

## Appendix A – Definitions

Terms are not included if they are:

- defined in the Resource Management Act 1991 or other commonly used Acts;
- the usual dictionary meaning,
- referred to only in the explanatory text, not the policies

**Abstraction:** In relation to a water body means the taking of water from that water body.

**Act:** Unless the context otherwise requires, “Act” means the Resource Management Act 1991 and any amendments to it.

**Airshed:** An area defined by parameters including topography, meteorology, demography and human activities, where people may be exposed to an airborne contaminant.

**Ancestral land:** In relation to its use under section 6(e) of the Act means land that was the traditional home of Māori and holds some significance for the descendants of those who lived there. There must be some factor or nexus between the descendants’ culture and traditions and the land in question which affects the relationship of them to that land. Ancestral land is not confined to land under Māori ownership.

**Annual individual fatality risk (AIFR)** means the risk measure obtained by multiplying the modelled number of deaths from a hazard event by the annual exceedance probability of the event and dividing by the population within the hazard assessment area.

**Anticipated environmental result:** An expected effect on the environment of implementing the policies and methods. Because of the complex nature of environmental systems, not all the effects of implementing policies and methods are foreseeable.

**Atua:** A god or gods (Māori).

**Biodiversity:** The variability among living organisms from all sources including inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems.

**Built environment:** The part of the physical surroundings which are made by people, such as buildings and other major structures, roads, bridges and the like, down to lesser items such as traffic lights and telephone boxes.

**Business land:** Areas of land used or zoned for commercial or industrial activities and includes areas shown in Appendix C.

**Catchments at risk:** Are the catchments of Lakes Rotorua, Rotoiti, Rotoehu, Rotomā, Ōkātina, Tikitapu, Ōkāreka, Tarawera, Rotomāhana, Rerewhakaaitu, Ōkaro and Rotokākahi, and catchments of other water bodies when they are defined and included in the Regional Water and Land Plan. A catchment includes the total area from which a receiving water body collects its surface or groundwater runoff.

**Coastal Environment:** Includes all of the coastal marine area, land inland to the point defined in Maps 17-35 in Appendix I, the natural and physical resources within it, and the atmosphere above it.

**Codes of practice:** Operational procedures and practices designed to achieve compliance with regulatory requirements or other defined outcomes.

**Compliance monitoring:** Monitoring to determine whether conditions imposed on resource consents are being met.

**Critical buildings** means land and buildings:



- (a) owned or leased by agencies assisting the public in times of emergency, including the New Zealand Fire Service or an equivalent emergency fire service, the New Zealand Police, the Coastguard and ambulance services (including air ambulance services);
- (b) public and private hospitals and other similar facilities providing emergency medical services;
- (c) designated emergency shelters, emergency centres and designated safe zones.
- (d) designated Civil Defence Emergency centres.

**Culture:** The total of the inherited ideas, beliefs, values, and knowledge, which constitute the shared basis of social action.

**Developable land:**

- (a) Comprises land used for:
  - (i) Residential activity purposes, including all open space and on-site parking associated with dwellings;
  - (ii) Local roads and roading corridors, including pedestrian and cycle ways, (and excluding State highways and other major arterial routes, as determined by the local roading hierarchy);
  - (iii) Collector roads and roading corridors (as determined by the local roading hierarchy), where direct access from lots is obtained. Where lots on only one side of the road have direct access only 50% of the corridor shall be used for the purpose of this definition;
  - (iv) Local neighbourhood reserves.
- (b) Excludes land that is:
  - (i) Stormwater ponds and detention areas;
  - (ii) Geotechnically constrained (such as land subject to subsidence or inundation);
  - (iii) Set aside to protect significant ecological, cultural, heritage or landscape values;
  - (iv) Set aside for non-local recreation or esplanade reserves or access strips that form part of a larger regional, sub-regional, or district network;
  - (v) Identified or used for non-residential activity including business activities, schools, network utilities, health centres or other district, regional or sub-regional facilities.

**Development of land** means the process of subdividing land and/or changing or intensifying the use of land.

**Development site** means an area on which development of land is undertaken, or proposed to be undertaken, either in one stage or in multiple stages over time that is:

- (a) a parcel of land held in a separate Certificate of Title; or
- (b) a parcel of land held in multiple Certificates of Title that are contiguous; or
- (c) multiple-owned Maori land not necessarily held in a separate Certificate of Title.

**Domestic, marae or municipal water supply:** A reticulated supply publicly or privately owned where the take is;

- 1 for the primary purpose of human drinking, or sanitation or household needs wherever they arise; or
- 2 for the purpose of enabling local authorities to meet their general responsibilities (wherever they arise) under the Local Government Act 2002, the Health Act 1956 and relevant legislation, including supply for the purposes of industrial and agricultural use.

**Dune:** A mound or ridge of windblown sand.

**Dwelling:** A self-contained residential unit designed for or occupied exclusively by one household and includes apartments, semi-detached and detached houses, home units, town houses and similar forms of residential development.



**Ecological gradient:** An ecological sequence that includes a natural transition from one indigenous ecosystem or habitat type to another. Ecological gradients may include transitions from aquatic (wetland, river or saltmarsh) to terrestrial systems, altitudinal gradients or gradients associated with changing lithology (e.g. from volcanic to sedimentary landforms).

**Efficiency:** For the purposes of measuring efficiency of geothermal resource use (section 7 RMA) efficiency has several dimensions. Efficiency includes the comparison of the overall benefit to society (economic efficiency) of competing uses (allocative efficiency), productive efficiency, and the ability of productive efficiency to increase over time through technology improvements and better understanding of the resource (dynamic or innovative efficiency).

**Efficient allocation:** In relation to freshwater allocation, including economic, technical and dynamic efficiency.

**Efficient use:** In relation to the use of freshwater, the amount of water beneficially used in relation to that taken. It relates to the performance of a water-use system, including avoiding water wastage.

**Enhanced geothermal systems:** (EGS) do not require natural convective hydrothermal resources. EGS technologies "enhance" and/or create geothermal resources in hot dry rock (HDR) through hydraulic stimulation. Water travels through fractures in the rock, capturing the heat of the rock until it is forced out of a second borehole as very hot water, which is converted into electricity using either a steam turbine or a binary power plant system. All of the water, now cooled, is injected back into the ground to heat up again in a closed loop.

**Existing urban area:** Those urban areas that are outside of the greenfield development growth area.

**Fine particulate matter (PM<sub>10</sub>):** Is all material that is less than 10 microns in aerodynamic diameter. A micron is one thousandth of a millimetre.

**Flow variability:** The range, frequency, duration and timing of flows in a river or stream.

**Geothermal hazard** means hydrothermal eruptions, dormant surface features, natural gases, subsidence and tomos from geothermal systems.

**Geothermal system:** A system defined by scientific investigation comprising geothermal energy stored as geothermal water or steam and the rocks confining them and associated water, steam and gas emissions and the geothermal surface features resulting from these emissions and is believed to have no hydrological connection to another system.

**Greenfield development:** Subdivision, use or development of rural land for urban activities. Greenfield development does not include the development of land that has been previously developed for urban activities and also excludes development of papakāinga or housing in association with marae.

**Groundwater:** All the water contained in the void space within rocks. The term is generally taken to include vadose water (water travelling between the surface and the water table). Most groundwater derives from surface sources (meteoric water), the remainder is either introduced by magmatic processes (juvenile water) or is connate water.

**Growth area:** A locality, part or stage, within a Management Area or included in a district plan, targeted for major development.

**Hazard assessment area** means the natural hazard zone or development site whichever is applicable.

**Hazard susceptibility area** means the spatial extent of a potential hazard event identified by susceptibility mapping.

**Hui:** Meeting, congregation of people.



**Indigenous vegetation:** Any native naturally occurring plant community containing a complement of habitats and native species normally associated with that vegetation type or having the potential to develop these characteristics. It includes vegetation with these characteristics that has regenerated following disturbance, has been restored or planted. It excludes plantations and vegetation that have been established for commercial purposes.

**Infrastructure:** For the purposes of Policies UG 6A and UG 10B, infrastructure means 'Community Infrastructure' and 'Network Infrastructure' as defined in s197 of the Local Government Act 2002. For the avoidance of doubt it includes Network Infrastructure that is funded by central government. Otherwise the term "infrastructure" has the same meaning as defined in section 2 of the RMA.

**Instream minimum flows:** The flow of water in a river or stream necessary to sustain aquatic life, water quality, recreational use, outstanding natural features or Māori cultural values.

**Intensification areas:** Selected centres or areas where intensive housing is developed. Intensification Areas are comprehensively designed. Examples are terrace or row housing or low-rise apartments and mixed commercial and residential use.

**Iwi:** Tribe or grouping of people.

**Iwi and hapū resource management plans:** Any planning document prepared by an iwi or hapū, recognised by the relevant iwi authority and lodged with the regional, city or district council.

**Kaitiaki:** A person or agent who cares for taonga; may be spiritual or physical. Guardian, steward, but the meaning of kaitiaki in practical application may vary between different hapū and iwi.

**Karakia:** Prayer.

**Kaumātua:** Elder.

**Kaupapa Māori:** Māori way or method.

**Kawa:** Protocol.

**Kāwanatanga:** Governorship, governance. It refers to the right of local authorities and government agencies to make laws and regulations for good government of the country and to represent the interests of the public.

**Key sites:** Sites or areas identified, using criteria consistent with those in Appendix F, as warranting recognition and provision for as a matter of national importance.

**Kōrero:** Narrative.

**Land use capability (LUC):** LUC classification is an assessment of land identifying its capacity for sustained productive use, taking into account physical limitations, management requirements and soil conservation needs, as described in the document; "Land Use Capability Survey Handbook – A New Zealand handbook for the classification of land, 3<sup>rd</sup> Edition, 2009"<sup>7</sup>

**Large-scale:** In the context of land-use change involving the proposed development of land for urban purposes including proposed changes in zoning, refers to an area greater than or equal to 5 ha.

**Lifeline utilities** means essential infrastructure services provided to the community such as water supply, wastewater networks and treatment facilities, transport facilities (including road, rail, airports and sea ports), telecommunication, television and radio facilities and structures, electricity generation and distribution facilities, and gas and liquid fuels storage and distribution/retail facilities.

<sup>7</sup> Lynn IH, Manderson AK, Page MJ, Harmsworth GR, Eyles GO, Douglas GB, Mackey AD, Newsome PJF 2009. *Land Use Capability Survey Handbook – a New Zealand handbook for the classification of land* 3<sup>rd</sup> ed. Hamilton, AgResearch; Lincoln, Landcare Research; Lower Hutt, GNS Science, 163p.

**Managed reduction:** In relation to nutrients and water quality, “managed reduction” means planned progressive lowering of excess nutrient losses; where a target date exists, the progressive lowering is to reach the nutrient limit by that date.

**Management areas:** Aggregations of statistical areas (Statistics New Zealand meshblocks 2001) as shown on Map 4A.

**Marae:** A specific area containing a complex of buildings which a hapū regards as their base for hosting meetings and other ceremonial occasions (hui).

**Marina:** An area of protected water and may be located either on or above seabed or, alternatively, on or above or within existing land which is to be excavated and incorporated into tidal water. Marina may include the following: Berthing private and commercial boats, launching and retrieval facilities for such boats, locker and storage facilities for such boats, vehicle, trailer and boat parking, caretaker residential accommodation, clubrooms and includes ancillary commercial retail (shop and convenience) and ancillary industrial land-use activities.

**Mauri:** The essential life force, energy or principle that tangata whenua believe exists in all things in the natural world, including people. Tangata whenua believe it is the vital essence or life force by which all things cohere in nature. When Mauri is absent there is no life. When Mauri is degraded, or absent, tangata whenua believe this can mean that they have been remiss in their kaitiakitanga responsibilities and this affects their relationship with the atua (Māori gods). Mauri can also be imbued within manmade or physical objects.

**Mean high water springs:** The average of the levels of each pair of successive high waters during that period of about 24 hours in each semi-lunation (approximately every 14 days), when the range of the tide is greatest (Spring Range).

**Moana:** Sea, body of water.

**Native forest:** An area of woody indigenous vegetation containing naturally occurring tree species, which attain within the region 30 cm diameter at breast height at maturity, and is either:

- (a) Over 1 ha, and with average canopy height 6 m or taller; or
- (b) Over 5 ha of any height.

**Natural character:** The qualities of the environment that give New Zealand recognisable character. These qualities may be ecological, physical, spiritual, cultural or aesthetic in nature. They include modified and managed environs. Natural character exists on a spectrum of values from low to outstanding with areas of high, very high and outstanding natural character being mapped and shown in Appendix I.

**Natural environment regional monitoring network (NERM):** A monitoring programme initiated by Bay of Plenty Regional Council in 1989.

**Natural hazard zone** means that zone within a hazard susceptibility area defined by the relevant regional, city or district plan, on the basis of existing or proposed land use, as the appropriate geographic scale to assess hazard risk. For the avoidance of doubt, a natural hazard zone may be an entire hazard susceptibility area or such smaller zone as is appropriate taking account of the nature and scale of actual and potential land uses that are exposed to the natural hazard.

**Non-productive purposes:** In the context of rural land means activities not based on the inherent primary productive capacity of the land or on the mining of any mineral resources (including aggregate) situated on, within, or below it. This definition includes “rural lifestyle activities” but excludes “rural production activities”.

**Non-structural:** Comprising predominantly of natural processes, non-built solutions or temporary built elements. Excludes concrete, rock or steel structures. Includes sandbags, avoidance, replenishment, sand fences and planting.

**Nutrient:** A substance contributing to nourishment. Nutrients can be contaminants; for example, nitrates and phosphates can have adverse effects on water quality.



**Oturoa Agreement:** The 18 February 2013 Memorandum of Understanding between Bay of Plenty Regional Council, Federated Farmers Rotorua and Lake Rotorua Primary Producers Collective.

**Papakāinga:** A settlement developed by and for tangata whenua on ancestral land in their traditional rohe including but not limited to residential activities.

**Point source discharge:** A discharge from a specific and identifiable outlet, onto or into land, air, a water body or the sea.

**Policy:** Policies provide guidance for decision making and the development of courses of action directed towards the accomplishment of objectives. Policies are guides to action.

**Population in care** means the population within the hazard assessment area that is in:

- (a) Hospital; and
- (b) Aged care facilities; and
- (c) Schools; and
- (d) Early education and infant day care facilities.

**Pūkenga:** Tangata whenua persons acknowledged by their iwi, hapū or whānau as having the appropriate knowledge, expertise and genealogical linkages to allow them to assist kaitiaki to determine and express the group's relationships and their culture and traditions with their ancestral lands, water, waahi tapu, special sites and other taonga.

**Rāhui:** Temporary prohibition; a set of restrictions or controls; a conservation measure.

**Rangatiratanga:** Refer to tino rangatiratanga.

**Region:** Unless the context otherwise requires, "region" means the Bay of Plenty region which comprises the area delineated on S.O. Plan No 58080 deposited with the Chief Surveyor of the South Auckland Land District (The New Zealand Gazette of Thursday, 8 June 1989. Orders in Council for Local Government Reorganisation. Wellington: Tuesday, 13 June 1989 – Issue No.99).

**Regional parks:** those parks which are developed in accordance with Bay of Plenty Regional Council's Regional Parks Policy (2003) (e.g. Pāpāmoa Hills Regional Park).

**Regionally significant infrastructure:** Is infrastructure of regional and/or national significance and includes:

- Rotorua International, Whakatāne and Tauranga airports;
- The regional strategic transport network as defined in the Bay of Plenty Regional Land Transport Plan or state highways as defined in the National State Highway Classification System;
- The Bay of Plenty rail network;
- Commercial port areas including Tauranga Harbour and its channels necessary for the operation of ports and related adjoining land and storage tanks for bulk liquids;
- The national electricity grid, as defined by the Electricity Governance Rules 2003;
- Facilities for the generation and/or transmission of electricity where it is supplied to the national electricity grid and/or the local distribution network. Broadband and strategic telecommunications facilities, as defined in section 5 of the Telecommunications Act 2001;
- Strategic radio communications facilities, as defined in section 2(1) of the Radio Communications Act 1989;
- Local authority water supply network and water treatment plants;
- Local authority wastewater and stormwater networks, systems and wastewater treatment plants;
- Pipelines for the distribution or transmission of natural or manufactured gas or petroleum and other energy sources;



- Regional parks; and
- Tauranga, Rotorua and Whakatāne public hospitals.

**Reinjection:** The return of geothermal water into the geothermal aquifer from which the water was sourced.

**Reverse sensitivity:** The potential for the operation of an existing lawfully established activity to be compromised, constrained or curtailed by the more recent establishment of other activities which are sensitive to the adverse environmental effects being generated by the pre-existing activity.

**Risk** means the likelihood and consequences of a hazard.

**Rohe:** A territory or boundary which defines the area within which a tangata whenua group claims traditional association and mana whenua.

**Rural lifestyle activities:** Subdivision and development of rural land wholly or predominantly for residential and related uses, rather than principally for rural production activities.

**Rural production activities:** Rural land use activities that rely on the productive capacity of land or have a functional need for a rural location such as agriculture, pastoral farming, dairying, poultry farming, pig farming, horticulture, forestry, quarrying and mining. Also included in this definition are processing and research facilities that directly service or support those rural land use activities.

**Sensitive activities:** Activities which suffer should they experience adverse effects typically associated with some lawful activities. For example, smells from a sewage treatment facility or noise from a port facility. Activities considered to be sensitive include but are not necessarily limited to any residential activity, any childhood education centre and any other accommodation facility.

**Significant geothermal features (SGFs):** Geothermal features include active and relic geothermal features and habitats including vegetation and fauna. “Significant Geothermal Features” are those that have been identified as geothermal features through the use of the feature descriptors of Appendix A - Definitions Annex A, and, then identified as significant through the application of the criteria of Appendix F Set 7 – Geothermal features, in accordance with Method 22 of this Policy Statement.

**Social and cultural buildings** means places of worship, marae, art galleries, museums, libraries and educational facilities.

**State of the environment monitoring:** Baseline monitoring of the health of the environment.

**Structure plan:** A planning technique applied to a defined geographical area so as to ensure co-ordinated development of the area through the integrated provision of infrastructure and the integrated management of related environmental effects, and which may also encompass financial, economic, social and cultural considerations.

**Surface water bodies:** Freshwater in a river, lake, stream, pond, or wetland that is not located within the coastal marine area.

**Surf break:** Has the same meaning as surf break under the NZCPS 2010.

**Susceptibility** means potential of an area to generate and/or be affected by a natural hazard.

**Sustainable use:** For geothermal resource use purposes, “sustainable use” requires a case by case consideration of the resource for its extractable energy use values.

In the context of a proposal for extractive use, determining sustainable use will consider:

- the level and certainty of scientific information on the particular system;
- the size of the geothermal energy resource;



- the rate at which the energy within the geothermal system is proposed to be extracted, and the timeframe over which any proposed rate of take of geothermal energy is predicted to be able to be sustained, informed by modelling for a period of at least 50 years (the depletion rate is a matter for decision makers to determine when an application is being considered);
- the predicted quantity of energy available for extractive use at the end of 50 years;
- the predicted length of time that the geothermal system will take to recover once extractive use ceases;
- the overall management of the geothermal resource, including the depth and locations of the proposed take and return of geothermal fluid, and the impacts of such management on the longevity of the resource; and
- once extractive use has commenced, how closely observed changes to the geothermal resource affecting its productive capacity and longevity match the modelled or predicted effects, by review of the data and other information collected. This information could include: pressure, temperature, chemistry, surface water flow or level and vegetation monitoring indicating the state of the geothermal resource, including identified changes to geothermal features.

**Taonga:** Treasure, property; taonga are prized and protected as sacred possessions of the tribe. The term carries a deep spiritual meaning and taonga may be things that cannot be seen or touched. Included for example are te reo Māori (Māori language), Waahi Tapu, waterways, fishing grounds and mountains.

**Taonga raranga:** Plants which produce material highly prized for use in weaving.

**Tapu:** Sacredness or beyond common usage.

**Tikanga Māori:** Māori customary values and practices.

**Tino rangatiratanga:** Chiefly authority, chieftainship, full tribal authority to tribal self-management. In the context of resource management this means the right of iwi and hapū to manage and control their resources in accord with their customary preference.

**Travel demand management:** Includes a range of approaches and techniques such as behavioural change programmes, road pricing tools and improvements to the efficiency of the existing transport networks.

**Tsunami:** A sea wave of local or distant origin that results from sea floor fault movement, large scale sea floor slides or volcanic eruption on the sea floor.

**Urban activities** include:

- Residential accommodation at a density of more than one dwelling per 2000 m<sup>2</sup> of site area;
- Commercial and industrial business, retailing and other commercial activities;
- Papakāinga or other Marae-based housing; and
- Any other land use for which reticulated wastewater and water supply is a requirement.

**Urban limits:** The outer extent of the areas (shown on Maps 5 to 15 in Appendix E) within which urban activities are located or which are committed for future urban expansion.

**Urupā:** Burial ground.

**Versatile land:** Versatile land is land under the New Zealand Land Use Capability Classification System categorised as being in Classes 1, 2 and 3.

**View shaft:** A corridor through which an outstanding natural feature or landscape can be viewed.

**Waahi tapu:** A place sacred to Māori in the traditional, spiritual, religious, ritual or mythological sense. (Section 2, Historic Places Act 1993.)

**Waahi tupuna:** Ancestral site.

**Wairua:** Spirit.

**Waka:** Canoe.



**Waste water:** Waste matter in a liquid state from domestic or industrial establishments.

**Watershed:** The upper edge of a catchment.

**Whānau:** The extended family, i.e. grandparents, parents, and children, sharing a mutual existence.

**Whenua:** Land, placenta.

**Yield:** The number of dwellings or allotments per hectare of developable land.



## Annex A: Geothermal feature types and definitions

Active geothermal systems are often expressed at the ground surface by a wide variety of surface geothermal features. As shown in Table 15, surface feature fluids are part of a complex continuum. These range from those fed directly by primary geothermal fluids (similar to those at depth), to mixtures with other ground water fluids, to those mixed with fluids derived from condensed steam, to those features fed only by steam. The surface expression ranges from high energy discharges (such as eruptions and large overflows), through medium energy discharges (minor overflows), to lower energy discharges (such as evaporating ponds). The steam dominated features range from warm ground heated by weak, diffuse steam discharges, through to boiling temperature and super-heated fumaroles.

As with all natural environments there are some special cases where the influence of chemistry, gas and heat, has created features that are not easy to characterise, and so do not easily fit into classification systems. Examples are feature sub-types that include the presence of molten sulphur, or excessive amounts of carbon dioxide. These sub-types are often associated with mixtures of different types of geothermal fluids, including condensed steam, various dissolved minerals and gases. They can be considered as variants and are classified as ‘other’ in the first part of this glossary.

Landforms derived from previous phases of surface geothermal activity, and which are no longer actively discharging geothermal heat or fluids, are labelled remnant landform features. They are also part of a continuum. Such landforms and habitats associated with them can be considered separately from active features because the predominant consideration in terms of their management is control of land use rather than management of geothermal fluid utilisation. But they may contribute to the significance of an area, (and potentially to hazards which are considered separately) so they still need to be considered as part of overall management.

Geothermal systems and the various surface feature types provide habitats for geothermal species. Those species may form part of a wider ecosystem(s). Habitats are largely dependent on the heat associated with and the presence of the discharged fluids, but are also influenced by the fluid type, chemistry, atmospheric conditions and terrain.

Geothermal ecosystems are driven more fundamentally by heat and moisture than by habitat. The boundary between geothermal and non-geothermal ecosystems can be defined by the presence or absence of geothermal heat as a primary ecosystem driver, plus a secondary driver of moisture including atmospheric conditions. Tertiary ecosystem drivers include chemical composition (most clearly in ecosystems in hydrothermally altered soils) and landforms where microhabitats may be important. Temperature and moisture gradients are fundamental, and they may be dynamic.

Table 15 Geothermal features: main types and associated habitats

Table 15 - Geothermal features : main types and associated habitats				
<b>Discharge energy</b> High  Low	1. Geysers	4. Intermittent or active hydrothermal eruption craters	7. Mud geysers	10. Fumaroles
	2. Flowing springs	5. Mixed springs	8. Ejecting mud pots	11. Steaming ground
	3. Non flowing pools	6. Mixed pools	9. Mud pools	12. Heated ground
	<i>Primary geothermal fluid</i>	<i>Mixed/diluted geothermal fluid</i>	<i>Mixed/diluted steam heated fluid</i>	<i>Steam Fed</i>
Geothermally-influenced aquatic habitat				
Geothermal habitat on heated/acid dry ground				

Habitat dependent on geothermally-altered atmosphere overlays all types (warm air, frost-free)



Table 16 Geothermal feature descriptors

<b>Table 16: Geothermal feature descriptors</b>			
<b>A – Active geothermal features (physical attributes)</b>			
<b>Feature Type</b>	<b>Description</b>	<b>Example of Feature</b>	<b>Description of Example</b>
<b>1. Geyser</b>	Any naturally occurring geothermal spring or pool that occasionally or frequently erupts, producing a cyclic, intermittent or continuous discharge of two-phase fluid (water and steam or other gases), vigorous enough to jet liquid water into the air above a static water level or vent opening. The area of a geyser comprises that of the spring basin and the area covered by water composed of the undiluted discharge from the geyser, and by any sinter deposits created by that discharge.	Cyclic / intermittent geyser	Relatively large discharge, >1 m height.
		Crypto-geyser	Intermittently discharging geothermal features which do not project water into the air. Intermittency is generally exhibited by regularly fluctuating water levels and discharge rates.
		Small geyser (sput)	Relatively small, intermittent spouter.
		Soda-geyser	Driven by CO <sub>2</sub> discharge rather than boiling.
<b>2. Flowing spring (primary fluids)</b>	Any naturally occurring geothermal spring, whose discharge consists of undiluted (primary) geothermal fluids typically containing a high level of dissolved minerals, which deposits sinter on exposed surfaces covered by its outflow. The area of a spring depositing sinter comprises that of the spring basin, together with the area covered by any surface water composed of the undiluted outflow from the pool and any sinter deposits created by that outflow.	Spouting spring	Vigorously boiling and overflowing.
		Chloride spring	Neutral pH mineralised water of deep origin, dominant dissolved anion is chloride, commonly deposits sinter.
		Acid chloride spring	Chloride water made acid by geothermal steam or by mixing with acid sulphate water, may deposit sinter.
<b>3. Non-flowing pool (primary fluids)</b>	Any naturally occurring basin (typically lined with sinter) containing primary geothermal fluids (typically highly mineralised). The area of a pool comprises that of the basin, together with the area covered by any variation of the water level.	Chloride pool	Neutral pH mineralised water of deep origin, dominant dissolved anion is chloride, commonly deposits sinter.
<b>4. Intermittent or active hydrothermal eruption crater</b>	Any large, naturally-occurring eruption of boiling liquid, steam and soil or rock, that occurs very occasionally or intermittently from a boiling hot spring, pool or vent, and is driven by rapid expansion of a steam-water column, through a vent, typically triggered by a rapid pressure drop near the surface, when fluid is at boiling temperature conditions. The fluid origin can be steam-heated ground water or a mixture of primary fluid, steam and heated groundwater. The area of a hydrothermal eruption includes the area of its vent, crater walls and rim. Hydrothermal eruption features will show a history of eruptions.		
<b>5. Mixed spring (with mixed chemistry)</b>	Any naturally occurring geothermal spring that has a natural outflow. The chemistry of the fluid indicates a mixed origin for the source fluids. Sub-types include acid-chloride, acid-sulphate and sodium-bicarbonate springs. The area of a spring comprises that of the spring basin, together with the area covered by any surface water	Acid sulphate spring	Shallow origin acidic water formed by oxidised geothermal steam, dominant dissolved anion is sulphate.
		Bicarbonate spring	Shallow origin water with dissolved CO <sub>2</sub> dominant dissolved anion is bicarbonate, generally dilute.



<b>Table 16: Geothermal feature descriptors</b>			
	composed of the undiluted outflow from the pool and any deposits created by that outflow.	Mixed spring	Mixed water of various origins, may be mixed with groundwater.
<b>6. Mixed pool (with mixed chemistry)</b>	Any naturally occurring geothermal basin or pool that contains geothermal fluids of chemically mixed origin, but that is not discharging liquid through an overflow. Examples of sub-types are acid-chloride, acid-sulphate and sodium-bicarbonate pools. The area of a pool comprises that of the pool basin, together with the area covered by any variation of the water level.	Acid sulphate pool	Shallow origin acidic water formed by oxidised geothermal steam, dominant dissolved anion is sulphate.
		Bicarbonate pool	Shallow origin water with dissolved CO <sub>2</sub> dominant dissolved anion is bicarbonate, generally dilute.
		Mixed pool	Mixed water of various origins, may be mixed with groundwater.
<b>7. Mud geyser</b>	Any naturally-occurring geothermally-heated mud pool, that occasionally or frequently erupts. The eruption produces an intermittent or continuous discharge caused by steam or other gases passing through the mud pool. The activity is vigorous enough to forcefully raise liquid mud by ejecting it into the air above a static mud level. The area covered by these features includes the mud pool, its banks, and any significant mud formations, like 'volcanoes' built up by the ejection of mud from the pool.	Mud-volcano	Spouting mud splatter, builds sustained "volcano" features.
		Ejecting/ geysering mud	Intermittent, steam-fed, large, violent.
<b>8. Ejecting mud pot</b>	Any naturally occurring basin of turbid mud, heated by geothermal processes (typically an underlying steam vent), which occasionally or frequently ejects a small amount of mud. Such mud features are often ephemeral, and can change over time from one sub-type to another in response to natural variations in rainfall, mud consistency, and the permeability of the vent to the underlying feed of steam. The area of a mud pot comprises that of the pool itself, its banks, and any mud formations built up by the ejection of mud from the pool.	Non-discharging mud pots	Steam-heated pool, often turbid.
		Mud cone	Small volcanic-like cone of mud splatter around its vent.
<b>9. Mud pool</b>	Any naturally occurring basin of turbid water and mud, heated by geothermal processes, but typically affected by rainfall, and therefore may dry out in summer. The area of a mud pool comprises that of the pool itself, its banks, and any mud formations.	Non-discharging mud pots	Steam-heated pool, often turbid.
<b>10. Fumarole</b>	Any naturally occurring vent, whose discharge consists of steam and other gases of geothermal origin. Sometimes mixing with air. The area of a fumarole consists of the vent and any surface accumulating mineral deposits derived from its gases.	Super-heated fumarole	Vent temperature greater than local boiling temperature, may have large flow rate and noisy emission.
		High temperature fumaroles	Vent temperature at or near local boiling temperature.
		Minor fumaroles	small, irregular, transient, steam vents.
		Sulphur-depositing fumaroles	A subtype where emitted H <sub>2</sub> S gas changes to native sulphur at the vent outlet.

<b>Table 16: Geothermal feature descriptors</b>			
<b>11. Steaming ground</b>	Any naturally occurring area discharging steam, diffusively passing through surface soils, with local boiling point temperatures at less than 0.2m depth, and night-time ground surface temperatures greater than 15°C above ambient.	Diffuse steam	Weak, diffuse emissions, not always visible.
<b>12. Heated ground</b>	Any naturally occurring area with surface soils radiating heat from underground geothermal sources where the boiling point depth is greater than 0.2m deep and the night-time surface temperature is greater than 5°C above ambient.		
<b>13. Other (variants, sulphur or CO<sub>2</sub> discharge)</b>	<p><b>13a Molten sulphur mobilising spring</b> - A hot spring which passes through elemental sulphur-bearing rock at a temperature that can melt the sulphur (&gt;119 °C) and bring it towards the surface. It may pool at the bottom of a deep liquid-filled vent or lake bed, or form solid sulphur deposits at ambient surface conditions.</p> <p><b>13b Kaipohan</b> - Cold gas discharge, consisting mostly of CO<sub>2</sub> of deep geothermal origin, with no associated steam discharge, but of sufficiently large flow-rate to influence vegetation.</p> <p><b>13c Gas Seep</b></p>	Sulphur depositing fumarole	Deposits sulphur around vent.
		Molten sulphur depositing	Deposits molten sulphur.
		Kaipohan	Diffuse ambient temperature gas emission, influences vegetation.
		Gas seep	Vent of geothermal gas, generally at ambient temperature.
<b>B - Remnant geothermal landforms</b>			
<b>Feature Type</b>	<b>Description</b>	<b>Example of feature</b>	<b>Description of example</b>
<b>1 Hydrothermal eruption crater</b>	Any naturally occurring remnant crater, now dormant/extinct, but originally produced by the explosive boiling of geothermal water without the direct involvement of near-surface magma, and by the consequent ejection of material derived from the soil/rock matrix. The area of a remnant hydrothermal eruption crater comprises that of the crater and its rim, and may contain a wetland.	Extinct vents	Pre-historic hydrothermal eruption craters.
<b>2 Sinter deposits</b>	Any silica or carbonate sinter body that has received natural sinter deposition. Subtypes are recent and fossil sinters. Recent sinter was historically active based on photos or other records, but is no longer receiving natural sinter deposition. Fossil sinter was active at some stage prior to human occupation of the area when it received natural sinter deposition from discharging geothermal fluids, based on geological evidence. The area of a recent sinter body consists of that of all interconnected sinter in a single occurrence.	Recent sinter	Historically active, based on photos or other records, but now dormant deposits.
		Epithermal (fossil) sinter	Old sinters resulting from pre-historic (prior to human occupation of the area) discharges. Based on geological evidence.
<b>3 Remnant tomos</b>	Any shallow depressions, small holes or collapses (known as tomos) of natural geothermal origin that have cooled off and are no longer associated with active thermal vents.	Thermal tomos	Old depressions in cooled steam zones.
<b>4 Hydrothermally altered clays</b>	Deposits of thermal clay (such as kaolinite and smectite) originating from surface	Recent clays	Deposits from historically active but now dormant features.



<b>Table 16: Geothermal feature descriptors</b>			
	thermal activity that has since cooled off.	Epithermal clays	Pre-historic (on a geological time scale) thermal clay deposits.
<b>5 Other remnant landforms</b>	Other geothermal landforms exhibiting historic or pre-historic geothermal processes.		
<b>C - Geothermal habitats - affected by extraction and land use</b>			
<b>Feature Type</b>	<b>Description</b>	<b>Habitat type</b>	<b>Typical species found in habitat</b>
<b>A. Geothermally influenced aquatic habitats</b>	Any area of naturally occurring aquatic habitat of thermo-tolerant, thermophilic or otherwise extremophilic indigenous species, which may form part of an ecosystem(s), in a water body influenced by natural geothermal input.	Wetland/ pond, thermal swamp	Thermally dependent algae and vascular plants including frost sensitive ferns, species of baumea rushes unique to geothermal areas, indigenous invertebrates, and fish dependent on geothermal conditions.
		Warmed water	Thermally dependent algae, aquatic bryophytes, frost sensitive ferns, arsenic tolerant snails, ephydrid flies and other indigenous macroinvertebrates.
		Hot water	Thermal microbes- thermophilic bacteria.
		Acid water	Acidophilic bacteria.
		Steaming micro-climate, high temperature	Thermal bryophytes.