# APPENDIX F

# Analysis of Surface Water Temperatures, Headquarters Landfill

# T E C H N I C A L  M E M O R A N D U M

TO: Cal Palmer DATE: March 5, 2013

FROM: Eric Tuppan PROJECT: TE-001-001

RE: Analysis of Surface Water Temperature-Headquarters Site

In its comments on the draft Environmental Impact Statement (EIS), the Department of Ecology (Ecology) states that "*Given that leachate or stormwater runoff will be produced under either landfilling scenario, and that reduced groundwater recharge will reduce base flow in the Southern Tributary and Sucker Creek, **it seems likely** (emphasis added) that stream temperatures will increase as a result of either alternative. However, the first sentence of the 3rd paragraph on page 13 states, 'Stream temperatures and stream shading would not change as a result of the Proposed Action.' Ecology notes higher landfilling rates under the proposed alternative (tons received per year) would likely lead to earlier increases in stream temperatures."*

This technical memorandum examines the underlying assumptions and technical analyses that determined the effect of the landfill on stream temperatures. It then reviews whether the Ecology comments, in light of these analyses and current stream temperature data for the past 20 years of landfill operations, is supported by the data and accepted science.

## PROBLEM STATEMENT:

Variables that affect stream temperature include the volume and temperature of the water entering a stream, ambient temperature which varies seasonally, and streamside shading conditions. As explained in the current DEIS, there are no changes to these variables between the No Action (i.e., current landfilling conditions) and the Proposed Action (conversion to MSW landfill). The Ecology comment makes two important assertions. The first is that stream temperatures will likely rise under either alternative (even though this was shown not to be the case in the initial URS analysis done in 1992 for the now current "No Action Alternative"). The second is that higher landfilling rates as proposed in the new alternative would likely lead to earlier increases in stream temperature, although the rationale for this conclusion is not explained.

The rest of this memo summarizes relevant technical data and the observable results of mitigation efforts, already constructed and proposed, from past reports which include:

- Weyerhaeuser SW Washington Solid Waste Facility Project, Final Technical Report: Surface Water Resources. Beak Consultants Incorporated, June 1991.

- Final Environmental Impact Statement, Headquarters Camp Solid Waste Disposal Facility. URS Consultants. December 1992.

- Final Engineering Report Thiel 2013

This memo then discusses whether there are conditions that would occur under either alternative that would change these variables and whether those conditions would create a significant impact in the steam temperature.

## PAST ANALYSIS

### Surface Water Resources (Beak, 1991)

The Beak report found the following:

- Of the Sucker Creek drainage basin of 3,802 acres, the landfill footprint is 308 acres, or 8.1 percent. Of that, two thirds drains to Southern Tributary; this calculates to roughly 5.4 percent of Sucker Creek drainage area covered by landfill footprint that drains to the Southern Tributary. Drainage of the remaining one third of the footprint is ephemeral (two small swales) and shallow groundwater recharge.

- Average surface flow for Sucker Creek is 14.7 cubic feet per second (cfs) and for Southern Tributary is 2.2 cfs; Southern Tributary is 15 percent of total flow in Sucker Creek (*as a note, if you attribute that 5.4 percent of the drainage basin covered by the southwestern part of the landfill and apply that to the 15 percent [Southern Tributary percentage] of total flow in Sucker Creek, the area of drainage basin covered by the southwestern part of the landfill calculates to a contribution of less than 1 percent of Sucker Creek average flow—these estimates do not separate groundwater discharge versus direct storm runoff*).

- Approximately 90 percent of the total annual runoff occurs from November through April in response to rainfall events, when air and water temperatures are naturally lower. Summertime base flows are low, less than 1 cfs, and flows may cease on occasion – clearly they do in the eastern third of the footprint.

- The water budget shows that 63 percent of annual precipitation is surface runoff. 23.1 percent of the precipitation is shallow infiltration that re-emerges as surface water base flow in adjacent stream channels.

- Shallow groundwater intersects and discharges to stream channels within, upgradient, and downgradient of the site throughout the year, providing surface

water accretion and maintaining surface water channel flow, which is greatest during the wet months and recedes during the dry summer months.

- Surface water temperatures correspond to meteorological conditions with peak temperatures in mid-July through August. More moderate temperature conditions occur in the Southern Tributary compared to Sucker Creek, and are attributed to relatively steep hillslopes (less direct solar radiation to water), abundant stream-side shading and perhaps a greater groundwater accretion component relative to surface discharge. Groundwater temperatures remain relatively constant throughout the year near 10°C.

- It should be noted that previous logging activities at the site and in the area have reduced the amount of natural vegetative shading. However, mitigation efforts including various plantings associated with the diversion of the Southern Tributary around the southern and western boundary of the landfill have matured significantly from the original project construction.

## Final EIS, URS (1992)

The final EIS from 1992 found that the proposed landfill at that time would not contribute to significant impacts (including surface water temperature and flow) in comparison to the no landfill alternative. This conclusion was based on management practices and engineering designs intended to mitigate adverse effects on the environment as summarized below.

**Runon and Diversion Channel - Stream Base Flow.** Flow quantities that used to exist solely in the Southern Tributary were divided in 1993 so that runon travels via the diversion channel (and constructed wetland) and runoff via on-site ditches and the sedimentation/detention basin (discussed in next section). The diversion channel was, in part, designed to replace lost habitat and hydrologic functions of the creek.

On average, flows in the diversion channel were initially estimated at up to 30 percent less than existing flows in the Southern Tributary, primarily because storm runoff within the landfill footprint would drain to the sedimentation/detention basins rather than the diversion channel (these flows are reunited with the Southern Tributary below the detention basin discharge point). Importantly, during the summer period when rainfall and runoff are low, the diversion channel would be expected to retain as much or more base flow than existed in the Southern Tributary for two primary reasons. First, more base flow would be gained from the wetlands adjacent to the diversion channel than is gained in the original Southern Tributary. Second, the bottom of the diversion channel includes a compacted soil-clay layer that reduces seepage loss of base flow through the stream bed.

Base flows normally develop in stream channels from the slow release of soil waters or shallow groundwater. The decrease in base flow varies seasonally and depends on the proportion of drainage area that is overlain by the plastic liner. During dry summer conditions, little reduction in base flow is anticipated, since little if any summer base flow accretion occurs on the site. During wetter seasons, when base flows are much higher and are contributed from a larger portion of the drainage area potentially under landfill cover, base flows could be decreased. However, much of this lost flow is regained through the stormwater collection and detention structures.

**HGCS Base Flow Augmentation.** Some base flow augmentation comes from surface discharge from the hydraulic gradient control system (HGCS). This system collects some groundwater from beneath the landfill and returns it to surface streams.

**Runoff Control - Sedimentation/Detention Basin.** Interim plastic cover on developed cell areas would reduce any infiltration of rainfall and sheds substantially greater runoff volume at a faster rate than occurs under natural conditions. As a result, runoff from these areas would be characterized by higher peak flow rates and lower base flow rates than occurs naturally. Final design calculations indicate that the sedimentation/detention basins have adequate storage capacity to detain peak flows from all storm events up to and including the 100-year storm event following landfill closure and during all interim development stages. Detained stormwater is released at a rate *no greater* than the existing peak runoff rate from the site. Therefore, the proposed landfill would not be expected to increase peak flows in the Southern Tributary, in Sucker Creek, or discharging to Silver Lake.

**Final cover and drainage to surface water.** During closure of landfill cells, a final cover is placed which consists of a composite liner with top component of polyethylene FML overlain by a drainage layer and a soil layer, and planted with shrubs and grasses. This final cover would prevent infiltration of rainfall into the waste and below the landfill footprint. However, rainfall would infiltrate into the revegetated soil and drainage layers and move downslope through these layers *in much the same manner* as it infiltrates into and moves through the soil under existing conditions. Because the final cover is designed to provide efficient subsurface drainage, runoff volumes and rates from areas with final cover would be expected to be slightly greater than under existing conditions. However, the sedimentation/detention basin(s) would continue to detain peak flows at or below existing pre-project levels. Therefore, no significant long-term impacts are anticipated

## DISCUSSION

To address Ecology's first assertion that presumes surface water temperature will increase as a result of landfilling requires us to assess whether variables that affect stream temperature, including the volume and temperature of the water entering a stream, ambient temperature which varies seasonally, and streamside shading conditions, have

changed or will change under either alternative. The current draft EIS found no changes to any of these variables, given that landfill operations will retain the mitigation measures and engineering controls constructed for surface water and that are now operating at the site. These conclusions are based on the analysis of stream volume and temperature discussed above. Contrary to Ecology conclusions, flows in Sucker Creek and the Southern Tributary are expected to be similar to pre-existing flows through a combination of: 1) the diversion channel design, 2) base-flow augmentation from the HGCS, 3) runoff control through sedimentation-detention, and 3) final cover drainage to surface water.

Ecology's initial premise that less groundwater accretion to surface water (from areas below impermeable landfill cover) will contribute to lower stream volumes and higher temperatures, while intuitively correct, is not founded on a complete assessment of the site controls that mitigate for slightly less flow from below the landfill as discussed above. Further, a review of the percentage of groundwater that could potentially contribute to the annual discharge volume of the Southern Tributary (based on surface areas below the lined part of the landfill) demonstrates it to be less than 1 percent. For Sucker Creek drainage, a small area is covered by the landfill (100 acres) that potentially shields infiltration, and thus reduces shallow groundwater recharge. However, this area is at the upgradient part of drainages, which typically contribute less to stream base flow through accretion than those regions farther downslope, especially during drier summer months.

Elements of site controls designed to maintain surface water temperatures and already implemented for the landfill include 1) sedimentation/detention basin(s) that would detain peak flows at or below existing pre-project levels, especially during heavy rainfall months when there are lower overall ambient and stream temperatures, and 2) increased base flow (from diversion channel design) during critical summer months, and 3) streamside shading along all reaches of streams contributing to site runon and diversion and to site runoff structures (i.e., in the detention basin). This includes increased shading along Southern Tributary due to the greatly expanded riparian buffer zone below the landfill, mitigation of the original project in 1993 compared to the forest lands requirements existing at that time.

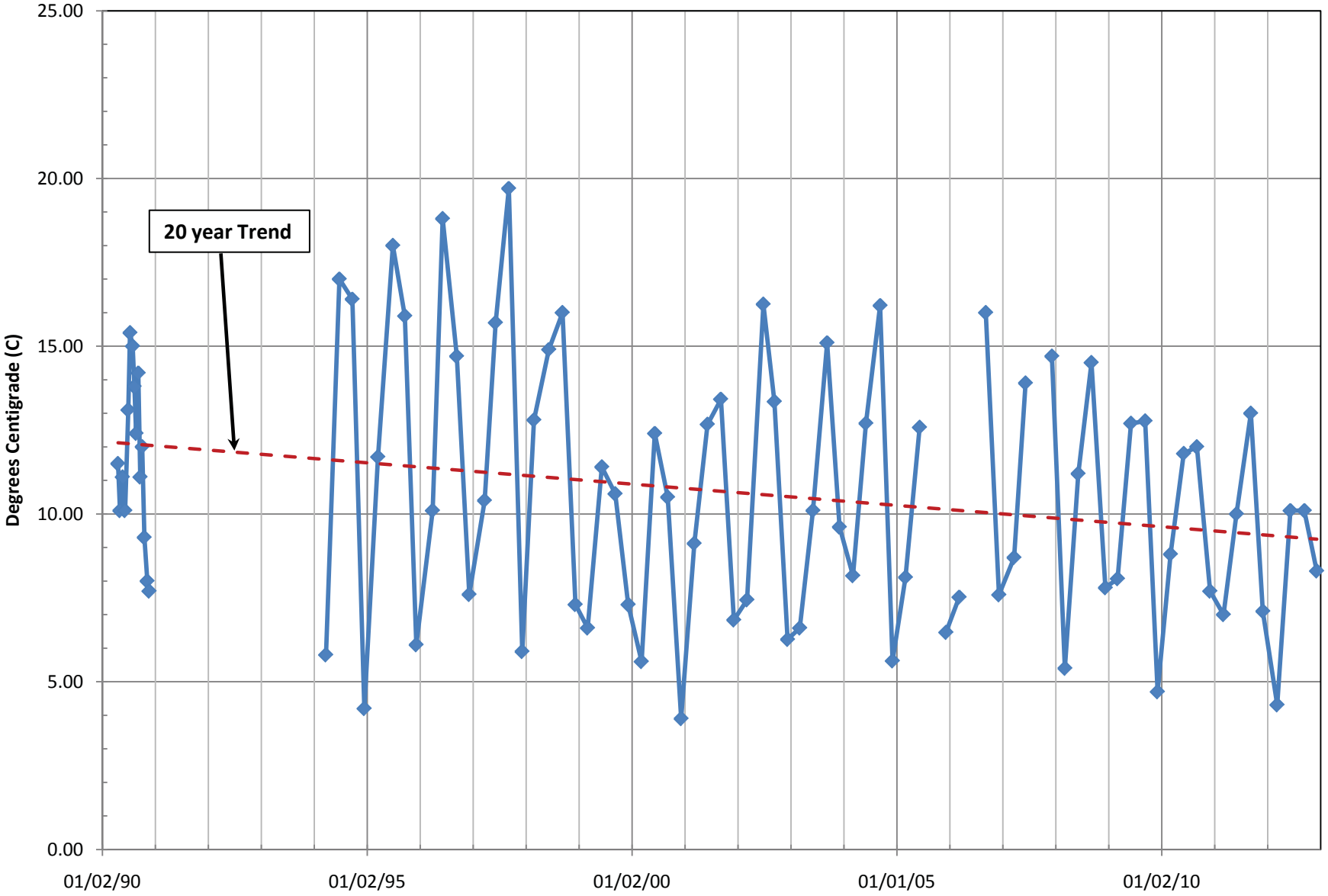
Moreover, temperatures monitored in the Southern Tributary since operations began in 1993 show that the trend of stream temperatures has declined over the past 20 years (see attached figures). This can be attributed to the mitigation efforts embodied in the upper diversion channel and increased stream side shading implemented at the time of landfill construction

Ecology's comment that higher landfilling rates (i.e., higher waste flows) would likely lead to earlier increases in stream temperatures is based on two concepts that are incorrect in the assessment of this proposal. The first is that temperatures would increase by the very fact of the landfill's presence; this is clearly not the case as previously discussed. The second is that faster development under the Proposal compared to No-Action would

somehow accelerate these increases. Increased waste flow may require slightly quicker development of landfill cell construction; however, with the current mitigation efforts now mature and use of controls during construction and operations that manage runoff, there are no conditions that could be attributed to earlier or more rapid construction that would change the variables that affect stream temperature.

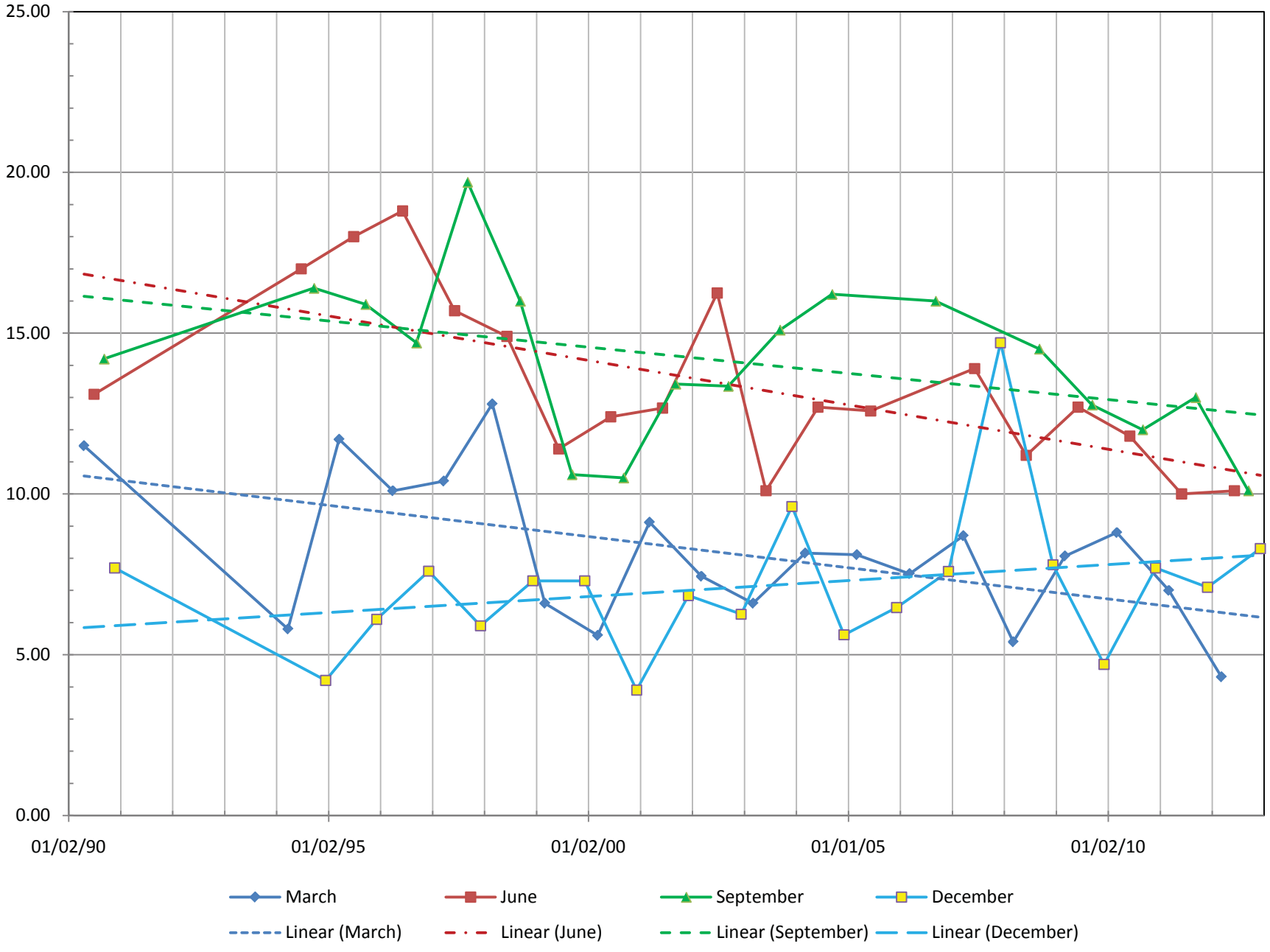
Attachment: Plot of Historical Temperatures in Southern Tributary Sucker Creek

# Field Measured Temperature
# Headquarters Landfill
# Surface Water Location SS-1




SW Quality Plots\Temp (2)

**Seasonal Temperatures**
**in Surface Water - Southern Tributuary Sucker Creek (SS-1)**
**Headquarters Landfill**



# APPENDIX G

# Supplemental Information on Waste Sources and Flows

DATE: February 28, 2013

TO: Phil Rupp, Cowlitz County Department of Building and Planning

Art Campbell, Herrera Environmental Associates, Inc.

FROM: Cal Palmer, Energy and Environment, LLC

SUBJECT: **Cowlitz County Headquarters Landfill Project: Additional Information to Support Preparation of the Final EIS**

You have asked for additional information from the project team concerning the County's purpose and description of the above project, particularly as relates to the projected types, volumes, and sources of waste that may be disposed at the Headquarters Landfill over the course of its life. This memorandum is intended to furnish that information.

Purpose and Summary of Likely and Maximum Annual Average Waste Flows

To address some of the comments you received on the DEIS, we need to clarify what we are projecting and why. We are attempting to project two estimates: first, a reasonable expectation of the likely long-term annual average waste quantity delivered to the landfill sustained over its life; and second, a reasonable maximum, the upper limit of that annual average quantity.

The first projection is useful for sizing and estimating costs of operational components, planning the timing of capital projects, and other decisions that are based on what one thinks the future is likely to hold. More importantly from a SEPA point of view, it is necessary for determining whether in each element potential adverse impacts that could be significant are likely, and if so then the nature of available mitigation methods. The second, maximum projection is useful for framing the level of uncertainty that is residual in the first, the likely projection. In making such estimates, it is important to remember that the Headquarters Landfill is a very long-lived facility (e.g., ~100 years), so waste flows and other projections for future events beyond the next one or two decades is speculative to a degree; there are no "right answers" to waste projections into the distant future.

In direct response to the Ecology comment concerning likely and maximum waste flows, the Proponent is proposing the following:

- The likely long-term annual average waste flow is 490K tons/year, as presented in the DEIS;
- The reasonable maximum long-term annual flow is in the range of 600K – 700K tons/year.

The likely average waste projection has been determined largely based on current experiences of the County in managing its municipal solid wastes (MSW) and industrial waste, and of Weyerhaeuser through operating the Headquarters Landfill for the past twenty years. We summarize below some of the considerations that build that projection of 490K tons/year sustained over the long-term. Further detail is provided in the DEIS

The maximum average waste flow that we would reasonably expect has been developed by evaluating the long-term economic development plans and prospects that are in place in southwest Washington including Cowlitz County, and then making a judgment as to what a realistic outcome might be in terms of demand for solid waste disposal at Headquarters Landfill. Again, this projection is not what we think will happen, but is reasonable as to what could happen.

County Project Objectives

Of the important goals that can be achieved in part by the proposed action, the County has two project objectives that particularly relate to the waste flow projections:

(1) the long-term cost-effective management of its MSW in a manner that significantly improves the County ratepayers' outcome compared to the No-Action alternative; and,

(2) an effective industrial economic development strategy, which among other dimensions includes offering an attractive utilities and public works infrastructure, including environmentally protective and cost-effective waste management system.

Both of these objectives provide a fabric for considering assumptions about the future as will affect the region's reliance on the Headquarters Landfill for solid waste disposal over future decades.

Economic Development

As a backdrop for projecting both likely and maximum waste flows over the long-term, the regional economic development programs are clearly germane. Cowlitz County (and the region) has suffered significant deterioration of its industrial base over the past twenty years, as evidenced by declines in employment, industrial output, tax revenue and similar economic measures. In response, Cowlitz County's economic development strategy is in part to revitalize its economic policy and infrastructure framework so as to grow existing manufacturing investment, and to also attract new industrial production to the County[i]. It hopes to capitalize on its inherent competitive advantages, which include its extensive forest resources, its excellent access to marine, rail, and truck transportation, a still very large industrial sector with diverse facilities, and its highly trained and productive industrial work force. Cowlitz County's economic development plan identifies business concerns for infrastructure services as one of the impediments to future growth (see http://cowlitzedc.com/documents/CowlitzEDCStrategicPlan.pdf).

The Cowlitz County strategy is generally similar to that of neighboring counties, particularly of Lewis, Grays Harbor, Mason, Pacific and Wahkiakum Counties. See, for example their economic development plans at: http://www.graysharbor.org/downloads/GraysHarbor_2009_CEDS.pdf ; http://www.lewisedc.com/owners.html; http://www.credc.org/business/pdf/manufacturing2011.pdf.

The industrial component of the southwest Washington economy, including Cowlitz County, has largely been natural resource based (i.e., forest products manufacturing). Additionally, however, there are numerous economic success stories in primary metals, agriculture/food processing, and other sectors. It is not possible to know today in which sector(s) the economic development strategy will have most effect in the future. However, most of the likely possibilities involve facilities that produce significant solid wastes.

In summary, as a region the general economic development effort emphasizes industrial development and diversification in sectors that typically generate significant residual waste from production processes. None of the neighboring counties appears to have a realistic prospect for a significant regional waste disposal facility for these wastes, and may be faced with some degree of long-haul transport to and disposal in eastern Washington or Oregon in the future. Therefore they each represent a potential source of increased waste production, some of which may be delivered to the Headquarters Landfill.

The Likely Annual Average Waste Projection

The DEIS presents our view of a reasonable if appropriately conservative projection of the long-run annual average waste flows to the landfill over at least the next several decades. It projects 490K tons/year as the annual average on a sustained basis. The projected waste volumes presented in Table 2 of the DEIS were not directly the subject of comment, but assumptions inherent in the projection are responsive to some of the comments, and include the following bases:

1. It is assumed that execution of Cowlitz County and/or regional industrial development and diversification programs will achieve at least low to moderate growth;
2. The resulting waste mix and volume projection results in a ~40% increase in average annual flow under the proposal compared to current conditions, projecting 490K tpy beginning 2017, versus 340K tpy in 2011 (when County MSW is included);
3. MSW is assumed to grow in accordance with the Solid Waste Management Plan's low-growth model, with any additional growth in gross MSW volumes mitigated by aggressive future expansion of waste reduction and recycling programs;
4. Predicting annual rates of growth for industrial waste is challenging at best, certainly compared to MSW which is largely population-driven and generally changes only gradually. We conservatively assumed a step-increase in industrial waste to the landfill occurs by 2017 rather than gradually build to it. As noted in the DEIS, this contemplated growth in industrial waste will for the most part be available to and could be captured by Weyerhaeuser under the No-Action alternative, as well as to the County under the proposed action.

The Maximum Annual Average Waste Projection

Regionalization of waste transportation and disposal is common in many regions including most of western Washington, and it has characterized operation of the Headquarters Landfill since its inception. Weyerhaeuser routinely disposed and continues to dispose of waste generated as far away as Springfield, Oregon, Everett, Washington, and Aberdeen, Washington. The County intention is to continue Weyerhaeuser's practice of attracting solid wastes from the region so as to operate the facility with favorable economic results. In the above waste projection, which is summarized in the DEIS, it was recognized that some of the waste may come from counties neighboring Cowlitz County, and not from within Cowlitz County. Some obvious wastes that would likely flow to the Headquarters Landfill (such as 20K tons/year of MSW from a nearby county) were included. Some of the industrial waste is assumed to be from outside the County as well.

Our view of a reasonable expectation for the maximum sustained waste flow to the landfill, expressed again as a long-run annual average, is about 600K to 700K tons/year, and is based upon the economic development assumption summarized above. Several forest products manufacturing facilities have been curtailed or closed at least temporarily in the past decade, both within Cowlitz County and in neighboring counties. Every jurisdiction is working hard to re-open or re-purpose some of those, and/or to otherwise attract industrial investment. It is reasonable to expect some success will be achieved over time. For this maximum scenario, then, a set of industrial expansions is assumed to occur that aggregate to the equivalent of one significant pulp mill, wherein an incremental 100K-200K tons/year of solid waste could be generated. Clearly, it is not suggested that the development *will be* a pulp mill, but such a mill is a useful benchmark in light of the region's history, to consider the likely maximum annual waste volume. Hence, we believe a maximum sustained waste flow of the order of 600K - 700K tons/year is reasonable.

The One Million Tons/Year

In describing the County's proposed action, the DEIS stated, "The maximum proposed annual waste volume would be the same as the currently permitted maximum of 1 million cubic yards[ii]." This sentence is unintentionally slightly misleading – the County has never believed that under its proposal a reasonable maximum annual average waste flow sustained over decades would be so high. The statement was based on the existing permit conditions currently imposed on the operation of the Headquarters Landfill by Weyerhaeuser, not on the County's proposal nor its realistic expectations for future waste volumes. Several comments concerned the above threshold. On the other hand, and as mentioned in the DEIS, we do believe that peak period flows, during which significant remedial project activity could occur over several months or even as much as a few years, may result in waste deliveries to the landfill at a rate approaching 1 million tons/year, but for much shorter periods than the long-term averages described here.

In response to the comments concerning analyses summarized in the DEIS utilizing the current Weyerhaeuser permit limit of 1 million tons/year, the Proponent does not intend to propose nor desire a specific numerical cap to the facility's ability to properly receive and manage waste for disposal. We are not aware of any MSW landfill in Washington which has an annual cap imposed by its solid waste handling facility permit. In providing the analyses referenced, we simply recognized the existence of the current permit limit, and acquiesced to using that waste flow scenario for determination of significant adverse impacts. It was intended to be an appropriate complement to the primary analysis of the reasonably expected waste flows described above for determination of possible impacts, their significance, and any necessary mitigation. Especially important was an understanding of the potential for significant adverse transportation impacts if there were to be future projects or other circumstances that would lead to a period of waste flows near that level. We also evaluated the proposed landfill gas collection and treatment system for capacity and determination of impacts.

A final point related to the million-tons scenario is one of economic value of the landfill to Cowlitz County. The County has negotiated to purchase the landfill and related assets from Weyerhaeuser at a substantial cost to the County. As stated, the County's application for an MSW permit does not seek a

cap, and it was only for the purposes of evaluating environmental impacts in the DEIS that maximum volumes are relevant at all. However, the potential to receive as much as 1 million tons/year is viewed as an economic asset, particularly if the County were to ever consider to sell the facility to another party. Any diminishment in the permitted capacity of the facility would be detrimental to its economic value, which is undesirable to the County, and the Proponent is not aware of a regulatory basis for such a constraint.

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[i] *Personal communication, Cowlitz County Commissioner George Raiter, June 7, 2012.*

[ii] *Note that the current solid waste handling facility permit contains a condition of "one million cubic yards per year." The Proponent standardized its permit applications on a weight basis, which is the standard convention in the industry, and made the simplifying assumption for undefined waste that they will generally be industrial in nature, and that one cubic yard equals one ton.*