backwash pump. Combining these projects may provide significant savings to the City in mobilization costs of similar contractor types, and common construction periods for both categories of work while the clearwell is dewatered.

During any of the repairs stated above, the floor deck and possibly the adjacent beams are to be shored to limit the possibility of the floor deflecting.


MWH
By TWP
Date 5/24/11
Client Grants Pass
Sheet of
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Description 1930 Clear Well
Job No.
Design Task: Inspection
West Beam
Middle
East Beam
North Beam
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South Beam
A : North - West
B : North - Middle
C : North - East
D : South - West
E : South - Middle
F : South - East
G : West - South
H : West - Middle
J : West - North
K East - South
L : East - Middle
M : East - North

Figure 1

Appendix A

City of Grants Pass
Water Filtration Plant
821 SE M Street
Grants Pass OR 97526

Inspection Date: **May 24, 2011**
Inspected By: **Todd Petrik**
Clearwell

West-South Beam
Photos 00700 – 0074

Photo 0070

- The concrete is Sound overall
- Rock pockets on west side. 30" in length.

Photo 0071
Showing the rock Pockets

Photo 0072
Showing the rock Pockets

Photo 0073

Photo 0074

South-West Beam
Photos 0075 – 0080

Photo 0075

- The concrete is Sound overall
- Rock pockets on south side

At west end of the beam, there is a drain in slab that is rusting and needs to be cut back and slab bottom patched.

Photo 0076

Photo 0077
Showing the rusting floor drain

Photo 0078
Showing the rusting floor drain

Photo 0079
Showing the rusting floor drain

Photo 0080

South Clearwell Wall
Photo 0081

Rock pocket in south wall

West-Middle Beam
Photos 0082 – 0085

Photo 0082

- West side beam at the lower corner has 48” of spalling concrete and exposed reinforcement.
- Scraped the Reinforcing bar & lost about 50% of the area of reinforcement..
- East side is okay

Photo 0083

No real spalling of concrete. Burn back pipe and patch.

Photo 0084

- West side beam at the lower corner has 48” of spalling concrete and exposed reinforcement.

Photo 0085

- West side beam at the lower corner has 48” of spalling concrete and exposed reinforcement.

Photo 0086
Exposed steel pipe that is rusting

Photo 0087

East side rock pocket

Photo 0088

Pipe in ceiling & reinforcement in corner

South-Middle Beam
Photos 0089 – 0096
Photo 0089

- At the West end of the beam and in the middle of the beam width there is a deep rock pocket – with rusted reinforcement showing. 16” wide at this part of beam.
- East end solid
- The clearwell ceiling is okay in this area
- North side of beam has rock pockets for a length of 5’-0”

Photo 0090

- North side of beam has rock pockets for a length of 5’-0”

Photo 0091

- Rock pockets and exposed reinforcement

Photo 0092

Photo 0093

- North side of beam has rock pockets for a length of 5’-0”

Photo 0094

- Rock pockets and exposed reinforcement

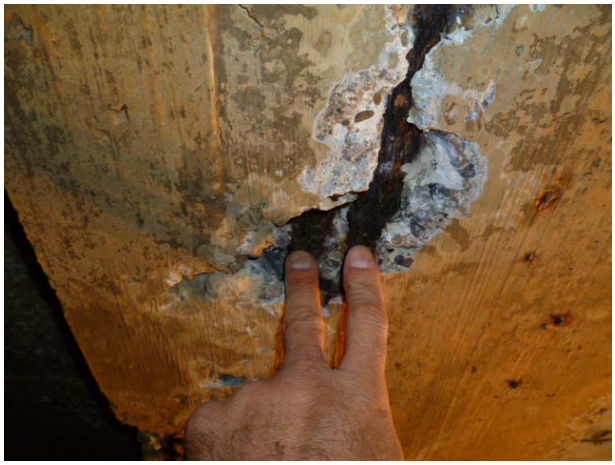

Photo 0095

- Rock pockets and exposed reinforcement

Photo 0096

East-Middle Beam
Photos 0097 – 0103

Photo 0097

- The entire bottom corner on the west side of the beam up to ceiling has spalled off.
- 1 bar is exposed the entire length of spall
- 2 bars are exposed at the center of beam
- At the East side of the beam at north end, there is also spalling concrete and exposed reinforcement.

Photo 0098

- Showing a close up of the spalled concrete and exposed bar on the west side of the beam.

Photo 0099

- Showing a close up of the spalled concrete and exposed bar on the west side of the beam.

Photo 0100

- Showing a close up of the spalled concrete and exposed bar on the west side of the beam.

Photo 0101

- Showing the spalled concrete at the center of the beam

Photo 0102

Photo 0103

- Showing the spalled concrete at the center of the beam

Middle-East Ceiling Panel
Photos 0104 to 0110

Photo 0104

- Showing a patch and a hole in the ceiling

Photo 0105

Photo 0106
Reinforcement bar with no cover has spalled the concrete for about a 5’-0” length

Photo 0107

Photo 0108

- 2-inch deep hole with rotting wood up inside of it.

Photo 0109

- 2-inch deep hole with rotting wood up inside of it.

Photo 0110

- Abandoned steel floor drain pipe that is rusting.

East-south Beam
Photos 0111 – 0116

Photo 0111

- There are rock pockets on the west and east sides of the beam
- There is no visible rusting reinforcement in the rock pockets
- Near the center column There is an abandoned steel pipe stuffed with installation and about 2-inches deep of spalled of concrete

Photo 0112

Photo 0113

- Showing rock pockets

Photo 0114

- Showing the abandoned steel pipe with insulation

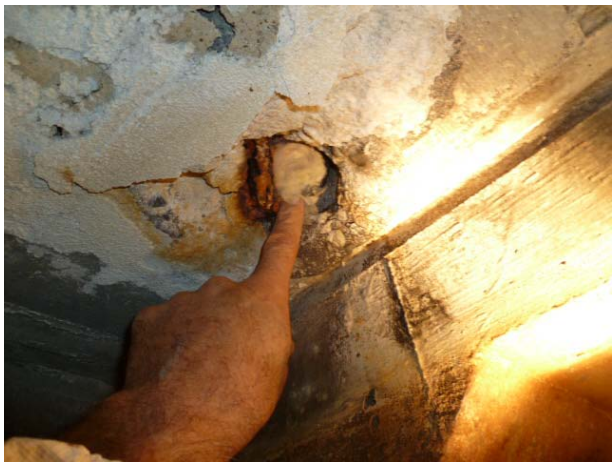

Photo 0115

- Showing the abandoned steel pipe with insulation

Photo 0116

- Showing the abandoned steel pipe with insulation

South-East Beam
Photos 0117 – 0120

Photo 0117

- The concrete is solid on all sides and the bottom of the beam
- No spalling of concrete
- No visible reinforcement

Photo 0118

Photo 0119

Photo 0120

South-East Ceiling Panel
Photos 0121 – 0124

Photo 0121

- There is a circular inside patch and an irregular patch around the outside of the circle.
- The outside patch is spalling and revealing rusting reinforcement

Photo 0122

Photo 0123

Photo 0124

Wall at the Clearwell southeast corner
Photos 0125 - 0127

Photo 0125

- Showing a short section of rusting reinforcement at the face of the wall

Photo 0126

Photo 0127

- There is a small length of exposed reinforcement and spalled concrete

Clearwell access hole in East wall (Photos 125 to 131)

Photo 0128

- Hole cut in East Wall for water flow and access
- The reinforcement around the edge of the opening is rusting and spalling of section of concrete.
- The wall is about 4-1/4 inches wide

Photo 0129

- Showing the edge of the opening

Photo 0130

- Showing the edge of the opening

Photo 0131

North-West Beam
Photos 0132 - 0136

Photo 0132

- At the North side at west end the entire corner has spalled off
- The corner reinforcing bar is exposed and the middle bar is exposed for about 4’-0”

Photo 0133

Photo 0134

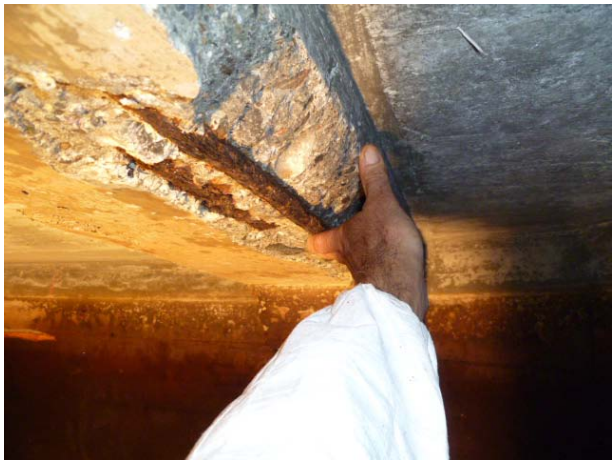

Photo 0135

- Showing exposed reinforcing bars

Photo 0136

North-West Ceiling Panel
Photos 0137 – 0138

Photo 0137

- Cone-tie hole needs to be patched

Photo 0138

- Cone-tie hole needs to be patched

West-North Beam
Photos 0139 – 0141

Photo 0139

- The concrete is solid on both sides and the bottom of the beam
- No spalling
- No rusting reinforcement
- Small rock pockets

Photo 0140

Photo 0141

North-Middle Beam
Photos 0142 - 146

Photo 0142

- The concrete is solid on both sides and the bottom of the beam
- No spalling
- No rusting reinforcement
- Small rock pockets

Photo 0143

Photo 0144

Photo 0145

- Showing a small hole at the west end and it is about 1-1/2 inches deep with a short piece of
- Reinforcement exposed but not rusted

Photo 0146

North-Middle Ceiling Panel
(Photos 147 to 153)

Photo 0147

- There are two patched holes where it appears there used to be pump cans. Both of the patches are in good condition

Photo 0148

Photo 0149

- Against north wall are 2 spalling and rusting reinforcement bars.

Photo 0150

Photo 0151

- The West bar is rusting and spalling concrete for about 6-inches from the wall

Photo 0152

- The East bar is rusting and spalling concrete for about 14-inches from the wall

Photo 0153

- Shows an abandoned pipe. The concrete around it is good but the end of the pipe is rusting

North-East Beam
Photos 0154 - 0159

Photo 0154

- There is one main hole in the middle of the beam about 1 to 2-inches deep
- In the hole, the reinforcement is exposed and rusting
- All other parts of the beam are solid

Photo 0155

Photo 0156

Photo 0157

- Showing the hole in the beam

Photo 0158

Photo 0159

- Showing at the south end of beam on the west side there is a small rock pocket

North-East Beam
Photos 0160 – 0165

Photo 0160

- At the east end of the beam on the south side of beam there is spalling concrete and reinforcement is rusting
- There is also spalling at the center of beam about 3’-0” from the east end
- At the west end of the beam the concrete is solid

Photo 0161

Photo 0162

- Showing the spalling concrete and rusting reinforcement at the east end of the beam

Photo 0163

Photo 0164

Photo 0165

North-East Ceiling Panel
Photos 0166 - 0169

Photo 0166

- There is a concrete cone tie hole 2-inches deep and about 1-1/2 inches in diameter at the concrete surface
- There are also 2 other small reinforcement or tie rusting spots
- And there are a few smal rock pockets

Photo 0167

- Showing the small reinforcement rusting

Photo 0168

Photo 0169

Clearwell East of the 1930 octagon (Photos 0170 to 0194)

For all of this area, there is no visible spalling of concrete or rusting reinforcement

Photo 0170

Photo 0171

Photo 0172

Photo 0173

Photo 0174

Photo 0175

Photo 0176

Photo 0177

Photo 0178

Photo 0179

Photo 0180

Photo 0181

Photo 0182

Photo 0183

Photo 0184

Photo 0185

Photo 0186

Photo 0187

Photo 0188

Photo 0189

Photo 0190

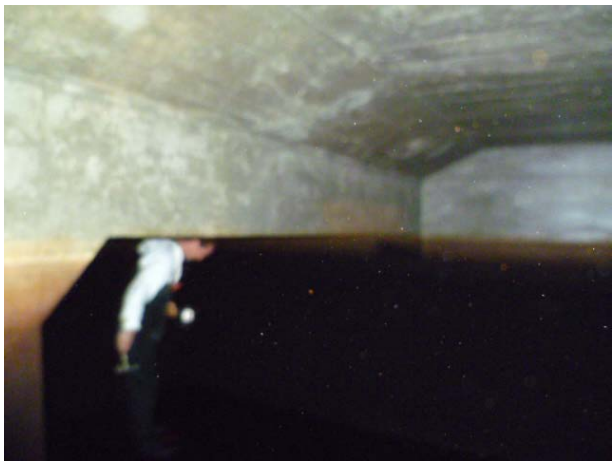

Photo 0191

Photo 0192

Photo 0193

Photo 0194

Clearwell West of the 1930 octagon (Photos 0195 to 0198)

For all of this area, there is no visible spalling of concrete or rusting reinforcement

Photo 0195

Photo 0196

Photo 0197

Photo 0198

Appendix B

MEMORANDUM

To:	**Jason Canady, City of Grants Pass**
From:	**Todd Petrik, MWH**
Date:	**3/15/2011 – Inspection Date**
Subject:	**Grants Pass, Inspection of the Clearwell**

Background

The staff at the Water Treatment plant in Grants Pass contacted MWH to come inspect water intrusion into the interior spaces of the plant. Plant staff stated that it appear that the water intrusion is occurring at a joint that is between the original 1930 construction and the West Clearwell constructed in the 1950s.

In summary, the structural inspection was to review the following items at the plant:

- The current condition of the water intrusion in the space that is above the clearwell in the pipe gallery west of the Octagon lobby. This is dry space.
- The current condition of the water instruction in the water channel down in the clearwell west of the Octagon Lobby. This is wet space.
- Since the entire clearwell was able to be de-watered, a walkthrough of all three spaces was completed.

Clearwell Water Intrusion Inspection Summary

Each of the spaces stated above are below the final grade that is exterior to the building and adjacent to where the water intrusion is occurring.

(All of the photos referenced below are included in the attached site inspection photo log.)

<u>Dry Space Above the Clearwell</u>

1. Photos 1 through 3 show the area of water intrusion from the exterior of the building.
2. Photos 4 and 5 show the inside wall of the 1930s constructed Octagon. There was no indication of water instruction into this space. It appears that the wall of the original 1930 building is holding up to any water intrusion.
3. Photos 6 through 8 shows where the water intrusion is occurring into the space constructed in the 1950s. The conclusion is that the water is coming in through the joint between the exterior wall of the 1930 building and the exterior wall of the 1950 building. The construction detail of this joint can be found in the 1950 expansion drawings in the upper right corner of Sheet No. 5 of 13.

<u>Wet Space Down in the Clearwell</u>

1. Photos 9 through 11 show the joint between the manhole access into the clearwell and the top slab. The water that is coming in from outside has also found its way into this joint. This water is rusting the reinforcement steel in the joint and spalling the concrete. This spalling and rusting is only evident on the East side of the manhole access, which, is adjacent to the vertical crack in the exterior wall shown in Photos 6 through 8.

2. While the channel below the top deck, down in the clearwell is wet, the top part of the channel is above the water line and remains dry. The concrete here also looks dry. This is the case except in the corner at the joint between the 1930 and 1950 construction. Reference photo 12. This picture shows a white effloresce.

Clearwell Water Intrusion Repair Recommendations

- MWH recommends that the back fill on the exterior of the wall adjacent to the joint between the 1930 and 1950 construction be removed for further inspection of this joint from outside the building.
- The most likely outcome will reveal that the water intrusion is starting in this exterior fill and migrating through the joint between the 1930 and 1950 buildings. This would mean that the seal shown in the 1950 drawing detail on sheet 5 of 13 has deteriorated. This seal, or waterstop, is called out in this detail as a "10ga galv. Iron – caulked into a saw cut slot and grouted into place with lead or cement".
- Once the cause of the water intrusion is know for sure, then repairs to the leak should proceed as quickly as possible.
- There is more than one way to repair this leak. These are, but are not limited to:
  - An exterior rubber strip sealed on both sides of the crack and covering over the crack to prevent the migration of the groundwater into the building.
  - Injection grouting into the crack
- One thing that should be considered by the City is to chip away the exterior wall concrete down to the 10 ga galv. iron waterstop and remove it altogether. This will help to eliminate any future rusting of this waterstop and help to prevent the rusting of the waterstop and spalling of concrete.

Clearwell, General Inspection Summary

In general, all of the concrete floors, walls, columns, beams, undersides of the top decks and the interior baffle walls are in good condition. There are a total of three different chambers that make up the complete clearwell and these three chambers also serve as the chlorine contact basin. The flow of the water goes in the direction as follows:

- Starts in the channel on the North side of the west clearwell constructed in the 1950 addition
- Through a pipe that passes through the clearwell constructed in the original 1930 building
- Into the east clearwell that was constructed in the 1980 building.
- Through baffle walls in the east well, into the 1930 well and finally into the west well.

There are several areas found during the inspection that are of concern and a repair for these issues should be put forth soon.

(All of the photos referenced below are included in the attached site photo log.)

Ladder Rungs in Each of the Three Clearwell Manhole Access

1. Photos 13 through 19 show the ladder rungs in the three clearwell access manholes. Most all of the ladder rungs are in poor shape and are in need of replacement sometime in the near future.

Various Concrete Beams in the Roof of the Octagon Clearwell

2. Photos 20, 21 and 22 show the corner of one of the clearwell floor beams. This floor beam (floor to the dry room above and roof to the wet clearwell space below) occurs south of the NW column in the octagon well. The reinforcement rusting and concrete spalling occurs on the bottom west corner of the beam.
3. Photos 23 through 26 show the corner of one of the other clearwell floor beams. This floor beam (floor to the dry room above and roof to the wet clearwell space below) occurs west of the NW column in the octagon clearwell. The reinforcement rusting and concrete spalling occurs on the bottom north corner of the beam.
4. Photo 27 shows a spot in the center of a third beam. This beam occurs north of the NE column in the octagon clearwell. It appears that there was a wood block left in place during the construction. The wood block has rotted and exposed the reinforcement. Then, the reinforcement rusted, causing concrete around the hole to start spalling away from the beam.

Clearwell General Inspection Repair Recommendations

Ladder Rungs in Each of the Three Clearwell Manhole Access

- None of the ladder rungs are in a state of immediate collapse. Yet they should be replaced in the near future. It is important to mitigate any further rusting of the ladder rungs back into the concrete wall. New rungs should be installed with a “drill and epoxy” system. The rungs should be either stainless steel or FRP.

Various Concrete Beams in the Roof of the Octagon Clearwell

- None of the beams have deteriorated to a point where the beams are failing. Yet, they should be repaired in the near future. It is important to mitigate any further rusting of the reinforcement. Once the rusting starts, it will travel over time down the length of the entire bar. They are many different options for the repair of these types of deterioration in concrete. These options will be discussed at length with the City Staff at a time closer to put together a repair plan.

City of Grants Pass
Water Filtration Plant
821 SE M Street
Grants Pass OR 97526

Inspection Date: **March 3, 2011**
Inspected By: **Todd Petrik**
Clearwell

<u>Inspection Photos of the Water Intrusion</u>

Photo 1
Overview of the interface of the 1930 (left side of photo) and 1950 (right side of photo)

The water intrusion is occurring directly behind the water fountain through a crack that is visable from the exterior of the building.

Photo 2

Close up of the interface between the 1930s and 1950 construction.

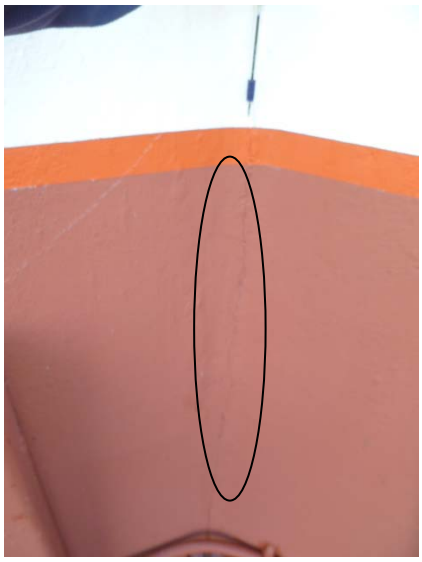

Photo 3

Close in view showing the crack between the 1930s and 1950s construction. This crack was visible from the eave of the roof line clear down to the walk that was sitting on grade

Photo 4

Photos 4 & 5 showing the interface between the 1930 and 1950 construction from inside the Octagon structure, or the 1930s construction.

Photo 5

Photo 6

Photos 6, 7 and 8 show the interface from inside the 1950 construction

Photo 7

Water is coming in from outside in the location directly in the corner where the dark stain is traveling up the joint.

Photo 8

Photo 9

This photo shows the interface, or joint, between the top of the clearwell slab and the tall curb around the manhole access.

Photo 10

Photo11

Photo 12

This photo shows the underside of the top slab interfacing with exterior wall of the 1930 construction (right hand wall) and the exterior wall of the 1950 construction (left hand wall). The white in the picture is staining from the water intrusion that is coming through this joint from outside the building.

Photos for the General Inspection of all three Clearwells

Photo 13

This photo and photo 14 shows the ladder rungs in the manhole access that enters into the channel along the north side of the west clearwell. These ladder rungs were installed in the 1950 construction.

Photo 14
This photo is a close up of the joint.

Photo 15

Photos 15, 16 and 17 show the ladder rungs that enter into the east clearwell.

These ladder rungs were installed in the 1980 construction.

Photo 16

Photo 17

Photo 18

This photo and photo 19 show the ladder rungs extending out of the access in the center, Octagon clearwell. These rungs were most likely installed in the 1930 construction.

Photo 19

Photo 20

Photos 20, 21 and 22 show a corner of one of the beams in the octagon clearwell. This beam is located south of the NW column in the octagon clearwell. The spalling is occurring on the west bottom corner of this beam.

Photo 21

Photo 22

Photo 23

Photos 23, 24, 25 and 26 shows a corner of one of the other beams in the octagon clearwell. This beam is located west of the NW column in the octagon clearwell. The spalling is occurring on the north bottom corner of this beam.

Photo 24

Photo 25

Photo 26

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Photo 27

This photo shows a spot in the center of the beam where the reinforcement is rusting and the concrete is spalling. This beam is located north of the NE column in the octagon clearwell. It appears that there was a wood block left in place during the construction. The wood has rotted and exposed the reinforcement. Then the reinforcement rusted causing concrete around the hole to start spalling away from the beam.