ONTARIO ENERGY BOARD

IN THE MATTER OF the *Ontario Energy Board Act, 1998, S.O. 1998*, c. 15, Sch. B, as amended (the "**OEB Act**")**;**

AND IN THE MATTER of an application by Grand Renewable Wind LP for an Order or Orders granting Leave to Construct new Transmission Facilities within Haldimand County, Ontario.

APPLICANT RESPONSE TO HALDIMAND COUNTY HYDRO INC. ("HCHI") INTERROGATORIES

Interrogatory # 1

Questions:

(a) Please confirm the project as currently proposed is approximately 19 kilometres [long].

Confirmed. The exact length of the Transmission Line on the ROW is 18.82 km, of which approximately 800 meters will be buried underground.

(b) Will the transmission line be located on one side of Haldimand Road 20 for the full 19 km and if so is it the north or south side? If not please provide a drawing showing where along Haldimand Road 20 the transmission line will be on the north side and where it will be on the south side.

No, the Transmission Line will not be located on one side of Haldimand Rd 20. In designing the Transmission Line, the Applicant was required to maintain setbacks from environmental features such as wetlands and woodlots as well as to mitigate perceived impact to landowners by locating the Transmission Line on opposite sides of residential divides. Please refer to Schedule B, Transmission Line Layout, of the Board Staff IRRs for location drawings of the Transmission Line.

Please note however that the proposed design is preliminary only and may be subject to change to accommodate landowner concerns. The proposed current Transmission Line crosses Haldimand Rd 20 a total of four times and crosses once beneath the Highway 3 corridor at Nelles Corners.

(c) Has Grand Renewable determined where within the road allowance the proposed transmission line is to be located? If so, please provide a map, plan or description of the location including the side of the roadway on which it is to be located and distance from the travelled portion of the road, as well as the property line. If not, has Grand Renewable determined a minimum separation distance from HCHI's distribution system.

Please see cross section graphic (the "**Cross Section**") attached here to as **Schedule A** for the location of the Transmission Line within the road allowance, both overhead and underground configurations. The Cross Section shows the minimum and maximum location of poles relative to the property line. At a minimum, the poles will be located approximately 2.2 m from the property line and a maximum of 5.5 m (for a 30 m ROW) and 3.5 m (for a 26 m ROW). Note that the width of the right of way varies. The Applicant has confirmed with the County's planning department the accuracy of the ROW widths for the entirety of the Transmission Line Route.

The position of the Transmission Line within the ROW will ensure a minimum clearance from the driving surface of the road to the Transmission Line poles of 6m. The preliminary design also shows that 2.2 m minimum clearance is required from the structure to the property line. The width of the ROW will vary depending on the span length although it is normal practice to establish a maximum ROW and use this width for the entire length of line. The structure position within the ROW will depend on the position of existing utilities both overhead and underground and any construction

restraints. These details would be obtained by a ground survey and incorporated into the detail design which would finalize structure positions and blow out clearances to confirm ROW width.

(d) Is the proposed location of the transmission line to be on the same side of the roadway as the existing HCHI distribution system? If the answer depends upon the location, please provide a map or plan showing the location.

HCHI currently has a total of 7 km of existing distribution infrastructure ("**HCHI Infrastructure**") located along Haldimand Road 20. As evidenced in the Transmission Line Layout attached as Schedule B of Board Staff IRRs, the HCHI Infrastructure is located on either side of Haldimand Rd. 20. The Applicant has taken steps to ensure that the Transmission Line is located on the opposite side of the Halidmand Rd 20 in cases where HCHI Infrastructure is present.

Where the Transmission Line structures (monopoles) are located on the same side of Haldimand Road 20, the Applicant has planned to relocate the infrastructure to the opposite side of the road. This includes for underground crossings of Haldimand Road 20 by the local distribution infrastructure and all overhead to underground transitions. The relocated infrastructure can be either overhead or underground in accordance with the agreement of HCHI.

Furthermore, the Applicant has proposed to HCHI and Haldimand County (the "**County**"), as shareholder of HCHI, to bury HCHI Infrastructure at the cost of the Applicant. The Applicant continues to discuss this option with the County in the context of its negotiations with the County regarding a proposed community vibrancy fund. The community vibrancy fund aims to provide benefits to the community, in the Applicant's role as a community partner.

The preliminary design has not considered locating the new Transmission Line alongside the existing HCHI distribution system but has recommended that the distribution poles be either moved to the other side of the road or that the low voltage lines be buried. The proximity of the distribution line to the 230 kV Transmission Line will be restricted by available space within the proposed ROW and the required horizontal clearances to ensure CSA requirements are met. HCHI may also have proximity restrictions that would need to be considered.

(e) Does Grand Renewable plan to have joint use poles or co-locate its proposed transmission facilities with the distribution facilities of HCHI or any other party? If so, what type of arrangements is Grand Renewable intending to enter and with which other party.

The Applicant assumes for the purpose of this question that "joint use" refers to underbuild (i.e. same poles, with both transmission and distribution infrastructure) and that "Co-locate" refers to transmission poles being built within close proximity to distribution poles on the same side of the ROW or the situation in which either the transmission or distribution is buried within close proximity to the above ground infrastructure and on the same side of the ROW.

Joint use is not possible due to the differing span lengths of the Transmission Line and HCHI Infrastructure, although this scenario was investigated by the Applicant. The Applicant also determined that joint use would have a higher visual impact.

(f) Would any co-location with HCHI also involve the 34.5 kV collector lines proposed by Grand Renewable as part of the Grand Renewable Energy Park?

The Applicant notes that the construction of collector is not within the scope of this application. However, the Applicant currently intends to bury its collector lines, although this is subject to change.

(g) Exhibit B, Tab 1, Schedule 1, para. 31(d) identifies two transition stations. Will any portion of the transition stations be located within the municipal right-of-way?

No, the transition stations will be located on private lands.

Interrogatory # 2

Questions:

(a) Does the Applicant have any responsibility for coordination of transmission facilities with other wind generation proponents in order to ensure these are constructed in the most cost efficient manner from the perspective of costs absorbed by the transmission pool?

While the Applicant does not have a formal responsibility to coordinate construction of transmission facilities, the Applicant is always looking for ways to reduce costs and partner with other generators in the area. Based on the geographic location of the Project, it does not appear that coordination with other transmission facilities is possible. This position is supported by the IESO and Hydro One Networks Inc., neither of which has suggested joint facilities.

(b) Does the Applicant have any responsibility for coordination of transmission facilities with other wind generation proponents or transmitters (licensed or unlicensed) in order to ensure these are constructed with due regard to optimizing the reliability of the transmission network?

The Applicant is not responsible for optimizing the reliability of the transmission network, but relies on the IESO to carry out this task. The Applicant will meet all conditions established by the IESO and Hydro One in the SIA and the CIA respectively.

(c) Does the Applicant consider itself bound to connect third parties that request connection to the proposed transmission system? If not, why not? If the response depends upon whether the third party request is from a distributor, generator or transmitter, please provide a complete explanation for the different treatments.

Please see Board Staff IRR# 10(i) and 10(iii).

(d) Which agency or corporate entity is most responsible for coordination of wind and other generation proponents to ensure that transmission facilities are planned and constructed in the most cost effective and reliable manner?

The Applicant does not believe that this question falls within the scope of this leave to construct hearing, however the Applicant relies on a number of agencies in developing its Project including the Ontario Energy Board, which administrative body relies on the IESO and Hydro One Networks Inc.

(e) What is the estimated cost of the transmission interconnection station and what portion of this estimate is expected to be contributed by the Applicant?

The Applicant does not have a current estimate of the total costs of the Interconnection Station. However, the Applicant will be absorbing 100% of the costs of the Interconnection Station, as per the Transmission System Code.

(f) Has the Applicant considered the possibility of extending the Summerhaven transmission line as described in the Preamble above? If yes was this option discussed with Summerhaven, the IESO or Hydro One? If so what reasons were given for or against this alternative?

The Applicant does not have the legal right to extend the Summerhaven transmission line. Furthermore, Summerhaven and the Applicant are connecting to different circuits. These circuits were identified in their respective applications to the Feed-in-Tariff program and bind the Applicant and Summerhaven to these particular interconnection points.

(g) If the Applicant has not considered the possibility of extending the Summerhaven transmission line or has not discussed this possibility with the IESO or Hydro One why has this not occurred?

Please refer to HCHI IRR 2(f).

(h) Did the Applicant consider other alternatives to the currently proposed transmission project? Please describe each such alternative, why it was not chosen and whether such alternative would have provided improved reliability and quality of service for customers as compared to the current proposal in this Proceeding.

Route selection began by first establishing the end points. The end Point of Common Coupling (PCC) with the Ontario electricity grid was broadly established as a PCC to a 230 kV transmission circuit originating out of the Nanticoke GS, heading northward to Hagersville, east of Haldimand Rd 55, east of Highway 6 and east of Hagersville. The starting point of the Collector Substation was broadly defined as being located central to the wind and solar siting area and more specifically, close to the Solar Project at the intersection of Mt. Olivet Rd and Haldimand Rd 20. A meeting was held with the IESO, OPA, OEB, Hydro One and MEI in June 2010 and the IESO expressed a preference for the PCC to be made electrically to Circuit N5 of the transmission corridor originating from the Nanticoke GS and at a location that was farther, rather than closer to the Nanticoke GS for protection and control reasons.

Initially, 6 transmission line routes were identified for consideration. Originating at the Collector Substation near Mt Olivet Rd and Haldimand Rd 20, these routes were:

- Option 1: Concession 4 from Haldimand Road 20 to Haldimand Road 55 including a short section along Haldimand Rd 53;
- Option 2: Concession 4 from Haldimand Road 20 to Haldimand Road 53, northward along Haldimand Rd 53 and westward along Concession 7;
- Option 3: Haldimand Rd 20 to Concession 7, westward along Concession 7 to Haldimand Rd 55;
- Option 4: Haldimand Rd 20 to Concession 9, westward along Concession 9 to Haldimand Road 55;

- Option 5: Haldimand Rd 20 to the abandoned Railway corridor, just west of Nelles Corners, westward along the Railway corridor to Haldimand Rd 55;

- Option 6: Haldimand Road 20 from Mount Olivet Road to Hagersville.

At the June meeting of the Applicant, the IESO, OPA, OEB, Hydro One and MEI, all parties expressed a preference for Option 1, Option 4, and Option 6. Option 1 was replaced with Option 5 since it was preferred by the Applicant to remain clear of the NextEra and Capital Power wind generation projects, generally located in the land area south of Haldimand Road 20 and Concession 7. The initial six route options are shown on the Line Routes map attached hereto as **Schedule B**. In summary, Options 1 and 2 were ruled out to avoid conflict with the NextEra and Capital Power projects. Option 3 was also ruled out due to the close proximity to the other projects but also because the number of residents along Concession 7 and the continuous presence of 16 kV Haldimand County Hydro overhead infrastructure. These criteria were considered to have a much lower impact on any of the other three remaining Options 4, 5, and 6.

The short-listed three route options (4, 5, and 6) were presented to the public at the first GREP Public Meeting in July 2010. A feasibility study had been completed to examine the technology to be employed for the Transmission Line. Preliminary Transmission Line structure concepts were developed. The route selection criteria were also established. Considerations for a private right-of-way route option were explored at this time. The three line route options needed to be narrowed down to a preferred line route option.

Route selection criteria identified included:

- Safety

- Design Technology and Construction Requirements

- Land Ownership and Right of Way Considerations

- Environmental Considerations

- Geotechnical Considerations

- Operations and Maintenance

- Time to Construct

- Cost

There is an interdependence of the selection criteria based on the technology used so it was important to determine whether the Transmission Line would be overhead on steel lattice structures or monopole structures vs underground buried cables. The feasibility

study completed in July presented a comparison of overhead vs underground technology and these results are summarized in Table 1 attached hereto as **Schedule C**. The feasibility study assumed an ideal 20 km Transmission Line length and also assumed that land acquisition was not a constraint.

It was concluded that if the Transmission Line was to be overhead, it would be best if it followed the Haldimand Rd 20 line route Option 1 and/or Option 6. If the Transmission Line was to be underground, it would be best if the shortest line route was chosen or Option 6 to minimize cost impact to the Project.

Each of the three short-listed route Options were compared by the selection criteria. Issues that made the Applicant pass on Option 4 were failure to meet the CSA clearance requirements on the abandoned ROW. The width of the ROW was only 20 m and, in some areas, only 15 m. Hence, the line route failed the safety criteria for the portion of the route along the abandoned railway ROW.

In the case of Option 5, the same issue as Option 4 was present. The width of the existing Concession 9 ROW is 20 m. The Transmission Line design did not meet the clearances required under the governing CSA Standard and as a result, the line route option failed the safety criteria for the portion of the route along Concession 9.

The last remaining Option, 6, along Haldimand Rd 20, for its entire length, met the safety requirements except where the Transmission Line passes through Nelles Corners. In this case, the required clearances are not met and the Applicant has proposed to bury the Transmission Line in the ROW through Nelles Corners. An alternate route overhead was considered via Dry Lake Road and the abandoned Railway but in both cases the width of the existing ROW was only 20 m and the safety criteria was not met.

Interrogatory # 3

Questions:

(a) Is the Applicant aware of any instance where a municipality has granted an easement to a utility for the locating of plant along a municipal road right-of-way? Please do not include road crossings.

Although the Applicant cannot attest to the legal right assigned to a transmitter or distributor, the Applicant is aware of many instances in which transmission and/or distribution have been built along a municipal right of way. The City of Toronto, Hamilton, etc. have multiple examples of distribution and transmission that have been built using the municipal road right of way. Furthermore, the Applicant notes that there is no legal definition of "easement". In fact, many types of road use agreements, licences, letters of permission could be considered an "easement" depending on the municipality in question. The Applicant has identified the road use agreement attached in its application as an "easement", but HCHI should not be overly concerned with legal nomenclature.

(b) Did the Applicant consider another form of agreement such as a road use agreement? If so, please indicate what form and why such form is not being proposed.

Please see HCHI IRR #3(a). The form of easement submitted with the Application was used as the basis for negotiations with Haldimand County. Negotiations with the County have since progressed and the Applicant is currently negotiating the terms of community vibrancy fund, which outlines benefits to the community as an informal partner in the Applicant's wind energy business. The community vibrancy fund will also refer to the road use agreement, which terms are currently being negotiated and the Applicant plans on executing them concurrently.

(c) Is the easement to be registered on title?

For financing purposes, the Applicant will seek to have notice of its rights, privileges and interests to the municipal right of way, whatever form these rights may take, registered on title.

(d) What is the width of the right-of-way of Haldimand Road 20? If the width varies along the proposed 19 km transmission line, what is the minimum width at any point, what is the maximum width at any point, and what is the most common width?

As per the legal survey provided by Haldimand County, Haldimand Road 20 generally is a width between 26 and 30 meters wide. The minimum width appears to be 22 meters for a short distance (less than 10 meters) at the intersection of Kohler Rd and Haldimand Rd 20. The maximum road width is 30 meters and represents the majority of the length of Haldimand Road 20.

(e) What is the width of the easement sought? Please specify for both above ground and underground sections and identify any temporary easements beyond the permanent easement sought.

Easements are not being sought at the present time. Permission to use the right of way known as Haldimand Rd 20 is being sought from the County. The Transmission Line and its supporting structures are planned to be located within the Haldimand Rd 20 Right of Way. There may/likely will be a requirement for an easement to the landowner on the north side of Haldimand Road 20 where Bains Rd intersects Haldimand Road 20 to allow for the overhead conductor to make passage around the curve in Haldimand Road 20."

Please see **Schedule D** for a typical cross section of the road.

For the underground section of 230 kV line, the ROW required is normally dictated by the working space required to excavate and install the concrete duct bank, this in turn is dictated to the layout of the duct bank i.e. horizontal versus vertical formation, spare cable and communication cable requirements and depth of installation. The installation can be positioned closer to the road surface and adjacent to the shoulder so that installation can be carried out from the road. As an example, for a vertical duct bank consisting of 3 cables plus one spare plus up to two OPGW communication cables, the required ROW can be as little as 1.0 m if installation and maintenance can be carried out from the road.

(f) Is the Applicant seeking exclusive rights to the area within the Easement Lands?

The Applicant has not finalized details with the County yet, however use will be restricted based on safety considerations and according to code. The Applicant is not necessarily seeking exclusive rights to the area within the Easement Lands. Use of the area inside the overhead Transmission Corridor will be allowed but it will be restricted. Transmission lines are designed so that safe electrical clearances are maintained during the line's operation. The height of the energized conductors above ground accessible to vehicles and over the farmland is sufficient to allow large vehicles (i.e. trucks and standard agricultural machines) to safely pass under the conductors. The land under the Transmission Line can be used for agriculture purposes; however the growing of tall trees or constructing buildings under the Transmission Line is not permitted. The Transmission Corridor will be so arranged that ground access for maintenance and urgent repairs is available at all times.

(g) Please confirm the period of the easement is intended to last for 50 years.

Although the Applicant has not finalized the form of easement/road use agreement, the Applicant is seeking rights to the municipal ROW for a period of 50 years.

(h) How does the location of the easement relate to the right-of-way (i.e. does it extend beyond the right-of-way)? Please provide a cross-section of the right-of-way showing the proposed location of the easement and the location of the transmission line. Please show for both the above ground and underground sections of the transmission line.

Please see HCHI IRR #1(c).

The easement for the Transmission Line will be contained with the road ROW for both overhead and underground sections.

(i) Exhibit A, Tab 2, Schedule 1, page 4, Footnote 1 indicates that "consent of the owner or (or any other person having interest) of the public street or highway is not required in order to erect the transmission line." Does the Applicant agree that the right of occupation described above is subject to either agreement with the owner of the public street or requires the order of the Ontario Energy Board? If the Applicant does not agree, please explain the basis for such disagreement.

The above wording was taken directly from section 41(5) of the *Electricity Act, 1998*, which states: "The exercise of powers under subsections (1), (2) and (3) does not require the consent of the owner of or any other person having an interest in the street or highway." This provision applies to unlicenced transmitters and distributors.[1]

The Ontario Energy Board also has the authority to make an order authorizing a person to construct a work upon, under or over a highway, utility line or ditch (see *Ontario Energy Board Act, 1998,* s. 101).

Despite the foregoing, the Applicant is seeking to enter into the community vibrancy fund agreement with the County as a good neighbour and to form the basis of what it hopes will be a sustainable relationship with Haldimand County and its partners in the community.

(j) The proposed Easement Agreement, Clause 9, cited from page 4, see above, does not refer to any wires, cables or infrastructure of HCHI or any person other than Haldimand County. Is Grand Renewal's position that HCHI and other utilities receive no protection or benefit from the form of easement agreement or are prohibited from using the municipal right-of-way?

Please see HCHI IRR# 3(b). Although the details have not been finalized, based on current negotiations with the County, the final form of road use agreement will likely provide appropriate protections to HCHI and other third parties that are making use of the right of way. The Applicant will also seek additional easements where necessary. Please see Board Staff IRR#5(i) through (iv) for further details related to crossings. The Applicant also presumes that HCHI is afforded protection for its infrastructure pursuant to any road use agreement/license, etc. it has entered into with Haldimand County.

(k) Is Grand Renewable's position that HCHI would have to obtain approval from Grand Renewable to locate HCHI infrastructure within the municipal right-of-way? If so, upon what basis would such approval be approved or rejected.

[1] See: Decision with Reasons respecting Plateau Wind Farm and s. 41 of the *Electricity Act, 1998I,* January 12, 2011 (EB-2010-0253)

The Applicant cannot declare its position that HCHI would have to obtain approval from Grand Renewable to locate HCHI infrastructure within the municipal right of way since the extent or type of rights that may be granted to the Applicant by the County have not been finalized.

(l) The easement agreement, clause 2, provides the Transferee with a right to blast. Has the Applicant done any studies regarding the need for blasting? If so, please provide such studies. What precautions will Grand Renewable take to ensure that these activities do not impact HCHI, its infrastructure and ratepayers?

The Applicant has not concluded any studies regarding blasting. The Applicant will take all necessary safety precautions and abide by all regulations related to blasting in the event blasting is required.

(m) Clause 12(b), of the form of easement agreement requires the Transferor to covenant that "the Transferee shall have quiet enjoyment of the rights, privileges, easement and right-of-way hereby granted". Is this clause intended to give Grand Renewable an exclusive right to the easement lands? If not, please explain the intent of this covenant.

The right of quiet enjoyment is not intended to provide Grand Renewable with the exclusive use of the municipal right-of-way. Rather, this covenant is intended to ensure that the Transferor will not, through its actions or the actions of others, disturb the right of Grand Renewable to use the municipal right of way for the purposes set out in the easement agreement.

(n) Clause 12(d), of the form of easement agreement requires the Transferor to covenant that "the Transferor has not done, omitted or permitted anything whereby the Easement Lands are or may be encumbered (except as the records of the appropriate land registry office disclose)." How does this covenant reconcile with the rights of HCHI, including statutory rights provided by section 41 of the Electricity Act, and any other utility that may have a franchise or similar agreement with Haldimand County either through the Municipal Franchises Act or otherwise?

Please see HCHI IRR# 3(b). It is likely that this covenant can be removed from the easement agreement. Title to municipal rights of way is not ordinarily encumbered by the same types of instruments (e.g. mortgages) that encumber privately owned lands. As such, it is highly unlikely that there will be any encumbrances that would affect the Applicant's right to use the lands. In addition, even if there are encumbrances registered on title, there are statutory rights under the Electricity Act that allow for the construction of transmission systems on municipal rights of way.

Interrogatory # 4

Questions:

(a) Exhibit B, Tab 3, Schedule 1, Paras. 48 and 56 indicate that existing HCHI infrastructures will have to be relocated.

(i) Has Grand Renewable determined the extent of HCHI's infrastructure that it would desire to see moved? Please provide a plan indicating the location of potential conflicts between the proposed transmission facility and the existing HCHI distribution system, including to where it proposes HCHI facilities will be located.

A map detailing the underground road crossings will be produced at the detailed design stage once the route has been finalized. Based on the preliminary design, a preliminary summary of the crossing and relocation of HCHI Infrastructure is provided below. The figures referenced can be found in the Transmission Line Layout, attached as Schedule B to the Board Staff IRRs.

Overhead Primary Voltage	Crossing Location	Figure No.
4800 V	Btw Poles 15 and 16	E401
16 kV	Btw Poles 49 and 50 at Link Rd	E406
16 kV	Btw Poles 55 and 56 at HR 20 at Conc. 7	E 407
27.6 kV	Btw Poles 62 and 63 at HR 12	E408
16 kV	Btw Poles 67 and 68 at Conc 8	E408

Overhead Primary Voltage	Relocated Infrastructure	Figure No.
4800 V	Btw Pole 17 and 23 on the north side of HR 20	E402
4800 V	Btw Pole 23 and pole 29 at Richert Rd and Conc 5	E403
8320 V	Btw Poles 30 and 34 at HR 20 and Kohler Rd.	E 404
16 kV	Btw Poles 72 and 79 at HR 20 and Dry Lake Rd.	E409

(ii) Please describe the discussions that have taken place with HCHI regarding any such relocation.

The possible relocation of HCHI infrastructure was discussed between the Applicant and HCHI in meetings dated September 1, 2010 and October 22, 2010, as evidenced by the meeting minutes.

(iii) Has any agreement with HCHI been entered into by the Applicant?

Not as of yet, however the Applicant remains open to discussions with HCHI.

(iv) Who would bear the cost(s) of any relocation of HCHI facilities? Please be specific about the type of cost and responsibility.

In the event that it is necessary to relocate HCHI facilities, the Applicant would bear the costs of such relocation.

(b) Has the Applicant performed any studies for the proposed transmission line regarding the potential for electric or magnetic fields, induced or stray voltage to impact the HCHI distribution system? If so, please provide the studies.

At this time, considering the Applicant only is at the preliminary design stage, the Applicant has not performed any studies for the proposed Transmission Line regarding the potential for electric or magnetic fields, induced or stray voltage to the HCHI distribution system.

We can confirm that at this stage, no induction studies have been carried out as the design has been based on the Transmission Line and the HCHI distribution systems being on opposite sides of the road.

(c) If there is an impact (i.e. induced voltage), would Grand Renewable be responsible for paying for the elimination or mitigation of such impact? Please explain.

The Applicant would be responsible for any reasonable mitigation measures associated with stray voltage.

It is recommended that a pre-construction study is carried out to highlight any areas where induced voltage may be significant. Induced voltages may only be of concern during maintenance outages on one line where the other line is live. These effects can be mitigated by using normal grounding methods and adherence to established maintenance procedures. Induced voltages during normal operating times on either line are not likely to be of major concern when both lines are live anyway. As induced voltages reduce exponentially depending on the distance between the lines, the best mitigation is to ensure adequate horizontal and/or vertical clearances, which clearances are set out according to Code.

(d) Is Grand Renewable aware of a study prepared for the British Columbia Ministry of Transportation entitled “Effects of High Voltage Transmission Line In Proximity of Highways” dated September 30, 2005 which includes a survey of “Utility Policies from other States and Provinces” (see attached) and notes that in Quebec a transmission line

above 50 kV is “not allowed in ROW” and “BC Hydro policy would not permit placing a distribution circuit (25 kV or less) on the same structures as 138 kV and higher voltage lines.”

Yes, the Applicant is aware of the above noted study.

(e) Is Grand Renewable aware of any location in Canada where a 230 kV transmission line is built parallel to and within a municipal road right-of-way for a distance greater than 5 km?

(i) If so, please provide the name of the street, municipality, and province.

Please refer to the photos of distribution and transmission infrastructure that is located in close proximity to one another, attached hereto as **Schedule E.** Please note that the photos indicate the approximate location and include examples of distribution infrastructure that is located on both the opposite side of the road from the transmission infrastructure, as well as the same side. The examples provided, with the exception of the Brampton Street example (which is close to 5 km), are all greater than 5 km in length.

(ii) If so, does it involve joint use of the poles:

No.

(iii) If so, is a distribution line located within the same right-of-way and at the same location as the 230 kV transmission line.

Please see HCHI IRR# e(ii).

(f) Please provide a proposed cross-section of the road showing the proposed location of the transmission line and the location of existing roadway, HCHI distribution facilities, other utilities (gas, sewer, water, telephone, and communications) and the 34.5 kV collector lines.

The disposition and arrangement of existing utilities is not known at this stage and only typical locations and clearances can be provided.

(g) Please confirm the separation distance for the proposed transmission poles from HCHI distribution lines and poles?

Separation distance can be satisfied either in the vertical direction or horizontally.

The vertical separation required would be a maximum of 1.7 m from the lowest 230 kV conductor at maximum sag to the distribution conductor under no sag.

If the vertical clearance cannot be satisfied then the horizontal separation distance is dependent on the maximum swing of the conductor, the voltages of the adjacent lines and the position of the poles on one line with respect to the mid-span of the other line. These clearances are calculated during detailed design. For the purposes of illustration,

a 200 m span on the 230 kV line will give a maximum swing of about 1.7 m and if this is running parallel to a 27.6 kV line, there would be a combined sum of rms line to ground voltage of 164 kV.

According to CSA standards, this would require a clearance increment of 1933 mm to be added to the swing, giving a conductor to conductor clearance of about 3.6 m in still air conditions. The actual pole to pole separation will be greater than this and dependent on pole geometry.

(h) How was the 28m pole height determined?

(i) Did it take into account the proposed facilities, two 27.6kV distribution circuits, of HCHI?

The pole height was determined based on total ROW width and the CSA Standard for Overhead Systems.

The pole height is determined using the minimum required ground clearance to the lowest conductor and the vertical spacing between phases which are calculated from the required electrical clearances under various loading conditions. The vertical spacing also needs to allow for conductor galloping. The clearances are obtained from the CSA code and are modified using the PLS-CADD design program to incorporate insulator string length and galloping. In addition, conductor spacing was vertically arranged to allow for a minimum traffic clear zone of 6.0m from edge of pavement along HR 20 to the face of the monopole structure.

Any existing HCHI infrastructure has not been taken into account.

(ii) Did it take into consideration any future space requirements for communications or other potential users? If yes, please specify which requirements and users. If not, why not?

No additional space or capacity has been considered. At this stage, information on any future or existing requirements for communications or other facilities is not known, nor would we recommend the placement of communication infrastructure on the transmission line structures.

(i) How large are the concrete foundation for the proposed poles?

The Applicant is considering three types of foundations, each of which is attached hereto in **Schedule F.** The type of pole foundation used will be dependent on line stresses.

(j) How close will the concrete foundation be located to HCHI facilities?

The Applicant will be able to confirm the distance of the pole foundations from HCHI Infrastructure once the detailed design, including geotechnical work, has been completed.

(k) Will the proposed transmission poles require guying? If so, please specify type and location of such guying.

Currently, the Transmission Line will not require guying. This may be subject to change based on the detailed engineering work that has yet to be conducted.

(l) What are the distribution supply needs of the transformer stations and the transmission interconnection station from HCHI as the local distributor? Please indicate the demand, single or three phase and any other information needed to provide service.

Based on the preliminary design, the electrical service requirements for the interconnect station and the collector substation are estimated to be 30 kW and 150 kW respectively. Both services are anticipated to be single phase. Specific connected and demand load estimates will be completed as part of the final design process. It is anticipated that applications for the services would be submitted to the local electrical distribution company through the normal service request procedure.

(m) HCHI has requested Grand Renewable to provide space on all new collector poles for two HCHI 3-phase 27.6 kV circuits everywhere its collector lines are built in order to facilitate HCHI's current and potential future needs to supply its load and distribution connected generation customers. If Grand Renewable is proposing a joint use arrangement, we ask that detailed pole configuration drawings be provided to show how it intends to accommodate the two 27.6 kV circuits of HCHI as well as its own collector line(s) and an overhead transmission line along municipal right-of-ways?

The issue of collector lines is not within the scope of the leave to construct application. However, the Applicant intends to bury its collector lines, which may be subject to change.

(n) Does Grand Renewable agree that locating a pole within the municipal right-of-way increases the risk of damage from vehicles greater than either (i) locating the poles on private lands; or (ii) burying the transmission line?

The Applicant is unable to either agree or disagree with the premise because it would require speculation on the part of the Applicant (i.e. what type of private lands, do such lands include privately owned roads, what are the private lands used for, etc..). The Facility will be built to meet or exceed all applicable safety standards.

(o) Does Grand Renewable agree that locating a transmission pole within the municipal right-of-way increases the risk of damage to HCHI infrastructure?

The Applicant cannot answer this question since it is unclear as to what type of damage is being referred to, under what circumstances and the type of HCHI infrastructure that is at issue. The Applicant will be designing to meet all safety standards in both construction, operation and maintenance.

(p) The existence of both distribution lines and a transmission line on the same poles would be expected to require shorter span lengths than a transmission line without distribution.

(i) What span lengths has the Grand Renewable planned for the transmission line along municipal road rights-of-way?

The anticipated distance between span lengths for the Transmission Line is 200 meters. The span length in locations where the Haldimand Road 20 curves may differ.

(ii) Please provide a drawing showing the exact plan view with span lengths and pole locations for the entire distance of the transmission line along municipal road rights-of-way?

Please see Transmission Line Layout, attached as Schedule B to Board Staff IRRs.

(q) Will the proposed transmission line be built to the Hydro One Networks Inc. standard for a 230 kV line?

Please refer to Exhibit B-9-1 of the Application for the list of standards applicable to the Transmission Line.

(r) Does Grand Renewable or any of its affiliates own or have planned any 230 kV underground lines utilizing XLPE cable?

Yes, the Applicant plans to use XLPE or similar type cable for the underground portion of the Transmission Line located at Nelles Corners, for an approximate distance of 800 meters.

(s) If the answer to (19) is yes please identify the locations, lengths, and completion date of these transmission lines.

Please see HCHI IRR 3(s).

(t) Has Grand Renewable considered placing a greater length of its transmission line underground? If not why not?

The Applicant has not considered placing a greater length of its Transmission Line underground since burying long amounts of transmission lines is cost prohibitive.

(u) If the reason for rejecting underground 230 kV for the full length of Haldimand Road 20 includes cost please provide cost estimates for both overhead and underground for the sections which are proposed parallel to and within a road right-of-way.

According to a feasibility study conducted by Stantec, overhead cost to build Transmission Line is approximately estimated as CND $1,000,000/km and the underground cost is estimated to be CND $4,000,000/km.

(v) Cost estimates can be prepared with different degrees of accuracy or quality. Please provide the relative accuracy of each of the estimates in question (22) above including the contingency amount in each.

The estimation was conducted by the Applicant's consultant Stantec July 2010. The contingency amount is ± 30% of its estimated cost, respectively addressed in the above question.

(w) Grand Renewable notes that the transmission line will be designed to meet "galloping recommendations". What specific galloping mitigation measures are planned for those

sections of the overhead transmission line which are parallel to and within a municipal road right-of-way?

At this time, the preliminary design is in accordance with the CSA Standard for Overhead Systems. Sags and tensions have been taken into account in the preliminary design.

Galloping is an infrequent occurrence which may never occur on the majority of lines and where it does it is usually limited to bad weather conditions where ice buildup occurs on a conductor under moderate crosswinds. Galloping is normally mitigated by design as there are no known practical methods of effective prevention. At the design stage, cross arm length, vertical conductor spacing and conductor sag is checked to allow for enough clearance to account for any potential looping of a conductor. This is calculated using empirical formulae that re-create the elliptical path of the conductor during galloping. This looping can be calculated directly by the design software. Where maximum sag may be a factor, this can be controlled through conductor tensions and by limiting span length.

(x) Has Grand Renewable considered that HCHI and its ratepayers may be subjected to additional costs related to the cost of distribution service related to the use of the municipal right-of-way for a 230kV transmission line? If so, please specify type and estimated amount of such costs.

The Applicant is prepared to cover any reasonable relocation costs related to HCHI Infrastructure, as well as reasonable mitigation measures and associated environmental considerations. The Applicant would be pleased to discuss with HCHI details of any perceived incremental costs to HCHI ratepayers. Furthermore, the Applicant is negotiating a community vibrancy fund with Haldimand County, which agreement will cover any of these anticipated costs.

(y) What considerations for ice-loading have been taken into account for the design of the 230 kV transmission line? If joint use pole arrangements are intended what other ice loading design of the distribution and communication wires has been used in the selection of the poles?

See **Schedule F** for details related to ice loading. The Applicant does not anticipate joint use pole arrangements.

(z) Is the Applicant planning to build its extensive 34.5 kV collector line system overhead or underground where these will occur along and within municipal road rights-of-way?

Please refer to HCHI IRR# 4(m).

(aa) If a combination of overhead and underground collector lines along and within road rights-of way is expected, under what circumstances will it be overhead and under what circumstances will it be underground?

Please refer to HCHI IRR #4(m).

(bb) Are overhead collector lines planned for anywhere long and within the road right-of-way for Haldimand Road 20 or along any road which intersects Haldimand Road 20?

Please refer to HCHI IRR #4(m). The Applicant notes that no overhead collector lines are currently planned, however this may subject to change.

(cc) Is the Applicant planning its transmission line height and location relative to the existing single circuit 8/4.8 kV and 27.6/16 kV lines along Haldimand Road 20 or is it planning relative to HCHI's potential need for two 27.6 kV three phase circuits along the full 19 km transmission line and along any roads crossed by the transmission line? If the applicant is not building relative to the potential needs of HCHI, why not?

The Applicant has not received or been made aware of any concrete plans by HCHI to upgrade its system to two 27.6 kV three phase circuits. As indicated in HCHI's Distribution Asset Management Plan 2008-2011, energy demand is forecasted to be flat or take a downward trend.[2] However, the Applicant would be pleased to work with HCHI and would be willing to take commercially reasonable steps to accommodate any concrete and imminent plans by HCHI to upgrade the HCHI Infrastructure in the affected by the Transmission Line. As stated in HCHI IRR# 3(l), the Applicant does not believe that HCHI Infrastructure will need to be upgraded in order to provide the required power to the Applicant.

[2] *HCHI Distribution Asset Management Plan, 2008-2011*, at s.4.1.1.2.

Interrogatory # 5:

Questions:

(a) Does the Applicant anticipate receiving Board approval for this Application during August 2011? If not, when does the Applicant anticipate receiving such approval?

The Applicant does not anticipate receiving Board approval during August 2011. Please see HCHI IRR# 5(f) for an updated schedule.

(b) The schedule does not include any reference to the relocation work for HCHI. Please indicate when it is anticipated that such work would be completed. Include the timeframe when HCHI is anticipated to have entered into an agreement with Grand Renewable regarding such work.

It is anticipated that any work required to relocate HCHI Infrastructure will be carried out concurrently with the construction of the Transmission Line. Construction for the Transmission Line is anticipated to begin after any appeals of the REA have expired or been addressed.

The community vibrancy fund that is currently being negotiated with Haldimand County will serve as the basis for detailed discussions with HCHI surrounding the relocation of HCHI Infrastructure. As noted in other IRRs, the Applicant will be responsible for relocation costs associated with HCHI infrastructure and relocation of HCHI Infrastructure will not impact HCHI ratepayers.

(c) The schedule does not include any reference to the new distribution work for HCHI to service any of Grand Renewable's stations. Please indicate when it is anticipated that such work would be completed. Include the timeframe when HCHI is anticipated to have entered into an agreement with Grand Renewable regarding such work.

The planning, timing, cost allocation and construction standard for any work to upgrade to HCHI's infrastructure to accommodate the Applicant's load connection (i.e. service to the Interconnection Station and Collector Substation), if such work is required, would be carried out in accordance with the Distribution System Code.

The Applicant will provide HCHI with the detailed design of the Interconnection Station and Collector Substation as soon as the designs are finalized, as well as the final design of the GREP, which will also require stand-by power from HCHI.

Based on the preliminary design, the electrical service requirements for the interconnect station and the collector substation are estimated to be 30 kW and 150 kW respectively. Both services are anticipated to be single phase. Specific connected and demand load estimates will be completed as part of the final design process. It is anticipated that applications for the services would be submitted to the local electrical distribution company through the normal service request procedure.

The agreement required for the Applicant's load connection would take the form of connection agreement for load customers outlined in Appendix D of the Distribution System Code. The Applicant, in its role as a load customer of HCHI, will meet all requirements under the DSC, including cost and timing requirements. Likewise, the Applicant expects that HCHI would also meet its obligations to the Applicant, as load customer, as prescribed by the DSC.

(d) Has the Applicant received approval from the Ministry of the Environment for the Renewable Energy Approval? If not, when does the Applicant anticipate receiving such approval?

The Applicant has not received the REA approval. However, as evidenced by the letter filed with the Board on August 10, 2011, the Applicant has provided instructions to hearing participants to access the updated REA documents. The complete draft REA documents are now publicly available. The Applicant intends to submit the final REA to the MOE by October 2011 and anticipates receiving the REA approval within the six month approval timeframe prescribed by O. Reg. 359/09.

(e) The Proposed Schedule does not indicate when the proposed transmission line would be constructed. Please identify when the above ground transmission line would be constructed and also identify the period during which the underground transmission line would be constructed.

Please see HCHI# IRR 5(f).

(f) Please provide a complete, up to date revised project schedule that incorporates the responses to (a) thru (e) this interrogatory.

No.	***Milestone***	***Start***	***Finish***	***Remarks***
1	Draft REA Notice to Public	2011.07	2011.09	
2	Second Open House	2011.09		
3	LTC approval	2011.04	2011.10	Application Submitted on February 11, 2011
4	HCHI agreement	2011.09	2011.12	
5	REA approval	2011.10	2012.01	
6	Relocation of HCHI existing Facilities	2013.02	2013.08	Including Design
7	TL A/G construction	2012.09	2013.09	Including Structure Assembly
8	TL U/G construction	2013.05	2013.09	
9	Wind Farm Construction	2012.06	2013.09	
10	Solar Farm Construction	2012.06	2013.09	
11	TL Commissioning	2013.10	2013.11	
12	TL Operation	2013.12	2014.03	

Interrogatory # 6

Questions:

(a) What is the expected response time between event occurrence and linemen being present on site in order to perform emergency work particularly when the problem may cause a power interruption or hazard to distribution connected generation customers or distribution customers?

The timing of any response is based upon many factors. The first being safety. The transmission system is designed so that a typical failure will cause the affected equipment to be isolated to protect the reliability of the transmission grid. Response time will also be based upon the cause of the failure and equipment/tools/personnel required for the work. All in all, response times will be in accordance with operating and maintaining current prudent industry practices.

(b) Where will the responding linemen and equipment be located? How far is this location from the transmission line?

To be determined based upon final design, but personnel will be located in the general facility area to address issues as they arise.

(c) Will such linemen be located at the operations centre or on call, requiring travel to get to the operations centre to respond? If the linemen will be on call what is the mandated response time to arrive on site?

Personnel will be located at the facility during normal working hours and on-call for after hours.

(d) As an unlicensed transmitter and distributor, will Grand Renewable abide by the response times and service standards required for licensed distributors and transmitters in the Distribution System Code and the Transmission System Code?

Yes, the Applicant will abide by the response times and service standards under the TSC and DSC. The Applicant would be pleased to see this requirement as a condition of any LTC approval issued by the Board.

(e) If the Easement Agreement is assigned or transferred without notice, how is Haldimand County, HCHI or any other party to ascertain who is responsible for the transmission line?

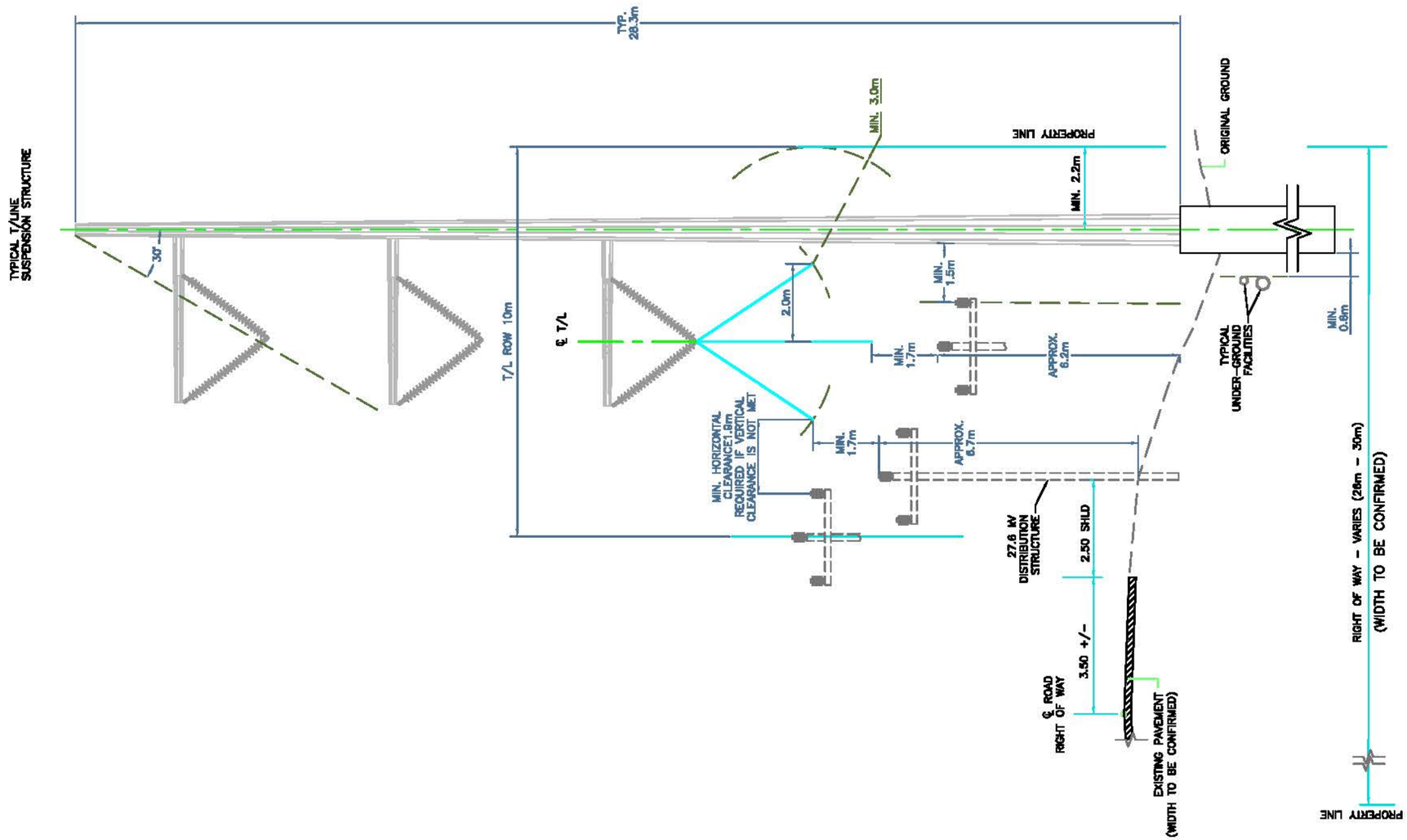
Please see HCHI IRR# 3(b).

(f) Has Grand Renewable considered potential hazards to distribution linemen (or other utility workers such a telecommunications) working in the vicinity of a transmission line? If so, please explain what has been considered. If not, please explain why not.

The responsibility for worker safety rests with the Individual performing the work. The Employer has a responsibility to insure that worker has the proper tools. PPE and training to perform the work safely. Stantec has met or exceeded the safety requirements prescribed by the CSA Standards for the preliminary design of the transmission line.

SCHEDULE A

TYPICAL POLE CROSS SECTION



TYPICAL SUSPENSION CROSS - SECTION

NOTE: DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED

Stantec
49 Frederick Street
Kitchener, ON Canada
N2H 6M7
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Fax. 519.579.8998
www.stantec.com

PRELIMINARY
NOT FOR CONSTRUCTION

Revision	By	Appd.	YY/MM/DD
PRELIMINARY Issued	By	Appd.	11.5.11 YY/MM/DD

File Name:

Dsn.	Chkd.	Dept.	YY/MM/DD

Permit-Seal

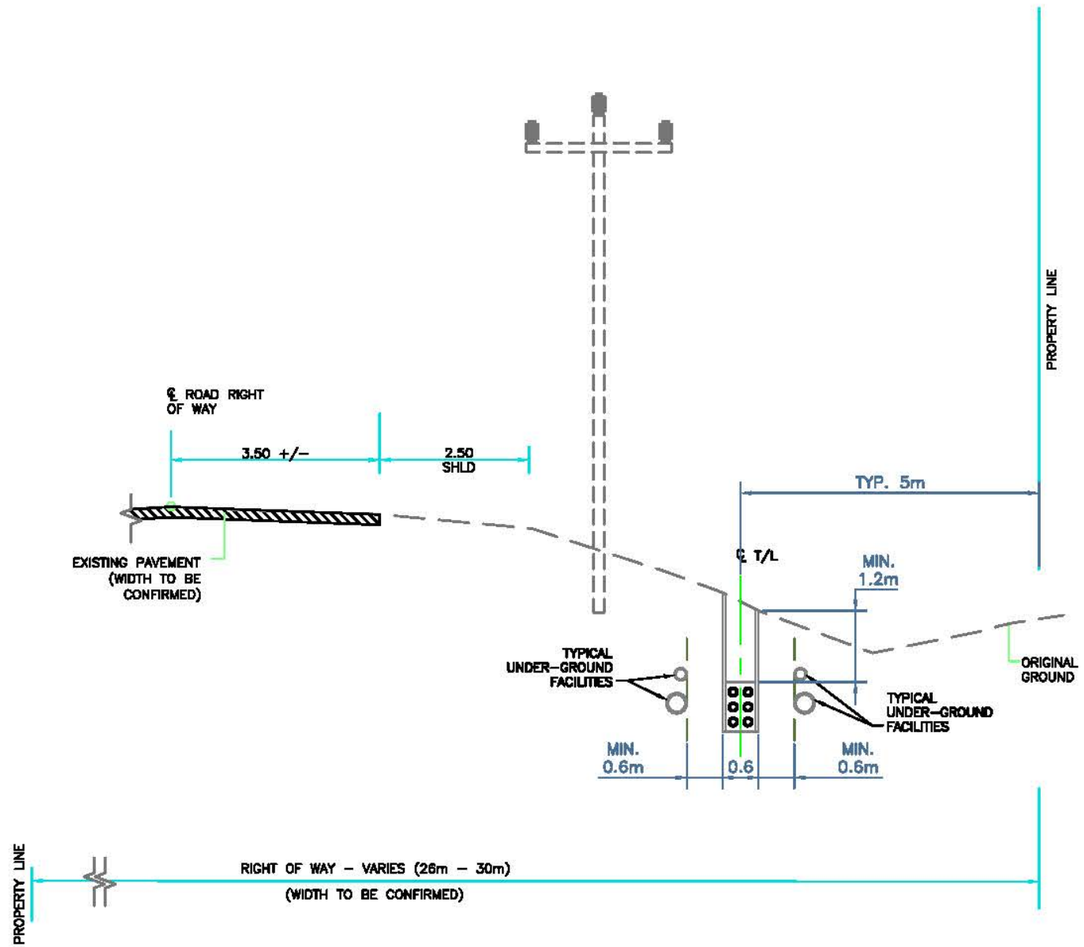
Client/Project
SAMSUNG RENEWABLE ENERGY INC

GRAND RENEWABLE ENERGY PARK

HALDIMAND COUNTY, Ontario

Title
TYPICAL SUSPENSION CROSS-SECTION

Project No.	Scale	
	NTS	
Drawing No.	Sheet	Revision
		0



TYPICAL UNDERGROUND CROSS - SECTION

NOTE: DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED

Stantec
49 Frederick Street
Kitchener, ON Canada
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PRELIMINARY
NOT FOR CONSTRUCTION

Revision	By	App'd	YY.MM.DD
PRELIMINARY Issued	By	App'd	11.5.11 YY.MM.DD

File Name:

Permit-Seal	Des.	Chkd.	Dwgn.	YY.MM.DD

Client/Project
SAMSUNG RENEWABLE ENERGY INC

GRAND RENEWABLE ENERGY PARK

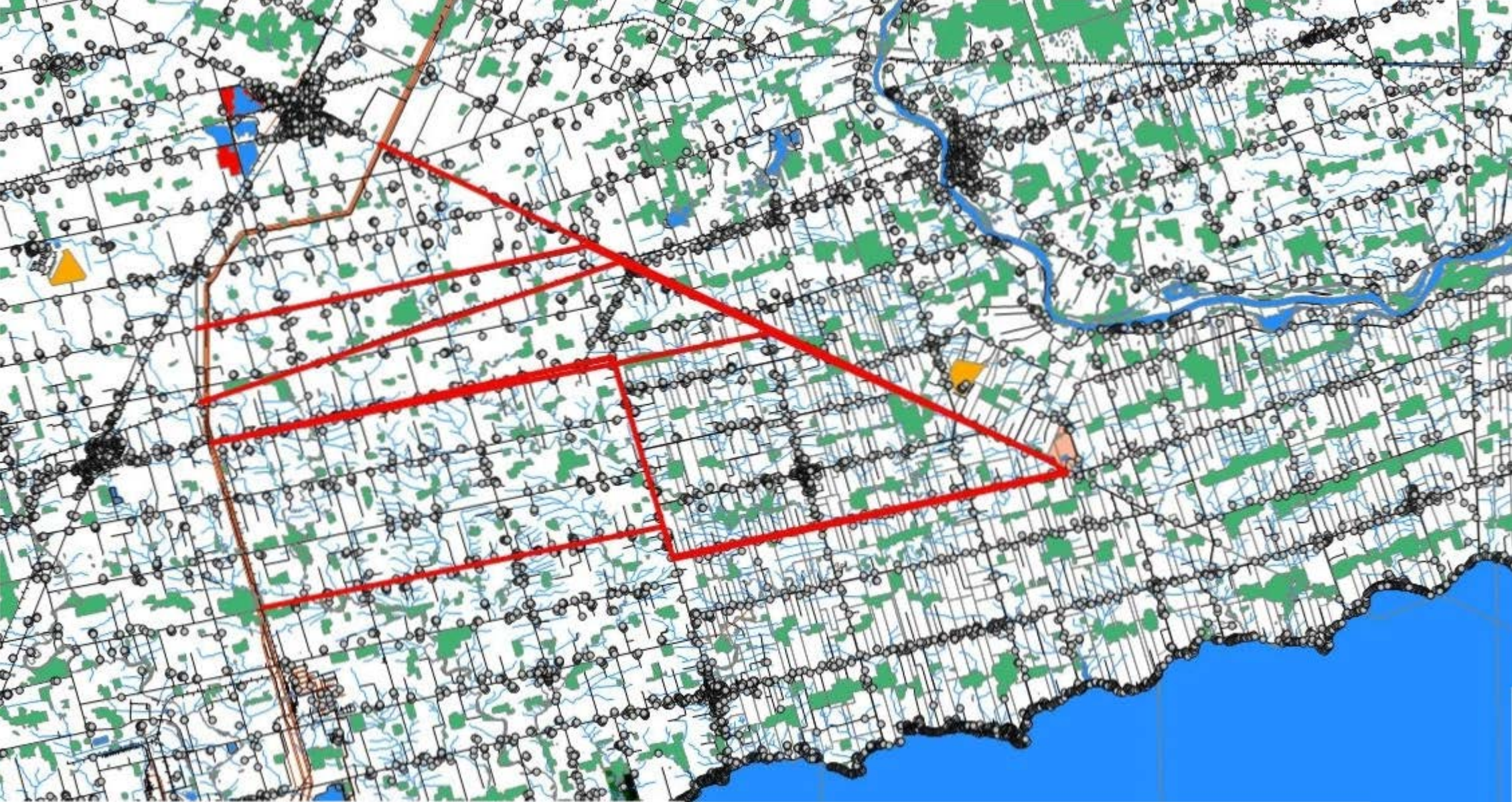
HALDIMAND COUNTY, Ontario

Title
TYPICAL UNDERGROUND CROSS-SECTION

Project No.	Scale	
	NTS	
Drawing No.	Sheet	Revision
		0

SCHEDULE B

ROUTE OPTIONS



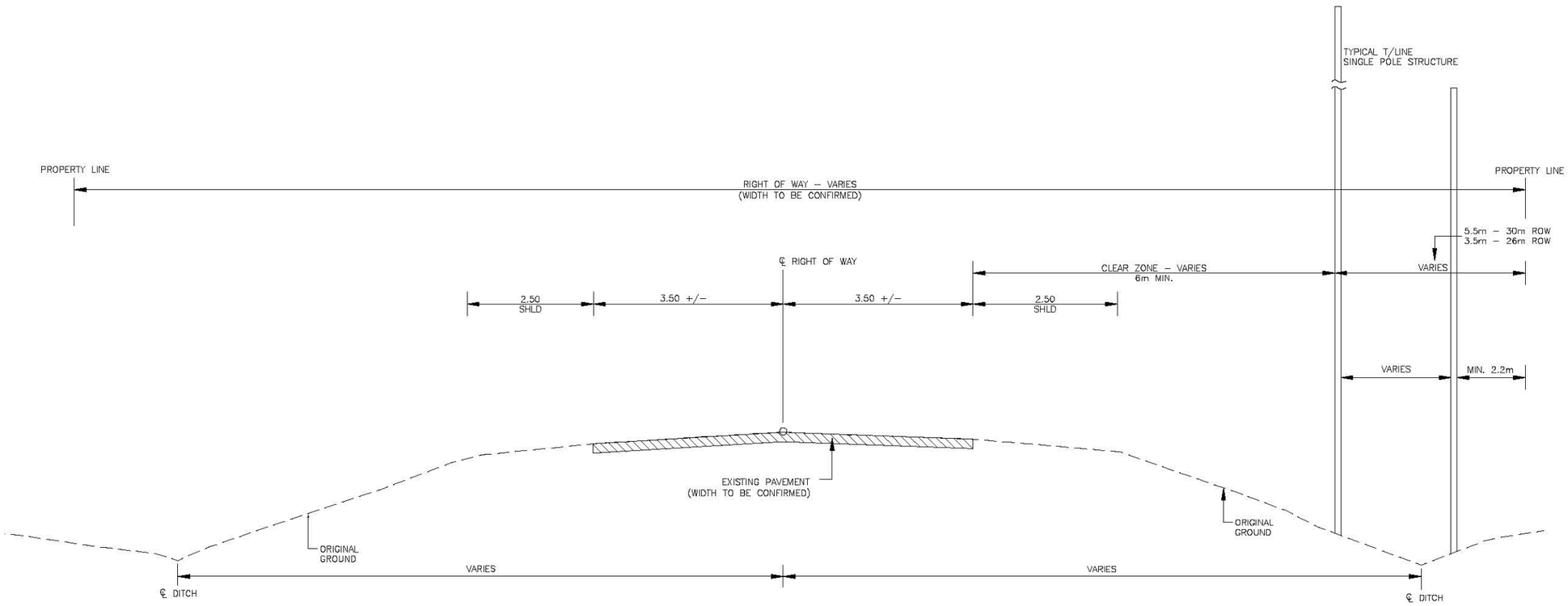
SCHEDULE C

TABLE - OVERHEAD VS UNDERGROUND TRANSMISSION @ 230 KV

Table 1 Overhead vs Underground Transmission @ 230 KV		
Criteria	**Overhead**	**Underground**
Technology	Proven	New
Reliability	Good	Fair
Repair Time	Short	Long
Decommissioning	Easy	Difficult
Service Contractors	Several	Limited
Ground Temperature	No Change	Elevated
Magnetic Fields	Elevated	@Ground level
ROW Width	Wide	Narrow
Time to Construct	24 months	17 months
Cost	$1M per km	$4M per km

SCHEDULE D

TYPICAL TWO LANE CROSS-SECTION



TYPICAL 2 LANE CROSS - SECTION

N.T.S

NOTE: DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED

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49 Frederick Street
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PRELIMINARY
NOT FOR CONSTRUCTION

Revision	By	Appd.	YY.MM.DD
PRELIMINARY Issued	By	Appd.	10.10.7 YY.MM.DD

File Name: ROAD-X-SECTION	JDM Dwn.	MC Chkd.	MC Dsgn.	10.10.7 YY.MM.DD

Permit-Seal

Client/Project
SAMSUNG RENEWABLE ENERGY INC

GRAND RENEWABLE ENERGY PARK

HALDIMAND COUNTY, Ontario

Title
TYPICAL 2 LANE
CROSS-SECTION

Project No.	Scale	
161010646	NTS	
Drawing No.	Sheet	Revision
		0

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2010/11/09 8:53 AM By: Martin, Jon (Kitchener)

ORIGINAL SHEET – ARCH D

SCHEDULE E

DISTRIBUTION AND TRANSMISSION INFRASTRUCTURE


Hyde Park Avenue / Walsh Street East, Thunder Bay, Ontario, Canada
Address is approximate
Walsh St E
Hamilton Ave
Hamilton Ave
Hyde Park Ave
Walsh St E
© 2011 Google
Report a problem

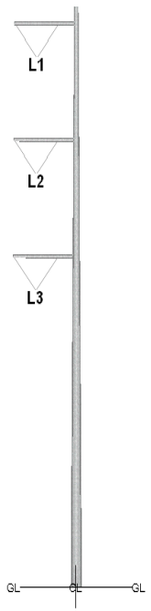

Brampton Street, Hamilton, Ontario, Canada
Address is approximate
Brampton St
Brampton St
Brampton St
Woodward Ave
© 2011 Google
Report a problem
Internet
105%

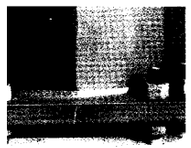

6967 County Road 124, Breslau, Ontario, Canada
Address is approximate
Wellington Road 124
124
124
© 2011 Google
Report a problem


Ontario 6, Hamilton, Ontario, Canada
Address is approximate
6
6
80

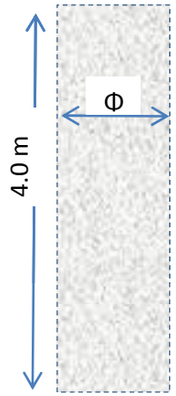
SCHEDULE F

FOUNDATIONS UNDER CONSIDERATION





Pole Base plate Detail



440 kN-m Overturning Moment

Caisson dia Φ: 1.0m
Caisson depth 4.0m

Anchor Bolts: 1.37 m long
1.12 m embedment

Note:
Pole and Foundation Not to Scale

SUMMARY OF MAXIMUM JOINT SUPPORT REACTIONS					
LOAD CASE	**LOAD CASE DESCRIPTION**	**WIND ON POLE [Pa]**	**Structure weight L.F.**	**DIRECTION**	**Force/ Bending moment**
1	CSA- Heavy 12.5mm Ice -20 C	400	1.3	VERTICAL LOAD	90 kN
				SHEAR	25 kN
				Overturning Moment	440 kN-m
2	CSA- Heavy No Ice	400	1.3	VERTICAL LOAD	74 kN
				SHEAR	16 kN
				Overturning Moment	233 kN-m

NOTES
1. Minimum base concrete compressive strength 30 Mpa
2. The calculation is based on following assumptions:
   Soil: clay density-8600 N/m³, Cu=47000 Pa
3. Additional Safety Factor against soil failure = 1.25

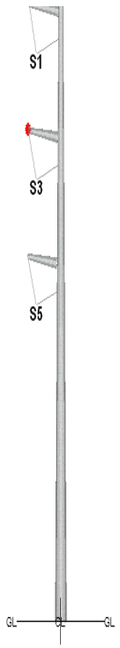
This design is for estimation purposes only

Samsung Grand Renewable Energy Park

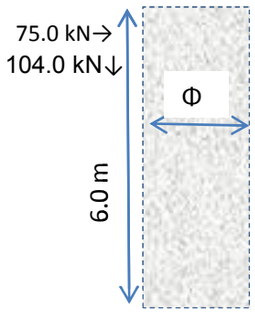
Preliminary Foundation Detail for Tangent Pole

Designed by: TB
Checked by: SPP

Revision:1
Date 06-04-2011



Pole Base plate Detail



1500.00 (kN-m) Overturning Moment

Caisson dia Φ: 1.0 m
Caisson depth: 6.0m

Anchor Bolts: 2.44 m long
2.19 m embedment

Note:
Pole and Foundation shown Not to Scale

SUMMARY OF MAXIMUM JOINT SUPPORT REACTION					
LOAD CASE	**LOAD CASE DESCRIPTION**	**WIND ON POLE [Pa]**	**Structure weight L.F.**	**DIRECTION**	**Force/Bending Moment**
1	CSA- Heavy 12.5mm Ice -20 C	400	1.3	VERTICAL LOAD	104 kN
				SHEAR	75 kN
				Overturning Moment	1500 kN-m
2	CSA- Heavy No Ice	400	1.3	VERTICAL LOAD	90 kN
				SHEAR	62 kN
				Overturning Moment	1250 kN-m

NOTES
1. Minimum base concrete compressive strength 30 Mpa
2. The calculation is based on following assumptions:
   Soil: clay density-8600 N/m³, Cu=47000 Pa
3. Additional Safety Factor against soil failure = 1.25

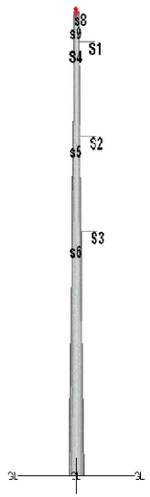
This design is for estimation purposes only

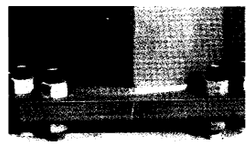
Samsung Grand Renewable Energy Park

Preliminary Foundation Detail for Angle Pole 30 deg.

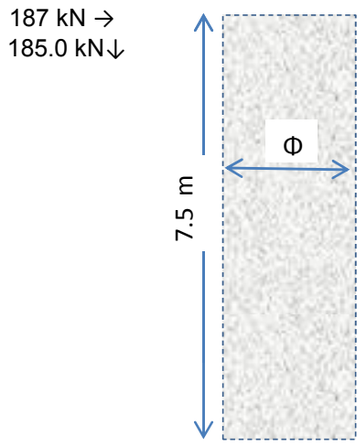
Designed by: TB
Checked by: SPP

Revision:1
Date 06-04-2011





Pole Base plate Detail



3740.00 (kN-m) Overturning Moment

Caisson dia Φ : 1.5 m
Caisson depth 7.5m

Anchor Bolts: 2.44 m long
2.19 m embedment

Note: Pole and Foundation shown are Not to Scale

SUMMARY OF MAXIMUM JOINT SUPPORT REACTION					
LOAD CASE	**LOAD CASE DESCRIPTION**	**WIND ON POLE [Pa]**	**Structure weight L.F.**	**DIRECTION**	**Force/ Bending Moment**
1	CSA- Heavy 12.5mm Ice -20 C	400	1.3	VERTICAL LOAD	185 kN
				SHEAR	78 kN
				Overturning Moment	1500 kN-m
2	Broken subconductors	400	1.3	VERTICAL LOAD	172 kN
				SHEAR	187 kN
				Overturning Moment	3740 kN-m
3	Stringing -20 C	0	1.3	VERTICAL LOAD	170 kN
				SHEAR	50 kN
				Overturning Moment	1018 kN-m

NOTES

1. Minimum base concrete compressive strength 30 Mpa
2. The calculation is based on following assumptions:
   Soil: clay density-8600 N/m³, Cu=47000 Pa
3. Additional Safety Factor against soil failure = 1.25

This design is for estimation purposes only

Samsung Grand Renewable Energy Park

Preliminary Foundation Detail for Angle Pole 90 deg.

Designed by: TB
Checked by: SPP

Revision:1
Date 06-04-2011