Mapping of Woody Invasive Alien Plants in the uMngeni Catchment

Draft Inception Report

Submitted to

Submitted by

Ecosystems Theme
Wesley Evans, Scientist
P.O. Box 100396, Scottsville, 3209, South Africa
Tel: +27 (33) 346 0796;
Mobile: +27 (81) 435 9405;
Email: wevans@inr.org.za;
Website: www.inr.org.za

In collaboration with

February 2023

This is a deliverable of the Ecological Infrastructure for Water Security (EI4WS) Project implemented through a collaboration between the South African National Biodiversity Institute (SANBI) and Umgeni Water.

1. Introduction

1.1 Background

South Africa is ranked 30th in terms of driest countries in the world (Department of Water and Sanitation, 2018) and water scarcity is an issue of great social, economic and environmental concern. Concern over water security is also growing given the increasing severity and frequency of drought under climate change conditions. Rising temperatures are also expected to increase the daily demand for water in a country where the greatest use of water is irrigated agriculture as the ability to rely on rain-fed agricultural practices diminishes. This increasing concern over water security is emerging within the context of unrelenting degradation of the natural environment. The deteriorating condition of natural ecosystems has a material impact on the ability of the ecosystems to provide important water-related services such as the regulation of the balance between rainfall infiltration and runoff and the slow release of baseflow in the dry season.

Invasive alien plants (IAPs) are of particular relevance to the water security of South Africa given that they have been shown to consume greater quantities of water than indigenous vegetation (Le Maitre *et* al., 2000; Rebelo *et al.,* 2021), degrade indigenous ecosystems, displace indigenous vegetation and reduce grazing potential in rangelands (van Wilgen *et al.*, 2020). In summary, they are a direct threat to a range of critical ecosystem services and can alter the functionality of ecological infrastructure.

Figure 1: Invasive wattle trees growing in the riparian area in the upper Thukela catchment

An essential step towards improving water security is, therefore, to systematically establish the extent (geographic and frequency) and types of interventions required to address the threat posed by IAPs in water source areas (Moncrieff *et al.,* 2021). This information can in turn be used to establish the level of investment required to implement interventions that restore ecosystem services and improve water security. A requisite for this decision-making is a sound understanding of the distribution, species composition, and density of IAP infestations. Creating accurate maps of the distribution and density of IAPs as a basis for such planning has proved challenging (van Wilgen *et al.* 2020).

Recent advances in the use of satellite imagery, drone technology and participatory mapping have however highlighted the value of these novel approaches (both independently and in an integrated manner) to generating

data for evidence-based decision making for IAP control (Holden *et al.* 2021). Quayle *et al.* (2021) developed a semi-quantitative protocol for mapping woody invasive alien plant species, which was piloted in the Breede River catchment, in the Western Cape. The study showed that a semi-quantitative and low-tech approach can used to map woody IAPs with accuracy sufficient for the purposes of the IAP clearing teams. Umgeni Water and SANBI have taken this approach on board and has contracted the Institute of Natural Resources (INR) partnered with GeoNest, to implement this approach and develop a map of IAPs in the Umgeni River catchment. Many of the authors of the Quayle et al. protocol are included on the INR team for this project, including the project team from SANBI who will be closely consulted throughout the project.

1.2 Implementing a semi-quantitative, low-tech approach to mapping

The approach outlined by Quayle *et al* (2021) can find application within the eThekwini and Pietermaritzburg water supply system which gets 97.8% of its water from the Southern Drakensburg Strategic Water Source Area (SD SWSA), most of which comes from the uMngeni River with contributions from the Mooi and uMdloti Rivers (Figure 2) (Le Maitre, *et al.,* 2018; Quayle *et al.* 2020). The SDSWSA is a biodiversity hotspot with critical ecological infrastructure that has been threatened by urban sprawl, increased agricultural activities (such as commercial crops and plantations), and IAPs that continue to spread within the SDSWSA.

Despite the importance of the catchment for the water supply systems of Pietermaritzburg and eThekwini, the density and distribution of woody IAPs have not been thoroughly mapped in the uMngeni catchment recently. This (at least in part) is due to a number of financial and technological issues. There have been several mapping exercises in the uMngeni Catchment in the last few years, most notably work done as part of the SEBEI. This work was geographically limited and had limitations in terms of accuracy. As alluded to above, the approach developed by Quayle *et al.* (2021) enables the mapping of IAPs at a scale, resolution and accuracy level that is fit for the purposes of informing IAP interventions and most importantly given its sufficiently rapid, low tech and inexpensive design, can be implemented in a wide range of settings.

Having developed this method in-house, the Institute of Natural Resources together with its partner GeoNest is perfectly positioned to implement this approach and to map the extent and distribution of woody IAPs in the uMngeni River catchment.

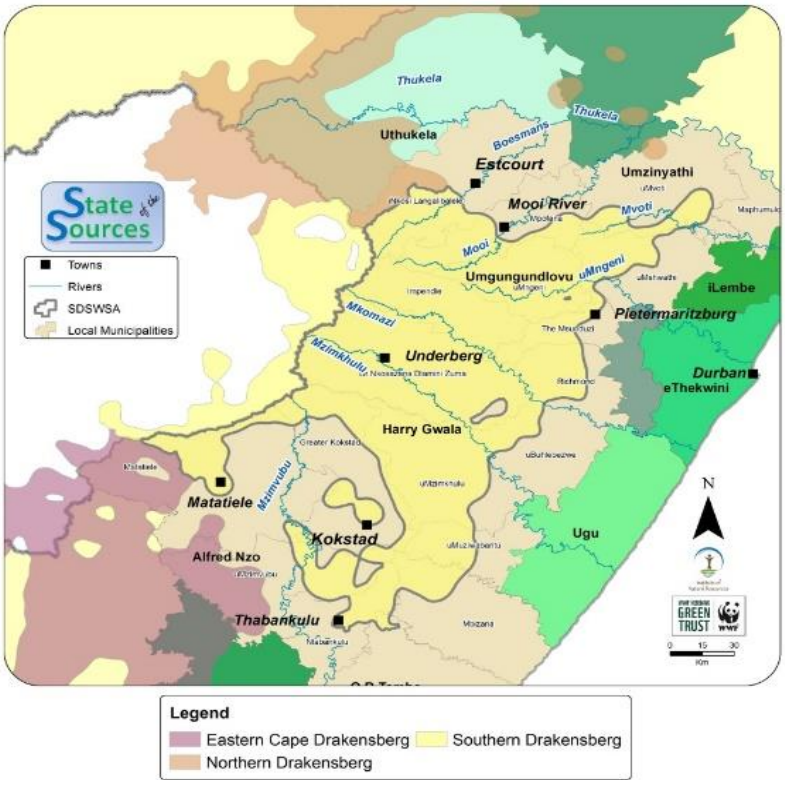


Figure 2: The SDSWSA for surface water: - the source of the uMngeni River and main water supply for eThekwini and Pietermaritzburg (figure from Quayle *et al*., 2021)

1.3 Understanding of the terms of reference

We understand that the purpose of the assignment is to map the extent, abundance and species composition of woody invasive plant species in the uMngeni River catchment, informing IAP clearing initiatives. To achieve these objectives, the following activities are required:

- Development of a segment layer for the uMngeni River catchment, and an associated GIS attribute table;
- Undertake a plenary workshop with specialists to introduce the mapping project and identify individuals who might be able to assist;
- Undertake one-on-one IAP mapping workshops to map IAPs in the uMngeni River catchment;
- Undertake in-field mapping and verification of desktop maps;
- Production of a technical report detailing accuracy of IAP map;
- Adaptation of a process **Infographic** for the steps that were followed to undertake the mapping of invasive alien plants in the uMngeni River catchment; and
- Production of a brief **Knowledge Dissemination** report detailing how skills and expertise were transferred to project staff from Umgeni Water and SANBI.

2. Methodological Approach

The project team will use a phased approach as outlined below.

2.1 Phase 1: Inception

A project inception meeting with Umgeni Water's project team will be initiated to finalise the proposed project plan, timeframes, milestones, and methodology. A draft inception report (this document) will be presented at this meeting for Umgeni Water's comment. Amendments to the plan will then be made and a final **Inception Report** will be drafted.

PHASE	DELIVERABLE	DUE DATE
PHASE I	Draft Inception Report	23/02/2023
PHASE I	Inception Meeting	28/02/2023
PHASE I	Final Inception Report	7/03/2023

2.2 Phase 2: Preparation for workshops

Phase 2 will commence with an internal project team meeting to discuss a number of project administration and technical matters. This will include allocating tasks to project team members, finalising the approach to be taken to capacity development and involvement of Umgeni Water and SANBI staff and the development of the segment layer and attribute table which forms the foundation of much of the mapping work and which will be presented at the Plenary Workshop in Phase 3.

PHASE	DELIVERABLE	DUE DATE
PHASE II	Gap Analysis Report	31/12/2023

Also as part of Phase 2, the project team will begin discussions with local specialists to acquire ancillary data that meets the following prerequisites:

- Recent;
- Reliable;
- Same spatial extent; and
- Freely available.

The methods detailed in Quayle *et al.* (2020) will be followed to develop the segment layer and attribute table, as outlined below.

2.2.1 Segmentation of the uMngeni Catchment

The foundational layer used for the analysis is the "segment layer" which will be developed using image segmentation techniques. Image segmentation is a process whereby the pixels of satellite imagery are classified to represent similar landscape features based on spectral signature. The "Segment Mean Shift" tool in ArcGIS (ArcMap 10.8.1) will be used to identify features in the imagery by grouping together pixels that have similar spectral characteristics. This approach is able to classify features in the landscape and generate fine-scale polygon areas based on the similarity of spectral signatures (similar characteristics). This is important in the mapping process because areas with significant tree cover or alien invasive tree species could be grouped together and separated from other features in the landscape such as waterbodies or cultivated land where there are less likely to be woody alien plants. This provides an initial intelligent fragmentation of the landscape based on spectral characteristics and reduces the time required to digitise landscape features, though it will still need to be manually edited.

The following land cover classes will then be extracted from the latest provincial or national land cover data:

- Built-up (including mines and quarries) (Figure 3);
- Cultivated land;
- Dams;
- Forested land; and
- Barren land.

Built-up areas, cultivated and barren land are excluded from the assessment due to the low likelihood of the areas having invasive alien species present that should be targeted by IAP clearing teams. The above classes will be extracted from the land cover raster database and converted into vector format to determine the percentage (in area) of each class per segment using overlay analysis. Boundaries of the segment layer will be adjusted to better fit the landscape and unique identification codes will be assigned to each segment.

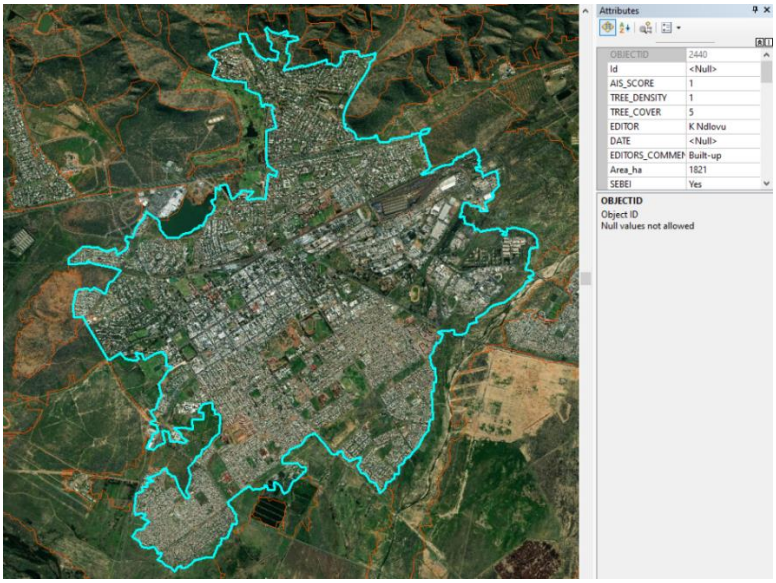


Figure 3: Built-up urban areas, unlikely to be targeted for clearing.

2.2 Development of the Segment Layer Attribute Table

To facilitate the capture of IAP information for each segment in accordance with the identified factors, a purpose-designed attribute table will be set up. The schema of this table is given in Table 1. This will be further developed by the establishment of a set of domains (Table 2) in the geodatabase which will facilitate the use of drop-down lists for attribute capture in the segments layer. This has been designed to increase efficiency in attribute capture and eliminate variability in the capture of the information (e.g. different spelling, different use of class thresholds, etc.).

Table 1: Attribute field properties to be added to the specialist input layer.

Field	Quat	IAS_Score	SegID	Species 1-3*	Density 1-3*	Distribution 1-3*	Riparian
Type	String	Integer	Integer	String	String	String	String
NULL Values	No	Yes	No	Yes	Yes	Yes	Yes
Domain	-	-	-	Species	Percent	Distribution	Percent
Length	10	5	5	50	50	50	50

*** These fields require three iterations to account for the three dominant species. These should be arranged as below:**

Species1	Density1	Dist1	Species2	Density2	Dist2	Species3	Density3	Dist3

Table 2: Domains to be added to the specialist input layer for IAP data input.

Number	Species	Percent	Distribution	Accessibility	Confidence	Complete
1	Species 1	0-5%	Even	Easy	Low	Complete
…	…	…	Patchy	Moderate	Moderate	Partial
10	Species 10	95-100%	Uneven	Hard	High	Not started

2.3 Phase 3: Engagement with Specialists

PHASE	DELIVERABLE	DUE DATE
PHASE III	Plenary Stakeholder Workshop	05/2023
PHASE III	One-on-One Specialist Workshops	10/2023

2.3.1 Plenary Workshop

Key stakeholders and specialists with a good understanding of the distribution and abundance of IAPs in the study area will be identified by engaging with sector role players. The project team will then host a plenary workshop at the Institute of Natural Resources (and make provision for virtual attendees via MS Teams) with the selected knowledgeable stakeholders (referred to as specialists), outlining the methodology for mapping IAPs and capturing attribute data. The objectives of the plenary workshop are as follows:

- Create awareness of the project;
- Source ancillary data by consulting key stakeholders within the sector (including but not limited to EKZNW, SAPPI, WWF, Upland River Conservation, DFFE, DUCT, etc.);
- Identify specialists who would be able to attend One-on-One Woody IAP Mapping Workshops for the uMngeni Catchment;
- Demonstrate how the specialist workshops are going to run;
- Workshop the segment layer and the attribute table that were generated in Phase 2: Preparation for workshops, including but not limited to:
    - Number of species to be included in the workshops;
    - Species of woody IAPs to be included in the attribute table; and
    - Density classes to be included in the attribute table.

Following the plenary workshop, attendees and specialists who are willing to assist in the project but unable to attend will be sent a link to a short video providing a summary of the approach, and a 1-page methodology. This summary will be made by the project team from a recording of the plenary workshop. Communication with specialists is critical to secure their buy-in and ongoing involvement in the project. This will receive appropriate attention.

2.3.2 One-on-One Specialist Meetings

Following the plenary workshop, an indication of specialists' availability will be determined using meeting scheduling platforms, such as Doodle. Meetings will then be scheduled with specialists, based on their availability, for two-hour slots. The workshop will be hosted by a project team member and will involve interactive mapping according to the protocol, working through quaternary catchments. The objective of these workshops is to use the specialist's local knowledge to capture distribution and density data on IAPs within the uMngeni Catchment. Once the specialist joins the virtual workshop, they will be provided with a brief re-cap / overview of the method, to remind them of the protocol and its requirements. The member of the project team then guides the specialist through each segment of the quaternary catchment, prompting them to answer a series of questions thereby furnishing the attributes outlined in the attribute table.

Segments can be merged if the specialist can confirm that they were similar enough to be considered as one segment. Conversely, if one segment is obviously not homogenous in its distribution and density of IAPs, the project team and the specialist can choose to split the segment into two or more segments. Each of the new segments will be assigned a new unique identification code. Splitting of polygons can only be undertaken where there is clear and obvious heterogeneity in a segment. The project team will repeat this process with the specialist for each segment until the whole quaternary catchment is complete.

Upon completion of the quaternary catchment, the data will be saved and backed up to a centralised database. This will be repeated for each of the quaternary catchments possible, based on the availability of specialists. Once the desktop mapping of the focus area is complete for all quaternary catchments, IAP data for all

quaternary catchments will be merged into one geospatial database and backed up. This layer will be used in Phase 4: Field Verification and In-Field Mapping.

2.4 Phase 4: Field Verification and In-Field Mapping

Field verification is an important part of the mapping approach. It provides an opportunity to conduct ground truthing and to validate data produced in the desktop mapping workshops. Field visits also provide an opportunity to map areas not covered in sufficient detail during the one-on-one specialists working sessions, and to assess and improve the mapping in areas addressed at low confidence.

In-field verification and additional mapping will be conducted after the conclusion of specialist virtual workshops and cover the entire uMngeni River Catchment. As time in the field is limited, the in-field efforts will be prioritized as follows:

1. Verification of low and low-moderate confidence areas
2. Incomplete quaternary catchments. This occurred when specialists were not familiar with an entire quaternary catchment and no additional woody IAP information could be found for the area.
3. Moderate-high confidence areas (captured in virtual workshops) with no other woody IAP data. This will allow the project team to get a measure of the accuracy of the data collected in the virtual workshops.
4. Quaternary catchments with no woody IAP data.

The project team will be split into at least two sub-teams, each with their own vehicle. Each of these teams consists of a driver, a scribe and, where possible, one or more specialists that had already been involved in the specialist workshopping. Three field days been budgeted for but one additional day could be arranged should the need arise.

An analysis will be carried out by comparing four different types of data, namely:

- Unverified desktop data;
- Verified desktop data;
- In-field data;
- Ancillary data.

Comparison between these datasets will provide a measure of the accuracy of the data collected in the specialist workshops.

PHASE	DELIVERABLE	DUE DATE
PHASE IV	In-field mapping	October/November 2023

2.5 Phase 5: Reporting

The project team will report quarterly to the project steering committee on their progress and challenges. A comprehensive report will be produced by the project team at the conclusion of Phase 4: Field Verification and In-Field Mapping. The **Technical Report** will detail the following:

- Extent of the woody IAP map (including any gaps);
- Level of confidence and accuracy;
- Details of any ancillary data that has been used in the map;
- Infographic detailing the process followed;
- Metadata report.

Additionally, Umgeni Water and SANBI team members will be invited to join the INR and GeoNest project team on any of the aforementioned phases. The Umgeni Water and SANBI staff members will be encouraged to learn and understand the process, and they will be provided with learning material to aid this process. As part of the

reporting phase, the project team will produce a short **Knowledge Dissemination** report which details the knowledge and skills that were demonstrated and disseminated to Umgeni Water and SANBI staff members.

PHASE	DELIVERABLE	DUE DATE
PHASE V	Draft Report	12/2023
PHASE V	Draft Meta-data Report	12/2023
PHASE V	Final Shapefiles	01/2024
PHASE V	Final Meta-data Report	12/2023
PHASE V	Final Report	01/2024

3. Capacity Development

Building capacity within the sector is a core component of this project and one which needs to be carefully considered. Capacity development in this project helps individuals and organizations acquire new knowledge and skills, which can enable them to perform better and become more effective in achieving their objectives. Opportunities for capacity development within this project are outlined in the table below.

Phase	**Team**	**Role**
Segmentation	SANBI PMB, SANBI Kirstenbosch, Umgeni GITs	Attend demonstration of segmentation process by SM, participation in refinement of segments at INR.
Plenary	SANBI PMB, SANBI Kirstenbosch (virtually), Umgeni GITs	Attend and participate
One on Ones	SANBI PMB, SANBI Kirstenbosch (virtually), Umgeni GITs	Observe
Field work	SANBI PMB, Umgeni GITs	Attend and participate

4. Key dates

The following outcomes and deliverables are expected as part of the services that will be provided by the INR, aligned with the Gantt chart (Table 3):

- An **Inception report** (this report) which includes a detailed work plan indicating the phases of work, timing, key deliverables and milestones, and the budget breakdown;
- **Gap analysis/data availability report** which identifies what data is available for the focus area, and the gatekeepers;
- **Plenary Workshop** with specialists at the Institute of Natural Resources (hybrid via MS Teams for those who are unable to attend in person);
- Commencement of one-on-one meetings with specialists to map IAPs in the uMngeni River catchment;
- **In-field IAP mapping and verification** in the uMngeni catchment;
- A **Draft Technical report** showing a map/s of woody invasive plants including:
    - **GIS Project files** where all the maps are produced (either as map package or geopackage) and all spatial data with accompanying **metadata** (primary and secondary data);
    - Identified challenges and forward recommendations for improving the mapping protocol;

    - Adaptation of the process **Infographic** for the steps that were followed to undertake the mapping of invasive alien plants in the uMngeni catchment; and
- A **Final Technical Report** and brief **Knowledge Dissemination** report detailing how skills and expertise were transferred project staff from Umgeni Water and SANBI.

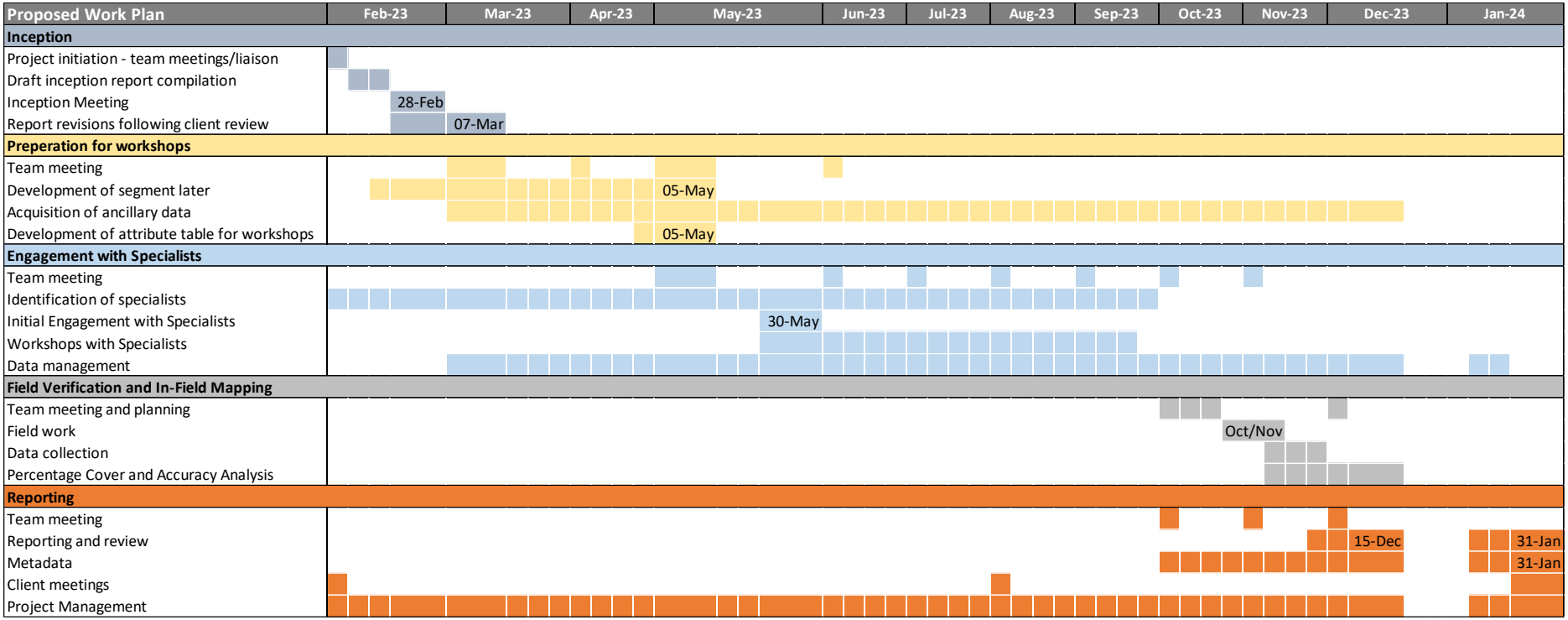
PHASE	DELIVERABLE	DUE DATE
PHASE I	Draft Inception Report	23/02/2023
PHASE I	Inception Meeting	28/02/2023
PHASE I	Final Inception Report	7/03/2023
PHASE II	Gap Analysis Report	31/12/2023
PHASE III	Plenary Stakeholder Workshop	05/2023
PHASE III	One-on-One Specialist Workshops	09/2023
PHASE IV	In-field mapping	September/October 2023
PHASE V	Draft Report	11/2023
PHASE V	Draft Meta-data Report	11/2023
PHASE V	Presentation of Results	11/2023
PHASE V	Final Shapefiles	01/2024
PHASE V	Final Meta-data Report	12/2023
PHASE V	Final Report	01/2024

5. Project invoicing

The table below details the proposed deliverable-based invoicing schedule.

PHASE	**INVOICE DATE**	**SUM**
PHASE I: INCEPTION	31/03/2023	R36 216.00
PHASE II: PREPARATION FOR WORKSHOPS	5/05/2023	R76 168.00
PHASE III: ENGAGEMENT WITH SPECIALISTS	31/10/2023	R157 208.00
PHASE IV: FIELD VERIFICATION AND IN-FIELD MAPPING	30/11/2023	R125 448.00
PHASE IV REPORTING	31/01/2024	R100 983.00
TOTAL		**R496 023.00**

Table 3: Proposed work plan for the year ahead



6. Competencies and Expertise

Institute of Natural Resources

The project will be led by the INR. The INR is an applied research organisation that integrates data, techniques, tools, perspectives, concepts, and theories from multiple disciplines to develop practical solutions for real-world environmental problems. We have done this for 40 years by partnering with government, civil society, the private sector, and other leading research organisations, making us a leading knowledge provider, strategic and operational supporter, capacity developer, and advocate for natural resource and environmental management in southern Africa. Providing science advice, developing decision-making tools for practitioners, researchers and policy-makers, and building capacity within the environmental sector represents some of our strengths. We are an independent, non-profit, public benefit organisation that brings seasoned and emerging social and natural scientists together to translate science into solutions for people and the environment.

Our work is arranged into three thematic areas: Ecosystems; Climate Action and Sustainability; and Agriculture and Rural Livelihoods. Please see attached company profile.

GeoNest

GeoNest brings passion for our planet and a range of important environmental advisory experience together into one nest. This includes experience in the fields of Geographic Information Systems and Earth Observation, Environmental Monitoring and Information Systems, Climate Change Vulnerability and Ecosystems Based Adaptation, Catchment Management, Aquatic Ecology and Ecosystem Services.

Key Personnel

The qualifications and experience of the team members and their proposed roles on the assignment are outlined below. Please see the attached CVs for detail and project specific experience.

Name	Company	Role	Qualification	Experience
Wesley Evans	INR	Project Manager, Ecologist, GIS Analyst	MSc Ecological Sciences	5 years
Leo Quayle	GeoNest	Technical lead, Ecologist, GIS Analyst	MPhil Environmental Management	20 years
Simone Murugan	INR	GIS Analyst	MSc Hydrology	7 years
Dr Admire Nyamwanza	INR	Social Scientist	PhD Development Policy and Management	16 years
Theolin Naidoo	INR	Engagement Specialist	MSc Environmental Scientist	5 years
Mzamo Mnikathi	INR	Intern	MSc Biological Scientist	1 year

No	Proposed Function	Key Person Name	Number of Years / Projects
1	**Project Manager** with excellent conceptual, writing, planning, coordination, and organisational skills	Lead: **Wesley Evans** Co-Lead: Leo Quayle	5 years 20 years
2	**GIS Analyst / GIS Specialist** with a proven record in compiling maps of ecological features and undertaking spatial analysis including the use of ArcGIS and QGIS, and an ability to map and identify invasive alien plants	Lead: **Leo Quayle** Support: Simone Murugan Support: Mzamo Mnikathi (intern)	>6 projects (including development of IAP mapping protocol) >6 projects

3	An **Ecologist** with a proven experience of working with and understanding of IAPs and associated impacts	Lead: **Wesley Evans** Support: Leo Quayle	5 years 18 years
4	A **Social Scientist** with proven experience of excellent communication, stakeholder engagement and facilitation skills in conducting workshops and meetings, and ability to incorporate action learning and information transfer	Lead: **Admire Nyamwanza** Support: Theolin Naidoo (scientist) and Mzamo Mnikathi (intern)	16 years 4 years 0 – 1 years

7. References

Holden, P.B., Rebelo, A.J. and New, M.G., 2021. Mapping invasive alien trees in water towers: A combined approach using satellite data fusion, drone technology and expert engagement. Remote Sensing Applications: Society and Environment, 21, p.100448.

Quayle, L., Ndlovu, K., Daniels, F., Evans, W., Malebu, T., Malatji, M., Simka, B., Bredin, I., Manuel, J. 2021. Development of a Semi-Quantitative Protocol for Mapping Woody Invasive Alien Plants Species: Piloted in the Breede River Catchment, South Africa. Project Technical Report developed for the South African National Biodiversity Institute. Institute of Natural Resources Report Number: 532/21

Quayle, L. Sitas, N., Pringle, C., Bredin, I., Murugan, S., Evans, W., Dlamini, S., Myeza, N. 2020. STATE OF STRATEGIC WATER SOURCE AREAS Monitoring and Reporting Framework, and Information Platform – Southern Drakensberg Pilot STATUS QUO REPORT. Institute of Natural Resources, Pietermaritzburg.

Le Maitre, D.C., Versfeld, D.B. and Chapman, R.A., 2000. Impact of invading alien plants on surface water resources in South Africa: A preliminary assessment.

Moncrieff, G.R., Slingsby, J.A. and Le Maitre, D.C., 2021. Propagating uncertainty from catchment experiments to estimates of streamflow reduction by invasive alien plants in southwestern South Africa. Hydrological Processes, 35(4), p.e14161.

Rebelo, A.J., Gokool, S., Holden, P.B. and New, M.G., 2021. Can Sentinel-2 be used to detect invasive alien trees and shrubs in Savanna and Grassland Biomes?. Remote Sensing Applications: Society and Environment, 23, p.100600.

Comments from SANBI

Section	Comment/s	
	General:- - The inception report doesn't outline how the initial protocol for Berg-Breede catchment will be improved or advanced. This is crucial to address and outlined how all will be improved instead of repeating the exact process without outlining where improvements will be made. - Recommendation for the INR project team to incorporate suggestions made during the inception meeting on 28th Feb regarding: o Using Sentinel imagery for the segmentation process o Rethinking the field work duration as 3 days may not be enough to cover much ground. - There are no clear guidelines or structure about how capacity development will be undertaken and implemented. This should be clearly outlined, and this will be another component that the institution will be measured on to determine whether they managed to develop capacity or not. Recommendation for the EI4WS interns to be fully involved in each phase of the project and in developing the deliverables.	This was discussed in a follow-up meeting, it was agreed that the project team will not need to make any substantial changes to the mapping method. There may be changes that can be incorporated into the method along the way but these will be minor. The project team is to list learnings in reporting and strive for continuous improvement in the implementation of the IAP mapping method. Yes, we can include these. This was discussed in a follow-up meeting and it was agreed that the teams from SANBI PMB and Umgeni Water should be more involved in the project as they are living and working in the focus catchment. The Kirstenbosch SANBI team should operate as a reference group, with the reports being sent to them for comment. Further, they will be invited to join and participate at various stages of the project such as virtual attendance at the plenary workshop and, if possible, the field work in the uMngeni Catchment
Section 1.1. Paragraph 1: (Page 3)	- The role and responsibility for SANBI Planning team should be clearly outlined. What support and advice is required from the Planning team. The inception report does not provide sufficient details about what level of support is expected from the SANBI Planning Team, this needs to be clearly communicated so everyone is on the same page.	I agree with this, but this was cleared up in the follow-up meeting
Section 1.2.	- The segments layer is not a coarse land cover map but rather polygon-dataset derived from satellite imagery based on	This description has been removed

Paragraph 3: (page 3)	the land-use/land-cover grouping (with no attribute info as to what land-use is in the polygons).	
Section 1.3. Paragraph 1 (page 4)	- No component that identified or illustrate data sourcing or understanding what other projects undertaken in the catchment are all about. This build or strengthen co-development and co-learning. - Another important step in the IAPs Mapping Protocol is using existing data where available, from the inception report there is no time allocation indicated for this process and the approach to be used in integrating the data.	Agreed - this is missing from the step-by-step plan in "understanding the terms of reference". This may be because the ToR did not specify this. I disagree as we describe gathering ancillary data. What we don't really do is describe how it will be incorporated, though I acknowledge that this will depend on the nature of the data.
Section 2.2. Paragraph 1 (page 5)	- How will this be measure because this might end up being a nice to have in the report but nothing concrete is done when it comes to capacity development? Measurable outcome needs to be clearly stated when it comes to capacity development.	Addressed in the capacity development section -
Section 2.2.1. Paragraph 2 (page 5)	- With regards to the process outlined here which might be similar to how the national landcover is done. Why is the National Land Cover used as a guide? The reason being the Woody classes from the landcover can be extracted from NLC and this layer can be used as a foundational layer to refine the segments or conduct further analysis to develop the segments.	I can't see which section this refers to. -
Section 2.3.1. Paragraph 3 (page 7)	- A crucial step is missing here. That step or approach of co-creating the IAP layer. There are numbers of organization that are undertaking the alien mapping in the catchment. It will be great to bring everyone and see if there can be linkages or synergies to work efficiently to develop the map of alien species in the catchment. - Have a more focus technical workshop will all the partners to indicate and co-develop the process.	I have elaborated on how the ancillary data will be collected. However, we have been specifically contracted to implement the approach we developed, so I don't see that we need to be radically altering our approach based on other methods. This was cleared up in the follow-up meeting

Section 2.3.2. Paragraph 4 (page 7)	- The project should look into using farm boundary layer when asking specialist for insight info regarding the invasion. - This layer will form part of indigenous/expect knowledge layer.	Farm boundary layer can be used as an ancillary data set to help specialists orientate themselves.
Section 2.4. Paragraph 3 (page 8)	- Nothing in the document is mentioned regarding the categorization of the density. The percentage breaks and category to be used.	It is mentioned in the development of the attribute table, but we can perhaps include an addendum showing the attribute table with domains / drop down options.
Section 2.5. Paragraph 2 (page 8)	- Nothing stated above in detailed on how the skills and knowledge will be shared with junior staff. This will assist to measure if any of the work has been undertaken or not.	Same response as above regarding Capacity Development. -