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October 6, 2015

**VIA ELECTRONIC FILING**

Public Utility Commission of Oregon  
Attention: Filing Center  
201 High Street SE Suite 100  
Post Office Box 1088  
Salem, Oregon 97308-1088

Re: **LC 60 – NW Natural’s 2014 Integrated Resource Plan  
Response to Staff’s Comments on the North Mist Expansion Update**

Northwest Natural Gas Company, dba NW Natural (“NW Natural” or the “Company”), hereby submits a response to Staff’s Comments on the Company’s May 29, 2015 IRP Update relating to the completion of its analysis of a North Mist expansion.

Please call me if you have any questions or require any further information.

Sincerely,

NW NATURAL

*/s/ Gail A. Hammer*

Gail A. Hammer  
Rates & Regulatory Affairs

Enclosure

**Response to Staff's Comments**  
**North Mist Analysis**  
**2014 IRP**  
**October 2015**

This filing represents NW Natural's response to Staff's Comments and has a primary objective of clarifying the large change in the estimated cost of a North Mist expansion project for Core customers.<sup>1</sup> Staff's Comments regarding the Company's North Mist analysis, filed May 29, 2015 in fulfillment of Action Item 2.3.a of the 2014 IRP,<sup>2</sup> appear to characterize the change from the earlier cost estimate, which formed the basis for analysis in the 2014 IRP, and the later estimate, which formed the basis for analysis in the May Update, as resulting from an error.<sup>3</sup> This change did not result from an error, but rather as a result of the two estimates being prepared at different times and for different purposes.

In this filing NW Natural:

- Identifies the specific North Mist project that was included as a prospective resource in the 2014 IRP and the May 2015 Update.
- Discusses the multiple reasons behind the large increase from the first estimate to the second for one configuration of the project; and
- Discusses the different types of cost estimates which generally form the basis for analysis in the Company's IRPs.

This filing includes an appendix in which NW Natural addresses Staff's other concerns related to the analysis associated with the May Update. NW Natural understands these concerns of Staff<sup>4</sup> to include:

- The magnitude of differences in the estimated Present Value of Revenue Requirements (PVRR) for the three North Mist alternatives analyzed in the May Update;
- Whether North Mist remains a resource in the 2014 IRP's least cost resource portfolios; and
- The omission of a real options analysis associated with Alternative 1 of the North Mist project in the May 2015 Update.

**Clarification of North Mist Projects**

NW Natural can appreciate that there may be confusion regarding what "North Mist" is as a project. More specifically, there is North Mist, the standalone project for Portland General Electric (PGE) and North Mist, the project that includes some resources shared with PGE but is for Core customers. NW Natural, in the 2014 IRP and the May Update as well as this update, is referring to the North Mist project that will be for the intended use by Core customers. More specifically, NW Natural's analysis of a North

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<sup>1</sup> As used in this filing, Core customers specifically exclude Portland General Electric.

<sup>2</sup> See page 1.21 of NW Natural's 2014 IRP.

<sup>3</sup> See page 2 of Staff's Comments filed August 18, 2015. NW Natural is unclear regarding Staff's characterization of the difference between the two estimates, as Staff's Comments have the term "error" (or "errors") in quotation marks at each appearance.

<sup>4</sup> See page 2 of Staff's Comments.

Mist expansion in the 2014 IRP was of a prospective resource for use by Core customers. As mentioned above, this is a different facility and a different project than the current North Mist project that involves developing a resource to serve Portland General Electric (PGE). The project discussed in the 2014 IRP<sup>5</sup> included a 20-inch transmission pipeline with use shared by Core customers and PGE in, respectively, 100 MDT/day and 120 MDT/day capacity proportions, which represented the parties' respective requirements. Additionally, the project used in the 2014 IRP included different reservoirs and other features for Core customers than are in the PGE project. Whereas, the North Mist expansion project to provide service solely to PGE under Rate Schedules 90 and 91 is a different project; one which includes a non-shared 16-inch transmission pipeline.

### **North Mist for Core Cost Estimates**

NW Natural contracted with Willbros to perform a Front End Engineering Design (FEED)<sup>6</sup> study associated with a North Mist expansion to provide service for PGE. The project for PGE is similar to the project for Core customers, and the Company therefore considers the two projects as analogous. NW Natural used an early version of the FEED study, and incorporated cost estimates resulting from detailed engineering—adjusted for the engineering and constructing of a larger, shared transmission pipeline—into the 2014 IRP analysis. The \$73.5 million cost estimate for a North Mist project for Core customers represented the best information regarding a new development project using time and materials contracting for construction services available to NW Natural at the time the Company analyzed resource alternatives for the 2014 IRP.

NW Natural used an estimated PVRR based on the estimated \$73.5 million cost for North Mist in assessing alternative portfolios of resources in the 2014 IRP using SENDOUT®.<sup>7</sup> Portfolio optimization results included North Mist as a component of the lowest cost portfolio irrespective of which alternative future examined in the 2014 IRP unfolds.<sup>8</sup>

NW Natural's May 2015 Update included analysis of three alternative configurations of a North Mist expansion project for Core customers. Alternative 1 is the North Mist configuration analyzed in the

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<sup>5</sup> See; e.g., pages 3.23 through 3.25 of the 2014 IRP.

<sup>6</sup> See; e.g., EPCengineer's definition at <http://www.epcengineer.com/definition/556/feed-front-end-engineering-design> or Wikipedia's at [https://en.wikipedia.org/wiki/Front-end\\_engineering](https://en.wikipedia.org/wiki/Front-end_engineering) (both accessed August 26, 2015), including the latter's characterization of cost estimates included in a FEED as "rough investment costs."

<sup>7</sup> NW Natural used investment cost estimates to develop revenue requirements associated with multiple prospective resources examined in the 2014 IRP, including not only North Mist, but also the Clark County gate/distribution system upgrades, the South Salem Feeder, the Christenson Compressor project, and a Clark County LNG storage resource. See pages 7.4 through 7.17.

<sup>8</sup> See page 7.18 of the 2014 IRP.

2014 IRP.<sup>9</sup> NW Natural used an estimated cost of \$114.0 million to develop revenue requirements for analysis of a North Mist expansion project to serve Core customers in the Update. NW Natural based this estimate on a fixed price Engineering, Procurement, and Construction (EPC)<sup>10</sup> bid associated with a North Mist project for PGE's sole use submitted by AECOM<sup>11</sup> in November 2014. AECOM used the results of both fixed price and time and materials bids submitted by prospective subcontractors and suppliers as the basis for developing the cost estimate included in its EPC bid.

There are five primary reasons for the increase in estimated cost between the estimate NW Natural used in the 2014 IRP and based on Willbros FEED Study and the estimate used in the May 2015 Update and based on AECOM's 2014 EPC bid:

1. More detailed engineering indicated the need for additional compression. This increased the estimated cost used in the IRP by approximately \$12 million.
2. The cost of construction labor escalated in accordance with subcontractors' contracts over the timeframe.<sup>12</sup>
3. The *per diem* cost associated with the skilled labor required for the horizontal directional drilling (HDD)<sup>13</sup> required by Alternative One increased over the intervening timeframe. This resulted from market dynamics, as this specialized labor does not reside locally and *per diem* costs increased due to demand associated with HDD activity elsewhere.
4. Additional increases in the cost of HDD associated with pipeline construction in the Columbia River floodplain.
5. The management fee in the fixed price EPC bid was not included in the original estimate.<sup>14</sup>

It is important to note that NW Natural will rebid the fixed price EPC associated with the North Mist project for PGE, including opening it to additional bidders. This is currently planned to take place in early

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<sup>9</sup> See pages 7 and 8 of the May Update.

<sup>10</sup> See; e.g., EPCengineer's definition at <http://www.epcengineer.com/definition/132/epc-engineering-procurement-construction> (accessed August 26, 2015).

<sup>11</sup> AECOM's website describes the company as "...a premier, fully integrated professional and technical services firm positioned to design, build, finance and operate infrastructure assets around the world for public- and private-sector clients." See at <http://www.aecom.com/News/Fact+Sheet> (accessed August 31, 2015).

<sup>12</sup> Note that the 2014 IRP resource analysis was based on \$2013 and costs included in the May Update were expressed in \$2015. See page 7 of the Update and page 2 of Staff's Comments.

<sup>13</sup> See; e.g., Wikipedia's definition at [https://en.wikipedia.org/wiki/Directional\\_boring](https://en.wikipedia.org/wiki/Directional_boring) (accessed August 26, 2015).

<sup>14</sup> This resulted from NW Natural's assumption at the time that the customer would assume the price risk for the development and not the contractor as part of a fixed price EPC contract.

2016 and, if appropriate, NW Natural will use the updated cost estimates as a basis for developing an updated estimate of a North Mist for Core project for use in the Company's 2016 IRP.<sup>15</sup>

NW Natural notes that the cost estimate forming the basis for the cost estimate used in the 2014 IRP and the cost estimate forming the basis of a cost estimate used in the May 2015 filing differ in time, specificity with respect to engineering, and in the degree of uncertainty regarding the point estimate of cost embedded in each of these two estimates. Additionally, cost estimates typically evolve over time, as discussed below. As NW Natural tries to use the best information available when developing an estimate, increases and decreases in cost are not "errors," which may imply a mistake when correct information was available, but reflections of the aggregation of additional design details, fluctuation in labor and material costs, and refinements in scope.

### **Cost Estimates for IRP Resources**

NW Natural endeavors to use the best information available to the Company for estimating revenue requirements associated with a prospective resource to be evaluated in an IRP. Additionally, the Company seeks to evaluate alternative resources on comparable bases. However, the estimated investment cost for an on-system resource may vary considerably as estimates are refined over time. That is, alternative methods for developing cost estimates, even if prepared at the same time for a specific prospective resource, represent a spectrum of uncertainty regarding the actual cost if constructed. The general types of cost estimates NW Natural uses include:

- High-level internal estimate
  - Requires limited engineering
  - Requires relatively less time to complete
  - May have a high degree of uncertainty regarding estimated cost
- Lower-level internal estimate
  - Requires a more in-depth engineering assessment and evaluation
  - Requires relatively more time to complete
  - May include discussions with potential suppliers
  - Has less uncertainty than a high-level estimate

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<sup>15</sup> NW Natural's current analysis supports, as noted In Staff's Comments on pages 1 and 2, North Mist Alternative 3 as a least cost prospective resource. The rebidding is associated with meeting the needs of the third party customer mentioned in the Company's May 2015 Update. *See; e.g.*, page 1. However, the rebidding may result in further evolution of cost estimates for a North Mist expansion to serve Core customers.

- Estimate based on a Front End Engineering Design (FEED) Study<sup>16</sup>
  - Cost estimates developed by a third party
  - Requires more time and is more expensive than preceding methods
  - Has less uncertainty than preceding methods
  - Not typically available for IRP analysis
- Estimate based on an Engineering, Procurement, and Construction (EPC) bid<sup>17</sup>
  - Cost estimates developed by a third party
  - Is cost-effective only in the context of a conditional decision to proceed
  - Has less uncertainty than a FEED Study
  - Not typically available for IRP analysis

The timing of when a cost estimate is prepared can change the associated level of uncertainty. As an example, while a fixed price EPC contract may have much less uncertainty than other estimates, an EPC bid on a specific project prepared at one time may have a considerably different estimated cost than one prepared at an earlier (or later) date—even if prepared by the same third party using the same methodologies. Most costs vary over time as a result of market forces and not all costs change at the same rate over a given timeframe.

It is highly unusual to have a cost estimate based on either a FEED study (in the 2014 IRP) or a fixed price EPC bid (in the May 2015 Update). More typically, an internally developed cost estimate forms the basis for analysis in an IRP. Analysis of a North Mist expansion for Core customers project in the 2014 IRP and the May 2015 Update using cost estimates based on, respectively, a FEED study and a fixed price EPC bid resulted from NW Natural receiving estimated cost information for an analogous project nearly contemporaneously with the timing of analysis associated with, respectively, the 2014 IRP and the May 2015 Update. NW Natural used the estimates for the analogous project as a basis for estimating the cost of a North Mist project for Core customers, and not an internally developed estimate, as each of these two estimates constituted the best information available at the time. It is unrealistic to expect analysis in future IRPs to be based on an EPC bid, as this approach is cost prohibitive when developed solely for analytic purposes.

NW Natural plans to include in future IRPs and IRP Updates risk analyses associated with the cost (or PVRR) of prospective resources. These will specifically include, for any resource requiring a large capital expenditure, a Base Case point estimate of cost and a range of estimated cost. NW Natural may include a discussion on estimating investment costs for prospective resources as an agenda item for a future Technical Working Group (TWG) meeting with Stakeholders in conjunction with developing the Company's 2016 IRP.

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<sup>16</sup> This is the type of cost estimate used in the 2014 IRP, as discussed on page 2.

<sup>17</sup> This is the type of cost estimate used in the May 2015 Update, as discussed on pages 2 and 3.

### **Summary**

To clarify, the North Mist project referred to in both the IRP and the update is not the same project as the North Mist project being built solely to provide service to PGE under Rate Schedules 90 and 91.

The large increase from the cost estimate used in the 2014 IRP and the cost estimate used in the May Update resulted from several factors. NW Natural based the two cost estimates on estimates for a North Mist expansion project for PGE made by third parties having considerable experience developing such estimates. The first third party estimate was on a time and materials basis, while the second third party estimate was associated with a fix price bid, which impacts the uncertainty associated with the second estimate and therefore the relative uncertainty between the two estimates. The two third party estimates were prepared at different points in time and some components of the analogous project had large changes in cost over the intervening period. Additionally, the cost estimate used in the May Update included a more granular level of engineering regarding certain aspects of the project.

## Appendix

### Present Value of Revenue Requirements for North Mist Alternatives

NW Natural regrets not including in the May Update the numeric PVRR values associated with Figures 3 and 4 on pages 12 and 13 of the Update. This information appears in Table 1 (following).

The estimated PVRR<sup>18</sup> for Alternative 3 is less than that for Alternative 1 by 3.8 percent in the Base Case load sensitivity, by 3.2 percent in the High Load sensitivity, and by 6.0 percent in the Low Load sensitivity<sup>19</sup> for future scenarios A1 and A3.<sup>20</sup> In future scenarios A2, B1, and B2, the PVRR for Alternative 3 is less than that for Alternative 1 by 6.0 percent in the Base Case, by 5.1 percent in the High Load sensitivity, and by 9.1 percent in the Low Load sensitivity. These percentages understate the *relative degree* to which North Mist Alternatives 1 and 3 differ, as they share (with Alternative 2) component investments totaling an estimated \$73.8 million,<sup>21</sup> with the same investment timing for this amount in each alternative under any given combination of load growth sensitivity and future resource scenario.<sup>22</sup>

### North Mist as a Least Cost Resource

The estimated PVRR values for a Clark County LNG facility are 36.5 percent greater than those of North Mist Alternative 2, the North Mist alternative with the *highest* PVRR values.<sup>23</sup> This holds for every combination of load sensitivity and resource scenario, as all Alternative 2 component investments have

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<sup>18</sup> Staff's Comments, on page 3, erroneously refer to Figure 1 in the Update, located on page 9, as depicting PVRR values of the three North Mist alternatives. Figure 1 instead shows the investment amount for each alternative, consistent with its labelling. NW Natural confirms Staff's intuition, expressed on page 3, that an increase in costs for North Mist, and especially an increase with a greater relative impact to Alternative 1 than the other alternatives, does not invalidate the end result of the Company's analysis; i.e., North Mist remains a "least cost" resource. See, in addition to the following discussion, pages 12 through 14 of the Update.

<sup>19</sup> See the descriptions of the alternative load growth sensitivities on pages 2.30 through 2.39 of the 2014 IRP.

<sup>20</sup> See descriptions of the alternative future scenarios on pages 7.10 through 7.12 of the 2014 IRP.

<sup>21</sup> See Table 3 on page 10 of the May Update.

<sup>22</sup> The same amount of investment, invested at the same time for each of the three alternatives, has the same dollar impact on total PVRR. See NW Natural's description of investment timing and its impact on PVRR on pages 8 through 11 of the May Update.

<sup>23</sup> See Figures 3 and 4 on pages 12 and 13, respectively, of the May Update.



the same timing as the Clark County LNG facility for any given combination of load growth sensitivity and alternative future resource scenario.<sup>24</sup>

**Table 1 – Present Value of Revenue Requirements for North Mist Alternatives<sup>25</sup> and a Clark County LNG Facility (Millions of \$2015)**

	<b>Base Case</b>	<b>High Load</b>	<b>Low Load</b>
<i>2014 IRP Resource Scenarios A1 and A3</i>			
North Mist Alternative 1	201.7	223.0	148.1
North Mist Alternative 2	216.4	240.6	155.8
North Mist Alternative 3	194.1	215.9	139.3
Clark County LNG	295.4	328.3	212.5
<i>2014 IRP Resource Scenarios A2, B1 and B2</i>			
North Mist Alternative 1	148.1	164.4	107.2
North Mist Alternative 2	155.8	174.2	109.4
North Mist Alternative 3	139.3	156.0	97.4
Clark County LNG	212.5	237.7	149.3

**Valuation of North Mist Alternative 1 as a Real Option**

Staff's Comments expressed concern regarding NW Natural's conclusion that a real options analysis associated with the North Mist alternatives was unnecessary.<sup>26</sup> The Company's May Update included the following language:

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<sup>24</sup> NW Natural offers the following: if the PVRR for a Clark County LNG facility is always 36.5 percent greater than the PVRR of the *most expensive* North Mist alternative examined in the Update, the PVRR for a Clark County LNG facility is never less than 36.5 percent *greater* than the PVRR of the *least expensive* North Mist alternative examined in the Update. *See also* the discussion of North Mist as a "least cost" resource on pages 12 and 13 of the May Update, including Figures 3 and 4.

<sup>25</sup> NW Natural describes North Mist Alternatives 1, 2, and 3 on pages 7 and 8 of the May Update.

<sup>26</sup> See page 3 of Staff's Comments.

Figures 3 and 4 show that the Alternative 3 Hybrid Takeaway is the least cost alternative in terms of Core customer PVRR in each resource scenario and in each load sensitivity examined in the 2014 IRP. As a result of this dominance of Alternative 3, there is no need to complete a real options analysis, as no combination of subjective probabilities with respect to future resource scenarios or load growth sensitivities result in either Alternative 1 or Alternative 2 having a lower PVRR than Alternative 3.<sup>27</sup>

The real option NW Natural discusses in the Update<sup>28</sup> refers to upsizing and sharing with a third party a new northbound transmission pipeline from the North Mist reservoirs to an interconnection with the Kelso-Beaver (KB) Pipeline (over which gas is delivered to Northwest Pipeline for delivery back to NW Natural's service area) in the presence of uncertainty regarding when (or if) the capacity a North Mist expansion provides for Core customers will be needed. The PVRR associated with the costs of this upsizing and sharing of the transmission facility is the *cost* of the option for Core customers. The *value* of the option for Core customers is the difference between the PVRR of the lowest PVRR between those of Alternatives 2 and 3<sup>29</sup> and the PVRR of Alternative 1, plus the Alternative 1 option cost. Table 2 (following) reflects this valuation for each combination of the two resource scenarios and the three load sensitivities, providing a *net option value* for each combination. As defined here, the Expected Value less Option Cost in Table 2 is the net option value; i.e., the amount by which the total PVRR of Alternative 1 is *less than* the lowest PVRR of Alternatives 2 and 3. In other words, a negative value for Expected Value less Option Cost indicates one or both of Alternative 2 and Alternative 3 has a lower PVRR than Alternative 1. Note that, if probabilities cannot be negative, Table 2 has sufficient information for NW Natural to conclude that—no matter what value these individual probabilities may take—*any* probability-weighted expected value less option cost for Alternative 1 is negative: there is always an Alternative with a lower PVRR<sup>30</sup> than that of Alternative 1. Alternatively stated, there are no combinations of probabilities that, when individually multiplied by the respective *negative* value for Alternative 1's Expected Value less Option Cost and summed, provide a positive result.

NW Natural acknowledges Table 2 does not represent a completed real options analysis of North Mist Alternative 1, as probabilities have not been assigned for the two sets of resource scenarios and for the three load sensitivities. However, and as previously stated, doing so is not necessary, as the expected value of the option less its cost is always negative.

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<sup>27</sup> See pages 11 and 12 of the May Update.

<sup>28</sup> See pages 6 and 7 of the May Update.

<sup>29</sup> See page 8 of the May Update for NW Natural's description of Alternatives 2 and 3.

<sup>30</sup> Information in Table 1 shows that Alternative 3 has the lowest PVRR for every combination of load sensitivity and resource scenario.

**Table 2 – Discrete Outcomes for Real Options Analysis of Alternative 1 (PVRR in Millions of \$2015)**

Load Sensitivity	<b>Base Case</b>	<b>High Load</b>	<b>Low Load</b>
<i>2014 IRP Resource Scenarios A1 &amp; A3</i>			
Expected Value	5.7	6.2	4.5
Option Cost	13.3	13.3	13.3
Expected Value less Option Cost	(7.6)	(7.1)	(8.8)
<i>2014 IRP Resource Scenarios A2, B1 &amp; B2</i>			
Expected Value	4.5	4.9	3.6
Option Cost	13.3	13.3	13.3
Expected Value less Option Cost	(8.8)	(8.5)	(9.8)