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October 16, 2012

Mr. Lance Calvert  
Public Works Director  
City of West Linn  
22500 Salamo Road  
West Linn, Oregon 97068

Re: Lake Oswego – Tigard Water Partnership Project

Dear Mr. Calvert:

As requested, Murray, Smith & Associates, Inc. (MSA) has prepared this letter report to summarize the significance of the Lake Oswego-Tigard Water Partnership (LOTWP) project to the City of West Linn (City) in the context of the City's Water System Master Plan (WSMP) and Capital Improvement Program (CIP), to document a meeting with representatives of the LOTWP and to summarize the assessment of additional information provided by the LOTWP at the request of the City's Utility Advisory Board (UAB).

### **Summary of Findings**

- LOTWP's proposed expansion meets the City's needs for a reliable backup supply system with adequate year-round capacity
- The amended intertie agreement adopted by the cities of Lake Oswego and Tigard commits to providing backup water at the City of West Linn's average day demand of 4 million gallons per day (mgd) through 2041
- LOTWP's proposal to provide this upgraded backup supply at no cost to the City saves \$2.2 million over the intertie enhancement cost assumed in the WSMP
- The City's next best alternative to meeting backup supply reliability needs is to construct a new finished water transmission main at a cost of \$11.6 M, not included in the WSMP CIP budget, and the reliability of this alternative is substantially less than that offered by the full redundancy of LOTWP's new intake, pipeline, and water treatment plant (WTP)
- LOTWP can provide the City with access to significant storage and other water supply sources, including the City of Portland's, as further reliability enhancements
- LOTWP's proposed upgrade allows construction of the Bolton Reservoir on the preferred existing site, and allows downsizing from 8 MG to 4 MG

## Background

The City adopted the current WSMP in November 2008 (Resolution No. 08-44). The CIP for the water system included in the Master Plan report includes approximately \$31 million (2008 dollars) in system capital improvement and capital maintenance projects.

One of the primary focus areas in the WSMP is the identification of appropriate distribution system water storage volumes for emergency conditions, specifically considering water supply reliability and redundancy. The WSMP documented the following key findings:

- *Bolton Reservoir replacement is a high priority improvement* – The existing Bolton Reservoir structure is approximately 100 years old and observations summarized in the City's current and past (1982, 1987, 1999 and 2004) WSMP documents indicate the reservoir has reached the end of its useful life. In addition, the reservoir's hypalon cover, installed in 1989, has also reached the end of its useful life and will require replacement if full reservoir replacement does not occur soon.
- *Recommended storage volume* – The recommended storage volume of the Bolton Reservoir replacement is directly related to the vulnerability of City's supply source and the assessment of available backup supply.
- *Water supply vulnerability* – The City's sole source of water supply, from the South Fork Water Board (SFWB) WTP located in Oregon City, is vulnerable to disruption at critical single points of failure at multiple locations. As documented in the WSMP, the single greatest risk of supply disruption is at the City's 24-inch diameter transmission main crossing of the Willamette River which is suspended from the I-205 bridge. Several other elements of the SFWB supply system also lack redundancy, including the Division Street Pump Station and the segment of the transmission main extending from the pump station to the Willamette River crossing.
- *Availability of backup supply from Lake Oswego* – The City currently has an emergency intertie with the City of Lake Oswego that allows the City to boost water from Lake Oswego's finished water transmission main into the City's distribution system in the event of an emergency which disrupts the City's SFWB supply. However, during the summer season when water demands are high, Lake Oswego lacks available water supply capacity in order to meet the needs of its customers and provide adequate temporary water supply to the City during an emergency. In addition, the Lake Oswego water supply and the City's SFWB supply are both vulnerable to supply disruptions associated with the common Clackamas River water source.
- *Recommended strategy and storage volume* – The WSMP identified a major vulnerability in the City's water supply and presented three alternatives for establishing the recommended emergency storage volume required for the City's water system, in the context of meeting water supply needs during maximum day demand (MDD) conditions:
  1. Construct a parallel river crossing: This alternative focused on constructing improvements to address the most vulnerable portion of the City's water supply system, the I-205 bridge crossing of the Willamette River. Construction of a parallel Willamette River crossing would provide redundant transmission across

the river, reducing the risk of a supply disruption due to the loss of this transmission main. This alternative was not recommended because of the high capital cost and because it does not directly address other vulnerabilities, including the remaining segments of the transmission main system on both sides of the Willamette River.

2. Construct additional distribution system storage: This alternative focused on constructing additional distribution system storage, in the form of an 8 million gallon reservoir to replace the existing Bolton Reservoir, to provide for water supply in a supply disruption emergency. This alternative was also not recommended because of the high capital cost, and this alternative provides only limited benefit as distribution system storage only has a limited capacity to serve customers without additional supply to the system. The proposed Bolton Reservoir would contribute approximately one day of emergency supply.
3. Secure reliable peak season emergency supply: This alternative recognized the potential benefit of coordinating with the City's neighbor – the City of Lake Oswego – and other municipal water providers to utilize existing infrastructure and emergency connections to gain access to alternate supply sources. This alternative involved development of agreements and potential construction of new intertie facilities to secure emergency supply capacity from the Portland Bull Run source. This alternative was selected as the preferred approach as it presented the City with an opportunity to secure access to adequate and reliable backup water supply.

## **Meeting Summary**

At the direction of the City, representatives from MSA (Brian Ginter) met with members of the LOTWP project team (Joel Komarek, City of Lake Oswego; Dennis Koellermeier, City of Tigard; Jon Holland, Brown & Caldwell) and City staff (Jimmy Whynot) on August 16, 2012, to assist the LOTWP with interpretation of the WSMP's analysis, findings and recommendations. Through this discussion, the LOTWP team refined their narrative of project benefits to support the pending land use application(s) for the proposed LOTWP project elements within the City of West Linn.

MSA was directed by City staff to prepare a summary of the meeting and an independent assessment of the significance of the LOTWP's proposed project to the City's selected water supply redundancy and storage capacity strategy for presentation and discussion with the City's UAB.

## **Significance of LOTWP Projects to the City's Master Plan Recommendations**

As described earlier in this report, one of the primary recommendations of the City's adopted WSMP is the development of intergovernmental agreements (IGAs) and facilities necessary to secure access to a redundant source of supply. The recommended capacity of the proposed Bolton Reservoir replacement project is linked to the successful development of a reliable backup supply.

The LOTWP project is a key element of establishing reliable emergency supply for the City. The City has worked with the cities of Lake Oswego and Tigard to develop the required IGAs and to better understand the potential for development of a backup water supply source. Through this process, the LOTWP has confirmed a couple of key conditions:

1. In order for the City of Lake Oswego to reliably provide emergency water supply to the City during the summer season, expansion of the Lake Oswego Water Treatment Plant and other associated facilities, including upsizing the Raw Water Pump Station and Raw Water Transmission Main, as proposed by the LOTWP project are required.
2. The LOTWP has determined that intertie facilities with the Washington County Supply Line are not beneficial, and as such, will not be pursued. This decision is based on water quality concerns associated with blending chlorinated and chloraminated water, and the low likelihood that additional peak season capacity will be available in this transmission main based on the current allocation of the pipeline capacity. *The capital cost, approximately \$2,200,000 (2008 dollars), associated with development of emergency supply included in the WSMP CIP, was for this proposed intertie and associated facilities.*
3. Lake Oswego has inadequate available supply capacity today to provide the City with reliable emergency water supply during construction of the Bolton Reservoir replacement project. During construction, the City will be without a major source of water to maintain service during a short duration supply disruption. It is essential that measures to mitigate this risk during construction be taken. Assuming construction of the Bolton Reservoir replacement project is to begin after the summer of 2014, the LOTWP project will make adequate water supply available for the summer of 2015 as construction continues without the Bolton Reservoir on-line.
4. Conditions of the proposed IGA with the LOTWP and future regional water demand growth may limit the future availability of reliable backup supply during the peak season. Availability is not anticipated to be of concern for approximately 30 years.

If the City is unable to negotiate the necessary agreements with the LOTWP, then the City must reconsider alternatives to address the risk of emergency supply disruptions. In order to quantify the economic value of establishing agreements with the LOTWP, the other two alternatives considered in the WSMP were briefly reconsidered and one alternative was updated to reflect current known conditions.

Based on recent analysis, construction of a larger Bolton Reservoir Replacement is likely infeasible at the current site, and limited alternative sites exist for such a large volume of storage. As previously stated, this alternative also provides a reduced level of reliability as it only provides for one day of emergency supply from storage and does not provide any true measure of supply redundancy. *Further consideration of this alternative is not recommended.*

Construction of a parallel Willamette River crossing would address a major vulnerability, but still leaves several points of potential supply transmission failure. Based on the WSMP and

follow-on investigations of the City's transmission main, construction of parallel piping from the Division Street Pump Station to the beginning of project CIP-65 (replacement of 18-inch diameter transmission main from Broadway Street and Buse Street to Bolton Reservoir) would be required to address the most vulnerable elements of the City's water supply system. *Loss of supply at the SFWB WTP, finished water pipeline, or Division Street Pump Station is not addressed by these improvements.*

The total cost of needed improvements associated with the parallel river crossing option, not recommended in the WSMP, to improve transmission system reliability (if IGAs for emergency supply are not secured) is summarized below.

<b>Project</b>	<b>Estimated Project Cost (2012 Dollars)</b>
Parallel Transmission Main – Division Street Pump Station to Willamette River	\$ 2,140,000
Willamette River Crossing	\$ 9,000,000
Parallel Transmission Main – Willamette River to CIP 65	\$ 440,000
<b>TOTAL</b>	<b>\$ 11,580,000</b>

### **Presentation of Findings to the UAB**

The findings of the assessment described above were presented in preliminary form to the UAB on September 11, 2012. During this presentation, the UAB asked for clarification and additional information requiring follow-up and information from the LOTWP. Two key questions were asked by the UAB:

- What makes the LOTWP water supply system more reliable than West Linn's SFWB supply? Specifically, contrast the river intakes, the new submerged crossing versus West Linn's bridge crossing, and the reliability of the upgraded LOWTP in the event of a major earthquake event.
- What are the LOTWP's emergency water supply plans if an event occurs which impacts all supplies relying on the Clackamas River source, and what does this mean for the City?

The LOTWP provided MSA with detailed documentation to address both questions. This data was reviewed and a summary of the information provided is presented below as a response to the questions posed by the UAB.

### ***LOTWP Project Reliability***

The proposed LOTWP project includes major upgrades and/or construction of new facilities for all elements of the water supply system. As such, these facilities are all being designed to meet or exceed current building code requirements and are being designed to the highest standards with consideration of the need for redundancy and high reliability to supply the LOTWP's needs. A brief description of each element of the supply facility follows.

*River Intake and Pump Station:* The new river intake structure will house three independent fish screens, allowing each screen and pump bay to be isolated in the event that damage to a screen occurs from debris in the river (as happened to the SFWB intake this past winter). In addition, the new intake screens will be protected by an upstream debris deflector, and the screens can be lifted out of the river flow to an elevation above the 500-year flood level. These are all reliability features not included in the SFWB intake design. Furthermore, the new intake structure is being designed to withstand seismic overturning and the simultaneous buoyancy of a 10-year flood event – a conservative standard for dams applied by the Bureau of Reclamation – with an extensive system of 14 rock anchors drilled and grouted into 30 feet of rock.

*Raw Water Pipeline:* The LOTWP's new raw water transmission main will be constructed using cathodically protected, double lap welded ¼-inch thick steel pipe with interior lining and exterior coatings. An independent, third party review of the proposed pipeline material and design (*Lake Oswego Seismic Pipeline Design, Seismic Design Final Memorandum, Degenkolb, August 3, 2012*) verified the pipeline system design addresses the seismic risk associated with a 2,475 year return period event. As previously discussed, the City's water transmission main crossing of the Willamette River is highly vulnerable and has experienced multiple disruptions in service.

*Water Treatment Plant:* The upgraded and expanded LOTWP WTP is being designed to the same standard as the pipeline and intake, with measures in place to protect it from a seismic event with 2,475 year recurrence interval. A system of nearly 1,000 auger-cast piles is being designed to protect the new facility from ground movement and possible liquefaction associated with such a seismic event.

No effort has been made in this report to specifically contrast these design criteria with that of the SFWB WTP. The purpose of this description is to illustrate the specific measures being taken by the LOTWP to assure these facilities remain in service following a major seismic event.

### ***Emergency Water Supply Plans***

As described above, the UAB expressed concern that depending on the LOTWP as an emergency supply for the City may have limited benefit if an emergency condition occurs which impacts all water suppliers relying on the Clackamas River as the source of water. If such an event were to occur, the LOTWP has several emergency provisions in place to continue to provide water to its customers. The first option for both Tigard and Lake Oswego during a short duration supply disruption is the distribution system water storage in each of their respective systems. Tigard has 27 million gallons (MG) of storage and Lake Oswego has 24 MG of storage, plus a proposed addition of 2 MG in the clear well at the new water treatment plant. The combined 53 MG of storage between the two systems is adequate to supply customers through four average day's demand levels.

The City of Tigard also has a system of two aquifer storage & recovery (ASR) wells with a recovery capacity of approximately 5.5 million gallons per day (mgd) for 60 days or longer.

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In addition, the City of Tigard will maintain its connection with the City of Portland. This connection has approximately 8 mgd of capacity.

This additional storage volume, ASR capacity and connection to the City of Portland will achieve the recommended approach to addressing supply reliability needs outlined in the City's WSMP.

## Summary

This letter report summarizes the significance of the LOTWP project to the City in the context of the City's WSMP and CIP, documents the meeting with representatives of the LOTWP and summarizes the assessment of additional information provided by the LOTWP at the request of the City's UAB. This memorandum presents a synopsis of relevant data for City stakeholders as they review the current status of water system supply and storage strategies.

We appreciate the opportunity to be of service to the City. We would be pleased to further review the report and its findings with you and other City staff, the UAB, City Council or other interested parties.

Sincerely,

MURRAY, SMITH & ASSOCIATES, INC.



Brian Ginter, P.E.

Associate

BMG:mlm

cc: Mr. Jimmy Whynot, City of West Linn  
Mr. Jon Holland, Brown & Caldwell  
Mr. Joel Komarek, City of Lake Oswego  
Mr. Dennis Koellermeier, City of Tigard