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| S:\Communications\Logos and photos\SDBORLogos\final_sdbor_webreadyBW_trans.gif | **SOUTH DAKOTA BOARD OF REGENTS**ACADEMIC AFFAIRS FORMS |
| New Graduate Degree Program |
|  |  |

Use this form to propose a new graduate degree program. The Board of Regents, Executive Director, and/or their designees may request additional information about the proposal. After the university President approves the proposal, submit a signed copy to the Executive Director through the system Chief Academic Officer. Only post the New Graduate Degree Program Form to the university website for review by other universities after approval by the Executive Director and Chief Academic Officer. The university should consult the “Campus Guide to the New Graduate Program Approval Process” for information on specific aspects of the approval process.

|  |  |
| --- | --- |
| **UNIVERSITY:** | DSU |
| **PROPOSED GRADUATE PROGRAM:** |  |
|  **EXISTING OR NEW MAJOR(S):** | **Ph.D.** |
| **DEGREE:** |  |
|  **EXISTING OR NEW DEGREE(S):** | **Cyber Operations** |
| **INTENDED DATE OF IMPLEMENTATION:** | Choose an item. **2018**  |
| **PROPOSED CIP CODE:** | **11.0101** |
| **SPECIALIZATIONS:[[1]](#footnote-1)** |  |
| **IS A SPECIALIZATION REQUIRED (Y/N):** | **Y** |
| **DATE OF INTENT TO PLAN APPROVAL:** | **5/9/2018** |
| **UNIVERSITY DEPARTMENT:** | **Beacom College of Computer and Cyber Sciences** |
| **UNIVERSITY DIVISION:** |  |

**University Approval**

*To the Board of Regents and the Executive Director: I certify that I have read this proposal, that I believe it to be accurate, and that it has been evaluated and approved as provided by university policy.*

|  |  |  |
| --- | --- | --- |
|  |  | **5/11/2018** |
| President of the University |  | Date |

|  |
| --- |
|  |

1. **What is the nature/purpose of the proposed program?**

DSU is proposing a change in the degree designation from the Doctor of Science (D.Sc.) to the Doctor of Philosophy (Ph.D.). DSU received authority to offer the D.Sc. in Cyber Security at the April 2014 Board meeting. The Ph.D. would be a new degree to the university. In addition to making the change from D.Sc. to Ph.D., we are also requesting a name change for the program. We request the name be changed from Cyber Security to Cyber Operations. Cyber security is the umbrella title for more specific areas such as cyber operations and cyber defense. This title also aligns with our BS in Cyber Operations.

According to Techtarget.com[[2]](#footnote-2), “cyber security is the body of technologies, processes and practices designed to protect networks, computers, programs and data from attack, damage or unauthorized access. In a computing context, security includes both cybersecurity and physical security. One of the most problematic elements of cyber security is the quickly and constantly evolving nature of security risks”.

When DSU proposed its first doctoral program (Information Systems) in 2005, the Board of Regents issued the D.Sc. rather than the traditional Ph.D. designation. DSU received authorization from the Board in 2014 to offer a second doctoral degree, the D.Sc. in Cyber Security. During our doctorate program review, we found the more traditional nomenclature (Ph.D.) to be more readily understandable and relevant to growing and increasing the reputation of the programs. Secondly, the field of computer-cyber sciences is growing and maturing rapidly and this change in designation will more accurately reflect our current intensive, dissertation required program. It is essential that DSU programming reflect current and evolving market awareness. DSU has developed a national reputation for excellence in its existing doctoral programs. Offering the Ph.D., the most recognizable doctoral degree in the field, helps DSU maintain that reputation. The Ph.D. degree serves us better in this highly competitive and demanding market. Preserving and expanding our niche or place depends on quality programming along with a quality reputation. Although the D.Sc. in Cyber Operations has a very healthy enrollment of 45 students, we currently accept approximately 20% of applicants. This robust enrollment and very selective process allows the program to maintain the highest quality. The Ph.D. designation will further enhance the program’s reputation and it will further benefit in meeting the student’s professional goals since the Ph.D. is universally recognized.

When DSU proposed this program in 2014, the expert consultant who reviewed the program asked why we were proposing the degree as a D.Sc. rather than as a Ph.D.? He strongly encouraged us to make the program a Ph.D. at that time.

1. **How does the proposed program relate to the university’s mission and strategic plan, and to the current Board of Regents Strategic Plan 2014-2020?**[[3]](#footnote-3)

The Legislature established Dakota State University as an institution specializing in programs in computer management, computer information systems, and other related undergraduate and graduate programs as outlined in SDCL 13-59-2.2. The Beacom College of Computer and Cyber Sciences provides complete realization of this mission in its programs related to computer science, network administration, computer game design and cybersecurity. The Board implemented SDCL 13-59-2.2 by authorizing undergraduate and graduate programs that are technology-infused and promote excellence in teaching and learning. These programs support research, scholarly and creative activities and provide service to the State of South Dakota and the region.

This request to change the name from D.Sc. to Ph.D. relies on the same logic: the program is a strong, integrated, and effective culmination degree consistent with the mandated mission of the

university and the Beacom College of Computer and Cyber Sciences.

The transition to the Ph.D. recognizes the Board’s Strategic Plan 2014-2020, including goals to improve academic quality and to graduate more students from STEM fields by offering the most recognizable degree in the field.

1. **Describe the workforce demand for graduates of the program, including national demand and demand within South Dakota.** *Provide data and examples; data sources may include but are not limited to the South Dakota Department of Labor, the US Bureau of Labor Statistics, Regental system dashboards, etc.*

Employment demand for occupations requiring expertise in cyber security remains high. For example, positions as information security analysts are expected to grow by 28% nationally through 2026.[[4]](#footnote-4) In South Dakota, similar positions are expected to grow by 15% through 2024.[[5]](#footnote-5)

1. **How will the proposed program benefit students?**

The D.Sc. in Cyber Security from the Beacom College of Computer and Cyber Sciences provides learners who possess a solid foundation in computer science (BS or MS) an opportunity to pair their computer science emphasis with research in the many forms of IT security. In this program students learn how to take leadership roles in cybersecurity environments. Students are pushed to think in innovative and creative ways about offensive and defensive cybersecurity issues and are prepared for a variety of technology leadership roles in both government and private organizations. Upon graduation, students are well prepared to anticipate and mitigate risks in managing and deploying data-intensive systems. Building on the latest techniques in specialized cyber operations activities, particularly software exploitation, malicious code, and reverse engineering, these students leave prepared to occupy leadership roles in intelligence, military and law enforcement organizations, as well as to employers in other data-driven industries.

The faculty of the Beacom College are experts in cyber security. We leverage our expertise in all things tech to give students an innovative doctoral degree that meets the needs of a vast array of organizations. The Beacom College has strong working relationships with organizations including NSA, CIA, Navy SPAWAR, Department of Homeland Security, Johns Hopkins University’s Applied Physics Lab, Army INSCOM, Carnegie Mellon’s Software Engineering Institute and MIT’s Lincoln Labs. The college partners with these organizations to help fill the national need for cyber security leaders.

1. **Program Proposal Rationale:**
	1. **If a new degree is proposed, what is the rationale[[6]](#footnote-6)**

The Beacom College of Computer and Cyber Sciences at Dakota State University seeks to change the degree designation from D.Sc. to Ph.D. for the following reasons:

* The Ph.D. more accurately reflects the nature of the present DSU programs as research focused and dissertation driven.
* The Ph.D. is accepted as the terminal academic doctoral degree in the U.S. In terms of student community and issues of recognizability and legitimacy, the Ph.D. has a higher reputation simply because it is known in nearly all parts of the world.
* The Ph.D. is an already well-known degree, but the D.Sc. is still rather vague to many, particularly in the United States.
* The Beacom College feels awarding the Ph.D. will better serve our students who work in trans-national and higher education settings.
* DSU is recognized by government agencies, industry and education rankings as one of the premier cyber programs in the country. This Ph.D. will be the first stand- alone cyber operations Ph.D. in the country.
* DSU is a leader in preparing doctorate level cyber professionals. The Ph.D. is needed to be consistent with this leadership position in the field.
	1. **What is the rationale for the curriculum?**

The curriculum is unchanged from the existing successful D.Sc. program.

* 1. **Demonstrate/provide evidence that the curriculum is consistent with current national standards.** *Complete the tables below and explain any unusual aspects of the proposed curriculum?*
	2. **Summary of the degree program (complete the following tables):**

|  |  |  |
| --- | --- | --- |
| **Ph.D. Cyber Operations** | **Credit Hours** | **Percent** |
| Required courses, all students | 52 | 85% |
| Required option or specialization, if any | 0 | % |
| Electives | 9 | 15% |
| Total Required for the Degree Total | 61 |  |

**Required Courses**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Prefix** | **Number** | **Course Title***(add or delete rows as needed)* | **Credit Hours** | **New****(yes, no)** |
| CSC | 840 | Cyber Operations I | 3 | No |
| CSC | 841 | Cyber Operations II | 3 | No |
| CSC | 844 | Advanced Reverse Engineering | 3 | No |
| CSC | 846 | Advanced Malware Analysis | 3 | No |
| CSC | 848 | Advanced Software Exploitation | 3 | No |
| CSC | 803 | An Introduction to Cyber Security Research | 3 | No |
| CSC | 804 | Cyber Security Research Methodologies | 3 | No |
| CSC | 807 | Cyber Security Research | 3 | No |
| CSC | 890 | Research Seminar | 3 | No |
| Electives | 9 | No |
| Dissertation | 25 | No |
|  |  | Subtotal | 61 |  |

**Elective Courses:** **List courses available as electives in the program. Indicate any proposed new courses added specifically for the program.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Prefix** | **Number** | **Course Title***(add or delete rows as needed)* | **Credit Hours** | **New****(yes, no)** |
| Any 700 or 800 level course offering with a CSC, INFA or INFS prefix (Note: Program committee strongly suggest the following courses: |  |  |
| CSC | 748 | Software Exploitation | 3 | No |
| CSC | 791 | Collaboration Cyber Security Research | 3 | No |
| CSC | 842 | Security Tool Development | 3 | No |
|  |  | Subtotal | 9 |  |

1. **Student Outcomes and Demonstration of Individual Achievement**
	1. **What specific knowledge and competencies, including technology competencies, will all students demonstrate before graduation**? *The knowledge and competencies should be specific to the program and not routinely expected of all university graduates.* **Complete Appendix A – Outcomes using the system form.** *Outcomes discussed below should be the same as those in Appendix A.*

Please see Appendix A, which contains the student learning outcomes developed to ensure that graduates are prepared to perform cyber operations professionally.

* 1. **Are national instruments (i.e., examinations) available to measure individual student achievement in this field? If so, list them.**

None.

* 1. **How will individual students demonstrate mastery?** **Describe the specific examinations and/or processes used, including any external measures.[[7]](#footnote-7)** **What are the consequences for students who do not demonstrate mastery?**

The admission requirements for this program requires students to have a bachelors or master’s degree in computer science from a regionally accredited program to apply. Students must also have a minimum undergraduate grade point average of 3.0 on a 4.0 scale or equivalent on an alternative grading system. Each student will demonstrate mastery through successful fulfillment of the requirements of each outcome specified in Appendix A. DSU Program Guidelines require students to maintain a 3.0 GPA in the program, receive no grades below a C, and have no more than two grades of C. If a student does not maintain the required “B” average, they are placed on academic probation and given the opportunity to raise their GPA to 3.0 within the next nine credit hours. If a student does not raise their GPA to 3.0, they will be suspended from the program. If a student receives more than six credits of “C” or any grade lower than a “C” they will be suspended from the program.

1. **What instructional approaches and technologies will instructors use to teach courses in the program?** *This refers to the instructional technologies and approaches used to teach courses and NOT the technology applications and approaches expected of students.*

Standard outcome-oriented techniques will be used for instruction. Students are required to complete three face-to-face research seminar courses (one credit each), three separate times on the DSU campus during their studies. The SDBOR learning management system, Desire2Learn, will be used for all courses.

1. **Did the University engage any developmental consultants to assist with the development of the curriculum?[[8]](#footnote-8) Did the University consult any professional or accrediting associations during the development of the curriculum? What were the contributions of the consultants and associations to the development of curriculum?**

When this degree was proposed in 2014, a consultant was brought to campus to assist with the development of the curriculum and it was this same consultant who told us we should make the degree a Ph.D. rather than a D.Sc.

1. **Are students enrolling in the program expected to be new to the university or redirected from other existing programs at the university? Complete the table below and explain the methodology used in developing the estimates (*replace “XX” in the table with the appropriate year*)?** *If question 12 includes a request for authorization for off-campus or distance delivery, add lines to the table for off-campus/distance students, credit hours, and graduates.*

|  |  |
| --- | --- |
|  | **Fiscal Years**\* |
| **See Additional Information below** | **1st** | **2nd** | **3rd** | **4th** |
| **Estimates** | FY XX | FY XX | FY XX | FY XX |
| Students new to the university |  |  |  |  |
| Students from other university programs |  |  |  |  |
| Continuing students |  |  |  |  |
| =Total students in the program (fall) |  |  |  |  |
|  |  |  |  |  |
| Program credit hours (major courses)\*\* |  |  |  |  |
| Graduates |  |  |  |  |

 \*Do not include current fiscal year.

\*\*This is the total number of credit hours generated by students in the program in the required or elective program courses. Use the same numbers in Appendix B – Budget.

Students enrolling in this program are new to the university in most cases, although some MS students from the Beacom College of Computer and Cyber Sciences do apply to the doctorate program. Students in the existing D.Sc. program will transition to the new Ph.D. program upon BOR approval.

Below is information for number of applications and acceptance percentage for our current program:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Fall 2017 | 83 applicants | 19 invitations | 16 accepted | 19.28% acceptance | 77.10% rejection |
| Fall 2016 | 63 applicants | 15 invitations | 13 accepted | 20.63% acceptance | 76.19% rejection |
| Fall 2015 | 19 applicants | 8 invitations | 7 accepted | 36.84% acceptance | 57.89% rejection |
| Spring 2015 | 13 applicants | 6 invitations | 6 accepted | 46.15% acceptance | 53.85% rejection |

The demand for this program is growing at a rapid pace. Cyber Security as a discipline is in huge demand at all levels of higher education attainment. Since July 2015, the program has received 573 emails inquiring about the program. To date, two degrees have been conferred with two more dissertations being defended in spring 2018. Currently there are 38 candidates in the program. We estimate accepting approximately 15 students annually.

DSU will apply to the National Security Agency and Department of Homeland Security to earn the Advanced Center of Academic Excellence in the Cyber Operations designation. DSU has been Cyber Operations designated at the undergraduate level since 2012. The curriculum will be closely examined as we go through this designation process.

1. **Is program accreditation available? If so, identify the accrediting organization and explain whether accreditation is required or optional, the resources required, and the University’s plans concerning the accreditation of this program.**

No

1. **Does the University request any exceptions to any Board policy for this program? Explain any requests for exceptions to Board Policy.** *If not requesting any exceptions, enter “None.”*

None

1. **Delivery Location[[9]](#footnote-9)**
2. **Complete the following charts to indicate if the university seeks authorization to deliver the entire program on campus, at any off-campus location (e.g., UC Sioux Falls, Capital University Center, Black Hills State University-Rapid City, etc.) or deliver the entire program through distance technology (e.g., as an online program)?**

|  |  |  |
| --- | --- | --- |
|  | **Yes/No** | ***Intended Start Date*** |
| **On campus** | Yes | **Fall 2018**  |

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Yes/No** | ***If Yes, list location(s)*** | ***Intended Start Date*** |
| **Off campus** | No |  | Choose an item.Choose an item. |

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Yes/No** | ***If Yes, identify delivery methods[[10]](#footnote-10)*** | ***Intended Start Date*** |
| **Distance Delivery (online/other distance delivery methods)** | Yes | This program is now delivered both F2F and Online | **Summer 2018**  |

1. **Complete the following chart to indicate if the university seeks authorization to deliver more than 50% but less than 100% of the certificate through distance learning (e.g., as an online program)? [[11]](#footnote-11)**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Yes/No** | ***If Yes, identify delivery methods*** | ***Intended Start Date*** |
| **Distance Delivery (online/other distance delivery methods)** | No |  |  |

1. **Cost, Budget, and Resources: Explain the amount and source(s) of any one-time and continuing investments in personnel, professional development, release time, time redirected from other assignments, instructional technology & software, other operations and maintenance, facilities, etc., needed to implement the proposed major. Address off-campus or distance delivery separately.** *Complete Appendix B – Budget and briefly summarize to support Board staff analysis.*

|  |  |  |
| --- | --- | --- |
|  | Development/Start-up | Long-term Operation |
| Reallocate existing resources | No | No |
| Apply for external resources[[12]](#footnote-12) | No | No |
| Ask Board to seek new State resources[[13]](#footnote-13) | No | No |
| Ask Board to approve a new or increased student fee | No | No |

The university is not requesting any one-time money.  Because our request is to only change the degree designation from a D.Sc. to a Ph.D., DSU is not submitting a budget worksheet (Appendix B) since all courses in the program are already offered both on-campus and online.  It is anticipated that the change from D.Sc. to Ph.D. will further enhance the reputation of the program and student’s professional outcomes.  Currently, the university does not plan to increase the accepted enrollment numbers significantly. Our Ph.D. programs will remain highly competitive and selective in admissions (less than 20% acceptance rate in 2017).

1. **Board Policy 2:1 states: “*Independent external consultants retained by the Board shall evaluate proposals for new graduate programs unless waived by the Executive Director.”*  Identify five potential consultants (including contact information and short 1-2-page CVs) and provide to the System Chief Academic Officer (the list of potential consultants may be provided as an appendix). In addition, provide names and contact information (phone numbers, e-mail addresses, URLs, etc.) for accrediting bodies and/or journal editors who may be able to assist the Board staff with the identification of consultants.**

The requirement for an outside reviewer was waived for this request since the program already exits.

1. **Is the university requesting or intending to request permission for a new fee or to attach an existing fee to the program (*place an “X” in the appropriate box*)?** *If yes, explain.*

|  |  |  |
| --- | --- | --- |
|  |  | X |
| Yes |  | No |

*Explanation (if applicable):*

1. **New Course Approval: New courses required to implement the new graduate program may receive approval in conjunction with program approval or receive approval separately. Please check the appropriate statement:**

|  |  |
| --- | --- |
|  | YES,  |

*the university is seeking approval of new courses related to the proposed program in conjunction with program approval. All New Course Request forms are included as Appendix C and match those described in section 5D.*

|  |  |
| --- | --- |
| X | NO,  |

*the university is not seeking approval of all new courses related to the proposed program in conjunction with program approval; the institution will submit new course approval requests separately or at a later date in accordance with Academic Affairs Guidelines.*

1. **Additional Information:** *Additional information is optional. Use this space to provide pertinent information not requested above. Limit the number and length of additional attachments. Identify all attachments with capital letters. Letters of support are not necessary and are rarely included with Board materials. The University may include responses to questions from the Board or the Executive Director as appendices to the original proposal where applicable. Delete this item if not used.*
* In February 2018, “Military Times” named the top 218 universities for cybersecurity programs; DSU was named as the 3rd best program.11
* DSU recently hosted the eighth annual DakotaCon on the DSU campus. This event included 12 guest speakers and the annual North Central Collegiate Cyber Defense Competition, as well as training sessions for cybersecurity practitioners. Attendance for this conference averages about 700 participants.
* DSU professors received a $479,658 NSF grant for a Cyber Training Center to bridge the skill set gap with cyber security works. This is a three-year award which began in September 2017.12
* DSU team wins regional pen testing competition; DSU student is only member of the competing teams to successfully hack into the simulated election booth at national competition.13
* Two DSU students awarded SWISIS scholarships. 14
* DSU team wins regional pen testing competition; DSU student is only member of the competing teams to successfully hack into the simulated election booth at national competition.15
* In an article called “Will the Ph.D. become the Cybersecurity Terminal Degree?” by Sans.edu, they note that while the M.S. currently serves as the terminal degree in the field of cybersecurity, “it is reasonable to assume that something on the order of 23% of the jobs available would be mid to senior level employees. However, if 23% continues to grow, then clearly schools will have to develop quality programs for Ph.D.s”.16

11 <https://dsu.edu/news/10-schools-stand-out-in-latest-military-times-ranking-of-cybersecurity-prog>

12 <https://dsu.edu/news/dsu-professors-fill-niche-with-cyber-training-center>

13 <https://dsu.edu/news/dsu-team-takes-the-offense-at-national-cyber-competition>

14 <https://dsu.edu/news/students-win-swsis-scholarships>
15 <https://dsu.edu/news/dsu-team-takes-the-offense-at-national-cyber-competition>
16 <https://www.sans.edu/cyber-research/security-laboratory/article/sec-terminal-degree>

**Appendix A – Program Outcomes**

|  |  |
| --- | --- |
|  | **Program Courses that Address the Outcomes** |
| **Student Learning Outcomes** | CSC 840 | CSC 841 | CSC 844 | CSC 846 | CSC 848 | CSC 803 | CSC 804 | CSC 807 | CSC 890 | CSC 809 |
| articulate the importance of software reverse engineering and successfully complete hands-on exercises and demonstrate a thorough understanding of the domain.  |  |  | x | x | x |  |  |  |  |  |
| apply low level programming and understanding of operating systems and software to explain various types of vulnerabilities, their underlying causes, their identifying characteristics, and the ways in which they are exploited.  |  |  | x | x | x |  |  |  |  |  |
| conduct research that demonstrates an ability to model, analyze and design cyber operation processes and systems.  | x | x |  |  |  |  |  |  |  |  |
| communicate technical information, both orally and in writing, in an effective manner.  |  |  |  |  |  | x | x | x |  | x |
| fill the gap having well-trained and talented professionals in academic, industry, and government.  | x | x | x | x | x | x | x | x | x | x |

1. If the proposed new program includes specific specializations within it, complete and submit a New Specialization Form for each proposed specialization and attach it to this form. Since specializations appear on transcripts, they require Board of Regents approval. [↑](#footnote-ref-1)
2. <http://whatis.techtarget.com/definition/cybersecurity> [↑](#footnote-ref-2)
3. South Dakota statutes regarding university mission are located in SDCL 13-57 through 13-60; Board of Regents policies regarding university mission are located in Board Policies 1:10:1 through 1:10:6. The Strategic Plan 2014-2020 is available from <https://www.sdbor.edu/the-board/agendaitems/Documents/2014/October/16_BOR1014.pdf>. [↑](#footnote-ref-3)
4. 4 Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook*, Information Security Analysts, on the Internet at <https://www.bls.gov/ooh/computer-and-information-technology/information-security-analysts.htm> (visited *January 05, 2018*). [↑](#footnote-ref-4)
5. Projections Central – State Occupational Projections, Long Term Occupational Projections, South Dakota, Information Security Analysts, on the Internet at www.projectionscentral.com/projections/longterm (visited *January 05, 2018*). [↑](#footnote-ref-5)
6. “New Degree” means new to the university. Thus if a campus has degree granting authority for a Ph.D. program and the request is for a new Ph.D. program, a new degree is not proposed. [↑](#footnote-ref-6)
7. What national examination, externally evaluated portfolio or student activity, etc., will verify that individuals have attained a high level of competence and identify those who need additional work? [↑](#footnote-ref-7)
8. Developmental consultants are experts in the discipline hired by the university to assist with the development of a new program (content, courses, experiences, etc.). Universities are encouraged to discuss the selection of developmental consultants with Board staff. [↑](#footnote-ref-8)
9. The accreditation requirements of the Higher Learning Commission (HLC) require Board approval for a university to offer programs off-campus and through distance delivery. [↑](#footnote-ref-9)
10. Delivery methods are defined in [AAC Guideline 5.5](https://www.sdbor.edu/administrative-offices/academics/academic-affairs-guidelines/Documents/5_Guidelines/5_5_Guideline.pdf). [↑](#footnote-ref-10)
11. This question responds to HLC definitions for distance delivery. [↑](#footnote-ref-11)
12. If checking this box, please provide examples of the external funding sites identified [↑](#footnote-ref-12)
13. Note that requesting the Board to seek new State resources may require additional planning and is dependent upon the Board taking action to make the funding request part of their budget priorities. Universities intending to ask the Board for new State resources for a program should contact the Board office prior to submitting the intent to plan. [↑](#footnote-ref-13)