

ARECLEOCH WINDFARM EXTENSION

Technical Appendix 10.3: Private Water Supply Risk Assessment
Prepared for: ScottishPower Renewables



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1.0 Introduction and Methodology

1.1 Scope of Assessment

This Technical Appendix contains information relating to private water supplies (PWS) and the potential impacts on these during construction and operation of the proposed Development.

As requested by South Ayrshire Council (SAC) (ref.: CLOB/YF/18/04020/PLNAPP, 9th November 2018) this Technical Appendix presents a site specific hydrogeological and hydrological report that contains a review of the risk to private water supply sources. It considers the potential effects of the proposed Development on the quality and quantity of water at the PWS sources within and out-with of the Site boundary. To complete the assessment a conceptual site model is presented that considers the proposed activities that might impair water quality and yield, including the potential for the borrow pits to generate leachant. The conceptual model, which uses a source-pathway-receptor linkage, is then used to assess the risk to each PWS. Where necessary mitigation is proposed.

Following consultation with South Ayrshire Council (SAC) data was received for 19 PWS sources within 5 km from the centre of the main turbine area. This data was then augmented with information with regard to PWS and water use presented in the existing Arecleoch Windfarm EIA, the Kilgallioch Windfarm EIA and Addendum, the Mark Hill Windfarm EIA, the Altercannoch Windfarm EIA, as well as from Ordnance Survey mapping and aerial photography. Additional properties, and potential water users, were also identified following an extensive programme of site specific field investigation that involved visiting properties, enquiring about their water use and source, and mapping water abstraction locations.

A total of 31 PWS sources were identified within 1 km of the application boundary and/or potentially downgradient of the surface water and groundwater catchments that drain from the Site (see Figure 10.1). These data then informed a PWS survey conducted on 6th February 2019 and 12th April 2019 where SLR hydrologists visited the properties to confirm data provided by SAC, the neighbouring developments' EIAs and desk study. When residents were unavailable on the days that the surveys were conducted questionnaires were left at properties requesting details of their water source or PWS. The results of the PWS survey, returned questionnaires, SAC data and data from the previous EIAs is presented in Table 2-1 of this report.

Where a potential source-pathway-receptor linkage (e.g. an hydraulic connection) between a PWS source and the proposed Development has been determined a risk assessment has been conducted, the results of which are presented in Section 3 of this report.

This Technical Appendix should be read in conjunction with Chapter 10 of the Environmental Impact Assessment Report (EIAR) as the Chapter contains a detailed description of the local hydrology and hydrogeology, flow mechanisms and hydraulic properties of the soils and geology at Site, the embedded mitigation incorporated in the site design, and an assessment of impacts on groundwater and surface water flows and quality.

1.2 Report Structure

This Technical Appendix is structured as follows:

- Section 2 considers all of the identified potential PWS sources and whether there is a potential hydrological or hydrogeological linkage (e.g. there is a pathway) to the proposed Development. Where there is no linkage, these PWS sources have been screened from further assessment.
- Section 3 assesses the risk to the PWS sources that have a potential linkage to the proposed Development. The development in the surface or groundwater catchment to each PWS source is identified prior to completing an assessment of risk to each PWS source. Mitigation measures, if required, are identified and if it is recommended that baseline and construction monitoring of the PWS this is stated.
- Section 4 gives details of a potential water monitoring schedule and parameter list that could be used to monitor water quality at PWS sources that have an hydraulic linkage (e.g. pathway) to the proposed Development. The monitoring frequency, parameter list and reporting programme would be subject to agreement with SAC and SEPA should planning permission be granted, and it is expected would be secured by an appropriately worded planning condition.

2.0 Private Water Supply Details

Table 2-1 presents all the information collected from the PWS survey, returned questionnaires, SAC PWS data, EIAs for neighbouring developments and desk study. Where a source remains unconfirmed, typically because the questionnaire left at the property has not been returned by a resident, this is presented on Figure 10.1 as “Property (source unconfirmed)”.

If a PWS is assessed to have a hydraulic connection (e.g. there is a pathway) to the proposed Development this is assessed further in Section 3.

Table 2-1: Private Water Supply Details

PWS ID (Figure 10.1)	Property Name	Data Source(s)	PWS Source Type	Location of PWS Source (NGR) and Distance from Nearest Element of Proposed Development	Notes	Potential Complete Source – Pathway – Receptor Linkage?
PWS01	Creeside	Site visit	Well	NX 2994 81005 550 m north west of existing access track	The PWS source for Creeside is a spring to the north of the property over a small ridge. The spring lies upgradient and to the north of the A714 public road that the Site gains access from. The spring is sourced by a catchment that is not in hydraulic connectivity to the application boundary, and thus there is no pathway to the PWS from the proposed Development. This PWS is not assessed further.	✘
PWS02	Arnimean	Site visit	Well	Unconfirmed 10 m west of existing access track	Well approximately 10 m west from existing access track within windblown trees. Approximate source location illustrated on Figure 10.1. Well enclosure structure has been destroyed by fallen trees. Groundwater catchment to the spring likely to extend to the south, and beneath proposed access track (existing). Resident has commented that quality of the source has historically been effected during forestry operations.	✓ See Section 3 for further details.
PWS03	Corwar Farm	Site visit	Borehole	NX 28590 78646 400 m south of existing access track	Borehole located at Cowar Farm and serves all three properties. This borehole is located near the catchment divide but within the River Cree catchment and upstream / up groundwater gradient of the proposed Development, and thus there is no pathway to the PWS from the proposed Development. This source is not assessed further.	✘
	High Drumlamford / Corwar Cottage					
	Laigh Drumlamford					
PWS04	Burnside	Questionnaire	Watercourse	NX 28327 78564 200 m west of existing access track	Surface water abstraction from watercourse north of property. Abstraction is located approximately 200 m downstream of a minor watercourse crossing (1:10,000 scale OS mapping) of the existing access track (approximate NGR NX 27566 78626). There is, therefore a pathway from the proposed Development to the PWS source.	✓ See Section 3 for further details.
PWS05	Garizle	Site visit	Unconfirmed	Unconfirmed	Property abandoned, with doors open and no evidence of working water supply observed. OS 1:10,00 scale mapping indicates a well at NGR NX 27268 79220 however during the site visit no obvious well was recorded. A watercourse exists between the application boundary and the indicated location of the well and it is assessed that the well is not in hydraulic connection to the proposed Development. Property is situated at 130 m AOD and if water was not sourced from the well it likely had been fed from a watercourse of greater height to avoid pumping. The closest watercourse that is higher than the property is to the north and upgradient of the application boundary. It is assessed there is no pathway or receptor and thus this PWS is not assessed further.	✘

PWS ID (Figure 10.1)	Property Name	Data Source(s)	PWS Source Type	Location of PWS Source (NGR) and Distance from Nearest Element of Proposed Development	Notes	Potential Complete Source – Pathway – Receptor Linkage?
PWS06	Arnsheen	Kilgallioch Windfarm EIA & Addendum	Borehole	Unconfirmed	PWS source confirmed as a borehole. The borehole location has not been confirmed. Boreholes are typically in close proximity to the property it serves as the pump requires an electrical supply. During the site visit to the property a likely borehole structure was noted at the property. Arnsheen is located at the top of a small hill that divides the catchment of Duisk River to the north and River Bladnoch to the south. The likely borehole location does not lie downgradient of the application boundary and several surface water features exist between the existing proposed Development access track and the property. There is not, therefore, a pathway between the proposed Development and the borehole and thus it is not assessed further.	✘
PWS07	Knockycoid Cottage	Altercannoch Windfarm EIA and questionnaire	Spring	NX 25846 78140 600m north of existing access track	PWS source described by residents in the returned questionnaire as along forestry track to the south of properties. The forestry track was visited during the site visit on 12/04/2019 and to the east of the forestry track at NGR NX 25846 78140 a large brick holding tank was recorded, location provided in Figure 10.1. The holding tank was noted to be fed from a pipe that extended from beneath the ground to the tank. It is assumed that the pipe captures a spring within the pasture to the south of the tank. This area lies between two headwater catchments of Pollgowan Burn and not in surface or groundwater catchments that are served by the proposed Development. There is not, therefore, a pathway between the proposed Development and the spring and thus it is not assessed further.	✘
	Knockycoid Farm	Altercannoch Windfarm EIA and questionnaire				
	Craigance	Altercannoch Windfarm EIA and questionnaire				
PWS08 and PWS09 references not used						
PWS10	Laggish Farm	SAC, Altercannoch Windfarm EIA, Arecleoch Windfarm EIA, Kilgallioch Windfarm EIA and Addendum, and questionnaire	Well	NX 231553 78208 1 km north east of existing access track	SAC data and resident have confirmed their property is supplied by a well that is adjacent to their property however they are uncertain how the well is fed. Residents have commented that water levels have fallen significantly in summer periods suggesting that the PWS source is groundwater as local watercourses to the property (Laggish Burn to the north and Haw Burn to the south) are relatively large and unlikely to dry entirely in summer conditions. Groundwater flow is likely to follow local surface topography and be south west to north east. The existing access track lies to the south west and upgradient of the well. While new development is proposed in the catchment to the well, the access track would be used. There is, therefore a potential source and pathway that could impair the quality of water in this borehole without safeguards.	✓ See Section 3 for further details.
PWS11	Dochroyle Cottage	SAC and Altercannoch Windfarm EIA	Borehole	NX 23121 79109 850 m north east of existing access track	Location of borehole confirmed by SAC data and adjacent to the property. PWS11 lies in the Laggish Burn catchment, within a sub-catchment separated the ridgeline from Knockshin that runs to the east. Groundwater that feeds this borehole is likely to flow from the west and follow local topography. This ridgeline from Knockshin separates the application boundary from the PWS11 borehole and it is considered that the borehole is not in hydraulic continuity with the proposed Development. There is not, therefore, a pathway between the proposed Development and the borehole and thus it is not assessed further.	✘

PWS ID (Figure 10.1)	Property Name	Data Source(s)	PWS Source Type	Location of PWS Source (NGR) and Distance from Nearest Element of Proposed Development	Notes	Potential Complete Source – Pathway – Receptor Linkage?
PWS12	Dochroyle Farm	SAC and Altercannoch Windfarm EIA	Spring	NX 23140 79164 900 m north east of existing access track	The resident confirmed during the site visit that the PWS source is a spring to the south east from the property, which feeds a holding tank which is then pumped to the property. As detailed for PWS11, groundwater in this area is from a sub-catchment of Laggish Burn and receives its flow from the west up to the summit of Knockshin. This sub-catchment is separated by the application boundary by the Knockshin ridge and is not considered in hydraulic connection to the application boundary. There is not, therefore, a pathway between the proposed Development and the spring and thus it is not assessed further.	✘
PWS13	Chirmorrie	Kilgallioch Windfarm EIA and Addendum	Spring	NX 20681 76547 1.6 km south west from existing access track	Chirmorrie property lies within the upper catchment of Laggish Burn. The resident confirmed during the site visit that the PWS source is a spring on the eastern flank of Chirmorrie Cairn, upgradient of the public road, which then feeds a holding tank that is gravity fed to the property. Upgradient of the application boundary this PWS source is not in hydraulic connection to the proposed Development. There is not, therefore, a pathway between the proposed Development and the spring and thus it is not assessed further.	✘
PWS14	Barrhill Train Station Fergate Cottage	SAC, Altercannoch Windfarm EIA and Arecleoch Windfarm EIA	Watercourse	Approximately NX 2119 8018 400m downstream from upgraded track and watercourse crossing WX01	Details from the existing Arecleoch Windfarm EIA and the Altercannoch Windfarm EIA indicate that the PWS source that supplies both Barrhill train station and Fergate Cottage is from a watercourse while details from SAC include that the abstraction feeds a holding tank at NGR NX 215 802. Within the existing Arecleoch Windfarm EIA it is stated that a dam exists on the Cross Water watercourse and the PWS abstraction is here. From the coordinates of the holding tank provided by SAC it is assumed that watercourse abstraction is upgradient of the holding tank so that it is fed by gravity. An indicative location of the abstraction is provided on Figure 10.1. The surface water abstraction on Cross Water is located downstream of the watercourse crossings WX01, WX02, WX03, WX04, WX06 and WX25, and at proposed wind turbine generators (WTG) 1, 9, 10, 11, 12 and 13. There is, therefore a potential source and pathway that could impair the quality and quantity of water to these PWSs without safeguards.	✓ See Section 3 for further details.
PWS15	Ward of Cairnlea	SAC, Altercannoch Windfarm EIA and Arecleoch Windfarm EIA	Rain / surface water / watercourse	NX 22665 81424 2 km northeast from upgraded track	Data from SAC indicates this property is supplied by surface water runoff with the abstraction location unknown; however review of the existing Arecleoch Windfarm EIA indicates that the property is supplied by a tank located by the public road near Fergate Cottage. Review of Google street view (photography dated March 2009) highlights the presence of two tank structures immediately downgradient of the public road at the cattle grid. It is assumed these are structures that capture flow from the minor watercourse mapped by OS here and supply Ward of Cairnlea. Within the Cross Water catchment, this minor watercourse is fed from the west and not in hydraulic connection to the proposed Development. There is no pathway to this PWS source from the proposed Development, and it is therefore not considered further.	✘

PWS ID (Figure 10.1)	Property Name	Data Source(s)	PWS Source Type	Location of PWS Source (NGR) and Distance from Nearest Element of Proposed Development	Notes	Potential Complete Source – Pathway – Receptor Linkage?
PWS16	Cairnlea	Areleoch Windfarm EIA	Unconfirmed	Unconfirmed	SAC provided no details for this property that lies west of the railway line, however within the existing Areleoch Windfarm EIA it is detailed that the property is uninhabited and was supplied by a well however exact location is unconfirmed. The indicative location is approximately 200m west of the property within agricultural land. This location lies between the Cross Water catchment and the several minor tributaries of the wider Duisk River catchment. These minor catchments extend south to Whitecairn wood to a shoulder of Shiel Hill (NGR NX 21253 81488) that separates these catchments from the application boundary. This PWS source is not considered to be in hydraulic connection to the proposed Development. As there is no receptor or pathway, this PWS is not considered further.	✘
PWS17	White Cairn	SAC, Altermannoch Windfarm EIA and Markhill Windfarm EIA	Borehole	Unconfirmed	SAC provided data indicating that White Cairn is supplied by a borehole, collaborated by data provided in the Altermannoch Windfarm and Mark Hill Windfarm EIAs. The exact location of borehole is unknown but likely near the property to maintain an electrical supply. Like PWS16, PWS17 lies within the catchments of several minor watercourses that feed the wider Duisk River catchment. These catchments are separated from the application boundary by the shoulder of Shiel Hill and therefore not in hydraulic connection to the proposed Development. As there is no pathway to the PWS from the proposed Development it is not considered further.	✘
PWS18	Craigbrae	SAC and Markhill Windfarm EIA	Spring	Approximately NX 1992 8429 950 m west of existing access track	Within 1 km of the application boundary, Craigbrae is located to the north of the Burn of Lig, a tributary of Duisk River. SAC confirm that this property is supplied by a spring to the west of the public road and upgradient of the opposing valley side of the Burn of Lig to the application boundary. A review of aerial photography with details provided by SAC suggests that the spring is located at NX 19915 84294 however this has not been confirmed. As this supply is sourced from groundwater on the opposing side of a river valley it is considered not to be in hydraulic connection to the proposed Development. As there is no pathway to the PWS from the proposed Development it is not considered further.	✘
PWS19	Farden Farm	SAC	Spring	Unconfirmed	Farden Farm is located within the Burn of Lig sub-catchment like Craigbrae (PWS18) however on the southern side of the river valley. SAC confirm that this property is supplied from a groundwater spring however the location is unconfirmed. There are many surface water features in the immediate vicinity of Farden Farm and it is very likely that their PWS is sourced from these as they rise from groundwater. The catchment for Farden Farm is separated from the application boundary from the ridgeline along Farden Hill to the south west and Shiel Hill to the south that defines the catchment divide for the Water of Tig catchment. It is considered this PWS is not in hydraulic connection to the proposed Development and as there is no pathway to the PWS source it is not considered further.	✘
PWS20	Kilrenzie Farm	SAC	Spring	Unconfirmed	Located within 1km of the application boundary Kilrenzie Farm is within the Water of Tig catchment, however on the northern valley side and opposing the catchments that are in hydraulic connection to the application boundary. SAC confirmed that this PWS is sourced from a spring. Located in sub-catchments of the Water of Tig that are upgradient of watercourses connected to the application boundary it is assessed that this spring source is not in hydraulic connection to the proposed Development and as there is no pathway to the proposed Development it is not considered further.	✘

PWS ID (Figure 10.1)	Property Name	Data Source(s)	PWS Source Type	Location of PWS Source (NGR) and Distance from Nearest Element of Proposed Development	Notes	Potential Complete Source – Pathway – Receptor Linkage?
PWS21	East Altercannoch Farm	SAC, Altercannoch Windfarm EIA, Markhill Windfarm EIA and questionnaire	Spring	NX 23783 79922 1.8 km north east of existing access track	Residents confirmed details provided by SAC and the EIAs of Altercannoch Windfarm and Mark Hill Windfarm that their PWS source is a spring that rises near Loch Alty and is shared between the two properties; East and West Altercannoch Farm. Loch Alty lies in the headwaters of the Alty Burn sub-catchment that is separated from the Cross Water catchment to the west and the ridgeline from Knockshin to the small hill of Eyes. This catchment does not lie downgradient of the application boundary and is not in hydraulic connection to the proposed Development. There is no pathway to the proposed Development and the PWS source is not considered further.	✘
	West Altercannoch Farm					
PWS22	Caochan	SAC and site visit	Borehole	NX 24104 81417 3 km north of existing access track	During the site visit the resident confirmed that their PWS is from a borehole located adjacent to their property. Located within the Alty Burn sub-catchment, as PWS21, this PWS is not in hydraulic connection to the proposed Development. There is no pathway to the proposed Development and the PWS source is not considered further.	✘
PWS23	Laigh Altercannoch	SAC and Altercannoch Windfarm EIA	Spring	Unconfirmed	SAC have confirmed that Laigh Altercannoch is sourced from a spring (collaborated by the Altercannoch Windfarm EIA) however the exact location of abstraction is unconfirmed. Laigh Altercannoch lies within the Alty Burn sub-catchment, like PWS21 and PWS22, and the catchment upgradient of the property is not downgradient of the application boundary and therefore not in hydraulic connection to the proposed Development. There is no pathway to the proposed Development and the PWS source is not considered further.	✘
PWS24	Glenalty House	SAC, Altercannoch Windfarm EIA and questionnaire	Watercourse	Approximately NX 23754 79945 1.8 km north east of existing access track	The resident has confirmed details provided by SAC and the Altercannoch Windfarm EIA that their PWS is sourced from a spring that rises to north of Loch Alty within the Alty Burn sub-catchment. As PWS21, PWS22 and PWS23 the Alty Burn catchment is not in hydraulic connection to the proposed Development. There is no pathway to the proposed Development and the PWS source is not considered further.	✘
PWS25	Glenalty Cottage & The Lodge	SAC and Altercannoch Windfarm EIA	Borehole	NX 24104 81417 3 km north of existing access track	During the site visit the resident confirmed that their PWS is from a borehole located adjacent to their property. Located within the Alty Burn sub-catchment, as PWS21-PWS24, this PWS is not in hydraulic connection to the proposed Development. There is no pathway to the proposed Development and the PWS source is not considered further.	✘
PWS26	Waulkmill	Mark Hill Windfarm EIA	Groundwater	Unconfirmed	No details apart from those documented in the Mark Hill Windfarm EIA are known for these properties. The Mark Hill Windfarm EIA recorded that a groundwater abstraction shared between the two properties. Both PWS26 and PWS27 lie within the Alty Burn sub-catchment and as such both PWS are not in hydraulic connection to the proposed Development. There is no pathway to the proposed Development and the PWS source is not considered further.	✘
PWS27	Caraig-Na-Cridhe					
PWS28	High Altercannoch	SAC, Altercannoch Windfarm EIA and Markhill Windfarm EIA	Spring	Unconfirmed	SAC have confirmed details within the EIAs of Altercannoch Windfarm and Mark Hill Windfarm, that the PWS source for High Altercannoch is a spring however the source is unconfirmed. High Althercannoch lies between the Alty Burn sub-catchment to the west and the catchment of a tributary to the Duisk River to the east both catchments are separated from that of the Pollgowan Burn by the summit of Eyes hill to the south west. It is assessed unlikely that the spring source for High Altercannoch extends beyond either of these two sub-catchments. This catchment divide ensures the property and its source has no hydraulic connection to the proposed Development. There is no pathway, and the PWS is not considered further.	✘

PWS ID (Figure 10.1)	Property Name	Data Source(s)	PWS Source Type	Location of PWS Source (NGR) and Distance from Nearest Element of Proposed Development	Notes	Potential Complete Source – Pathway – Receptor Linkage?
PWS29	Lochton Mill	OS mapping	Unconfirmed	Unconfirmed	No details are known for the PWS at Lochton Mill. The property is located more than 2km from the proposed Development and upgradient of the River Duisk and between two of its tributaries. If this property is sourced from a watercourse it is likely it would be from either of the two tributaries so the property could be gravity fed instead of pumped up from the Duisk River. Should the property be sourced from a spring it is likely the spring would exist upgradient and within the catchments of the two tributaries. The two tributaries share a catchment divide between that of Alty Burn to the west and Pollgowan Burn to the south following the ridgeline from Eyes hill. The catchments of these two tributaries are not downgradient of the application boundary and it is considered unlikely that the PWS source has a hydraulic connection to the site. There is no pathway to the proposed Development and the PWS source is not considered further.	✘
PWS30	Wood Park Cottage	Markhill EIA	Unconfirmed	Unconfirmed	Located within 1 km of the application boundary this property is within the Lavery Burn sub-catchment of Duisk River. No details are known for the property PWS source however it is recognised that the property lies upgradient of the application boundary and a watercourse lies between the two. It is considered very unlikely that this property is sourced from surface or groundwater that is downgradient of the existing access track. Given the absence of a pathway, this PWS is not considered further.	✘
PWS31	Glenour	Areacleoch EIA	Unconfirmed	Unconfirmed	No details were provided by SAC for this property however a review of the existing Arecleoch Windfarm EIA highlights that this property appears abandoned with windows boarded up and with no obvious non-4x4 access. It is likely that the PWS for this property is abandoned. It is unlikely that the PWS source has a hydraulic connection to the proposed Development. As there is no receptor or pathways this PWS is not considered further	✘

3.0 Private Water Supply Risk Assessment

Of the properties identified as part of the screening process conducted in Section 2, 4 PWSs (the receptors) were identified to potentially be in hydraulic continuity (e.g. there is a pathway) between the proposed Development and the PWS. The risk posed to these PWSs is considered in detail in this Section, and if required mitigation measures required to safeguard the yield and quality of the PWS sources are identified.

3.1 PWS02 Arnimean

The Arnimean property is located immediately to the west of the site access from the A714 at the bridge of the River Cree. It is understood that the property is served by a PWS that supplies water for laundry use and for a small boarding kennels attached to the building. Historically the source had been used for drinking water but following water quality concerns it is understood it is no longer used as source for drinking water. The properties PWS is a well that is described as approximately 10 m deep with a wide chamber at the base. Groundwater is the potential pathway to this receptor.

The exact location of the well is unconfirmed but indicated by the resident as within 10 m to the west of the existing track within trees that have collapsed and destroyed the well enclosure leaving the well concealed. An indicative location is presented in Figure 10.1.

This existing access track near to this PWS source is in good condition and sufficient for the proposed Development and not scheduled for any upgrade. The access track will be used for all construction vehicles and deliveries to site. No car parking, fuel or material handling is proposed on the access track upgradient of the PWS source. The access track has shallow drainage channels at either side, discharging to local watercourses.

In light of the historical issues of contamination at this well, specific mitigation measures of an extended no-refuelling/vehicle maintenance zone from the River Cree crossing (WX20) up to the forestry spur track to Dornal Hill (NGR NX 29957 79577) should be implemented, signposted on site and strictly enforced. In addition, a strict vehicle speed limit and should be enforced and traffic management plan followed to minimise the potential for accidents. Beyond this forestry spur track surface and groundwater flow is to the south west towards a headwater of Corwar Burn and not to the PWS02 source. Spill kits should be located at intervals along the no-refuelling zone in the unlikely event of an vehicle accident.

No new development is planned within the catchment of the well and good practice and mitigation measures detailed within Chapter 10 and the construction environment management plan (CEMP, Technical Appendix 3.1) along with the site specific mitigation measures detailed above will remove or minimise the source of pollution to the PWS receptor (e.g. fuel and chemicals required during construction and operation of the proposed Development, or suspended solids generated as a result of using the existing track and ensure that the risk to this PWS is minimised.

It is recommended that confirmatory water monitoring is undertaken prior to and during construction of the windfarm. An accessible monitoring point, prior to any treatment, should be agreed with the resident. See Section 4 for an example monitoring suite and frequency which would be agreed with SAC and SEPA should the proposed Development be granted planning permission.

3.2 PWS04 Burnside

The Burnside property is located approximately 200 m to the west of the existing access track within a forest clearing. The property abstracts surface water from the watercourse that passes the clearing to the north and crosses beneath the existing access track at NGR NX 27561 78620, approximately 200 m upstream from the abstraction point. The watercourse is the pathway.

It is noted that the longitudinal gradient of the existing access track upgradient of this crossing is steep, and in addition to the potential spill of fuels from vehicles using the track suspended solids could readily from in runoff from the road and be shed to the watercourse that the PWS is taken from e.g. the source of potential pollution of the PWS.

There are existing drainage measures either side of the access track and the efficacy of the silt management features should be subject to routine inspection. The track drainage should not discharge directly to the watercourse that PWS04 abstracts from, rather diffuse discharge should be made to a filter strip before the watercourse. Further measures, such as check dams, along the track drainage upgradient of the minor watercourse crossing to reduce potential for silt entrainment should be maintained. At the crossing itself, silt fencing should be erected at both sides to prevent splashes of silt laden water entering the watercourse directly.

In addition, a strict vehicle speed limit and should be enforced and traffic management plan followed to minimise the potential for accidents, which could lead to the spill of fuel.

No new development is planned within the catchment of the surface water abstraction and good practice and mitigation measures detailed within Chapter 10 and the construction environment management plan (CEMP, Technical Appendix 3.1) along with the site specific mitigation measures detailed above will minimise the risk to this PWS abstraction.

It is recommended that confirmatory water monitoring is undertaken prior to and during construction of the windfarm. See Section 4 for an example monitoring suite and frequency which would be agreed with SAC and SEPA should the proposed Development be granted planning permission.

3.3 PWS10 Laggish Farm

Laggish Farm is supplied by a well that is adjacent to their property. The source of water for the well is unconfirmed however as a trend of low water levels in summer has been reported by the residents while the nearby watercourses are significant and unlikely to dry in summer it has been assumed that the source of the well is groundwater. The well is located approximately 1km downgradient from the closest point of the proposed Development (existing access track west of watercourse crossing WX11). There is a risk (e.g. the source) of pollution and yield of this PWS from fuels or chemicals brought to site if they are spilt or discharged to ground in the catchment to this PWS. The pathway would be shallow groundwater flow to the well.

No new development is planned within the catchment of the PWS and good practice and mitigation measures detailed within Chapter 10 and the construction environment management plan (CEMP, Technical Appendix 3.1) minimise the risk to this PWS source.

It is recommended that confirmatory water monitoring is undertaken prior to and during construction of the windfarm. See Section 4 for an example monitoring suite and frequency which would be agreed with SAC and SEPA should the proposed Development be granted planning permission.

3.4 PWS14 Barrhill Train Station and Ferngate Cottage

Both Barrhill Train Station and Ferngate Cottage are supplied by a surface water abstraction on the Cross Water immediately downgradient of the proposed Development. The abstraction point location is unconfirmed however reported to be at a dam on the Cross Water, an indicative location of the abstraction point is presented in Figure 10.1. This area lies downstream of new and upgraded infrastructure associated with the proposed Development and an area where wind turbines are proposed. The surface water abstraction point is located within 1km of the site boundary.

The abstraction point on the Cross water is the receptor. The pathway is surface water in the Cross Water and its tributaries. The source is suspended soils, fuels and chemicals that could impair the quality of water in the Cross water or the flows in the Cross Water, without appropriate controls being implemented in site.

In addition to general good practice and mitigation measures detailed within Chapter 10, it is recommended that oil booms are deployed on watercourses downgradient of watercourse crossings and active work areas (WX01, WX02, WX03, WX04, WX06 and WX25) and routine checks of the booms are conducted (with replacement if necessary) during construction of the windfarm.

Good practice and mitigation measures detailed within Chapter 10 and the construction environment management plan (CEMP, Technical Appendix 3.1) along with the site specific mitigation measures detailed above will minimise the risk to this PWS abstraction.

It is recommended that confirmatory water monitoring is undertaken prior to and during construction of the windfarm. See Section 4 for an example monitoring suite and frequency which would be agreed with SAC and SEPA should the proposed Development be granted planning permission.

4.0 Example Monitoring Protocol and Intervention Strategy

Sections 2 and 3 have shown that with the adoption of safeguards it has been assessed that no effects on PWSs near to and downstream of the proposed Development are anticipated. Notwithstanding this, it is recommended a programme of water monitoring is undertaken prior to and during construction of the windfarm.

The pre-development monitoring data can be used to establish baseline water quality and assessment or trigger values to which routine monitoring data collected during construction can be compared against.

The monitoring suite, monitoring locations, monitoring frequency and intervention strategy should a trigger event occur would be agreed with SAC and SEPA prior to any works being undertaken at Site and it is anticipated that this would be secured by an appropriately worded planning condition agreed between the applicant, SAC and SEPA. Table 4-1, however, shows an example protocol which could be used as a basis to agree a water monitoring protocol with SAC.

Table 4-1: Example Monitoring Protocol

Location	Frequency	Determinand Suite	
PWS02 (Arnimean) PWS04 (Burnside) PWS10 (Laggish Farm) PWS14 (Barrhill Train Station and Ferngate Cottage)	Monthly	<u>Field Sampling</u> Water Level (m bgl) (wells at PWS02 and PWS10 only) pH Redox Conductivity Dissolved Oxygen	<u>Extractive Samples – parameters to be measured will be agreed with SAC and will include the following:</u> Major anions and cations of water Hydrocarbons Suspended solids
Control Surface Water Catchment			
<u>Representative Water Samples for the following surface water catchments:</u> Cross Water Duisk Water River Cree Water of Tig			

* Monitoring locations, suite and frequency to be agreed with SAC

4.1 Monitoring and Reporting Personnel

The monitoring and reporting will be undertaken by appropriately experienced and trained staff.

4.2 Monitoring Methodology

Surface water samples will be collected following guidance within SEPA, July 2003, Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water, v2 (specifically Section 9 thereof). Surface water samples should be collected using an extendable rod (up to 3 m) attached to a beaker (decontaminated between sampling locations) to ensure that the sampler is at a safe distance from the watercourse particularly during high flow conditions and potentially unstable embankments.

Private water supply water samples will be collected in a similar manner to avoid cross-contamination between sample locations. Samples will be collected from dedicated sample taps or obtained using a clean disposable bailer.

Prevailing weather conditions, qualitative flow conditions as well as other visual indicators will be recorded in order to aid the sample reporting.

The water samples will be placed directly into appropriate sterile bottles, which are labelled and dispatched to a UKAS accredited laboratory, under chilled conditions and accompanied by the relevant chain of custody documentation.

4.3 Example Intervention Strategy

In the unlikely event that the routine monitoring data recorded potential pollution at a private water supply an investigation and intervention strategy would be agreed with SAC. Again, the details of which will be agreed prior to any construction and be secured by an appropriately worded planning condition.

4.3.1 Alerting Potentially Affected Properties

Contact details (land and mobile numbers / email addresses) for private water supplies PWS02, 04, 10 and 14 will be maintained by site management at all times.

In the event that monitoring data collected at any private water supply is above the baseline monitoring record and above prescribed regulatory standards then property owners will be advised and repeat water sampling will be undertaken (if agreed with the property owners). Property owners will be advised within 24 hours of receipt of monitoring results. Repeat water sampling will be undertaken as soon as reasonably practicable and within 72 hours.

Details of any affected property will be reported to SAC within 48 hours.

4.4 Provision of Alternative Water Supplies

ScottishPower Renewables commits to maintaining the yield and wholesomeness of water supplies. The following measures may be deployed in the unlikely event a private water supply is impaired by the works:

- provision of bottled potable water in the event of a short or transient derogation of a water supply (bottled water will be retained on site ready for quick dispatch to any effected property); and
- repair of the supply or provision of an alternative water source (e.g. spring, borehole, alternative surface water abstraction location) in the event of a permanent derogation of a water supply.

In the event of an alternative water source being implemented SAC will be advised as soon as is practical.

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