Conservation Assessment of *Hibbertia superans* Toelken (Dilleniaceae)

Gavin P. Phillips and Vera Wong 20/11/2025
NSW Department of Climate Change, Energy, the Environment and Water

***Hibbertia superans* Toelken (Dilleniaceae)**
Distribution: Endemic to NSW
Current EPBC Act Status: Not listed
Current NSW BC Act Status: Endangered
Proposed listing on NSW BC Act: Critically Endangered

Reason for change: Genuine change based on a very large reduction in the abundance of the species.

Summary of Conservation Assessment

Hibbertia superans was found to be eligible for listing as Critically Endangered under Criterion A4b.

The main reason for this species being eligible is a projected very large population reduction of 78–96% over a three-generation period (30 years) as a result of clearing for urban development, adverse fire regimes, and competition from weeds.

Hibbertia superans flowering. Image: Andrew Orme, Botanic Gardens of Sydney (used with permission).

Description and Taxonomy

Hibbertia superans (family Dilleniaceae) is a conventionally accepted species (CHAH 2025; PlantNET 2025). It is described by Toelken (2000) as "Low spreading shrubs to 0.3 m high, with few to many, weak twisted stems and branches, villous when young, becoming tomentose with longer hairs more or less wearing off. Vestiture on all parts consisting of more or less long silky [hairs] over a dense layer of usually short stiffly erect simple hairs, but particularly on the branches and the undersurface of leaves there are often some scattered stellate hairs with 2–3(–5) equal erect branches (. . .). Leaves (none modified into hypsophylloids) with axillary hair tuft below flowers 1–1.2 mm long; petiole 0–0.2 mm long; lamina linear, rarely linear-elliptic, (5.6–)7.5–10(–12.3) x 0.9–1.2(–1.4) mm, acute, often becoming obtuse, scarcely constricted into petiole, slightly broadened central vein usually raised to same level as revolute margins and continued (0.4–0.6 mm wide in the middle) into the apex, with undersurface not visible, villous over or becoming tomentose above and below. Flowers single, sessile to slightly stalked, terminal on main branches or rarely on short shoot, younger ones freely overtopping older ones; bracts linear, 8.3–9.5 x 1.0–1.3 mm, like leaves with distinct central vein, villous sometimes becoming tomentose. Calyx not accrescent; outer calyx lobes linear-lanceolate, acute, with slender central vein and recurved margins in upper third, (6.8–)7.5–9(–9.8) x 1.5–1.6 mm, much longer than inner ones, outside villous over or becoming tomentose, inside at least upper half like outside; inner calyx lobes oblong-elliptic to obovate, obtuse to rounded, 4.2–6.5(–7.6) x 1.9–2.7 mm, outside villous over more or less appressed pubescent, inside rarely with a few appressed hairs towards the apex. Petals broadly obovate, 5.5–6.7 mm long, emarginate. Stamens 6–9, subequal; filaments basally connate, but often some more than others; anthers narrowly oblong, (1.4–)1.6–1.8 mm long, dehiscing mainly by lateral slits. Pistils 2; ovaries laterally compressed, each with 4 ovules; style from outer apex of ovary, curved outwards and around the cluster of stamens to end at the apex of the outer anthers. Fruit villous with very dense erect simple hairs. Seeds oblong-obovoid, often oblique, 1.5–1.7 x 1.1–1.4 mm, fleshy aril expanding into a scarcely lobed sheath adpressed to the base of seed, often to one side of base of seed." Since this original description, confirmed plants of *Hibbertia superans* have been recorded up to 40 cm high and spreading up to 1 m wide (R. Miller *in litt*. December 2022).

Hibbertia superans was originally included within *Pleuranda sericea* in 1817, and was subsequently moved into the genus *Hibbertia* in 1863. *Hibbertia sericea* has since been found to be a species complex, with twelve discrete species being raised from the broad concept of *H. sericea* including *H. superans* (Toelken 2000). A number of sites of *H. superans* were also previously recognised as a threatened population of *H. incana*, though since the description of *H. superans* are now accepted as correctly belonging to the latter species (NSW Scientific Committee 2001), with *H. incana* itself being reduced to synonymy with *H. crinita* (Toelken 2000).

Hibbertia superans can be identified from its congeners by the villous ovary with long, simple hairs; the style being attached to the apex of the ovary; and the obviously narrowly oblong-obovate seeds with a distinct laterally attached aril, with this latter feature being unusual in the *H. sericea* group of species (Toelken 2000). *Hibbertia superans* most closely resembles *H. crinita*, but can be recognised from the latter by the predominantly simple hairs over the whole plant, especially on the leaf midvein

(*c.f.* 1–3-branched hairs), and the short 1–2 branched hairs on the outer calyx lobes (*c.f.* 8–25-branched stellate hairs; Toelken 2000).

Distribution and Abundance

Hibbertia superans is a range-restricted species endemic to the Greater Sydney region New South Wales (NSW). Known occurrences lie within the Cumberland, Pittwater, Wollemi and Yengo subregions of the Sydney Basin Bioregion (Commonwealth of Australia 2012), on the traditional lands of the Eora and Darug people (Horton 1996).

Hibbertia superans mainly occurs in northwest Sydney between Baulkham Hills and Wisemans Ferry, though has also been recorded in Dural, Berowra Valley National Park (NP), Hornsby Heights, and Ku-ring-gai Chase NP in northern Sydney and in Warrimoo, Winmalee and Faulconbridge in the lower Blue Mountains. It was previously thought that a disjunct occurrence near Mount Boss (inland from Kempsey) on the mid north coast of NSW was also *H. superans* (NSW Scientific Committee 2001), but this record is now recognised to be an undescribed taxon (H. Toelken *in litt*. December 2022) and is not included in this assessment.

As of 2025, there were an estimated 453 mature individuals in the population of *Hibbertia superans*, with the population consisting of 16 subpopulations following the IUCN (2024) definition (Table 1). Subpopulations are defined here where sites are geographically separated by 1 km or more, as distances greater than this are likely to be a barrier to gene flow. This is due to the typical foraging ranges of the primary pollinators of *Hibbertia* and the extremely limited seed dispersal range typical of the genus (see Ecology section below). The largest subpopulation occurs between the suburbs of Kellyville and Glenhaven, with an estimated 240 mature individuals across nine sites (Table 3). The majority of subpopulations are on private or local government managed land, with only four subpopulations (Maroota State Conservation Area (SCA), Berowra Valley NP, Ku-ring-gai Chase NP and Faulconbridge) occurring on NSW National Parks and Wildlife Service (NPWS) estate.

Table 1. Breakdown of the population of *Hibbertia superans*.

Subpopulation	Survey site	Survey year	Surveyed abundance[1]	Current estimate of mature individuals (2025)[2]	Fire History[3]
Maroota North	Maroota North	2009	unknown	unknown	Dec 2002 wildfire
Maroota East	Maroota East	2009	unknown	unknown	Dec 2002 wildfire
Maroota Central	Maroota Central	2001	unknown	unknown	Dec 2002 wildfire
		2003	unknown		
Maroota South	Maroota South	2009	1	0	Dec 2002 wildfire
Maroota SCA	Maroota SCA	2001	2	unknown[4]	Sept 2006 wildfire
					Sept 2019 wildfire
Glenorie	Niech Rd	2004	161	17	Dec 2002 wildfire
	Cattai Ridge Rd	1998	10	unknown[4]	2002/3 prescribed
	Gibbs Rd	2016	1	0	nil
	End of Miller Rd	1998	10	5	Dec 2002 wildfire
		2008	50-100		

Subpopulation	Survey site	Survey year	Surveyed abundance[1]	Current estimate of mature individuals (2025)[2]	Fire History[3]
		2022	7		
	Miller Rd Intersection	1999	10	0	Dec 2002 wildfire
		2008	7		
		2022	0		
	N of Miller Rd	2022	20	15	Dec 2002 wildfire
	Kemp Pl	2022	10	7	Dec 2002 wildfire
	Porters Rd	2004	34	54	Dec 2002 wildfire
		2007/8	135		
		2022	75		
	Cadwells Rd	1996	15	0	Dec 2002 wildfire
		2004	98		
		2022	0		
	Clarke Way	2004	249	36	Dec 2002 wildfire
		2008	250-300		
		2022	50		
	Kenthurst Park	2007	132	7	2001/2 prescribed
		2022	10		Dec 2002 wildfire
Kenthurst	Campbell Wy	2008	12	2	nil
	Murray Park Rd	2007	30	4	2002/3 prescribed
	Jones Rd	2007	30	4	nil
Kellyville to Glenhaven	Saltwater Cres[5]	2008	650	138	nil
		2019	479		
		2022	c. 190		
	Foxall Rd	1999	1	0	nil
	Robson Rd	2007	50-70	0	nil
		2022	0		
	Bannerman Rd	2007	100	3	nil
		2022	4		
	Cattai Creek Dr	1998	20	95	nil
		2004	147		
		2015	277		
	Ballymena Wy	2011	1	0	nil
	Drawbridge Pl	1996	10	1	nil
		2004	11		
	Samuel Gilbert Public School	1996	7	0	nil
		2004	0		
	Bill Woods Reserve	2003	10	3	1996 prescribed?
		2004	89		

Subpopulation	Survey site	Survey year	Surveyed abundance[1]	Current estimate of mature individuals (2025)[2]	Fire History[3]
		2022	4		
Baulkham Hills	Bidjigal Reserve	2004	43-50	42	2002/3 prescribed
		2022	58		
Dural	Hunt Rd	2008	3	0	nil
	Mitchell Rd	2008	5	1	nil
Berowra Valley NP	Cherrybrook	2008	3	0	August 2009 prescribed
					March 2010 prescribed
					August 2003 prescribed
Hornsby Heights	Binya Cl	2009	3	1	August 2008 prescribed
Ku-ring-gai Chase NP	Murrua Trail	2021	20	13	1946/47 wildfire
					1964/65 wildfire
					1971/72 wildfire
					1979/80 wildfire
					1990/91 wildfire
					August 2003 prescribed
Warrimoo	Spurwood FT	2016	6	2	January 2002 wildfire
Winmalee	Hawkesbury Rd	2020	unknown	unknown	1976/77 wildfire
					1993/94 wildfire
					October 2013 wildfire
Faulconbridge	Faulconbridge Ridge Trail	2022	4	3	1982/83 wildfire
					1993/94 wildfire
					July 2003 prescribed
					December 2006 wildfire
					April 2018 prescribed
TOTAL 2025 ESTIMATE OF MATURE INDIVIDUALS				**453**	

[1]Survey data are drawn from Brogan (2004), Miller (2022), BioNET (2025), and RBGDT (2025). All individuals surveyed are assumed to be mature given the difficulty in detecting non-flowering plants (Miller 2022).
[2]The abundance of mature individuals in 2025 is estimated using an exponential decline model applied to the most recent survey figures, with the rate of decline generated using survey results at eight sites surveyed in 2007/8 and resurveyed in 2022.
[3]Fire history is based on Miller (2022) and NSW NPWS (2025).
[4]The 2025 abundance at Maroota SCA and the Cattai Ridge Rd site in the Glenorie subpopulation are unknown as fire has occurred since the survey at these sites and may have stimulated a recruitment event.
[5]The 2022 population estimate for the Saltwater Cres site in the Kellyville to Glenhaven was generated based on an intersect of the 2019 records with satellite imagery showing development in subsequent years.

Table 2. Estimated subpopulation sizes in 2025, data drawn from Table 1.

Subpopulation	Estimate of Mature Individuals 2025
Maroota North	unknown
Maroota East	unknown
Maroota Central	unknown
Maroota South	unknown

Subpopulation	Estimate of Mature Individuals 2025
Maroota SCA	0
Glenorie	141
Kenthurst	10
Kellyville to Glenhaven	240
Baulkham Hills	42
Dural	1
Berowra Valley NP	0
Hornsby Heights	1
Ku-ring-gai Chase NP	13
Warrimoo	2
Winmalee	unknown
Faulconbridge	3
TOTAL	**453**

Despite the fact that numbers of *Hibbertia superans* fluctuate over time dependent on the frequency of fire which stimulates germination (James 2012), the population appears to be in long-term decline. Targeted surveys were conducted at 22 sites in 2004 (Brogan 2004), 11 sites in 2007 and 2008 (BioNET 2025) and 12 sites in 2022 (Miller 2022). The 2022 surveys revisited five of the sites surveyed in 2004 and seven of the sites surveyed in 2007, with declines recorded at all but one site (Miller 2022). Abundance at surveyed sites has reduced by 78% when comparing sites surveyed in 2004–2022 (520 to 113 mature individuals across five sites; Table 3) and 2007–2022 (1,494 to 336 mature individuals across seven sites; Table 4) (Miller 2022).

Table 3. Comparison of *Hibbertia superans* sites surveyed in 2004 and 2022.

Site	Number of mature individuals in 2004 (Brogan 2004)	Number of mature individuals in 2022 (Miller 2022)
Porters Rd (near gate only)	34	1
Cadwells Rd	98	0
Bill Woods Res	89	4
Bidjigal	50	58
Clarke Way	249	50
TOTAL	520	113

Table 4. Comparison of *Hibbertia superans* sites surveyed in 2007/2008 and 2022.

Site	Number of mature individuals in 2007/2008 (BioNET 2024)	Number of mature individuals in 2022 (Miller 2022)
End of Miller Rd	100	7
Miller Rd intersection	7	0
Porters Rd	135	75
Clarke Way	300	50
Kenthurst	132	10
Saltwater Cres	650	190

Site	Number of mature individuals in 2007/2008 (BioNET 2024)	Number of mature individuals in 2022 (Miller 2022)
Robson Rd	70	0
Bannerman Rd	100	4
TOTAL	1,494	336

Given most known sites consist of low numbers of individuals and most have seen no recent fire events, it is likely that the decline seen in these surveyed areas are representative of decline across the population as a whole.

Extent of Occurrence and Area of Occupancy

The Extent of Occurrence (EOO) is estimated to be 1,048 km^2 and is based on a minimum convex polygon enclosing a cleaned dataset of known occurrences of the species, the method of assessment recommended by IUCN (2024). The Area of Occupancy (AOO) of *Hibbertia superans* is estimated to be 140 km^2 using 2 x 2 km grid cells, the scale recommended by IUCN (2024). Both EOO and AOO were calculated using ArcMap (Esri 2021).

The current distribution estimate is based on 843 unique records compiled from BioNet (NSW Wildlife Atlas; Bionet 2025), the Atlas of Living Australia (ALA 2025) specimen records from the National Herbarium of New South Wales (RBGDT 2025) and Miller (2022).

Cultural significance

This assessment is not intended to be comprehensive of the Traditional Ecological Knowledge that exists for *Hibbertia superans* or to speak for Aboriginal people. Aboriginal people have a long history of biocultural knowledge, which comes from observing and being on Country, and evolves as it is tested, validated, and passed through generations (Woodward *et al*. 2020). Aboriginal Peoples have cared for Country for tens of thousands of years (Bowler *et al.* 2003; Clarkson *et al*. 2017). It is acknowledged that traditional ecological knowledge exists for all plants, animals and fungi connected within the kinship system (Woodward *et al.* 2020).

Some *Hibbertia* species, notably *H. scandens*, have been documented as being used by the Yaegl people of northern NSW as a medicinal plant to treat sores and rashes (Packer *et al.* 2012). *Hibbertia superans* may have had similar cultural uses given other *Hibbertia* species also contain pigments with antioxidant and anti-inflammatory properties (Lima *et al.* 2014).

Ecology

Habitat

Hibbertia superans occurs in woodlands on sandstone ridgetops and plateaus in sandy soils with some clay influence close to shale/sandstone transitions (Toelken 2000; James 2012). The species prefers open areas in heath or open woodlands (James 2012). Associated vegetation often includes *Allocasuarina littoralis*, *Angophora bakeri*, *A. hispida, Corymbia gummifera, C. eximia*, *Eucalyptus piperita, E. racemosa, E. squamosa, Gaudium trinervium, G. parvifolium, Pultenaea tuberculata,*

Dillwynia retorta, Grevillea buxifolia, Baeckea spp. and *Calytrix tetragona* (James 2012; Miller 2022). Other flora threatened on the *Biodiversity Conservation Act 2016* may also co-occur with *H. superans*, including *Eucalyptus cryptica* (Critically Endangered), *Acacia bynoeana* (Endangered), *Darwinia biflora* (Vulnerable), *Epacris purpurascens* var. *purpurascens* (Vulnerable), *Leucopogon fletcheri* subsp. *fletcheri* (Endangered), *Persoonia hirsuta* (Endangered), *Grevillea parviflora* subsp. *supplicans* (Endangered) and *Pimelea curviflora* var. *curviflora* (Vulnerable) (NSW Scientific Committee 2001; James 2012; Miller 2022).

Hibbertia superans has also been recorded adjacent to the threatened ecological communities of Sydney Turpentine-Ironbark Forest in the Sydney Basin Bioregion and Duffys Forest ecological community in the Sydney Basin Bioregion (NSW DCCEEW 2021), and may occur in these communities.

Life history

Hibbertia superans is a facultative seeder, meaning it both resprouts and germinates from seed in response to fire. The species primarily recovers after fire by reshooting from the rootstock (James 2012). Seed germination may be stimulated by higher severity fire events (James 2012), with seedling emergence observed to coincide with occurrences of at least moderate intensity fire in other *Hibbertia* species that occur in similar habitat to *H. superans* (*e.g. H. spanantha*; Toelken and Robinson 2015). The abundance of *H. superans* fluctuates around fire events, with large numbers recorded 2-4 years after fire and then subsequently falling over time as surrounding vegetation increases in height and density (James 2012). Dense, long unburnt vegetation becomes unsuitable habitat for *H. superans* in the long-term, and if a no-fire regime is maintained the species is unlikely to persist as standing plants in an area with an absence of fire of over 25 years currently considered the maximum allowable period (OEH 2024).

The primary juvenile period of *Hibbertia superans* is unknown. The primary juvenile period of other *Hibbertia* species in the Sydney region ranges from three years (*e.g. H. cistiflora,* a facultative seeding species; Benson 1985) to four years (*e.g. H. monogyna*, an obligate seeding species; Benson 1985), and it is assumed that the primary juvenile period for *H. superans* may be similar or longer. For example, several post-fire seedling cohorts of *Hibbertia ericifolia*, a related species with similar growth form and life history, had not produced their first flowers five years after fires in December 2019 (D. A. Keith unpublished data based on Keith *et al.* 2023). The secondary juvenile period of *H. superans* is approximately two years (OEH 2024). While some *Hibbertia* can be long-lived with lifespans of up to 60 years (*e.g. H. stricta* and *H. ericifolia*; Benson and McDougall 1995), others have shorter lifespans of 10–20 years (*e.g. H. tenuis*; Commonwealth TSSC 2010). It is likely that *H. superans* has a minimum lifespan of 15–20 years, consistent with recent observations of large declines in abundance over an 18–20-year fire-free period at multiple sites combined with the continuing presence of large, flowering plants in areas last burnt 20 years prior (Miller 2022).

Given *Hibbertia superans* relies on basal resprouting for stand maintenance with limited seedling recruitment outside of disturbance cycles, generation length can be estimated using the age of first reproduction + z * length of reproductive period (IUCN 2024), where z is a constant between 0 and 1 calculated using survivorship and the relationship between fecundity and age. Using a lifespan estimate of 15–20 years, a

primary juvenile period of 3–4 years, and a value for *z* of 0.21–0.33 as calculated for other woody shrub species (Fung and Waples 2017), the generation length of *H. superans* is estimated to be at least 6–10 years.

Reproductive ecology

Hibbertia superans flowers from July to December (OEH 2024; PlantNET 2025), with fruit ripening and producing mature seed from November (RBGDT 2025).

Hibbertia are insect-pollinated, with many species in the genus requiring buzz pollination by native bees due to the presence of poricidal anthers (Bernhardt 1984; Tucker and Bernhardt 2000; Doyle *et al.* 2023). Native bee pollinators recorded for *Hibbertia* include species in the genera *Allodapula, Exoneura, Xylocarpa, Tetragonula, Leioproctus, Homalictus, Lasioglossum* and *Nomia* (Armstrong 1979; Benson and McDougall 1995; Doyle *et al.* 2023). Given the estimated foraging ranges for these bees and those of similar sizes, it is likely that effective pollination takes place at distances of <1 km (Greenleaf *et al.* 2007; Biel *et al.* 2008; Smith *et al.* 2016).

Seed ecology

The fruit of *Hibbertia superans* is dehiscent, and the seed has a fleshy aril (Toelken 2000). This makes the seeds attractive to ants and encourages dispersal by them, a common trait in *Hibbertia* in the Sydney region (Westoby *et al.* 1990). In sclerophyll vegetation near Sydney, ants have been found to disperse seeds mostly less than 2 m and rarely over 4 m (Westoby *et al.* 1991), meaning that seed dispersal is likely highly localised in *Hibbertia superans.*

Hibbertia species typically have complex seed dormancy syndromes that vary between species. Seed dormancy is imposed by the seed coat as well as by the immature embryo (Ralph 2011; Hidayati *et al*. 2012). In many *Hibbertia* species germination is increased by scarification and/or smoke water (Dixon *et al*. 1995; Schatral 1996; Schatral *et al.* 1997; Allan *et al.* 2004) possibly indicating a positive response to fire, and such a response is already suspected in *H. superans* (James 2012). Variation in dormancy among individual seeds may also result in naturally staggered germination over several years (Schatral *et al.* 1997; Ralph 2011; Hidayati *et al*. 2012), potentially allowing limited germination away from disturbance. The longevity of *H. superans* seeds in the seedbank is unknown, however *Hibbertia* species are thought to have a persistent seedbank (Benson and McDougall 1995; Cuneo *et al*. 2018).

Threats

The primary threats to *Hibbertia superans* are adverse fire regimes, vegetation clearing for urban and rural development, habitat degradation from human activity including illegal dumping and competition from exotic weeds (Brogan 2004; James 2012; Miller 2022; OEH 2024). These threats often do not act independently, and the cumulative effects of these threats, such as illegal dumping facilitating the spread of weeds, have also been noted as placing significant pressure on the often-small stands of *H. superans* and its habitat (Miller 2022). Infection from pathogens such as *Phytophthora cinnamomi* has also been identified as a plausible threat to the species and its habitat (Miller 2022).

Adverse fire regimes

Adverse fire regimes are inferred to be a major driver of decline in *Hibbertia superans.* The species exists in small fragments primarily in an urban matrix which can experience highly variable fire regimes, ranging from very frequent due to high rates of arson and hazard reduction burning (Auld and Scott 1995; Stenhouse 2004), to very low due to heavy fire suppression efforts or disruption of fire spread pathways (Gill and Williams 1996; Tresize *et al.* 2020), and can even rapidly switch from one extreme to the other with urban expansion (Syphard *et al.* 2007). This means that the regime that best suits persistence of species such as *H. superans* can be easily altered due to urban influences, causing decline in the quality of habitat and number of mature individuals of the species.

Adverse fire regimes primarily threaten *Hibbertia superans* when fire is absent from the landscape for extended periods of time. In Sydney peri-urban bushland remnants, plant species diversity driven by shrub species richness has been found to increase with fire frequency (Pendall *et al.* 2022). At long-unburnt sites, native vegetation naturally becomes denser and taller with time, overshading *H. superans* and suppressing seedling germination (Miller 2022). Without fire and soil disturbance to provide germination cues and enhance resource availability (light, water, nutrients), allowing seedlings to grow and mature, *H. superans* may be unable to persist. Where *H. superans* occurs on private land or in reserves surrounded by urban development, planned burning is logistically difficult and seldom conducted. While localised arson incidents can be common in these areas, wildfire risk is low, and remnants fragmented by urbanisation can more typically experience fire suppression rather than planned burning (Gill and Williams 1996; Tresize *et al.* 2020). Isolation of bushland remnants in the greater Sydney area also inhibits chance migration to adjacent areas where a different disturbance regime may provide or maintain suitable habitat.

The majority of *Hibbertia superans* sites are now long-unburnt and are likely to remain as such given their proximity to modern residential and rural-residential areas. Most of the largest recorded patches of *H. superans* have not burnt for 18–20+ years, and large declines in standing plants (40-95%) have been recorded since the previous fire-stimulated germination event (Table 1). In the absence of fire (recommended maximum interval of 25 years; OEH 2024), *H. superans* has been observed to be suppressed by taller and larger understory shrub and trees species such as *Pittosporum undulatum, Allocasuarina littoralis, Kunzea ambigua,* and *Syncarpia glomulifera* (Miller 2022). Furthermore, a dense detritus layer comprised of leaf litter, fallen branches and twigs builds up in the absence of fire and smothers *H. superans* and suppresses seedling germination (Miller 2022). Dense, long unburnt vegetation therefore becomes unsuitable habitat for *H. superans* and if a no-fire regime is maintained the species is unlikely to persist in an area, or if it has disappeared, is increasingly unlikely to recover to previous levels as the seed bank, while persistent, loses viability over time (Miller 2022).

Conversely, too frequent and/or too severe fire can cause decline in *Hibbertia superans* if the minimum recommended fire-free threshold (seven years; NSW Rural Fire Service 2013) is not maintained, or if high severity fire were to affect key sites. A number of *Hibbertia* species are known to favour less-frequently burnt areas, with fire return intervals more frequent than 10 years having significantly lower abundances of standing plants than those burnt at 20+ year cycles (Watson and Wardell-Johnson

2008; Tuner *et al.* 2020). It is possible that *H. superans* also responds in this way given significant decline has been noted in sites which have been burnt at mean intervals of less than 10 years (Miller 2022). Given many of the areas of *H. superans* habitat are long-unburnt and therefore may have reduced soil seedbanks, and that previous burning regimes likely consisted of lower-intensity burning regimes that may not maximise recruitment from the soil seedbank, repeated incidences of fire could also kill standing plants and rapidly exhaust the remaining soil seedbank at a given site. Additionally, other *Hibbertia* species (*e.g., H. calycina*; Turner *et al.* 2020) have been locally extirpated following single occurrences of high severity fire which eliminates resprouting individuals and the soil seedbank, and only persist with lower-severity fire. This means that both increased frequency or increased severity of fire are inferred to reduce the number of mature individuals of *H. superans* when they occur.

'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition' is listed as a Key Threatening Process under the *Biodiversity Conservation Act 2016* and 'Fire regimes that cause declines in biodiversity' is listed as a Key Threatening Process under the *Environment Protection and Biodiversity Conservation Act 1999*.

Vegetation clearing for residential and rural-residential development

Hibbertia superans has been heavily affected by residential and rural-residential development, with much of its preferred ridgetop habitat now developed (Miller 2022). Many records from the northwest Sydney suburbs indicate that formerly known sites of *H. superans* are now housing developments (BioNET 2025), resulting in losses of mature individuals as well as available habitat, and fragmenting the species into smaller, more isolated sites.

Urban development has continued to remove individuals and the habitat of *Hibbertia superans* in recent decades. For example, analysis of satellite imagery data shows that a housing development at one of the sites in the Kellyville to Glenhaven subpopulation appears to have resulted in the clearing of approximately 60% (*c.* 289 of 479) of previously recorded individuals, severely reducing what was once one of the largest known stands of *Hibbertia superans*. As other housing developments continue to be proposed and built at and around *H. superans* sites to accommodate Sydney's growing population (*e.g.* see NSW DPE 2018), urban development is likely to continue to negatively affect the available habitat and number of mature individuals of *H. superans* into the future.

'Clearing of Native Vegetation' is listed as a key threatening process under the *Biodiversity Conservation Act 2016*. 'Land Clearance' is listed as a Key Threatening Process under the *Environment Protection and Biodiversity Conservation Act 1999*.

Habitat degradation from human activities

The proximity of the majority of *Hibbertia superans* sites to residential suburbs and rural-residential properties has resulted in human activities negatively affecting the species' habitat in many ways. Observed activities that facilitate the degradation of *H. superans* habitat include rubbish dumping, road and utility easement maintenance, unsympathetic land management, nutrification from urban runoff, and high levels of recreational use in small bushland reserves (Brogan 2004; James 2012; Miller 2022).

Household rubbish and domestic garden waste have been illegally dumped at numerous *Hibbertia superans* sites (Brogan 2004; Miller 2022). Dumped refuse recorded at *H. superans* sites include hard waste, food wrappings, plastic waste, garden and lawn clippings, and in one instance large quantities of slashed grasses including the invasive weed African lovegrass (*Eragrostis curvula*) (Miller 2022). This rubbish may directly smother low-growing species such as *H. superans*, contaminate soils and poison plants, create or increase fire risks, and facilitate the spread of exotic weeds in the species' habitat (NSW EPA 2024).

Road works and adjacent vegetation management is an ongoing threat to *Hibbertia superans* habitat on roadsides and utility easements. A number of sites exist almost solely in road reserves, and in some cases major roadworks on arterial roads could realistically result in the destruction of *H. superans* plants and/or habitat (Miller 2022). Roadside sites may also be at risk from vegetation maintenance in relation to powerlines, with several sites in easements that require periodic maintenance (James 2012; Miller 2022). At these sites, while the opening of the canopy could favour *H. superans*, current maintenance regimes have been observed to result in lopped vegetation remaining in place and potentially smothering lower growing species (Miller 2022). *Hibbertia superans* habitat that adjoins private land has been observed to be unsympathetically managed by property owners, with habitat modified to lawn, frequently underscrubbed (removal of sub-canopy vegetation), or retained in a semi-modified state unsuitable for the species (Miller 2022).

The sandstone soils of Sydney are naturally low in nutrients and the native flora can be adversely affected when exposed to higher concentrations of nutrients from urban stormwater run-off and other sources (Thomson and Leishman 2004). Increases in soil nutrients in urban bushland are associated with the presence of exotic species and the decline in the diversity of native species, with the survival of native plants decreased with increasing nutrient concentrations (Thomson and Leishman 2004). Run off from adjacent land can also transport weed species into bushland (Miller 2022). At some *Hibbertia superans* sites, increased nutrient concentration resulting from run off from adjoining land uses, such as sports ovals or horticultural enterprises, has altered the vegetation structure and degraded the habitat of the species (Miller 2022). Changes in soil chemistry have promoted the spread and growth of weeds into natural areas, and resulted in increased growth of species such as *Allocasuarina littoralis*, which creates a thick ground layer of needles and dead branches that suppress the growth of *H. superans* (Miller 2022).

Hibbertia superans bushland sites that are public land and adjacent to residential or rural-residential areas are often affected by high levels of foot and bike traffic, and in at least one case horse riding (Miller 2022). These activities are notable at sites containing some of the highest abundances of *H. superans*, where the plants are known to occur on track edges and may be at risk from trampling (Miller 2022). Furthermore, the creation of new informal tracks could also intrude into stands and habitat of *H. superans* (Miller 2022), and this risk is likely to increase with the continued development of land and development of northwest Sydney.

Competition from weeds

Weed species occur at most *Hibbertia superans* sites, and are a significant driver in the decline of habitat available for the species. Some sites are chronically infested with

potentially invasive weeds that have originated from gardens or nurseries, with Japanese honeysuckle (*Lonicera japonica*), ground asparagus (*Asparagus aethiopicus*), *Freesia* spp., blue stars (*Aristea ecklonii*), and bluebell creeper (*Billardiera heterophylla*) all having been recorded within stands of *H. superans* (Miller 2022). Some sites also contain substantial abundances of aggressive grass weeds including African lovegrass (*Eragrostis curvula*), whisky grass (*Andropogon virginicus*) and panic veldtgrass (*Ehrhata erecta*), and/or turf species such as kikuyu (*Cenchrus clandestinus*) and buffalo grass (*Stenotaphrum secundatum*) (Miller 2022).

Many of the weeds present in *Hibbertia superans* sites have the ability to aggressively outcompete the species, and negatively affect habitat. Ground asparagus and bluebell creeper in particular are capable of rapidly spreading and smothering the ground layer, changing soil composition and preventing the regeneration of native species such as *H. superans* (Government of South Australia 2015; DPI 2024). Additionally, increased occurrences of fire are sometimes seen in urban reserves along with increased weed loads (Stenhouse 2004). Grassy weeds in some urban reserves, including those found in many *H. superans* sites, can add substantially to the fire fuel load of the sites, especially when they die back over the summer months (Stenhouse 2004). This can make sites more fire-prone, and increased fire can promote the further spread of the weed species at the expense of native species (Milberg and Lamont 1994; Keighery *et al.* 2023).

'Invasion and establishment of exotic vines and scramblers', 'Invasion of native plant communities by exotic perennial grasses', and 'Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants' are listed as Key Threatening Processes under the *Biodiversity Conservation Act 2016*. 'Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants' is listed as a Key Threatening Process under the *Environment Protection and Biodiversity Conservation Act 1999.*

Disease

Phytophthora cinnamomi is a plausible threat to *Hibbertia superans*. The pathogen is known to affect other *Hibbertia* species, with at least 21 species being found to be severely or moderately affected by *P. cinnamomi* to date (McDougall 2005; Wan *et al.* 2019; McDougall and Liew 2024). Additionally, *H. superans* was placed in the top 100 species still requiring susceptibility testing that are likely to be susceptible, based on the suitability of *H. superans* habitat for harbouring *P. cinnamomi*, *H. superans* distribution, and the proximity of *P. cinnamomi* to *H. superans* records (McDougall and Liew 2024). *Phytophthora cinnamomi* was suspected to be present at some sites during the 2022 surveys, with a number of *Xanthorrhoea* plants showing the dieback symptoms indicative of *P. cinnamomi* infection of the sites (Miller 2022). This means that if the species is found to be susceptible as suspected, further spread of *P. cinnamomi* into *H. superans* stands which is easily facilitated in urban reserves could cause significant declines.

'Infection of native plants by *Phytophthora cinnamomi*' is listed as a Key Threatening Process on the *Biodiversity Conservation Act 2016*. 'Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*) is listed as a Key Threatening Process under the *Environment Protection and Biodiversity Conservation Act 1999.*

Number of Locations

Hibbertia superans is considered to occur at 5–7 threat-defined locations as per the IUCN (2024) definition when the most serious plausible threats of adverse fire regimes or habitat degradation and clearing due to urbanisation are considered.

The four subpopulations of *Hibbertia superans* that occur within conservation reserves are considered to be four separate threat-defined locations, as although they are still in low numbers likely due to lack of suitable fire, they are more likely to experience more sympathetic fire regimes, and are less likely to be affected by urbanisation.

All other *Hibbertia superans* sites occur in small fragments of bushland in the urban areas of northwest Sydney or the lower Blue Mountains, and almost all sites appear to be in long-term decline with little recruitment (Table 1), it can be assumed that a lack of fire, coupled with the effects of urbanisation including development and regular human disturbance are negatively affecting all these sites in a similar manner across many small-scale events. Therefore, it is considered that these sites, which mostly consist of small numbers of individuals, could be severely reduced or eliminated within a single generation (4-10 years) if current threats continue, meaning they can constitute a single threat-defined location and giving the species five threat-defined locations in total.

Alternatively, the urban sites could be considered to consist of three threat-defined locations defined by those with no wildfire history and thus reliant on prescribed burns for regeneration, those burnt in the December 2002 fire in northwest Sydney which could feasibly experience wildfire again, and those in the Blue Mountains that have burnt in a single wildfire event in the past and could also experience wildfire again. This would give *Hibbertia superans* a total of seven threat-defined locations.

Assessment against IUCN Red List criteria

For this assessment it is considered that the survey of *Hibbertia superans* has been adequate and there is sufficient scientific evidence to support the listing outcome.

Criterion A Population Size reduction

A. Population size reduction. Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4

	Critically Endangered	Endangered	Vulnerable
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3 & A4	≥ 80%	≥ 50%	≥ 30%

A1 Population reduction observed, estimated, inferred, or suspected in the past where the causes of the reduction are clearly reversible AND understood AND have ceased.

A2 Population reduction observed, estimated, inferred, or suspected in the past where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

A3 Population reduction projected, inferred or suspected to be met in the future (up to a maximum of 100 years) *[(a) cannot be used for A3]*.

A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

based on any of the following:

(a) direct observation *[except A3]*

(b) an index of abundance appropriate to the taxon

(c) a decline in area of occupancy (AOO), extent of occurrence (EOO) and/or habitat quality

(d) actual or potential levels of exploitation

(e) effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

Outcome

Hibbertia superans is eligible for listing as Critically Endangered under Criterion A4b.

Population reductions

The estimated three-generation timespan of *Hibbertia superans* is 18–30 years. This timespan covers the periods of the most recent surveys of the species, with comprehensive surveys being undertaken in 2004, 2007/2008 and 2022 allowing population reductions to be estimated over this period. When comparing five sites surveyed in 2004 (Brogan 2004) that were re-surveyed in 2022 (Miller 2022), there is an observed 78% decline (520 to 113 mature individuals; Table 3) over this 18-year period. Similarly, when comparing seven sites surveyed in 2007/2008 (BioNET 2024) that were re-surveyed in 2022 (Miller 2022), there is also an observed 78% decline (1,494 mature individuals to 336; Table 4) over a 14-year period. Given almost all sites have low numbers of mature individuals at the time of the last record (Table 1), it is considered likely that the full population of *H. superans* has undergone similar reductions to those observed in the sites surveyed in 2004, 2007/2008 and 2022.

In order to assess the decline over the longer three-generation period estimate of 30 years, an exponential decay model can be used to project population reductions as the proportion of decline appears to be constant over time (IUCN 2024). Using the equation:

$$Decay\ rate = \frac{\ln\ (\%\ survivorship)}{period}$$

gives decay rates of -0.0848 per year using the 2004-2022 site data, or -0.1066 per year using the 2007/2008 to 2022 site data. Using these decay rates and the equation:

$$No.of\ survivors = Starting\ population\ \times\ e^{(decay\ rate\ \times period)}$$

gives a reduction of 520 to *c.* 41 mature individuals or a 92% reduction between 2004 and 2034 in sites surveyed in both 2004 and 2022, or of 1,494 to *c.* 61 mature individuals or a 96% reduction between 2007/2008 and 2038 in sites surveyed in both 2007/2008 and 2022. This indicates that a reduction of 92–96% can be projected to occur across the population of *H. superans* over a three-generation window of 30 years.

Alternatively, reductions over the shorter three-generation period estimate of 18 years can also be estimated using the above equations and decay rates. Using sites surveyed in both 2004 and 2022 gives a reduction of 78%, and using sites surveyed in both 2007/2008 and 2022 gives a reduction of 85% over a three-generation window of 18 years.

These reductions are likely due to a combination of adverse fire regimes, urban development, and competition from invasive weeds. These threats have not ceased and are likely to increase in effect into the future, and in cases of urban development, are not reversible.

Overall, this means that *Hibbertia superans* meets the criteria for listing as Critically Endangered under Criterion A. This is because it is projected to suffer a population reduction of 78–96% based on estimated reductions in recent decades. As the causes of reduction have not ceased and may not be reversible, and taking a precautionary

approach as it is possible that the primary juvenile period, lifespan and generation length may be longer than estimated here, it is considered that realised population reductions will be greater than 80%, meeting the criteria for listing as Critically Endangered.

Criterion B Geographic range

B. Geographic range in the form of either B1 (extent of occurrence) AND/OR B2 (area of occupancy)			
	Critically Endangered	Endangered	Vulnerable
B1. Extent of occurrence (EOO)	< 100 km²	< 5,000 km²	< 20,000 km²
B2. Area of occupancy (AOO)	< 10 km²	< 500 km²	< 2,000 km²
AND at least 2 of the following 3 conditions:			
(a) Severely fragmented OR Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals			
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals			

Outcome

Hibbertia superans is eligible for listing as Endangered under Criterion B1ab(ii,iii,v)+2ab(ii,iii,v).

EOO and AOO

The extent of occurrence (EOO) of *Hibbertia superans* has been calculated as 1,048 km^2. The area of occupancy (AOO) has been calculated as 140 km^2.

Number of threat-defined locations

Hibbertia superans is found at a minimum of five threat-defined locations when considering the most serious plausible threat resulting in the minimum number of locations, being adverse fire regimes and habitat degradation and clearing due to urbanisation.

Severely fragmented

Hibbertia superans is considered severely fragmented. Almost all subpopulations consist of low numbers of individuals, with eight of 16 subpopulations estimated to contain 13 mature individuals or less in 2025, and five others having unknown but likely very low numbers (Table 2). The three remaining subpopulations have 240, 141 and 42 mature individuals, and it is likely that these subpopulations are also reducing in size (see Criterion A above). This means that all subpopulations can be considered small and at high risk of extinction, especially with the heightened risk of clearing for urban development in the larger subpopulations that can rapidly reduce abundance (see 'Vegetation clearing for residential and rural-residential development' section above).

All subpopulations of *Hibbertia superans* are also considered isolated, as the maximum seed dispersal distances are highly unlikely to ever breach the 1 km subpopulation delineation distance. This means that all subpopulations are relatively small and isolated, and therefore meet the definition of being severely fragmented (IUCN 2024).

Continuing decline

Continuing decline is inferred in the area, extent and quality of habitat, and estimated in the area of occupancy and the number of mature individuals of *Hibbertia superans*. This is due to adverse fire regimes, in particular reductions in the application of fire required to regenerate senescent stands; ongoing development of urban infrastructure and housing; habitat degradation through human disturbance; and competition from exotic weeds that can rapidly smother plants and negatively alter fire regimes.

A number of sites of *Hibbertia superans* have been observed as having no mature individuals by the time of the last surveys (Miller 2022) or are estimated to have no mature individuals remaining by 2025 (Table 1). These observations and estimates indicate that the area of occupancy and the number of mature individuals of the species is undergoing continuing decline, with adverse fire regimes and urban development both observed to have directly caused this decline in some areas (see 'Vegetation clearing for residential and rural-residential development' section above; Miller 2022).

The habitat of *Hibbertia superans* is inferred to be undergoing continuing decline due to a combination of factors. Adverse fire regimes cause habitat for *Hibbertia superans* to become unsuitable when fire is withheld from the landscape for extended periods of time. If a no-fire regime is maintained and dense vegetation is able to overshade the understorey, *H. superans* is unlikely to persist, or if it has disappeared, is increasingly unlikely to recover to previous levels as the seed bank, while persistent, loses viability over time (Miller 2022). The majority of *H. superans* sites are now long-unburnt, and are likely to remain as such given their proximity to modern residential and rural-residential areas where suppression of any fire is favoured over ecologically sensitive burning (Gill and Williams 1996; Tresize *et al.* 2020), meaning habitat quality is greatly reduced. *Hibbertia superans* has also been heavily affected by residential and rural-residential development, with much of its preferred ridgetop habitat now developed (Miller 2022). Development in areas proximate to *H. superans* subpopulations has in turn resulted in increased human disturbances including rubbish dumping, road and utility easement maintenance, unsympathetic land management, nutrification from urban runoff, and high levels of recreational use in small bushland reserves degrading the species' habitat. Weed species also occur at most *Hibbertia superans* sites, with some sites being chronically infested with potentially invasive weeds such as ground asparagus, bluebell creeper, African lovegrass and whisky grass that may have originated from gardens or nurseries (Miller 2022). These weeds can aggressively outcompete *H. superans*, and negatively affect habitat.

Extreme fluctuations

Hibbertia superans is a perennial shrub and is not known to undergo extreme fluctuations.

Conclusion

Hibbertia superans is eligible to be listed as Endangered as the EOO, AOO, the number of threat-defined locations falls under the required thresholds, and the species is considered to be severely fragmented. Additionally, continuing decline in inferred in the area, extent and quality of habitat, and estimated in the number of mature individuals due to adverse fire regimes, ongoing development of urban infrastructure

and housing, habitat degradation through human disturbance, and competition from exotic weeds.

Criterion C Small population size and decline

C. Small population size and decline		Critically Endangered	Endangered	Vulnerable
Number of mature individuals		< 250	< 2,500	< 10,000
AND at least one of C1 or C2				
C1. An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future):		25% in 3 years or 1 generation (whichever is longer)	20% in 5 years or 2 generations (whichever is longer)	10% in 10 years or 3 generations (whichever is longer)
C2. An observed, estimated, projected or inferred continuing decline AND at least 1 of the following 3 conditions:				
(a)	(i) Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
	(ii) % of mature individuals in one subpopulation =	90–100%	95–100%	100%
(b) Extreme fluctuations in the number of mature individuals				

Outcome

Hibbertia superans is eligible for listing as Endangered under Criterion C1+2a(i).

Number of mature individuals

The minimum estimated number of mature individuals of *Hibbertia superans* is currently 453.

Continuing decline

The estimated generation length in *Hibbertia superans* is 6–10 years. Using the exponential decay models discussed in Criterion A, *Hibbertia superans* is estimated to have undergone 40–66% reduction in the number of mature individuals in the 6–10 years (1 generation) following the 2004 and 2007/2008 surveys. Using the same models, *H. superans* is also projected to have further reductions of 40–66% in the 4–10 years following the most recent surveys in 2022. These reductions are likely to also be representative of declines in the broader population given many subpopulations consist of very low numbers of individuals and others have undergone substantial short-term irreversible reductions due to development of *c.* 60% (see 'Vegetation clearing for residential and rural-residential development' section above).

Continuing decline is inferred in the number of mature individuals of *Hibbertia superans* due to adverse fire regimes, in particular reductions in the application of fire required to regenerate senescent stands; ongoing development of urban infrastructure and housing; habitat degradation through human disturbance; and competition from exotic weeds that can rapidly smother plants and negatively alter fire regimes.

Mature individuals in each subpopulation

The largest subpopulation of *Hibbertia superans*, contains an estimated 240 mature individuals in 2025 (Table 2).

% of mature individuals in a single subpopulation

Current estimates indicate that the largest subpopulation of *Hibbertia superans* at Kellyville to Glenhaven contains approximately 53% of the population (240 of 453 mature individuals in 2025).

Extreme fluctuations

Hibbertia superans is a perennial shrub and is not known to undergo extreme fluctuations.

Conclusion

While the threshold for listing *Hibbertia superans* as Critically Endangered is met for subcriterion C1 with a projected decline of 40–66% in one generation, the number of mature individuals is estimated to be 453, only meeting the overall threshold for listing as Endangered under Criterion C. Additionally, there is an inferred continuing decline in the number of mature individuals due to adverse fire regimes, in particular reductions in the application of fire required to regenerate senescent stands; ongoing development of urban infrastructure and housing; habitat degradation through human disturbance; and competition from exotic weeds that can rapidly smother plants and negatively alter fire regimes, and the largest subpopulation is estimated to contain only 240 mature individuals.

Criterion D Very small or restricted population

D. Very small or restricted population			
	Critically Endangered	Endangered	Vulnerable
D. Number of mature individuals	< 50	< 250	D1. < 1,000
D2. *Only applies to the VU category* Restricted area of occupancy or number of locations with a plausible future threat that could drive the taxon to CR or EX in a very short time.	-	-	D2. typically: AOO < 20 km² or number of locations ≤ 5

Outcome

Hibbertia superans is eligible for listing as Vulnerable under Criterion D1+2.

Number of mature individuals

The minimum estimated number of mature individuals of *Hibbertia superans* is currently 453.

Risk of future extinction in a very short amount of time

Hibbertia superans occurs at only 5–7 threat-defined locations and has an estimated AOO of 140 km^2. However, given the high rates of population reduction the species is experiencing due to active threats and current low population numbers, it is plausible that human activities such as further urban development may rapidly drive the species to Critically Endangered or Extinct in a very short time.

Criterion E Quantitative Analysis

E. Quantitative Analysis			
	Critically Endangered	Endangered	Vulnerable
Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)	≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)	≥ 10% in 100 years

Outcome

Hibbertia superans is considered data deficient under Criterion E.

Probability of extinction

Currently there are not enough data to undertake a quantitative analysis to determine the extinction probability of *Hibbertia superans.*

Conservation and Management Actions

Hibbertia superans is currently listed on the NSW *Biodiversity Conservation Act 2016* and a conservation strategy has been developed by the NSW Department of Climate Change, Energy, Environment and Water under the Saving our Species (SoS) program. The conservation strategy identifies priority locations, critical threats and required management actions to ensure the species is extant in the wild in 100 years. *Hibbertia superans* sits within the Site-managed species stream of the SoS program, and the conservation project can be viewed here.

References

ALA (Atlas of Living Australia) (2025) Occurrence records of *Hibbertia superans* [dataset]. URL: https://biocache.ala.org.au/occurrences/search?q=taxa%3A%22hibbertia+superans%22#tab_mapView (accessed 20 February 2025).

Allan SM, Adkins SW, Preston CA, Bellairs SM (2004) Improved germination of the Australian natives: *Hibbertia commutata*, *Hibbertia amplexicaulis* (Dilleniaceae), *Chameascilla corymbosa* (Liliaceae), and *Leucopogon nutans* (Epacridaceae). *Australian Journal of Botany* **44**: 213–222.

Armstrong JA (1979) Biotic pollination mechanisms in the Australian flora – a review. *New Zealand Journal of Botany,* **17**: 467–508.

Auld TD, Scott J (1997) Conservation of endangered plants in urban fire-prone habitats. In 'Proceedings: Fire Effects on Rare and Endangered Species and Habitats Conference, Coeur D'Alene, Idaho, November 1995' (Ed. Greenlee JM). pp. 163–171. (International Association of Wildland Fire).

Benson DH (1985) Maturation periods for fire-sensitive shrub species in Hawkesbury sandstone vegetation. *Cunninghamia* **1**(3): 339–349.

Benson D, McDougall L (1995) Ecology of Sydney plant species. Part 3: Dicotyledon families Cabombaceae to Eupomatiaceae. *Cunninghamia* **4**(2): 217–431.

Bernhardt P (1986) The pollination biology of *Hibbertia stricta* (Dilleniaceae). *Plant Systematics and Evolution* **147**: 267–277.

Biel M, Horn H, Schwabe A (2008) Analysis of pollen loads in a wild bee community (Hymenoptera: Apidae) – a method for elucidating habitat use and foraging distances. *Apidologie* **39**: 456–467.

BioNet (2025) Records of Plants (Species: *Hibbertia superans*) recorded until 20 Feb 2025 [dataset]. NSW Department of Climate Change, Energy, the Environment and Water.

Bowler JM, Johnston H, Olley JM, Prescott JR, Roberts RG, Shawcross W, Spooner NA (2003) New ages for human occupation and climatic change at Lake Mungo, Australia. *Nature*, **421**(6925): 837–840.

Brogan C (2004) Survey for *Hibbertia superans* Cattai Creek Drive Kellyville. Unpublished report carried out for Graham Trilby Pty Ltd. 53 pp.

CHAH (Council of Heads of Australian Herbaria) (2025) Australian Plant Census. URL: https://biodiversity.org.au/nsl/services/apc-format/display/171316 (accessed 17 February 2025).

Clarkson C, Jacobs Z, Marwick B, Fullagar R, Wallis L, Smith M, Roberts RG, Hayes E, Lowe K, Carah X, Florin S. (2017) Human occupation of northern Australia by 65,000 years ago. *Nature*, **547**(7663): 306–310.

Commonwealth of Australia (2012) Interim Biogeographic Regionalisation for Australia, Version 7. URL:

https://www.dcceew.gov.au/environment/land/nrs/science/ibra#ibra (Accessed 14 January 2025).

Commonwealth TSSC (Threatened Species Scientific Committee) (2010) Commonwealth Listing Advice on *Hibbertia tenuis* (a shrub). Department of the Environment, Water, Heritage and the Arts. Canberra, ACT. URL: http://www.environment.gov.au/biodiversity/threatened/species/pubs/76189-listing-advice.pdf (accessed 24 February 2025).

Cuneo P, Emery N, Errington G, Sherieff A (2018) Assisted run(a)way: translocation planning to secure the Bankstown Hibbertia. *Australasian Plant Conservation: Journal of the Australian Network for Plant Conservation* **27**(1): 23–25.

Dixon KW, Roche S, Pate JS (1995) The promotive effect of smoke derived from burnt native vegetation of seed germination of Western Australian plants. *Oecologia* **101**: 185–192.

Doyle CAT, Yap JYS, Bragg J, Rossetto M, Orme A, Ooi MJK (2023) Reproductive characteristics, population genetics, and pairwise kinship inform strategic recovery of a plant species in a fragmented landscape. *Conservation Science and Practice* **5**(4): e12910.

DPI (Department of Primary Industries) (2024) Ground asparagus (*Asparagus aethiopicus*). NSW WeedWise. URL: https://weeds.dpi.nsw.gov.au/Weeds/Groundasparagus (accessed 27 February 2025).

Esri (Environmental Systems Research Institute) (2021) ArcMap 10.8.2 for desktop. Redlands, California, USA. Esri Inc. 1999–2021.

Fung HC, Waples RS (2017) Performance of IUCN proxies for generation length. *Conservation Biology* **31**(4): 883–893.

Gill AM, Williams JE (1996) Fire regimes and biodiversity: the effects of fragmentation of southeastern Australian eucalypt forests by urbanisation, agriculture and pine plantations. *Forest Ecology and Management* **85**: 261–278.

Government of South Australia (2015) Declared Plant Fact Sheet: Bluebell creeper *Billardiera heterophylla*. URL: https://cdn.environment.sa.gov.au/landscape/docs/ny/bluebell_creeper_fsheet.pdf (accessed 27 February 2025).

Greenleaf SS, Williams NM, Winfree R, Kremen C (2007) Bee foraging ranges and their relationship to body size. *Oecologia* **153**(3): 589–596.

Harvey JM, Hopkins AJM, Langley MA, Gosper CR, Williams WR, Yates CJ (2017) Long-term studies of post-fire reproduction in an Australian shrubland and woodland. *Australian Journal of Botany* **65**: 339–347.

Hidayati SN, Walck JL, Merritt DJ, Turner SR, Turner DW, Dixon KW (2012) Sympatric species of *Hibbertia* (Dilleniaceae) vary in dormancy break and germination requirements: implications for classifying morphophysiological dormancy in Mediterranean biomes. *Annals of botany* **109**(6): 1111–1123.

Horton DR (1996) The AIATSIS Map of Indigenous Australia. Australian Institute of Aboriginal and Torres Strait Islander Studies. URL: https://aiatsis.gov.au/explore/map-indigenous-australia (Accessed 20 February 2025).

IUCN (2024) Guidelines for Using the IUCN Red List Categories and Criteria. Version 16 (March 2024). Standards and Petitions Committee of the IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.

James T (2012) Threatened Species Management Plan for a significant area along Paulls Road, South Maroota. An unpublished report prepared for the Hills Shire Council. 30 pp.

Keighery G, Gosper CR, Barrett S, Coates D, Makinson RO (2023) The compounding impacts of disease and weeds after the 2019-20 wildfires on Australian vascular plants and communities. In 'Australia's Megafires: Biodiversity Impacts and Lessons from 2019-2020'. (Eds. Rumpff L, Legge SM, van Leeuwen S, Wintle BA, Woinarski JCZ) pp. 243–254. (CSIRO Publishing, Melbourne).

Keith DA, Benson DH, Baird IRC, Watts L, Simpson CC, Krogh M, Gorissen S, Ferrer-Paris JR, Mason TJ (2023). Effects of interactions between anthropogenic stressors and recurring perturbations on ecosystem resilience and collapse. *Conservation Biology* **37**(1), e13995. [DOI:10.1111/cobi.13995].

Lima CC, Lemos RPL,Conserva LM (2014) Dilleniaceae family: an overview of its ethnomedicinal uses, biological and phytochemical profile. *Journal of Phamacognosy and Phytochemistry* **3**(2): 181–204.

McDougall K (2005) The responses of native Australian plant species to *Phytophthora cinnamomi*. In 'Management of *Phytophthora cinnamomi* for biodiversity conservation in Australia: Part 2 - National best practice guidelines' (Eds E O'Gara, K Howard, B Wilson, GEStJ Hardy) A report funded by the Commonwealth Government Department of the Environment and Heritage by the Centre for Phytophthora Science and Management, Murdoch University, Western Australia.

McDougall KL, Liew ECY (2024) The susceptbility of rare and threatened NSW species to the root-rot pathogen *Phytophthora cinnamomi*: 2. The identification of species requiring protection or further research. *Australian Journal of Botany* **72**: BT23106.

Milberg P, Lamont BB (1994) Fire enhances weed invasion of roadside vegetation in southwestern Australia. *Biological Conservation* **73**: 45–49.

Miller R (2022) Key sites survey for *Hibbertia superans* in north-west Sydney, NSW. Cumberland Flora and Fauna Interpretive Services. An unpublished report for the NSW Department of Planning and Environment. 48 pp.

NSW DCCEEW (Department of Climate Change, Energy, the Environment and Water) (2021). *Threatened Ecological Communities Greater Sydney* [spatial dataset]. State Government of NSW and NSW Department of Climate Change, Energy, the Environment and Water. Accessed using ArcMap 10.8.2 for desktop, Redlands, California, USA. Esri Inc. 1999–2021.

NSW DPE (Department of Planning and Environment) (2018). North Kellyville Precinct Development Control Plan March 2018. URL: https://shared-drupal-s3fs.s3.ap-southeast-2.amazonaws.com/master-test/fapub_pdf/Final+North+Kellyville+Precinct+Development+Control+Plan+2018+(22+April+....pdf (accessed 25 February 2025).

NSW EPA (Environment Protection Authority) (2024) About illegal dumping and dumpers. URL: https://www.epa.nsw.gov.au/your-environment/illegal-dumping/illegal-dumping-dumpers (accessed 25 February 2025).

NSW NPWS (National Parks and Wildlife Service) (2025) *NSW Fire History* [spatial data set]. Accessed using ArcMap 10.8.2 for desktop, Redlands, California, USA. Esri Inc. 1999–2021.

NSW Scientific Committee (2001) *Hibbertia superans* (a low spreading shrub) – endangered species listing. URL: https://www2.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/2000-2003/hibbertia-superans-a-low-spreading-shrub-endangered-species-listing (accessed 17 February 2025).

NSW Rural Fire Service (2013) Threatened Species Hazard Reduction List – Part 1-Plants. URL: https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0017/24335/Web-Version-ThreatenedSpeciesHazardReductionList-Part1-Plants-06-04-2017.pdf (accessed 25 February 2025).

OEH (Office of Environment and Heritage) (2024) *Hibbertia superans* – profile. URL: https://threatenedspecies.bionet.nsw.gov.au/profile?id=10403 (accessed 24 February 2025).

Packer J, Brouwer N, Harrington D, Gaikwad J, Heron R, Yaegl Community Elders, Ranganathan S, Vemulpad S, Jamie J (2012) An ethnobotanical study of medicinal plants used by the Yaegl Aboriginal community in northern New South Wales, Australia. *Journal of Ethnopharmacology*,**139**(1): 244–255.

Pendall E, Hewitt A, Boer MM, Carrillo Y, Glenn NF, Griebel A, Middleton JH, Mumford PJ, Ridgeway P, Rymer PD, Steenbeeke GL (2022) Remarkable Resilience of Forest Structure and Biodiversity Following Fire in the Peri-Urban Bushland of Sydney, Australia. *Climate* **10**(6): 86.

PlantNET (2025) New South Wales Flora Online: *Hibbertia superans*. URL: https://plantnet.rbgsyd.nsw.gov.au/cgi-bin/NSWfl.pl?page=nswfl&lvl=sp&name=Hibbertia~superans (accessed 17 February 2025).

Ralph M (2011) Growing Australian native plants from seed (2nd ed.). (Bloomings Books, Australia.)

Royal Botanic Gardens and Domain Trust (RBGDT) (2025) [Specimen Record Catalogue – *Hibbertia superans*] Source: NSW Herbarium EMu Museum Management System application, exported 20 February 2025.

Schatral A (1996) Dormancy in seeds of *Hibbertia hypericoides* (Dilleniaceae). *Australian Journal of Botany* **44**: 213–222.

Schatral A, Osborne JM, Fox JED (1997) Dormancy in seeds of *Hibbertia cuneiformis* and *H. huegelii* (Dilleniaceae). *Australian Journal of Botany* **45**: 1045–1053.

Smith JP, Heard TA, Beekman M, Gloag R (2017) Flight range of the Australian stingless bee *Tetragonula carbonaria* (Hymenoptera: Apidae). *Austral Entomology* **56**(1): 50–53.

Stenhouse RN (2004) Fragmentation and internal disturbance of native vegetation reserves in the Perth metropolitan area, Western Australia. *Landscape and Urban Planning* **68**(4): 389–401.

Syphard AD, Radeloff VC, Keeley JE, Hawbaker TJ, Clayton MK, Stewart SI, Hammer RB (2007) Human influence on California fire regimes. *Ecological Applications* **17**(5): 1388–1402.

Thomson VP, Leishman MR (2004) Survival of native plants of Hawkesbury Sandstone communities with additional nutrients: effect of plant age and habitat. *Australian Journal of Botany* **52**: 141–147.

Toelken H (2000) Notes on *Hibbertia* (Dilleniaceae) 3. *H. sericea* and associated species. *Journal of the Adelaide Botanic Gardens* **19**: 1–53.

Toelken HR, Robinson AF (2015) Notes on *Hibbertia* (Dilleniaceae) 11. *Hibbertia spanantha,* a new species from the central coast of New South Wales. *Journal of the Adelaide Botanic Gardens* **29**: 11–14.

Tresize JE, Facelli JM, Paton DC, Davies RJP (2020) The effect of heat and smoke on the soil seed banks of heathlands on permanent freshwater swamps. *Austral Ecology* **46**(1): 39–51.

Tucker SC, Bernhardt P (2000) Floral ontogeny, pattern formation, and evolution in *Hibbertia* and *Adrastaea* (Dilleniaceae). *American Journal of Botany* **87**(12): 1915-1936.

Turner PAM, Wapstra M, Woolley A, Hopkins K, Koch AJ, Duncan F (2020) Long-term monitoring of the threatened Lesser Guineaflower *Hibbertia calycina* (DC.) N.A.Wakef. (Dilleniaceae) in Tasmania. *Papers and Proceedings of the Royal Society of Tasmania* **154**: 61–82.

Wan JS, McDougall KL, Liew EC (2019) The susceptibility of rare and threatened NSW species to the root-rot pathogen *Phytophthora cinnamomi*: 1. Initial testing and identification of key research questions. *Australian Journal of Botany* **67**(7): 510–516.

Watson P, Wardell-Johnson G (2008) Fire frequency and time-since-fire effect on the open-forest and woodland flora of Girraween National Park, south-east Queensland, Australia. *Austral Ecology* **29**(2): 225–236.

Westoby M, French K, Hughes L, Rice B, Rodgerson L (1991) Why do more plant species use ants for dispersal on infertile compared with fertile soils? *Australian Journal of Ecology* **16**(4): 445-455.

Westoby M, Rice B, Howell J (1990) Seed size and plant growth form as factors in dispersal spectra. *Ecology* **71**(4): 1307–1315.

Woodward E, Hill R, Harkness P, Archer R (Eds.) (2020) *Our Knowledge Our Way in caring for Country: Indigenous-led approaches to strengthening and sharing our knowledge for land and sea management. Best Practice Guidelines from Australian Experiences*. NAILSMA and CSIRO, Cairns, Australia. URL: https://www.csiro.au/en/research/indigenous-science/indigenous-knowledge/our-knowledge-our-way (accessed 20 February 2025).

Expert Communications

Miller, Robert. Consulting botanist and *Hibbertia* expert.

O'Donovan, Vera. Project Officer Threatened Species, Greater Sydney Branch, NSW National Parks and Wildlife Service.

Roper, Erin. Senior Regional Biodiversity Conservation Officer, Greater Sydney Branch, NSW Department of Climate Change, Energy, the Environment and Water.

Toelken, Hellmut. Botanist and *Hibbertia* expert.

APPENDIX 1

Assessment against *Biodiversity Conservation Regulation 2017* criteria
The Clauses used for assessment are listed below for reference.

Overall Assessment Outcome:
Hibbertia superans was found to be Critically Endangered under Clause 4.2(1 a)(2 b).

Clause 4.2 – Reduction in population size of species
(Equivalent to IUCN criterion A)
Assessment Outcome: Critically Endangered under Clause 4.2(1 a)(2 b)

(1) - The species has undergone or is likely to undergo within a time frame appropriate to the life cycle and habitat characteristics of the taxon:			
	(a)	for critically endangered species	a very large reduction in population size, or
	(b)	for endangered species	a large reduction in population size, or
	(c)	for vulnerable species	a moderate reduction in population size.
(2) - The determination of that criteria is to be based on any of the following:			
	(a)	direct observation,	
	(b)	an index of abundance appropriate to the taxon,	
	(c)	a decline in the geographic distribution or habitat quality,	
	(d)	the actual or potential levels of exploitation of the species,	
	(e)	the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.	

Clause 4.3 - Restricted geographic distribution of species and other conditions
(Equivalent to IUCN criterion B)
Assessment Outcome: Endangered under Clause 4.3(b)(d)(e i,iii)

The geographic distribution of the species is:			
	(a)	for critically endangered species	very highly restricted, or
	(b)	for endangered species	highly restricted, or
	(c)	for vulnerable species	moderately restricted,
and at least 2 of the following 3 conditions apply:			
	(d)	the population or habitat of the species is severely fragmented or nearly all the mature individuals of the species occur within a small number of locations,	
	(e)	there is a projected or continuing decline in any of the following:	
		(i)	an index of abundance appropriate to the taxon,
		(ii)	the geographic distribution of the species,
		(iii)	habitat area, extent or quality,
		(iv)	the number of locations in which the species occurs or of populations of the species,
	(f)	extreme fluctuations occur in any of the following:	
		(i)	an index of abundance appropriate to the taxon,
		(ii)	the geographic distribution of the species,

		(iii)	the number of locations in which the species occur or of populations of the species.

Clause 4.4 - Low numbers of mature individuals of species and other conditions (Equivalent to IUCN criterion C)
Assessment Outcome: Endangered under Clause 4.4(b)(d ii)(e i,ii A(II))

The estimated total number of mature individuals of the species is:						
	(a)	for critically endangered species				very low, or
	(b)	for endangered species				low, or
	(c)	for vulnerable species				moderately low,
and either of the following 2 conditions apply:						
	(d)	a continuing decline in the number of mature individuals that is (according to an index of abundance appropriate to the species):				
		(i)	for critically endangered species			very large, or
		(ii)	for endangered species			large, or
		(iii)	for vulnerable species			moderate,
	(e)	both of the following apply:				
		(i)	a continuing decline in the number of mature individuals (according to an index of abundance appropriate to the species), and			
		(ii)	at least one of the following applies:			
			(A)	the number of individuals in each population of the species is:		
				(I)	for critically endangered species	extremely low, or
				(II)	for endangered species	very low, or
				(III)	for vulnerable species	low,
			(B)	all or nearly all mature individuals of the species occur within one population,		
			(C)	extreme fluctuations occur in an index of abundance appropriate to the species.		

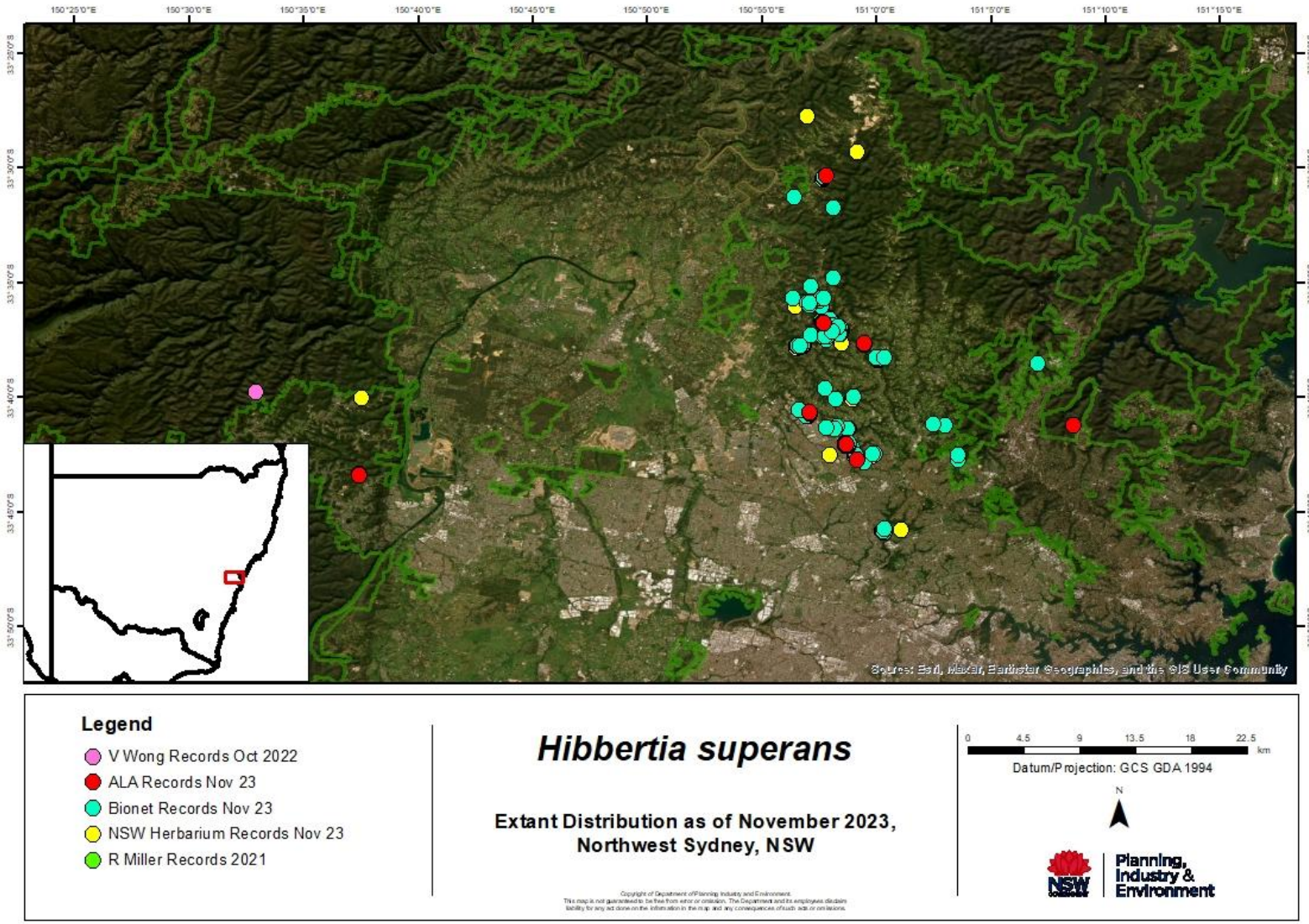
Clause 4.5 - Low total numbers of mature individuals of species (Equivalent to IUCN criterion D)
Assessment Outcome: Vulnerable under Clause 4.5(c)

The total number of mature individuals of the species is:			
	(a)	for critically endangered species	extremely low, or
	(b)	for endangered species	very low, or
	(c)	for vulnerable species	low.

Clause 4.6 - Quantitative analysis of extinction probability
(Equivalent to IUCN criterion E)
Assessment Outcome: Data Deficient

The probability of extinction of the species is estimated to be:			
	(a)	for critically endangered species	extremely high, or
	(b)	for endangered species	very high, or
	(c)	for vulnerable species	high.

Clause 4.7 - Very highly restricted geographic distribution of species–vulnerable species
(Equivalent to IUCN criterion D2)
Assessment Outcome: Vulnerable under Clause 4.7

For vulnerable species,	the geographic distribution of the species or the number of locations of the species is very highly restricted such that the species is prone to the effects of human activities or stochastic events within a very short time period.

Appendix 2 – ***Hibbertia superans*** **records**