

**PACIFIC NORTHWEST LNG - ADDENDUM TO THE ENVIRONMENTAL IMPACT STATEMENT**

Ambient Light  
December 12, 2014

## **9.0 AMBIENT LIGHT**

The assessment of potential effects of the Project on ambient light was provided in Section 9 of the EIS. This section of the EIS Addendum provides:

- An update to the potential effects on the Ambient Light VC as a result of the project changes
- An updated list of all mitigation measures for Ambient Light
- Conclusions on the assessment of effects on the Ambient Light VC, taking into account project changes and any requested additional information.

Table 9-1 lists the documents applicable to Ambient Light submitted by PNW LNG as part of the environmental assessment process to date and identifies if information is either *updated by EIS Addendum*, *superseded*, *not relevant*, or *not affected* by information in the EIS Addendum. The following section of the EIS Addendum contains information that updates the documents classified as *updated by EIS Addendum* in Table 9-1. Figures 9-1 to 9-3 have been updated from those provided in the EIS to reflect the project changes and any other applicable updates.

**Table 9-1 Status of Previously Submitted Documents**

<b>Document Name</b>	<b>Status</b>
Section 9 of the EIS (February 2014)	Updated by EIS Addendum

### **9.1 PROJECT EFFECTS ASSESSMENT UPDATE**

#### **9.1.1 Baseline Conditions**

The marine terminal design mitigation results in the relocation of the marine terminal berth by about 510 m from the location described in the EIS; however, the Ambient Light baseline conditions at the new location are similar to those originally presented in the EIS.

#### **9.1.2 Effects Assessment**

The marine terminal will not be visible for most of the road along the shore due to the presence of coniferous trees in the zone between the road and the coastline. At higher elevations in the village, the components of the Project will be visible, but with substantial attenuation of the lighting due to the separation distance. The bridge structure will be visible at more locations due to its height of approximately 128 m, but lighting on the higher parts of the structure will be limited to those lights necessary and required for navigation purposes, and aircraft avoidance.

The marine terminal design mitigation results in the relocation of the marine terminal berth by about 510 m from the location described in the EIS. The distance of the marine terminal from Port Edward will eliminate the risk of light spill and glare at the public areas of Port Edward, and the use of full horizontal cutoff and directed lighting will

## **PACIFIC NORTHWEST LNG - ADDENDUM TO THE ENVIRONMENTAL IMPACT STATEMENT**

Ambient Light  
December 12, 2014

greatly reduce the sky glow component. The marine terminal design mitigation will move the marine terminal berth closer to Kitson Island and lead to additional night time visibility of the suspension bridge. However, the terminal, suspension bridge and LNG carriers will still be a sufficient distance away so that the risk of glare and light spill will remain negligible. Some reflected light to the sky is unavoidable; however, mitigation through design will reduce this to a minor level.

### **9.1.2.1 Summary of Residual Effects**

The modified marine terminal will be locally visible and some light will be reflected to the sky, but should be minor and visible only during overcast conditions. The project changes are not expected to result in a material change to the assessment of residual effects for the construction, operations, and decommissioning phases of the Project. The potential change in effects to Ambient Light do not change the characterization of residual effects (i.e., context, magnitude, extent, duration, frequency, reversibility; see Table 9-2) or the predicted significance of those effects (i.e., not significant) compared with those effects presented in the EIS.

## **9.2 CUMULATIVE EFFECTS ASSESSMENT UPDATE**

The cumulative effects assessment provided in the EIS was reviewed with respect to the marine terminal design mitigation and the potential cumulative effects from the change in location of the accommodation camp, and additional information requests related specifically to cumulative effects assessment.

Changes in the construction schedule for the Project have not affected the outcomes of the cumulative effects assessment for Ambient Light. Conclusions on significance of cumulative effects on Ambient Light are based on effects occurring during operations as well as spatial overlaps, rather than temporal overlaps; therefore, changes in the construction schedule do not affect these conclusions.

The change in location of the accommodation camp will require transportation of workers from the camp to the Lelu Island worksite. Buses will be used to transport workers. Based on the maximum peak number of construction workers in the camp (4,500 workers per day for a period of 6 months), assuming two shift changes per day, and an average of 45 passengers per shuttle, traffic on Skeena Drive associated with camp relocation could amount to 200 additional vehicle movements (or 100 shuttle round trips) per day. The 2012 annual average daily traffic on Skeena Drive was approximately 1,498 vehicles per day, down from an average of 3,305 vehicles per day in 1995. With the expected traffic increase due to the Project, the annual average daily traffic on Skeena Drive will likely be less than the 1995 historic traffic volumes. Overall, the increase in ambient light levels due to project related vehicles will be assimilated with negligible observed difference.

The accommodation camp location change is not expected to result in a material change to the assessment of residual cumulative effects for the construction, operations, and decommissioning phases of the Project. The potential change in effects to Ambient Light does not change the characterization of cumulative effects (i.e., context, magnitude, extent, duration, frequency, reversibility; see Table 9-3) or prediction of significance of those effects (i.e., not significant).

## **9.3 MITIGATION**

### **9.3.1 Changes to Mitigation Measures Presented in the EIS**

No revisions to the mitigation plan are required as a result of project changes.

### **9.3.2 Complete List of Current Mitigation Measures**

All of the technically and economically-feasible mitigation measures currently being presented by PNW LNG to address potential effects to Ambient Light are listed below. This includes those originally presented in the EIS that remain relevant, as well as those that have been revised or added as a result of feedback received during the environmental assessment process or as a result of the project changes. By implementing this full set of mitigation measures, PNW LNG is confident that the Project will not result in significant adverse effects to Ambient Light.

- A 30 m mature vegetation buffer will be retained around Lelu Island to reduce effects of increased light
- Construction lighting will be selected to reduce spill-over light and will include shielded fixtures, where appropriate
- Operational lighting will be selected to reduce spill-over light and will include shielded fixtures, where appropriate
- Design principles (such as those within the Canada Green Building Council LEED guidelines (LEED 2004) and the International Commission on Illumination (CIE 2003) will be used where applicable and consistent with overarching requirements of safety and security
- A centralized lighting control system will be used to selectively turn off lights when not required.

## **9.4 CONCLUSION**

Project changes were assessed for potential effects, including cumulative effects, on ambient light. Based on this assessment the potential adverse effects, the mitigation measures, or the characterization of residual adverse effects (i.e., context, magnitude, extent, duration, frequency, reversibility) that were identified in the EIS remain valid and no changes are warranted.

The Project will not exceed guidelines for light spill and glare within a suburban environment. Consequently, project effects on the acoustic environment remain not significant (Table 9-2). The residual effects from the Project acting cumulatively on the acoustic environment with other past, present or reasonably foreseeable projects and activities is also expected to be not significant (Table 9-3).

**PACIFIC NORTHWEST LNG - ADDENDUM TO THE ENVIRONMENTAL IMPACT STATEMENT**

Ambient Light  
December 12, 2014

**Table 9-2 Characterization of Residual Effects for Ambient Light**

Project Phase	Mitigation Measures	Residual Effects Characterization						Likelihood	Significance	Confidence	Follow-up and Monitoring
		Context	Magnitude	Extent	Duration	Reversibility	Frequency				
<b>Change in Ambient Light</b>											
Construction	<ul style="list-style-type: none"> <li>Fixtures selected to reduce wasted or stray light</li> <li>Adherence to design specifications</li> <li>Use of a centralized lighting control system</li> <li>Maintain a 30 m vegetation buffer.</li> </ul>	M	L	LAA	MT	R	C	L	N	H	None
Operations		M	L	LAA	LT	R	C				
Decommissioning		No effects anticipated									
Residual effects for all phases		M	L	LAA	LT	R	C				
<p><b>KEY:</b></p> <p><b>CONTEXT:</b> L = low resilience, sensitive to disturbance M = moderate resilience H = high resilience, not sensitive to disturbance</p> <p><b>MAGNITUDE:</b> N = negligible: no measurable change from baseline conditions L = low: effect is detectable but is minimized through design mitigation M = moderate: plant lighting is effectively controlled, but navigation, security, and other required lighting have a measurable effect. H) = high: the design is without regard to lighting design criteria</p>	<p><b>EXTENT:</b> PDA = effects are restricted to the PDA LAA = effects are restricted to the LAA RAA = effects are restricted to the RAA</p> <p><b>DURATION:</b> ST = short-term: measurable for less than one month M = medium-term: measurable for more than on month but less than two years LT = long-term: measurable for the life of the Project P = permanent: measurable parameter unlikely to recover to baseline</p>	<p><b>REVERSIBILITY:</b> R = reversible I = irreversible</p> <p><b>FREQUENCY:</b> SE = single event: effect occurs once over the life of the Project. IE = multiple irregular event: effect occurs at sporadic intervals RE = multiple regular event: effect occurs on a regular basis and at regular intervals C = continuous: effect occurs continuous through the life of the Project</p>	<p><b>LIKELIHOOD:</b> L = low probability of occurrence M = medium probability of occurrence H = high probability of occurrence</p> <p><b>SIGNIFICANCE:</b> S = significant N = not significant</p> <p><b>CONFIDENCE:</b> Based on professional judgment. L = low level of confidence M = moderate level of confidence H = high level of confidence</p>								

Ambient Light  
December 12, 2014

Table 9-3 Summary of Cumulative Residual Environmental Effects on Ambient Light

Cumulative Environmental Effect and Project Contribution	Other Projects, Activities and Actions	Mitigation and Compensation Measures	Residual Cumulative Effects Characterization						Likelihood	Significance	Prediction Confidence	Follow-up and Monitoring Programs	
			Context	Magnitude	Extent	Duration	Reversibility	Frequency					
<p><b>Change in ambient light</b></p> <ul style="list-style-type: none"> <li>Light received beyond the project perimeter is spill or spill lighting</li> <li>Increased glare is a safety issue and an aesthetic issue</li> <li>Sky glow is a result of wasted light shining upwards and from excessive lighting reflected upwards.</li> <li>All forms of light pollution are of concern because of the potential effects it could have on migrating wildlife and sensitive human receptors.</li> </ul>	<p><b>Cumulative Effect with Project (future case)</b></p> <ul style="list-style-type: none"> <li>No existing developments located on Lelu Island</li> <li>Operations on Ridley Island may be within the viewshed of Port Edward and Skeena Drive residents.</li> </ul>	<ul style="list-style-type: none"> <li>Canpotex Potash Export Terminal</li> <li>CN Rail Line</li> <li>NaiKun Wind Energy Project</li> <li>Prince Rupert LNG Facility</li> <li>Prince Rupert Grain Limited</li> <li>Ridley Terminals Inc.</li> </ul>	None	M	L	LAA	LT	R	RE	H	N	M	None
	<p><b>Project Contribution to Cumulative Effect (in RAA)</b></p> <ul style="list-style-type: none"> <li>Lighting during nighttime construction will be limited to that which is required for safe, secure, and efficient work at night, directed to work areas where it is intended (that is, avoiding off-site directions) and that it is of shielded, cut off design</li> <li>Permanent lighting on buildings (exterior and interior), and streetlights along access roads, bridges and surrounding the marine terminal will be needed.</li> </ul>	<p><b>Construction:</b></p> <ul style="list-style-type: none"> <li>Site preparation (land-based)</li> <li>Onshore construction</li> <li>Vehicle traffic</li> <li>Dredging</li> <li>Marine construction</li> <li>Operational testing and commissioning</li> <li>Site clean-up and reclamation.</li> </ul> <p><b>Operations:</b></p> <ul style="list-style-type: none"> <li>LNG facility and supporting infrastructure on Lelu Island</li> <li>Marine terminal use</li> <li>Shipping.</li> </ul> <p><b>Decommissioning:</b></p> <ul style="list-style-type: none"> <li>Dismantling facility and supporting infrastructure</li> <li>Dismantling of marine terminal</li> <li>Site cleanup and reclamation.</li> </ul>	See Table 9-2 Summary of Residual Effects on Ambient Light	M	L	LAA	LT	R	C	L	N	H	None

**PACIFIC NORTHWEST LNG - ADDENDUM TO THE ENVIRONMENTAL IMPACT STATEMENT**

Ambient Light  
December 12, 2014

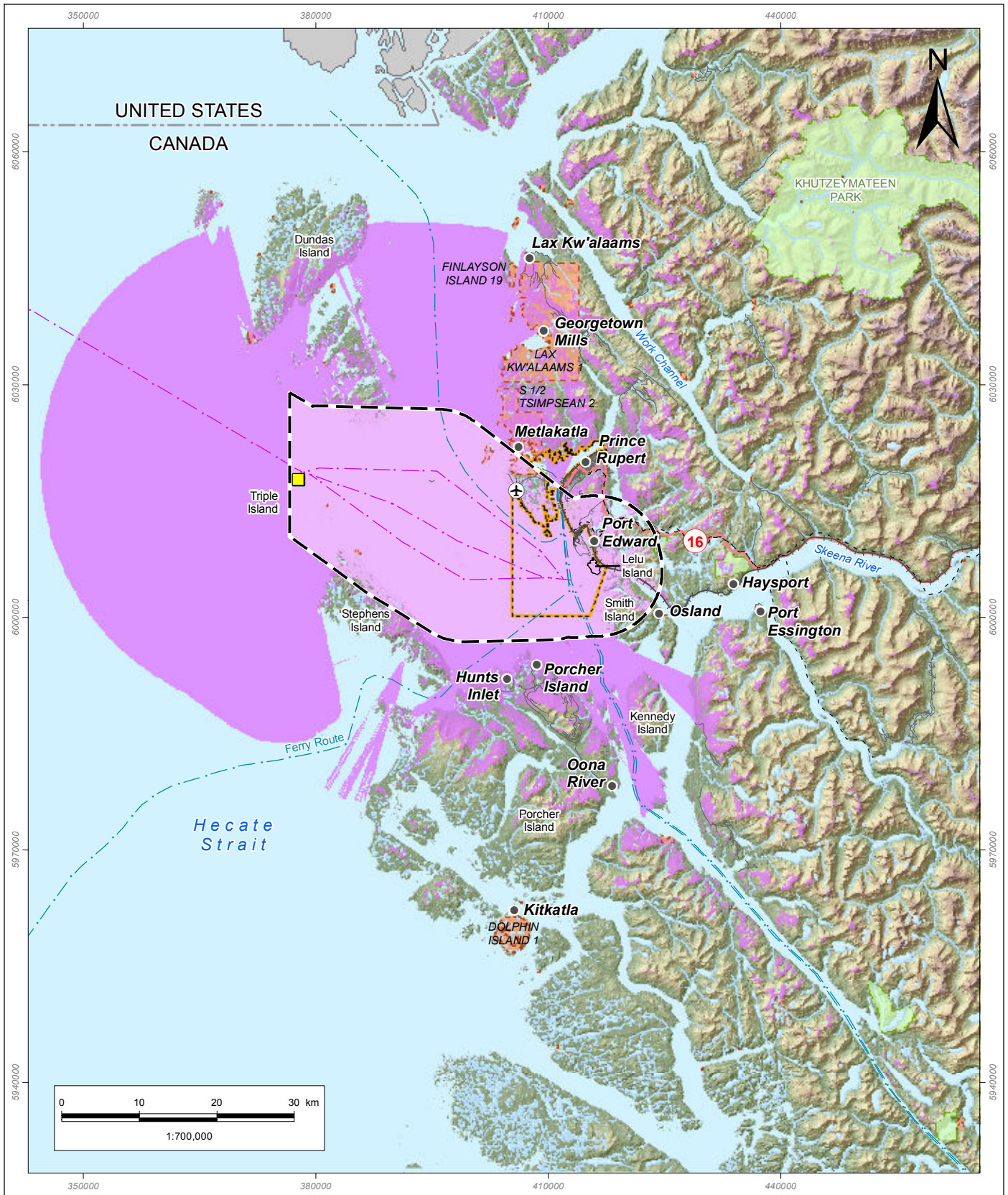
Cumulative Environmental Effect and Project Contribution	Other Projects, Activities and Actions	Mitigation and Compensation Measures	Residual Cumulative Effects Characterization						Likelihood	Significance	Prediction Confidence	Follow-up and Monitoring Programs
			Context	Magnitude	Extent	Duration	Reversibility	Frequency				
<p><b>KEY:</b></p> <p><b>CONTEXT:</b> L = low resilience, sensitive to disturbance M = moderate resilience H = high resilience, not sensitive to disturbance</p> <p><b>MAGNITUDE:</b> N = negligible: no measurable change from baseline conditions L = low: effect is detectable but is minimized through design mitigation M = moderate: plant lighting is effectively controlled, but navigation, security, and other required lighting have a measurable effect. H = high: the design is without regard to lighting design criteria</p>	<p><b>EXTENT:</b> PDA = effects are restricted to the PDA LAA = effects are restricted to the LAA RAA = effects are restricted to the RAA</p> <p><b>DURATION:</b> ST = short-term: measurable for less than one month MT = medium-term: measurable for more than one month but less than two years LT = long-term: measurable for the life of the Project P = permanent: measurable parameter unlikely to recover to baseline</p>	<p><b>REVERSIBILITY:</b> R = reversible I = irreversible</p> <p><b>FREQUENCY:</b> SE = single event: effect occurs once over the life of the Project IE = multiple irregular event: effect occurs at sporadic intervals RE = multiple regular event: effect occurs on a regular basis and at regular intervals C = continuous: effect occurs continuous through the life of the Project</p>							<p><b>LIKELIHOOD:</b> L = low probability of occurrence M = medium probability of occurrence H = high probability of occurrence</p> <p><b>SIGNIFICANCE:</b> S = significant N = not significant</p> <p><b>CONFIDENCE:</b> Based on professional judgment. L = low level of confidence M = moderate level of confidence H = high level of confidence</p>			

**PACIFIC NORTHWEST LNG - ADDENDUM TO THE  
ENVIRONMENTAL IMPACT STATEMENT**

Ambient Light  
December 12, 2014

**9.5 FIGURES**

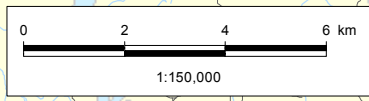
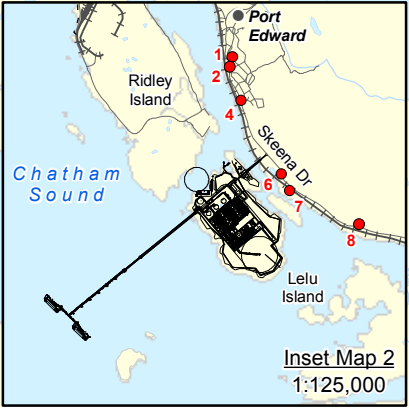
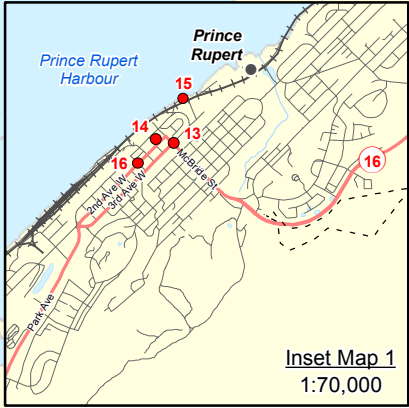
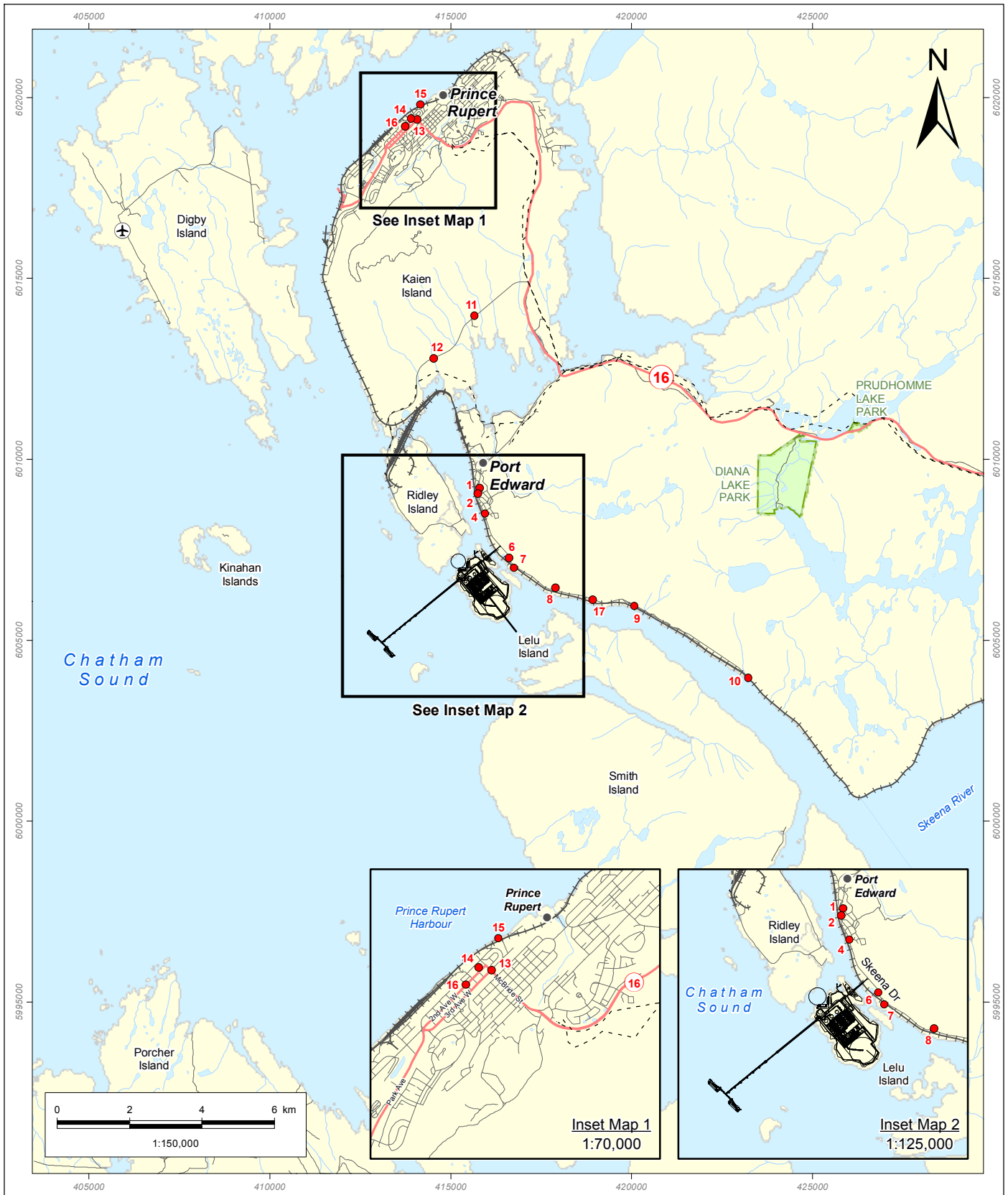
Please see the following pages.



V:\nw\123110537\figures\EA\_Addendum\Fig\_123110537\_ea\_add\_09\_01\_ambient\_light\_study\_areas.mxd

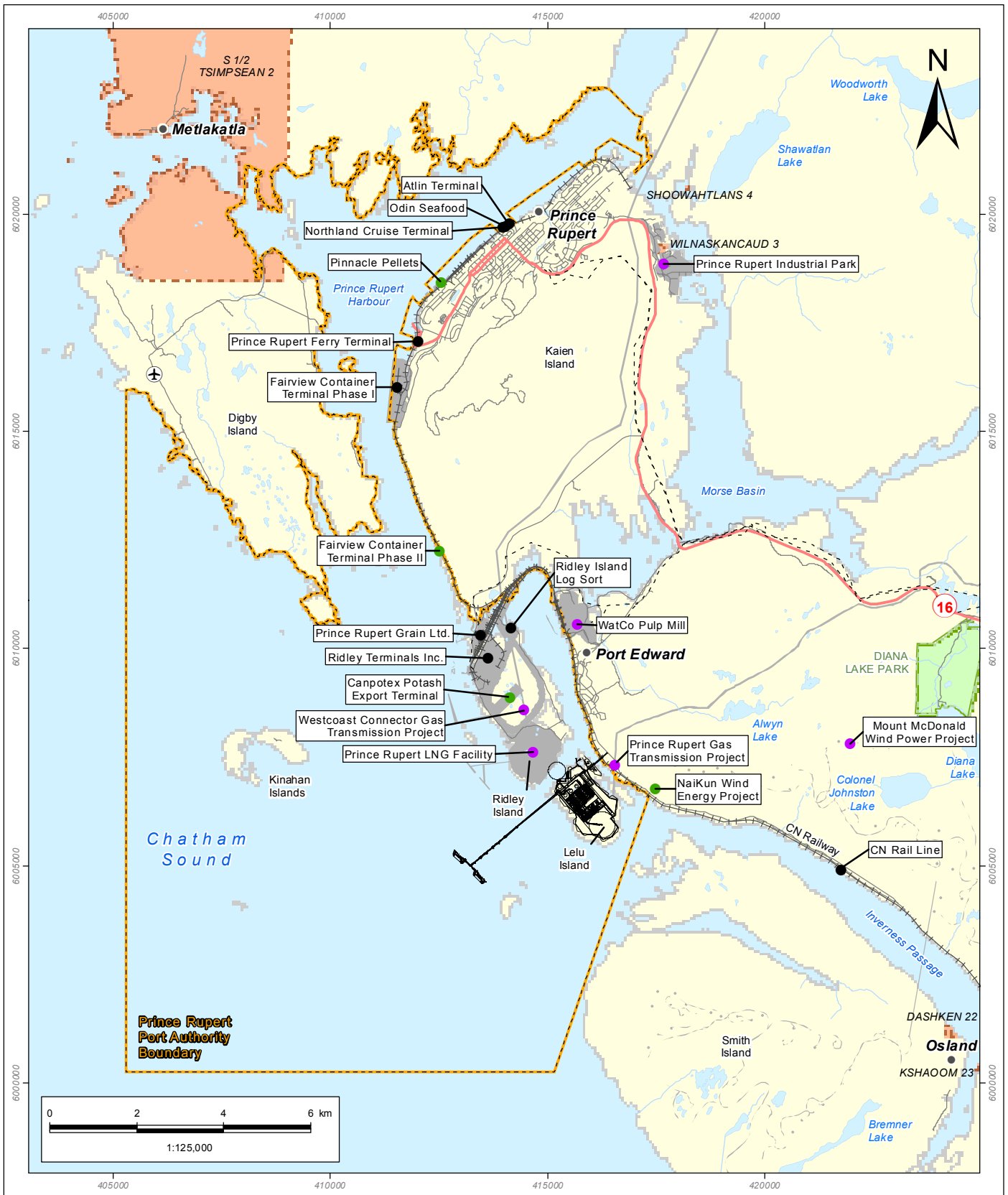
<ul style="list-style-type: none"> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #f080f0; border: 1px solid black; margin-right: 5px;"></span> Project Visibility in Local Assessment Area</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #800080; border: 1px solid black; margin-right: 5px;"></span> Project Visibility in Regional Assessment Area*</li> <li><span style="display: inline-block; width: 15px; height: 10px; border: 2px dashed black; margin-right: 5px;"></span> Local Assessment Area</li> <li><span style="display: inline-block; width: 15px; height: 10px; border-bottom: 1px dashed black; margin-right: 5px;"></span> Potential Shipping Route</li> <li><span style="display: inline-block; width: 15px; height: 10px; border: 1px solid black; border-radius: 50%; margin-right: 5px;"></span> Airport</li> <li><span style="display: inline-block; width: 15px; height: 10px; border: 1px solid black; border-radius: 50%; margin-right: 5px;"></span> City or Town</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: yellow; border: 1px solid black; margin-right: 5px;"></span> Pilotage Station</li> </ul>	<ul style="list-style-type: none"> <li><span style="display: inline-block; width: 15px; border-bottom: 1px dashed black; margin-right: 5px;"></span> Electrical Power Transmission Line</li> <li><span style="display: inline-block; width: 15px; border-bottom: 1px dashed blue; margin-right: 5px;"></span> Ferry Route</li> <li><span style="display: inline-block; width: 15px; border-bottom: 1px solid red; margin-right: 5px;"></span> Highway</li> <li><span style="display: inline-block; width: 15px; border-bottom: 1px solid gray; margin-right: 5px;"></span> International Boundary</li> <li><span style="display: inline-block; width: 15px; border-bottom: 1px solid gray; margin-right: 5px;"></span> Railway</li> <li><span style="display: inline-block; width: 15px; border-bottom: 1px solid gray; margin-right: 5px;"></span> Secondary Road</li> <li><span style="display: inline-block; width: 15px; border-bottom: 1px solid blue; margin-right: 5px;"></span> Watercourse</li> </ul>	<ul style="list-style-type: none"> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #ff8c00; border: 1px solid black; margin-right: 5px;"></span> Indian Reserve</li> <li><span style="display: inline-block; width: 15px; height: 10px; border: 2px dashed orange; margin-right: 5px;"></span> Prince Rupert Authority Boundary</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #90ee90; border: 1px solid black; margin-right: 5px;"></span> Protected Area</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #add8e6; border: 1px solid black; margin-right: 5px;"></span> Waterbody</li> </ul>
<p><b>Pacific NorthWest LNG</b></p> <p><b>Ambient Light Local Assessment Area and Regional Assessment Area</b></p> <p><i>EIS ADDENDUM</i></p> <p>Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information.</p> <p><i>Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.</i></p>		
<p>DATE: 20-NOV-14</p> <p>FIGURE ID: 123110537-419</p> <p>DRAWN BY: K. POLL</p>	<p>PROJECTION: UTM - ZONE 9</p> <p>DATUM: NAD 83</p> <p>CHECKED BY: G. HATCHER</p>	<p>PREPARED BY:</p> <p style="text-align: center;"> <b>Stantec</b></p> <p>PREPARED FOR:</p> <p style="text-align: center;"> <b>Pacific NorthWest LNG</b></p> <p>FIGURE NO:</p> <p style="text-align: center; font-size: 24px;"><b>9-1</b></p>
<p>* The Regional Assessment Area is defined as the area beyond the Local Assessment Area from which the Project is visible.</p>		





<ul style="list-style-type: none"> <li><span style="color: red;">●</span> Ambient Light Measurement Location</li> <li><span style="border-bottom: 1px solid black; width: 20px; display: inline-block;"></span> Project Component</li> <li> Airport</li> <li><span style="color: black;">●</span> City or Town</li> <li><span style="border-bottom: 1px dashed black; width: 20px; display: inline-block;"></span> Electrical Power Transmission Line</li> <li><span style="border-bottom: 2px solid red; width: 20px; display: inline-block;"></span> Highway</li> <li><span style="border-bottom: 1px solid black; width: 20px; display: inline-block; border-top: 3px double black;"></span> Railway</li> <li><span style="border-bottom: 1px solid blue; width: 20px; display: inline-block;"></span> Watercourse</li> <li><span style="background-color: #90EE90; border: 1px solid black; width: 20px; height: 10px; display: inline-block;"></span> Protected Area</li> <li><span style="background-color: #ADD8E6; border: 1px solid black; width: 20px; height: 10px; display: inline-block;"></span> Waterbody</li> <li><span style="border-bottom: 1px solid black; width: 20px; display: inline-block;"></span> Secondary Road</li> </ul>	<p><b>Pacific NorthWest LNG</b></p> <p><b>Ambient Light Measurement Locations</b></p> <p><i>EIS ADDENDUM</i></p> <p><small>Sources: Government of British Columbia, Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.</small></p> <p><small>Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.</small></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">DATE: 20-NOV-14</td> <td style="width: 50%;">PROJECTION: UTM - ZONE 9</td> </tr> <tr> <td>FIGURE ID: 123110537-348</td> <td>DATUM: NAD 83</td> </tr> <tr> <td>DRAWN BY: K. POLL</td> <td>CHECKED BY: G. HATCHER</td> </tr> </table>	DATE: 20-NOV-14	PROJECTION: UTM - ZONE 9	FIGURE ID: 123110537-348	DATUM: NAD 83	DRAWN BY: K. POLL	CHECKED BY: G. HATCHER	<p>PREPARED BY:</p> <p> <b>Stantec</b></p> <p>PREPARED FOR:</p> <p> <b>Pacific NorthWest LNG</b></p> <p>FIGURE NO:</p> <p style="font-size: 24pt; font-weight: bold; text-align: center;">9-2</p>
DATE: 20-NOV-14	PROJECTION: UTM - ZONE 9							
FIGURE ID: 123110537-348	DATUM: NAD 83							
DRAWN BY: K. POLL	CHECKED BY: G. HATCHER							

11/20/2014 - 12:25:18 PM V:\active\123110537\figures\EIS\_Addendum\Fig\_123110537\_04\_add\_09\_02\_ambient\_light\_locations.mxd



6020000  
6015000  
6010000  
6005000  
6000000  
405000  
410000  
415000  
420000  
6020000  
6015000  
6010000  
6005000  
6000000

V:\ar\123110537\figure\EA\_A\Address\fig\_123110537\_ea\_add\_09\_03\_approved\prpse.ed\_projects.mxd  
11/12/2014 - 11:21:37 AM

<p><b>Project Locations</b></p> <p><b>Status</b></p> <ul style="list-style-type: none"> <li><span style="color: green;">●</span> Approved</li> <li><span style="color: black;">●</span> Operational</li> <li><span style="color: purple;">●</span> Proposed</li> <li>— Project Component</li> <li>■ Proposed or Existing Industrial Development Footprint</li> </ul>	<ul style="list-style-type: none"> <li> Airport</li> <li><span style="color: black;">●</span> City or Town</li> <li>--- Electrical Power Transmission Line</li> <li>— Highway</li> <li>+++ Railway</li> <li>— Secondary Road</li> <li>— Watercourse</li> <li><span style="color: orange;">■</span> Indian Reserve</li> <li><span style="border: 2px dashed orange; display: inline-block; width: 10px; height: 10px;"></span> Prince Rupert Port Authority Boundary</li> <li><span style="background-color: lightgreen; border: 1px solid green; display: inline-block; width: 10px; height: 10px;"></span> Protected Area</li> <li><span style="background-color: lightblue; border: 1px solid blue; display: inline-block; width: 10px; height: 10px;"></span> Waterbody</li> </ul>	<p><b>Pacific NorthWest LNG</b></p> <p><b>Past, Present, and Reasonably Foreseeable Projects near the PNW LNG Project</b></p> <p><i>EIS ADDENDUM</i></p> <p><small>Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.</small></p> <p><small>Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.</small></p> <table style="width: 100%; border: none;"> <tr> <td style="border: none;">DATE: 12-NOV-14</td> <td style="border: none;">PROJECTION: UTM - ZONE 9</td> </tr> <tr> <td style="border: none;">FIGURE ID: 123110537-476</td> <td style="border: none;">DATUM: NAD 83</td> </tr> <tr> <td style="border: none;">DRAWN BY: K. POLL</td> <td style="border: none;">CHECKED BY: J. WALKER</td> </tr> </table>	DATE: 12-NOV-14	PROJECTION: UTM - ZONE 9	FIGURE ID: 123110537-476	DATUM: NAD 83	DRAWN BY: K. POLL	CHECKED BY: J. WALKER
DATE: 12-NOV-14	PROJECTION: UTM - ZONE 9							
FIGURE ID: 123110537-476	DATUM: NAD 83							
DRAWN BY: K. POLL	CHECKED BY: J. WALKER							
		<p>PREPARED BY:</p> <p style="text-align: center;"></p> <p>PREPARED FOR:</p> <p style="text-align: center;"></p> <p>FIGURE NO:</p> <p style="text-align: center; font-size: 24pt;"><b>9-3</b></p>						