Supplemental Information Level I Antidegradation Review

Union Pacific Railroad Great Salt Lake Causeway Permanent East Culvert Closure and Bridge Construction Project

Pending Water Qualification Certification No. SPK-2011-00755

January 7, 2015

Prepared for
Union Pacific Railroad
Omaha, NE 68179

Prepared by
HDR
Kidd Waddell
Wally Gwynn

Contents

Tables

Figures

1.0 Purpose of Report

Union Pacific Railroad (UPRR) is seeking authorization to make permanent the earlier emergency closure of the east culvert and construct a new opening in the railroad causeway that spans the Great Salt Lake, located in Box Elder County, Utah, as compensatory mitigation for the impacts of closing both the east and west culverts. This report supplements the project information previously provided on the Antidegradation Review Form submitted as part of the Utah 401 Water Quality Certification application on January 7, 2014 (UPRR 2014a). Project permitting background and Level I ADR factors are described below with the information provided

1.1 Background

UPRR is submitting supplemental information for the Utah Division of Water Quality's (UDWQ) consideration regarding the Level I Antidegradation Review (ADR) for the permanent east culvert closure and bridge construction project. UPRR submitted a Utah 401 Water Quality Certification and Level I ADR for the project on January 7, 2014, that determined the water quality impacts of the permanent east culvert closure and the construction of a bridge to offset the impacts of permanent east and west culvert closures were temporary and limited. The January 2014 Level I ADR stated:

> "… effects on water quality will be temporary and limited because mitigation to offset the impacts is being evaluated and will be implemented pursuant to the USACE permit and UDWQ certification. However, UPRR is proposing to review this issue again and supplement UPRR's ADR submission based on the results of the ongoing impacts reevaluation, which is expected to be completed in 2014."

UPRR has completed the project impacts reevaluation and provides supplemental information herein, based on the reevaluation as it applies to the Level I ADR and the factors used to justify the Level I determination.

1.2 Contents of This Level I ADR Supplemental Information

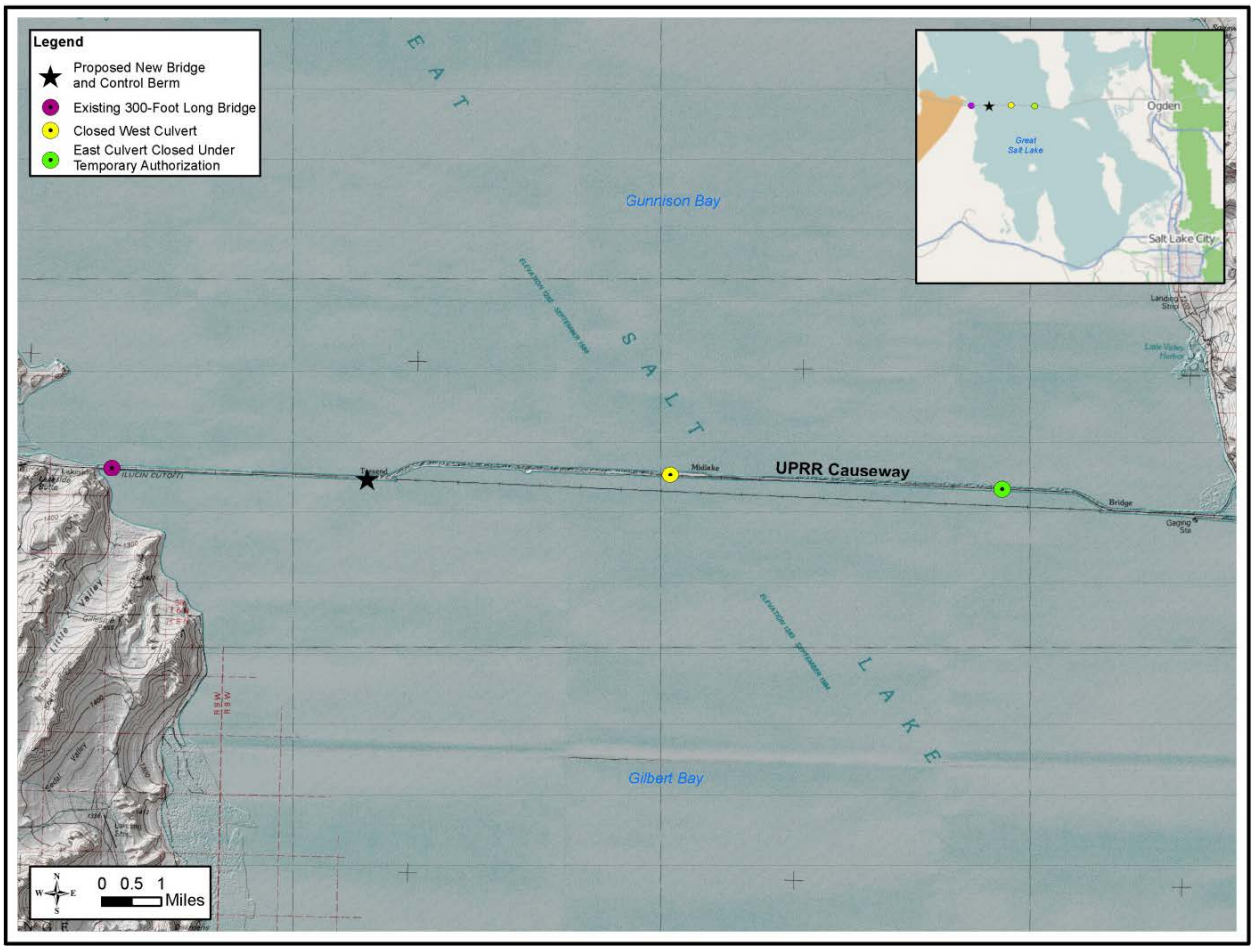
UPRR has prepared this report to be consistent with the Utah 401 Water Quality Certification and USACE Individual Permit application to demonstrate consistency with the antidegradation policy of the State of Utah. The following topics are discussed in this submittal:

- Project description
- Water quality standards of receiving waters
- Analytical approach for ADR
- Short-term salinity effects
- Long-term salinity effects
- Summary and conclusions

2.0 Project Description

The proposed project is located in the Great Salt Lake, which is in northwestern Utah. UPRR operates trains on a rock-fill causeway, which separates the lake into areas that are referred to as the North Arm and the South Arm. Water and salt are conveyed back and forth between the lake's North and South Arms through the permeable causeway rock fill, the existing 300-foot-long bridge. Until recently, water and salt were conveyed back and forth between the lake's North and South Arms through two culverts (the east and west culverts), an existing 300-foot-long bridge, and the causeway rock fill. The east culvert is about 6 miles west of Promontory Point, and the west culvert is about 11 miles west of Promontory Point (Figure 1). Both culverts are about 15 feet wide by about 20 feet deep. Originally constructed to provide small boat access between the North and South Arms, over time, the culverts settled and became submerged.

Figure 1. UPRR Project Area



USACE authorized the permanent closure of the west culvert in November 2012 on an emergency basis (USACE 2012). In December 2013, it became necessary for UPRR to close the east culvert under an emergency authorization from USACE when additional inspections identified the imminent risk of the east culvert failing. The 2013 emergency closure of the east culvert also required the approval of UDWQ.

USACE authorized temporary closure of the east culvert (USACE 2013), and UDWQ provided a conditional Utah 401 Water Quality Certification for this temporary closure (UDWQ 2013).

In January 2014, UPRR submitted individual permit application to the USACE and a Utah 401 Water Quality Certification application and Level I ADR to the UDWQ for proposed project which is the permanent closure of the east culvert and construction of the mitigation (UPRR 2014a). This submittal of supplemental information will support the Utah 401 Water Quality Certification and the Level I ADR for the proposed project.

2.1 Project Permitting Background

By way of review, the project considered for certification is the permanent closure of the east culvert and the construction of an opening through the causeway (bridge) to provide compensatory mitigation, under the U.S. Army Corps of Engineers (USACE) individual permit structure, for the east and west culvert closure. UPRR submitted a permit application to the USACE and a certification application to the UDWQ on January 7, 2014 (UPRR 2014a).The temporary east culvert fill activity was authorized by the USACE Nationwide 14 Permit (NWP) dated December 6, 2013 (USACE 2013) and the Utah 401 Water Quality Certification issued December 16, 2013 (UDWQ 2013).

In September 2013, UPRR provided to the USACE and UDWQ a plan to conduct an impact reevaluation, for the project (east and west culvert closure and compensatory mitigation (bridge construction), which consisted of conducting water and salt balance modeling and preparing a resource evaluation report (UPRR 2013). The impacts reevaluation was completed with the submittal of these documents and the revised proposed compensatory mitigation and monitoring plan (UPRR 2014c, 2014d, 2014e, 2014f). The proposed mitigation consists of a 180-foot-long bridge with a control berm to create a 150-foot-long opening through the causeway, to compensate for the permanent closure of the east and west culverts in the Great Salt Lake causeway.

The UPRR project, permanent closure of the east culvert and construction of compensatory mitigation does not discharge effluent into the Great Salt Lake that would degrade water quality and potentially impair the beneficial uses of the lake. The project, permanent closure of the east culvert, would have an effect on the exchange of water and salt through the causeway. The proposed compensatory mitigation, construction of a 180-foot-long bridge with a control berm to create a 150-foot-long causeway opening, will duplicate, as closely as possible, the transfer of water and salt that was occurring through the causeway with the culverts functioning as documented in November 2012 when it was necessary to close the first culvert (the west culvert).

UDWQ stated in its review comments that the use of the water and salt balance model was accepted and that salinity and salt load may be used as surrogate for water quality parameters of concern (UDWQ 2014b). Therefore, UPRR will summarize the results of the water and salt balance model, and present additional information that consider the temporary and limited effects of the project on the salinity and salt load of the lake.

2.2 Project Design Plans

2.2.1 Permanent Closure of the East Culvert

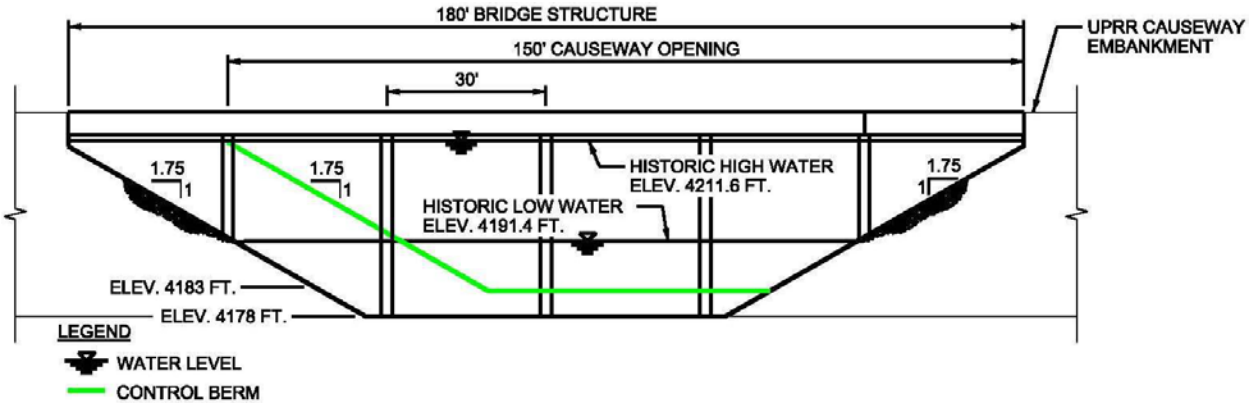
As described in the January 2014 Utah 401 Water Quality Certification application and ADR, the permanent closure of the east culvert would be accomplished by leaving in place approximately 3.650 cubic yards of clean rock previously placed into the culvert under emergency authorization (UPRR 2014a). This is necessary to prevent the collapse of the east culvert and the closing of the railroad causeway to train traffic. The concrete culvert was failing due to settlement and age (original construction in 1959) and was jeopardizing the structural integrity of the railroad causeway.

The east culvert is about 15 feet wide and 23 feet tall and spans the width of the causeway. The invert of the east culvert is at about elevation 4,173 feet (NGVD 29), the top of the causeway is about 4,216 feet (NGVD 29), and the Great Salt Lake is about 20 feet deep at the culvert location.

2.2.2 Mitigation Design Plans

UPRR has developed and submitted in the Compensatory Mitigation and Monitoring Plan (CMMP) conceptual design plans for the proposed project, including constructing and removing the temporary shoofly, constructing the bridge structure, and constructing the control berm (UPRR 2014f). The plans illustrate the 180-foot-long bridge structure including bridge span, side slopes, bridge invert, the control berm, and shoofly geometry. Final design of the structure will be prepared upon approval of the CMMP. Figure 2 illustrates the key geometric features of the proposed bridge structure and causeway opening geometry.

Figure 2. Proposed Bridge and Causeway Opening Geometry



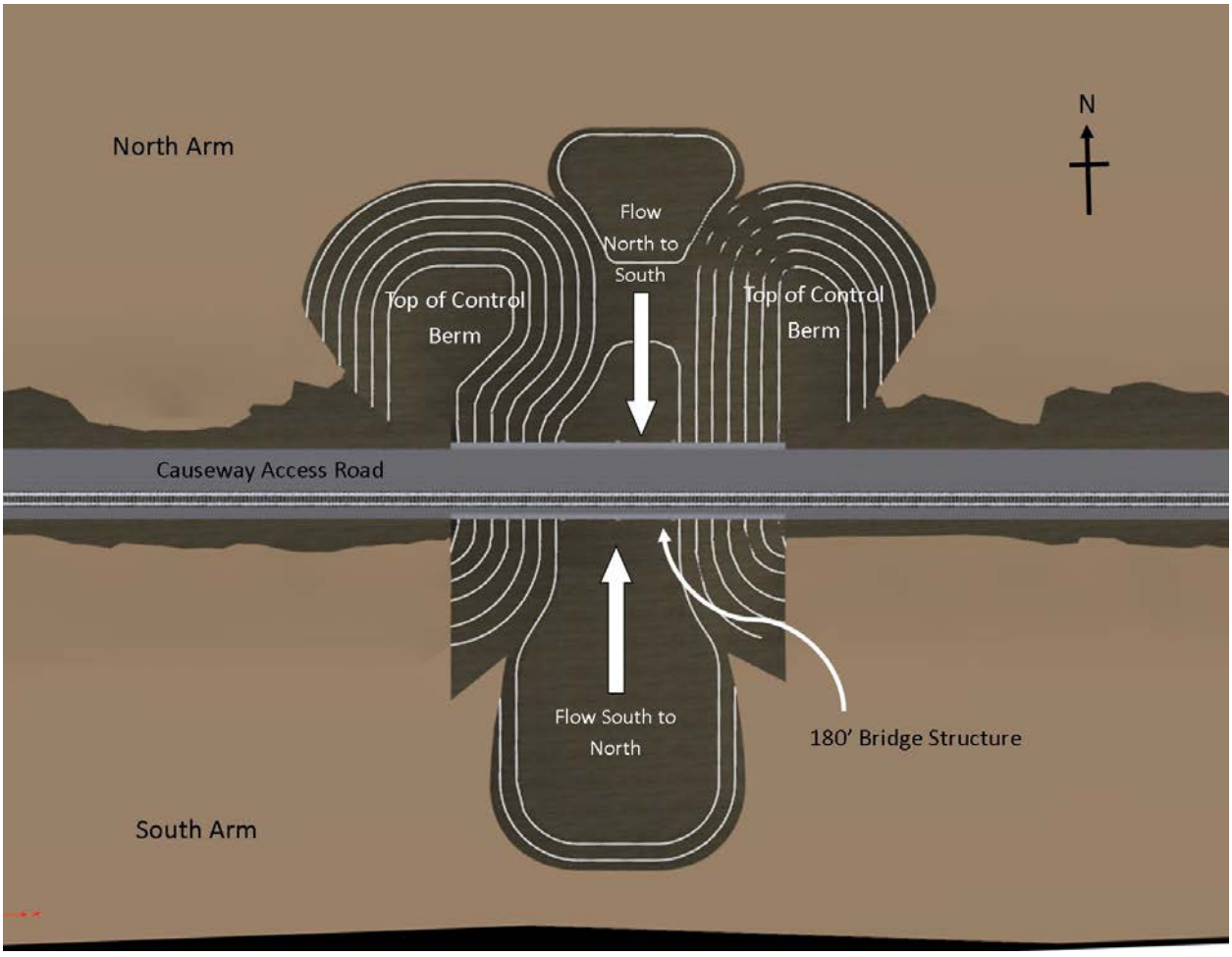
The main elements of the mitigation structure are the 180-foot-long bridge structure and the earthen control berm. The control berm would be located on the north side of the causeway to create an effective 150-foot-long opening through the causeway. The control berm would include a raised invert that elevates the natural lake bed from 4,178 feet to 4,183 feet. This elevated invert caused by the control berm would also restrict north-to-south flows through the causeway.

The control berm geometry was determined by the water and salt balance model to effectively narrow the 180-foot-long bridge structure to a 150-foot-long opening, thereby providing the appropriate ratio of north-to-south flows compared to south-to-north flows as described in the Bridge Evaluation Report

(UPRR 2014c). The model simulations indicated that the causeway with the 150-foot-long opening would most closely duplicate the contribution of salt transfer by the causeway with the culverts before they were closed. UPRR determined that the construction of the 180-foot-long bridge with the control berm to adjust the opening to 150 feet long would be beneficial for implementing adaptive management measures in the future, if required. The control berm would be placed just north of the causeway and may be accessed from the causeway access road. With this configuration, future work may be conducted on the control berm while not directly interfering with the causeway railroad access road, railroad operations, or bridge structure.

Figure 3 presents a conceptual view of the causeway with the bridge structure, railroad causeway access road, and control berm. Additionally, Figure 4, Bridge and Earthen Control Berm (Isometric View, Looking Southeast), on page 12 shows another view of the control berm and bridge structure.

Figure 3. Proposed Bridge and Control Berm Plan View



3.0 Water Quality Standards for Receiving Waters

The proposed project would make permanent the prior emergency closure of the east culvert, which is in the UPRR causeway that crosses the open waters of the Great Salt Lake, specifically between Gilbert Bay and Gunnison Bay and construct an opening (bridge and control berm) through the causeway. The following information is provided for the receiving waters.

3.1 Beneficial Uses

The Great Salt Lake has designated beneficial uses for the different named bays within the lake (Table 1). The proposed project would be located in the UPRR causeway, which borders Gilbert Bay (part of the South Arm) and Gunnison Bay (the North Arm). The project would have no direct impacts on Farmington and Bear River Bays (both located in the South Arm). Therefore, UPRR focuses this analysis on the open waters of Gilbert and Gunnison Bays.

Table 1. Beneficial-Use Classes for Gilbert and Gunnison Bays

Class	Location	Geographical Boundary	Beneficial Uses
5A	Gilbert Bay (South Arm)	All open waters at or below approximately 4,208 feet in elevation south of the UPRR causeway, excluding all of Farmington Bay south of the Antelope Island causeway and salt evaporation ponds.	Protected for frequent primary and secondary contact recreation, waterfowl, shore birds, and other water-oriented wildlife, including their necessary food chain
5B	Gunnison Bay (North Arm)	All open waters at or below approximately 4,208 feet in elevation north of the UPRR causeway and west of the Promontory Mountains, excluding salt evaporation ponds.	Protected for infrequent primary and secondary contact recreation, waterfowl, shore birds, and other water-oriented wildlife. including their necessary food chain

Source: Utah Administrative Code (UAC) R317-2-6, Use Designations, as in effect March 1, 2014

3.2 Water Quality Standards

UDWQ applies numeric and narrative standards to waters of the state to protect designated beneficial uses. Numeric standards refer to specific water quality criteria that are applied to each class of water to protect its beneficial uses. Gilbert Bay (Class 5A) has an established tissue-based standard for selenium (Utah Administrative Code [UAC] R317-14, Numeric Criteria, as in effect March 1, 2014), but no other numeric standards apply to the Great Salt Lake in terms of protecting water quality. The selenium criterion is 12.5 milligrams per kilogram (mg/kg) dry weight in bird egg tissue.

Narrative standards are applied to all waters within the state's boundaries, including the Great Salt Lake. Narrative standards are general statements that prohibit the discharge of waste or other substances that result in unacceptable water quality conditions such as visible pollution or undesirable aquatic life. If a water body does not meet numeric or narrative water quality standards and the beneficial uses of that water body are adversely affected, the water body could be designated as impaired under the federal Clean Water Act and targeted for activities to improve its water quality.

UDWQ previously conducted water quality sampling in the Great Salt Lake to assess ambient water quality and provide information for the future development of numeric water quality criteria for the lake

(UDWQ 2012). UDWQ's strategy recognizes that the numeric criteria might vary based on salinity levels that in turn affect biological and human uses of the lake.

For this project, UPRR considers the effects of permanently closing the east culvert and construction of the new causeway opening on the salinity and salt load of the lake and on the lake's beneficial uses. The project effect would be considered adverse if it resulted in significant changes in salinity such that the lake's beneficial uses were adversely affected.

Neither the Great Salt Lake nor any part of the lake is on or proposed to be included on the state list of impaired waters (UDWQ 2010, 2014c). The list of impaired waters is referred to as the 303(d) list since the listing process follows the regulatory requirements of Section 303(d) of the Clean Water Act. Impaired waters are defined as those water bodies not meeting their beneficial uses. Typically, these waters exceed the water quality standards associated with the designated class or beneficial use.

3.3 Antidegradation Policy

Along with protection of Great Salt Lake for beneficial uses, UDWQ has a statewide antidegradation policy that protects water bodies from activities that could lower or degrade water quality. The policy requirements include review and analyses to determine whether a project would violate water quality standards and impact the beneficial uses of the water bodies. Activities that lower or degrade water quality can be allowed if UDWQ determines that these activities are necessary for important economic or social development. To facilitate this policy, all waters in Utah are designated as Category 1, 2, or 3 waters. The Great Salt Lake is considered a Category 3 water subject to antidegradation reviews (UAC R317-2-12, Category 1 and 2 Waters, as in effect March 1, 2014). Category 3 waters are all waters not designated as Category 1 or 2.

4.0 Compliance with Utah Water Quality Standards

4.1 Analytical Approach for ADR

During the process of reviewing UPRR's original permitting proposal and proposed compensatory mitigation and monitoring plan in 2012 and 2013, federal and state agencies raised a number of concerns about the potential impacts of the project and the sufficiency of the original proposed CMMP, which UPRR submitted in January 2013 pursuant to USACE NWP 14. USACE rejected that CMMP on February 14, 2013, saying:

> [T]he Corps is unable to determine [that] the new causeway breach would adequately replace the functions of the culverts and that it would not cause additional adverse effects to the Great Salt Lake and, therefore, we cannot approve the current mitigation plan.

On February 21, 2013, USACE further stated:

> Additionally, since the emergency authorization was issued, we have received additional comments from the Utah Division of Water Quality underscoring the unknown effects of the culvert closure and new breach construction. There remain uncertainties about the ability for the new breach to provide the same functions as the culverts and the [proposed new] breach exacerbating the differing salinity concentration [differences] between the North and South Arms of the lake.

Among other things, virtually every agency commenting on UPRR's proposal insisted that UPRR update, calibrate, and use the U.S. Geological Survey's (USGS) 1998 Water and Salt Balance Model of the Great Salt Lake, Utah (referred to in this document as the 1998 USGS Model) to evaluate the effects of carrying out UPRR's proposal on the water and salt balance between the two arms of the lake. UDWQ had been raising concerns about the project since 2011, asserting the need for additional studies and the necessity of using the USGS Water and Salt Balance Model (September 8, 2011, letter to the Utah Public Lands Policy Coordination Office). In a March 2013 letter, UDWQ raised similar objections to the January 2013 CMMP and again called for UPRR to update and recalibrate the 1998 USGS Model (March 1, 2013, letter from Utah Public Lands Policy Coordination Office to USACE).

Based on these concerns, USACE stated in its February 21, 2013, letter:

> [T]he Corps suggests UPRR revise its mitigation and monitoring plan to address the Corps' and other agencies' comments and concerns. Further, to help inform the Corps' decision, we strongly encourage UPRR to update the U.S. Geological Survey's Salt Balance Model, working with USGS, to better understand and predict the likely effects of the project on the Great Salt Lake.

In response to these concerns, UPRR undertook a significant re-evaluation of the potential effects of the proposed project in 2013 and met with USACE, UDWQ, and other agencies to coordinate the development of a revised approach. UPRR developed and submitted a comprehensive impacts re-evaluation plan dated September 25, 2013 (UPRR 2013) that reflected this effort. Pursuant to the September 25 plan, UPRR proposed, and has since completed, several studies to support the impacts re-evaluation. The water and salt balance modeling requested by the agencies is the central element of this impacts evaluation. The analytical approach used in these studies to assess project impacts and confirm the mitigation proposal was necessarily tied to the model. Similarly, the results of these studies, the feedback that USACE, UDWQ, and other coordinating agencies provided during regular in-person progress meetings and the resulting CMMP and ADR are likewise tied to this same USGS model–based analytical approach described in the September 25 plan. The results of the modeling and other impacts evaluation studies are summarized below and are referenced throughout this document.

4.2 Supporting Studies

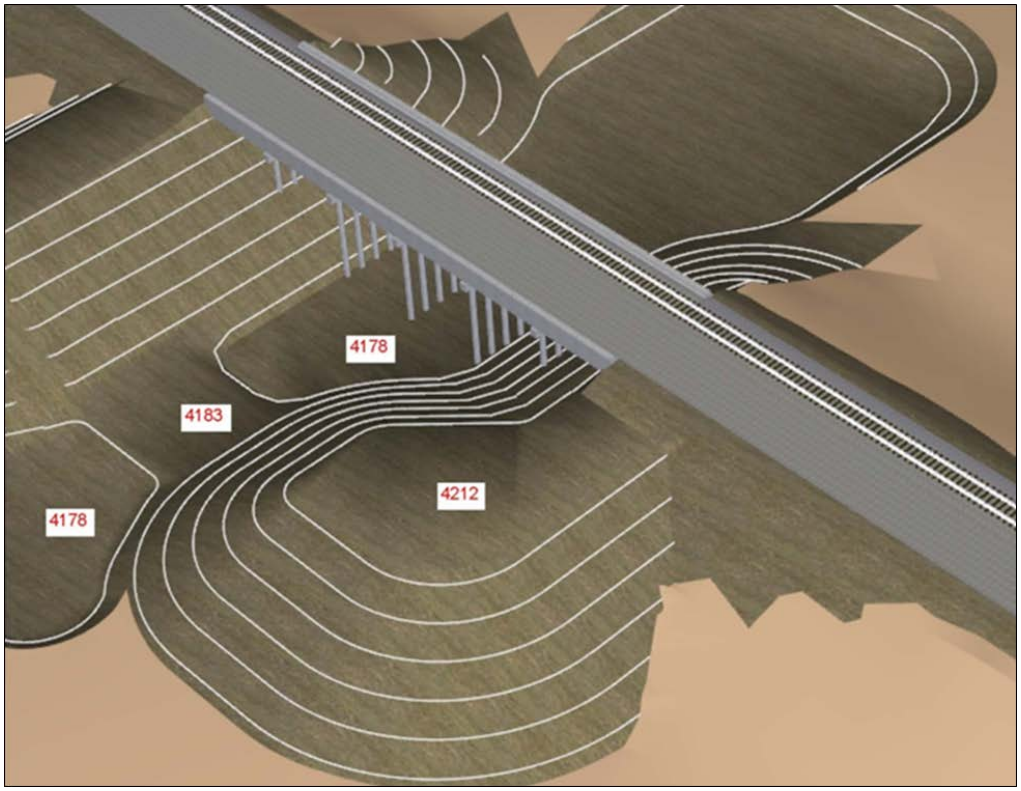
The following additional supporting documents are identified for reference to support the permanent east culvert closure and bridge construction project:

- *UPRR Causeway Water and Salt Balance Modeling Final Report.* USACE and UDWQ have accepted the water and salt balance modeling effort as a proper method to determine the overall effects of the project (permanent closure of the culverts and construction of the mitigation action [causeway opening]). Further, UDWQ has stated that salinity or salt load can be used as a surrogate for parameters of concern (POCs) for the ADR analysis (UDWQ 2014d). The report documents the water and salt balance modeling effort that compares the lake salinity and salt loads as a result of simulated conditions (UPRR 2014c). UPRR updated and calibrated the water and salt balance model to reflect lake conditions for 1987–2012. UPRR, then, conducted simulations to determine and compare lake salinities and salt loads between lake conditions with the proposed causeway opening and lake conditions with the east and west culverts, as represented prior to closure in 2012. The final report concluded that the South Arm of the lake with the proposed 180-foot-long causeway opening is more saline compared to South Arm salinities with the east and west culverts as they were functioning in 2012. This is primarily

attributable to greater north-to-south flows relative to south-to-north flows for the 180-foot-long causeway opening simulation compared to the free flowing culvert simulation. Thus there would be more net salt transfer from the North Arm to the South Arm with the 180-foot-long causeway opening in place than with the free flowing culverts in place.

- *UPRR Causeway Project Bridge Evaluation Report.* This report conducted an evaluation of alternative causeway openings and their effect on lake salinity and salt loads compared to lake salinity and salt loads resulting from free flowing culvert causeway openings. The report concluded with the recommendation to construct a 150-foot-long causeway opening, rather than the originally proposed 180-foot-long causeway opening, as the lake salinities and salt loads resulting from the 150-foot-long causeway opening best matched the lake salinities and salt loads resulting from the two culverts free-flowing and in their 2012 elevation, based on water and salt balance model simulations, for most hydrologic conditions (UPRR 2014d).
- *UPRR Resource Evaluation Report.* This report presented an evaluation of the effects of the project (east culvert closure and construction of a 150-foot-long causeway opening) on lake resources, specifically water chemistry, water quality, deep brine layer, mercury and methyl mercury, biological resources and lake circulation. The report concluded that, using salinity as surrogate for water quality, the project would not result in significant changes in lake salinity and salt loads (water quality) and therefore would not cause an adverse effect on lake resources (UPRR 2014e).
- *UPRR Proposed Compensatory Mitigation and Monitoring Plan.* This plan proposes that construction of a 180-foot-long bridge with a control berm to create a 150-foot-long opening through the causeway as shown in Figure 4 below. The bridge and control berm would duplicate, as closely as possible, the transfer of water and salt that was occurring through the causeway with the culverts functioning as documented in November 2012 when it was necessary to close the first culvert (the west culvert). The plan also proposes monitoring of ambient lake salinity to measure the performance of the causeway opening and adaptive management measures that would be implemented if monitoring triggers are not met (UPRR 2014f).

Figure 4. Bridge and Earthen Control Berm (Isometric View, Looking Southeast)



4.3 Factors Considered

UPRR considered the following factors in the original Level I ADR and provides additional information for the factors in the following section.

Pollutants Affected and Percent Change in Ambient Concentrations of Pollutants. There is no effluent or wastewater discharge of pollutants that would contribute to a percent change in ambient pollutant concentrations in the Great Salt Lake. The project would allow the clean rock fill placed in the east culvert previously, to remain in place, and allow for the construction of a new opening in the causeway. Following the analytical approach, as described in Section 4.1, the water and salt balance modeling results indicated that the construction of the bridge and control berm will duplicate, as closely as possible, the transfer of water and salt through the causeway as did the free flowing culverts (east and west) prior to closure. The water and salt transfer analysis concluded that the North and South Arm salinities and salt loads will be most similar with the proposed bridge and control berm in place, when compared to the free-flowing culverts. UDWQ has stated that, as the use of the water and salt balance model is accepted to determine project effects and salinity or salt load can be used as a surrogate for Parameters Of Concerns (POCs) for the ADR analysis (UDWQ 2014c).

Therefore, if the project results in no significant changes in lake salinity, it is determined that there will be no significant changes in water quality. The water and salt modeling effort resulted in the conclusion that the proposed 150-foot-long causeway opening would result in similar lake salinities, as compared to conditions that would occur with the free-flowing culverts in place; therefore, the project would not

significantly affect water quality, and accordingly the project is designed in a manner that meets the intent of the antidegradation review guidance, that is, the project will meet water quality standards.

Potential Adverse Effects on Aquatic Resources. In accordance with UDWQ guidance, the aquatic environment, namely receiving waters and water quality standards, cannot be degraded such that designated beneficial uses are not protected. UPRR, in coordination with USACE and UDWQ, identified the lake's aquatic resources, in relation with designated beneficial uses, as brine shrimp and brine flies that support the food chain for wildlife that depend on the beneficial uses. Aquatic resources (brine shrimp and brine flies) are dependent on South Arm hydrologic, water quality (salinity) and ecological (that is, predators or shoreline habitat) conditions that could be adversely affected by the project. UPRR focused the aquatic resource evaluation on the South Arm ecology, as diversity and productivity are considerably higher in the South Arm than the North Arm. UPRR water and salt balance modeling shows that the causeway with the mitigation constructed will result in similar South Arm salinities, as compared to South Arm salinities resulting from a causeway with free-flowing culverts, under certain hydrologic conditions (UPRR 2014d). The construction of the bridge and control berm will allow the lake salinities to vary, in response to hydrologic inflows and outflows, in a similar manner as the lake salinities would have varied under free-flowing culvert conditions. The model simulations showed that, under some lake level and hydrologic conditions, a slight increase in South Arm salinities occurred with the 150-foot-long opening in place when compared to the free-flowing culverts.

UPRR conducted a review of South Arm aquatic resources in the Great Salt Lake Causeway Resource Evaluation Report (UPRR 2014e), including effects on brine shrimp cyst production or hatching and brine fly egg deposition. This report concluded that an adverse effect on these resources would not occur as a result of the project because any changes to lake salinity caused by the project were projected to be within the historic variability when compared to the historic lake salinity variability that would have occurred with the free-flowing culverts in place. UPRR determined that the project would not adversely change the variable South Arm salinity compared to the variable salinity of the South Arm with the free-flowing culverts, based on the water and salt balance modeling. Therefore, the project would not change the lakes ecological conditions for aquatic resources of the lake, compared to free-flowing culvert conditions, and would not cause a significant adverse effect on beneficial uses, meeting the intent of the state antidegradation policy.

Likelihood for Long-Term Water Quality Benefits. The mitigation project, construction of a 180-foot-long bridge and control berm structure, allows for future modifications to change the amount of water and salt transfer through the causeway. Specifically, the width and depth of the causeway opening could be enlarged or restricted to increase or decrease the exchange of water and salt through the causeway to meet lake management objectives. The construction of the bridge and a control berm structure could provide water quality benefits if lake managers use the structure to achieve specific salinity and water quality objectives.

The 1987–2012 UPRR/USGS Model is now completed, in coordination and under peer review from USGS and UDWQ. This model can be used by regulating agencies, stakeholders and interested parties to evaluate various hydrologic conditions, future causeway modifications and other natural or man-made influences to the lake and its resources. The availability of this tool could be used to assist in lake management and decisions.

4.4 Short-Term Project Effects

The construction of the bridge and control berm is planned for completion in November 2015. Once the construction is complete and the bridge and control berm are operating, water and salt transfer through the causeway will be provided in a similar manner as the free-flowing culverts provided water and salt transfer through the causeway. The water and salt balance modeling projects that the lake will respond to hydrologic inputs, as it has reacted in the past, and that the transfer of water and salt through the causeway will occur simultaneously. Therefore there is no period of time between the opening of the compensatory mitigation and the permanent closure of the east culvert when the water quality will be impacted.

UPRR determined and reported in the water chemistry portion of the resource evaluation that salinity data collected during the opening of the 300-foot-long bridge in 1984 would suggest that a short term, post-construction effect would occur (UPRR 2014e). It is expected that for a short duration rapid changes in lake salinity and water surface elevation would occur, until the water and salt transfer through the causeway with the new 150-foot-long opening equilibrates, then the lake salinity and water surface elevation would vary naturally, according to hydrologic inflows and outflows. This short term post-construction effect would not affect ambient concentrations of water quality pollutants but would affect lake salinity, based on existing lake levels and salinities at the time the new opening is operating, causing a temporary and limited effect on lake salinities. This effect would be temporary and would be limited in extent, as was demonstrated when the existing 300-foot-long bridge opening was constructed and operated in 1984.

4.5 Long-Term Project Effects

As discussed in the Utah 401 Water Quality Certification application, UPRR was in the process of conducting water and salt balance modeling as part of the project impacts re-evaluation. The UPRR modeling effort included updating and recalibrating the 1987–1998 USGS Water and Salt Balance Model (USGS 2000) and conducting simulations under various hydrologic cycles (wet, mild and dry). This effort was completed with the submittal of the Great Salt Lake Causeway Final Modeling Report (UPRR 2014c) and Great Salt Lake Causeway Bridge Evaluation Report (UPRR 2014d).

UPRR conducted simulations comparing the lake salinity and salt load resulting from a causeway with free-flowing culverts and a causeway with various causeway openings. The simulations that resulted in the most closely matched salinity and salt load comparisons were determined to meet the mitigation objective, which was to duplicate, as closely as possible, the transfer of water and salt through the causeway that was occurring with the culverts functioning as documented in November 2012, when it was necessary to close the first culvert (the west culvert).

The bridge evaluation report presented the water and salt balance model simulation of lake salinity and salt loads comparisons for the free-flowing culvert and 150-foot-long opening simulations (UPRR 2014d). The water and salt balance modeling results indicate that the water and salt transfer through the causeway with the proposed mitigation will best match the water and salt transfer through the causeway with the culverts, prior to closure and meet the mitigation objective.

UPRR determined that the slight increase in net water and salt transfer to the South Arm, at certain lake levels, would be within lake historical salinity range and, therefore, would not adversely affect the lake's aquatic resources and the lake's beneficial uses (UPRR 2014e). Therefore, the project would not exceed the lake's water quality standards and therefore would meet the State of Utah's antidegradation policy of being limited and non-degrading.

The mitigation project, consisting of the construction of a 180-foot-long bridge and control berm structure to create a 150-foot-long causeway opening, allows for future modifications of the causeway opening. Specifically, the width and depth of the causeway opening could be enlarged or restricted to increase or decrease the exchange of water and salt through the causeway to meet a lake management objective. Currently there is no lake management objective (with respect to maintaining a specific South Arm and North Arm salinity or salt load) so that analysis of any future causeway opening activity to modify the control berm is outside the scope of the UPRR project analysis.

5.0 Water Quality Monitoring

UPRR will be conducting ambient lake water quality monitoring for salinity parameters, after the construction of the bridge structure and berm is completed and operational. Post-construction water quality monitoring is outlined in the proposed CMMP (UPRR 2014f), and is summarized below:

- Ambient water quality will be conducted quarterly at one North Arm site and three South Arm sites
- Monitoring parameters include: total water depth, specific conductivity, temperature, specific gravity, density and total dissolved solids
- Quarterly and annual monitoring reports will be submitted to the USACE and UDWQ

In addition to the water quality monitoring described above, UPRR will collect and report monthly measurements of the bi-directional flow through the new causeway opening. The monthly bi-directional flow measurements could be used to support future lake water and salt balance modeling simulations.

6.0 Summary

This Level I ADR report provides additional information regarding the project's effects on the lake's water quality that was not available when UPRR submitted the Utah 401 Water Quality Certification application for the permanent closure of the east culvert and the construction of a bridge to offset the impacts of permanent east and west culvert closures in January 2014. The information supplied by the project impacts re-evaluation is itemized below and summarized in this document:

- UPRR/USGS water and salt balance modeling final report, April 2014 (UPRR 2014c)
- Bridge Evaluation Report, June 2014 (UPRR 2014d)
- Resource Evaluation Report, July 2014 (UPRR 2014e)
- Proposed Compensatory Mitigation and Monitoring Plan, January 2015 (UPRR 2014f)

The permanent closure of the east culvert and construction of the mitigation is not associated with any effluent discharges that would degrade the lake's water quality. UPRR applied the agency-accepted analytical approach of using the water and salt balance model to determine project effects on lake salinities and salt loads. The analysis concludes that the project would not significantly change the lake salinity and salt loads. UDWQ stated that salinity and salt load may be used as a surrogate for the water quality impacts evaluation. Therefore, UPRR prepared this report, summarizing the analysis conducted to determine that the project, permanent east culvert closure and construction of a 180-foot-long bridge and control berm to create a 150-foot-long causeway opening, would not cause a significant adverse effect on the lake's aquatic resources and the lake's beneficial uses and that any minor project effects would be temporary and of limited extent. Therefore, the project is consistent with the State's Level I antidegradation review policy.

7.0 References

[UAC] Utah Administrative Code

2014 R317-2-7, Water Quality Standards, as in effect March 1, 2014. Accessed May 5, 2014.

[UDWQ] Utah Division of Water Quality

2010 2010 Utah Integrated Report Water Quality Assessment 305(b) Report/USEPA Approved 303(b) List. Available online at www.waterquality.utah.gov/WQAssess/PreviousIR.htm.

2012 Core Component 2: Strategic monitoring and Research Plan. April.

2013 Approved 401 Water Quality Certification with Conditions. Water Quality Certification No.: SPK 2011-00755. Temporary East Culvert Closure Project, Great Salt Lake Causeway. December 16.

2014a Utah Integrated Report Water Quality Assessment 305(b) Report/USAEPA. Draft 2012-2014 Report. Available online at http://www.waterquality.utah.gov/WQAssess/currentIR.htm

2014b Letter to UPRR, subject "Notification of Requirements to prepare a Level II Antidegradation Review." Temporary East Culvert Closure Project, Great Salt Lake Causeway. February 25.

2014c Utah Integrated Report Water Quality Assessment 305(b) Report/USEPA. Draft 2012–2014 Report. Available online at www.waterquailty.utah.gov/WQAssess/currentIR.htm.

2014d Letter to UPRR, subject "Level II Antidegradation Review Comments." May 9.

[UPRR] Union Pacific Railroad

2013 Letter to USACE, subject " UPRR- Great Salt Lake Causeway, Culvert Closure and Bridge Construction Project – SPK-2011-00755." Dated September 25.

2014a USACE Individual Permit and UDWQ 401 Certification Applications. Permanent East Culvert Closure and Bridge Construction Project, Great Salt Lake Causeway. January 7.

2014b Interim Monitoring Plan. Revised March 10.

2014c Great Salt Lake Causeway Final Water and Salt Balance Modeling Report. April 4.

2014d Great Salt Lake Causeway Culvert Closure and Bridge Construction Project, Bridge Evaluation Report. June 2.

2014e Great Salt Lake Culvert Closure and Bridge Construction Project, Resource Evaluations. July 1.

2014f Great Salt Lake Culvert Closure and Bridge Construction Project, Revised Proposed Compensatory Mitigation and Monitoring Plan. November 7. Resubmitted January 7, 2015.

[USACE] United States Army Corps of Engineers

2012 Nationwide 14 Permit SPK-2011-00755. UPRR Causeway West Culvert Closure and Bridge Construction Project. August 29.

2013 Nationwide 14 Permit SPK-2011-00755. Temporary East Culvert Closure, Great Salt Lake Causeway. December 6.

[USGS] United States Geological Survey

2000 Water and Salt Balance of Great Salt Lake, Utah, and Simulation of Water and Salt Movement through the Causeway, 1987–98. In cooperation with Utah Division of Forestry, Fire, and State Lands, Utah Department of Natural Resources, and Tooele County, UT. Water-Resources Investigations Report 00 4221.